















A GEOLOGICAL ACCOUNT  
OF THE  
**UNITED STATES;**  
COMPREHENDING  
A SHORT DESCRIPTION  
OF THEIR  
ANIMAL, VEGETABLE, AND MINERAL  
PRODUCTIONS,  
ANTIQUITIES AND CURIOSITIES.

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BY JAMES MEASE, M. D.

Member of the American Philosophical Society, and Corresponding  
Member of the Literary and Philosophical Society of Manchester.

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‘ Review these numerous scenes—at once survey  
Nature’s extended face, then Sceptics say,  
In this wide field of wonders, can you find  
No art discover’d, and no end design’d?’

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1807.



*District of Pennsylvania : to wit.*

Be it Remembered, That on the twenty-third day of April, in the thirty-first Year of the Independence of the United States of America, A. D. 1807, William Young Birch and Abraham Small, of the said District, have deposited in this Office the Title of a Book, the Right whereof they claim as Proprietors, in the words following, to wit :

“ A Geological Account of the United States ; comprehend-  
“ ing a short description of their Animal, Vegetable, and  
“ Mineral productions, Antiquities and Curiosities. By  
“ James Mease, M. D. Member of the American Philo-  
“ sophical Society, and Corresponding Member of the  
“ Literary and Philosophical Society of Manchester.

“ Review these numerous scenes—at once survey  
Nature’s extended face, then Sceptics say,  
In this wide field of wonders can you find  
No art discover’d, and no end design’d?”

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(L. S.)

D CALDWELL.

*Clerk of the District of Pennsylvania.*



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ERRATA.

Page 104, for vol. *viii.* read vol. *vi.*

254, 12th line from bottom, for *red,* read *white.*

324, Buffon is incorrectly quoted. The assertion of that great Naturalist is, that "no species of animal of the *Torrid Zone,* had been placed primitively in both Continents." It is difficult to say which position is most absurd, the one in p. 324, or the above.

347. The remark on the present winter, (1806-7) refers to the part of it preceding February.

368. The article *Testudo Polyphemus,* was placed through inadvertence, among the *FISHES.*



## PREFACE.

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IN treating of the Climate, the Geology, and the Winds of the United States, the divisions and remarks of Mr. Volney have been assumed as the basis :—in many respects they are extremely accurate and ingenious, and justify the opinion which has been formed of his talents for physical geography ; but care has been taken, at the same time, to correct some important errors, into which he had fallen, and to supply his defects. As to the rest of the work, the authorities upon which the facts and statements are founded, are generally given, and the reader may be assured, that the most scrupulous attention has been exercised in ascertaining their accuracy.

JAMES MEASE.

Philadelphia, February 14, 1807.



AN ACCOUNT  
OF  
THE UNITED STATES  
OF  
NORTH AMERICA, &c.

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CHAP. I.

*Boundaries, &c.*

AT the conclusion of the revolutionary war, in 1783, which effected the independence of the States, the boundaries between them and the territories of the king of England, were fixed by a treaty concluded at Paris; agreeably to which, the division-line between them commenced at that angle which is formed by a line drawn due north from the source of the St. Croix river to the highlands, along the said highlands, which divide those rivers that empty into the river St. Lawrence, from those which fall into the Atlantic ocean, to the north-westernmost head of

Connecticut river; thence down along the middle of that river to the 45th degree of north latitude; from thence by a line due west on said latitude, until it strikes the river Iroquois, or Cataraquie; thence along the middle of the said river into lake Ontario; through the middle of said lake until it strikes the communication by water between that lake and lake Erie; thence along the middle of said communication into lake Erie; through the middle of said lake until it arrives at the water communication between that lake and lake Huron; thence through the middle of said lake to the water communication between that lake and lake Superior; thence through lake Superior, northward of the isles Royal and Philippeaux, to the Long lake; thence through the middle of said Long lake, and the water communication between it and the Lake-of-the-Woods, to the said Lake-of-the-Woods; thence through the said lake to the most north-western point thereof; and from thence, on a due west course, to the river Mississippi; thence along the middle of the said river Mississippi, until it shall intersect the northernmost part of the 31st degree of north latitude. South by a line to be drawn due east from the determination of the line last mentioned, in the latitude of 31 degrees north of the equator, to the middle of the river Apalachicola, or Catahouche; thence along the middle thereof to its junction with the Flint river; thence straight to the head of St. Mary's river; and thence down along the middle of St. Mary's to the Atlantic ocean. East by a line to be drawn along the middle of the river St. Croix, from its mouth in the bay of Fundy to its source, and from its source, directly north, to the aforesaid highlands, which divide the

rivers that fall into the Atlantic ocean from those which fall into the river St. Lawrence; comprehending all islands within twenty leagues of any part of the shores of the United States, and lying between lines to be drawn due east from the point where the aforesaid boundaries between Nova Scotia on the one part, and East Florida on the other, shall respectively touch the bay of Fundy and the Atlantic ocean, excepting such islands as now are or heretofore have been within the limits of the said province of Nova Scotia.

According to the above courses, the boundary-line between the United States and British America, is to run west until it strike the river *Mississippi*, but, in the opinion of Mr. M<sup>c</sup>Kenzie, this can never happen, as the north-west part of the Lake-of-the-Woods is in latitude 49 deg. 37 min. north, and longitude 94 deg. 31 min. west, and the northernmost branch of the source of the *Mississippi* is in latitude 47 deg. 38 min. north, and longitude 95 deg. 6 min. west, as ascertained by Mr. Thompson, astronomer to the North-West Company, and who was sent expressly for the purpose, in the Spring of 1798..... He, at the same time, determined the northern head of the *Missouri* to be in latitude 47 deg. 32 min. north, and longitude 101 deg. 25 min. west; and, according to the Indian accounts, it runs to the south of west; so that if the *Missouri* were even to be considered as the *Mississippi*, no western line could strike it. Mr. M<sup>c</sup>Kenzie further observes, that it does not clearly appear to be determined, what course the line is to take, or from what part of lake Superior it strikes through the country to the Lake-

of-the-Woods: were it to follow the principal waters to their source, it ought to keep through lake Superior to the river St. Louis, and follow that river to its source; close to which is the source of the waters falling into the river of lake La Pluie, or the rainy lake, which is the common route of the Indians to the Lake-of-the-Woods.

This vast territory, measuring from north to south, comprises more than sixteen degrees of latitude, viz. from 31 deg. north, to about 47 deg. from east to west, includes upwards of five and twenty degrees of longitude, which would seem to produce an immense superficies, but as the coast of the Atlantic runs diagonally from north-east to south-west, and the five lakes of Canada encroach upon it, reaching to the latitude of 40 deg. the absolute superficies will be found to be diminished above one-third.

The late geographer-general of the United States, Thos. Hutchins,\* has given a calculation of the number of square miles in the habitable parts of what was once the British dominions in North America, and makes them amount to 1,200,000: but in this Canada was included, although he has been repeatedly quoted as referring to the territory of the United States alone; and it is clear, from late discoveries, that the data upon which he founded his calculation, must have been exceedingly inaccurate. Indeed, he is known to have declared his belief of having greatly mistaken the truth on this subject, which must at all times be attended with many dif-

\* Historical Narrative and Topographical Description of Louisiana and West Florida, Philad. 1784.

difficulties, that render every calculation far from accurate.



## ASPECT OF THE COUNTRY.

To an European traveller (says Volney) and especially to one accustomed to the naked lands of Egypt, of Asia, and on the borders of the Mediterranean, the prominent feature of the American soil is a wild appearance of almost uninterrupted forest, which displays itself on the shores of the sea, and continues growing thicker and thicker as you proceed into the interior of the country. It is true, on the shores of the Atlantic this continental forest displays some openings, formed by the brackish marshes, and the cultivated fields that are continually extending round the absorbing focus of the cities. It has also considerable vacancies in the western countries, particularly from the Wabash to the Mississippi, toward the borders of lake Erie and the river St. Lawrence, in Kentucky, and in Tennessee; where the nature of the soil, and still more the ancient and annual conflagrations of the savages, have produced spacious deserts, called *prairies*, covered with thick shrubby plants, three or four feet high, exhibiting, during Summer and Autumn, a rich tapestry of verdure and flowers, very seldom to be seen in the bare and naked deserts of Arabia. Throughout the rest of the United States, particularly in the mountainous parts of the interior country, from which the rivers flow in opposite directions, some to the Atlantic

others to the Mississippi, the realms of forest have experienced but slight infringements on their domain.

If the whole of the country could be taken in at one view, we should perceive this forest to be divided into three grand districts, distinguished from each other by the kind, species, and aspect, of the trees that compose it. The species of these trees, according to the remark of the Americans, indicate the nature and qualities of the soil, on which they grow.

The first of these districts, which may be called the southern forest, includes the maritime parts of Virginia, of the two Carolinas, of Georgia, and of the Floridas, and extends, generally speaking, from Chesapeak bay to the river St. Mary, on a soil of gravel and sand, occupying, in breadth, from eighty to a hundred and thirty miles. The whole of this space, covered with pines, firs, larches, cypresses, and other resinous trees, displays a perpetual verdure to the eye, but would not be on this account the less barren, if the sides of the rivers, land deposited by the waters, and marshes, did not intermingle with its veins rendered highly productive by cultivation.

The second district, or middle forest, comprises the hilly part of the Carolinas and Virginia, all Pennsylvania, the south of New York, all Kentucky and the North-Western Territory, as far as the river Wabash. The whole of this extent is filled with the different species of the oak, beech, maple, walnut, sycamore, acacia, mulberry, plum, ash, birch, sassafras, and poplar, on the coasts of the



Atlantic; and, in addition to these, on the west, the cherry-tree, horse-chesnut, papaw, magnolia, sumac, &c. all of which indicate a productive soil. These kinds of forest trees, however, do not anywhere entirely exclude the resinous, which appear scattered throughout all the plains, and collected in clumps on the mountains, even of the lower order, as the chain in Virginia called the South-West: and it is a singular circumstance, that here they deviate from their customary designation of sterility, for the fat and deep red soil of this chain is extremely fertile.

The third district, or northern forest, likewise composed of pines, firs, larches, cedars, cypresses, &c. begins from the confines of the former, covers the north of New York, the interior of Connecticut, and the Massachusetts, gives its name to the state of Vermont, and leaving to the deciduous forest-trees only the banks of the rivers and their alluvions, extends by the way of Canada toward the north, where it soon gives way to the juniper, and the meagre shrubs, thinly scattered among the deserts of the polar circle.

## GENERAL CONFIGURATION.

To conceive, properly, the general construction of this vast country, we must acquire a more particular knowledge of the chain of mountains, that forms its predominant feature. This chain begins in Lower Canada, at the mouth of the river St. Lawrence, on its southern bank, where its Capes are called, by seamen, Mounts Notre-Dame and Magdalen. As it proceeds up the river it gradually diverges from it, and separating the waters of its basin toward the north-west from those of New Brunswick, Nova Scotia, and the district of Maine, to the south-east, it traces the frontier of the United States on this side as far as New Hampshire. There it takes a nearly southern direction, penetrating into the interior of Vermont under the name of the Green Mountains, dividing the basin of the river Connecticut from that of lakes Champlain and George; and after having sent off branches on that side, which repel the sources of Hudson's river on the west and north-west, it crosses this river at West Point by a very rugged chain, which has acquired the name of the Highlands. At this place the chain may be said to experience a double interruption: in the first place being intersected by the waters; in the next because it has hitherto consisted of granite, while its continuation is of sandstone. The head of this continuation proceeds higher up the western bank of Hudson's river to the group of the Kaats Kill mountains, and a mass which furnishes the sources of the Delaware. From this place branches off a band of mountainous

ridges, which, after having incorporated themselves with the preceding chain, extend from north-east to south-west across the states of New York, Pennsylvania, Maryland, and Virginia, increasing their distance from the sea as they proceed southward. It is a singular fact, in geography, that several of these ridges intersect, at right angles, the course of the largest rivers of the United States that run into the Atlantic, leaving a passage for them only through breaches, which attest, that the force of the waters alone has overcome the obstacle opposed to their passage. These ridges, having continued parallel to each other, till they arrive at the frontiers of Virginia and North Carolina, unite there into a knot, which may be called the Alleghany Arch, because the principal chain embraces there in a curve all its collaterals from the east. A little farther south, but still in North Carolina, a second knot unites to the Alleghany all its collaterals from the west,\* and forms a culminating point of heads of rivers; the great Kanhaway issuing from it toward the north, the Holston, or northern branch of the Tennessee, toward the west, and the Pedee, the Santee, and all the other rivers of the two Carolinas, toward the east. From this knot likewise runs off to the west a ridge of mountains, which by one bifurcation to the north-west furnishes the numerous branches of the Kentucky; and by a second, directly west, stretches, under the name of the Cumberland mountains, across the state of Tennessee; where it divides north and south the basin of the rivers Tennessee and Cumberland, till they open into the Ohio: while the

\* The ridges of Kentucky.

proper Alleghany chain, left almost alone, continues its course to the south-west, and completes the boundary of the two Carolinas and Georgia, where it receives the various names of White Oak, Great Iron, Bald, and Blue mountains. When it reaches the angle of Georgia, it changes both its direction and name, and proceeding due west to the Mississippi, under the names of Apalachian and Cherokee mountains, it becomes the line of division between the basin of the Tennessee on the north, and the numerous rivers that run south through the Floridas into the Gulf of Mexico. The long continuity of this chain has obtained it the name of the Endless mountains from the northern savages: the French and Spaniards, who first became acquainted with it in Florida, applied to it, throughout its whole extent, the name of Apalachian, which was that of a tribe of savages, and is still retained by a considerable river of the country:\* but the English and American geographers, who knew it in the north, have constantly given it the name of Alleghany, or Endless, as it is rendered by Evans, who appears to consider these terms as synonymous. For greater clearness, I shall distinguish by the name of Apalachian, that branch, which, as before observed, turns off at the angle of Georgia, and which, less steep and lofty, is divided into a number of hills and ridges, that cover the country as far as the Mississippi, terminating abruptly there in rugged precipices, called cliffs, which continue from the Natchez nearly to the mouth of the Ohio. These hills do not cross

\* Apalachicola, a compound word, *cola* being the term for river in the Creek language.

the Mississippi, the opposite bank of which is low and flat, being a marsh of fifty miles breadth on a medium, from its mouth to that of the Ohio, which is 7 degrees, or 480 miles distant. There the continental forest terminates, and those *steeps* or savannas begin, which extend westward to the mountains on the north of Mexico and the Stony mountains, which, in the course of this work, will be called the Chipiwan chain, from the name of those savages, by whom it is inhabited.

From this arrangement of the land, which has just been described, arises a sort of natural division of the United States into three long parallel countries in the direction of the coast, or from north-east to south-west.

The first of these is the eastern, lying between the ocean and the mountains, commonly called the Atlantic coast.

Another is the western, situate between the mountains and the Mississippi, and named the western or back country.

A third is that of the mountains themselves, being intermediate to the other two.

All of these countries having their climate, soil, configuration, and interior structure, marked by peculiar characteristics, it appears to be proper, to enter into a few particulars respecting each.

### 1. *The Atlantic Coast.*

The Atlantic coast, so called from the ocean that washes its shores, and into which all its rivers flow, extends from Canada to Florida; its breadth, which varies from fifty to a hundred and eighty miles, increasing as it advances to the southward. It is the original and principal part of the states that compose the Union, which are arranged in it in the following order:

Georgia, South Carolina, North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, and the district of Maine.

This country has but little elevation throughout its whole extent, being flattest in the southern states, as far as Maryland, and even New Jersey, and more unequal, approaching to the mountainous in the northern states, particularly in Connecticut, Massachusetts, and Rhode Island. Long Island may be considered as a tolerably precise point of division between these two different kinds of land; for, from this island to the north, as far as the river St. Croix,\* and even to the mouth of the St. Lawrence, the shore is high, rocky, and interspersed with reefs, which are connected with the nucleus of the adjoining continent: on the contrary, proceeding from Long Island toward the south, the coast is uniformly a low shore, nearly level with

\* The frontier between the United States and the English possessions in Canada,

the water, and entirely of sand. This sand, which announces itself a deposit of the sea, is found to a considerable distance inland, where it serves as a bed to that forest of pines, fir, and other resinous trees, of which I have spoken. As it approaches the mountains, it is mingled with a portion of clay and gravel, washed down from the neighbouring heights; and hence results a yellowish, poor, loose soil, which predominates in the middle stripe of the southern states, in Maryland, Pennsylvania, and the upper part of New Jersey, to such a degree, that these three states may be considered as vast alluvions of the rivers Potowmac, Susquehannah, Delaware, and Hudson. Farther north, particularly in Connecticut, Rhode Island, and Massachusetts, the country is furrowed with little mountains and chains, which roughen the surface of all New England, properly so called. We should be almost tempted to suppose this country a prolongation of the mountainous band, did not the granitic nature of its stones, and the confusion of its ridges, distinguish it from the Alleghanies, which are formed of sandstone, and which run in a line farther west and inland.

2. *The Western Country, or Basin of the Mississippi.*

The country to the west of the Alleghany mountains may be termed with propriety the basin of the Mississippi, as almost all the streams that irrigate it, pour their waters directly or indirectly into this river. This basin is bounded on the east by the Alleghanics; on the west by the Mississippi; on the north by lakes Michigan, Erie, and Ontario; and, lastly, on the south by the Floridas.

The states contained in the basin of the Mississippi, are, western Georgia, Tennessee, Kentucky, the great district north of the Ohio, called the North-Western Territory,\* and some of the west parts of Virginia, Pennsylvania, and New York.

If this great country be examined more minutely, we shall find, that the nature of the soil, and certain natural limits of rivers and mountains, subdivide it into three large districts, which are very distinct from each other.

The first is the country south of the Tennessee, and of the Apalachian chain, which surrounds it, from which the rivers flow into the Gulf of Mexico and the lower part of the Mississippi. In its maritime part, which is Florida, the land is perfectly flat, sandy, and barren on the sea-shore; marshy, forming natural meadows, as it advances inland; and thence rich and fertile, particularly on the

\* Now state of Ohio.



banks of the rivers, where rice and Indian corn grow to the largest size. You will scarcely find a stone that weighs two or three pounds within thirty or forty miles of the shore. Proceeding into the country, the surface becomes more hilly, and the soil more stony; it is also less fertile.

The second district is bounded on the south by the Tennessee, on the north by the Ohio, on the east by the Alleghanies, and on the west by the Mississippi.

It comprises the state of Kentucky, and that of Tennessee.

All this space is extremely broken with little mountains, and steep ridges, most of them however covered with woods. From east to west in particular it is traversed by the chain that bears the name of Cumberland, which is thirty miles in breadth, and runs between the river of the same name and the Tennessee. In the valleys, and in what few plains there are, the soil is generally of an excellent quality, being a kind of black, rich, friable mould, from three to fifteen feet deep, and consequently of extreme fertility. The forest trees it produces are far superior in the size of their trunks and fullness of their branches, to the thin and slender trees of the Atlantic coast; some of the wild cherry-trees are five feet and a half in diameter.

The third district is bounded on the south by the Ohio; on the north by the lakes of the St. Lawrence; and, as the former, on the east and west by the Alleghany mountains and the Mississippi. Its surface is nearly plain, or commodiously undulated; scarcely can a mountain or a ridge two hundred

yards high be pointed out in it, and throughout its west part, from the Wabash to the Mississippi, we find nothing but vast level meadows. Yet from this land flow in opposite directions a number of considerable rivers, some of which empty themselves into the Gulf of Mexico by means of the Mississippi; others into the Northern Ocean through the St. Lawrence, and others into the Atlantic by the Mohawk, Hudson, and Susquehanna. Hence it follows, that the Alleghany mountains, from which the latter derive their sources, are in some respect only the breastwork of this flat, which almost equals them in height. The opposite declivities of this vast space are so gentle, that the rivers, dubious of their course, wander in sinuosities and marshes; and that, in the floods of Winter, streams navigable by boats form a junction between the sources of the Wabash, which joins the Ohio, the Miami, which runs into lake Erie, the Huron, which falls into the entrance of the same lake, Grand river, which flows into lake Michigan, and several others.

Contrary to those of Kentucky, the rivers of the North-Western Territory run even with the surface, not only on account of the flatness of the level but in consequence of the clayey nature of the soil, which prevents the water from penetrating into it. This is a happy circumstance both for the agriculture and trade of this country: accordingly, it begins to be preferred to Kentucky; and at some future period I conceive it will be the Flanders of the United States for corn and cattle.

From the Wabash, whence to the Mississippi, a space of eighty miles, there are nothing but savan-

nas: and, in reality, here commences an American Tartary, which has all the characters of that of Asia: hot in its southern part, it becomes gradually cold and sterile toward the north; and in the latitude of 48 deg. it is frozen ten months in the year, destitute of high trees, inundated with marshes, and intersected with rivers, which, in a space of near three thousand miles, have not fifty of interruptions, or carrying-places.

### 3. *The Mountain Country.*

The third parallel stripe is that line of mountainous country, already mentioned, which extends from the mouth of the St. Lawrence to the confines of Georgia, divides the waters of the east and west, and forms a lofty rampart or terrace between the countries of the Atlantic and Mississippi. Its length may be estimated at a thousand miles, and its breadth, which is very variable, pretty generally from seventy to a hundred and twenty.

This division, though comparatively very narrow, has notwithstanding great influence on the temperature of the two adjacent, from which it differs in climate, soil, and even produce. Toward the south the air is more pure, more dry, more elastic, more healthy: toward the north, commencing with the Potowmac, mists and rain are more common, the animals are larger and more lively, and the forest-trees, without being as large as those on the west, are superior to those of the east, and excel both in elasticity.

This chain of mountains differs from those in Europe, in being longer and more regular in its ridges, than the Alps or Pyrenees, yet much less lofty. Measurements made with accuracy at various points will afford instructive and satisfactory proofs of this.

In Virginia, Otter peak, the highest land in all the country, is only 4000 feet high.\*

In the same district Mr. Jonathan Williams, setting out from the point where the tide-water ceases to flow below Richmond, and measuring his route to the first chain of Blue Ridge, found 1150 feet elevation at Rockfish Gap. A peak near gave him 1822 feet. Farther on, beyond the town of Staunton, ascending a chain of the Alleghanies, he found 1898 feet: a second chain, that of Calf Pasture, gave him 2247: and lastly a third, that which divides the rivers and is intersected by none, measured six miles south-west of Red Spring, gave him 2760, feet, or 405 toises, above the level of the ocean. Blue Ridge, at the opening of Harper's ferry, below the mouth of the river Shenando, appeared to have nearly the same height as at Rockfish Gap; accordingly its mean height may be estimated at 1150 feet, that is less than half the height of the Alleghames in Virginia.

In Maryland, George Gilpin and James Smith took the following levels in 1789:

On the river Potowmac, from the limits of the tide, that is to say, from the rapids of Georgetown to the mouth of Savage river, in an extent of 218 miles, the

\* See Jefferson's Notes on Virginia, p. 29.

ascent is 1160 feet: in this account the rapids of Georgetown are taken at 37 feet, and the great fall of Matilda, including its rapids, which extend three miles above it, at 76 feet.

From the mouth of Savage river to the place called Moses Williams on the summit of the Alleghanies, in a space of eight miles and three quarters, the ascent is 2097 feet, making in the whole 3257.

In Pennsylvania the height of the Alleghanies above the flat country, according to Dr. Rush, is only 1300 feet; and in fact travellers observe, that we arrive at them by a series of gentle and gradual ascents, which are scarcely noticed.

In the state of New York, the highest peak of the Kaats Kill mountains, measured in 1798 by Peter de la Bigarre,\* was found to be 3549 feet above the level of Hudson's river, in which the tide flows ten miles above Albany.

In Vermont, Killington peak, measured by Samuel Williams as the loftiest of all the chain, is only 3454 feet.†

Lastly, the White mountains in New Hampshire, which are visible thirty leagues at sea, and which

\* Transactions of the Society of New York, Part II, p. 128.

† See History of Vermont, by S. Williams, p. 23. It is in one vol. 8vo. printed at Walpole, in New Hampshire, 1794. The author observes, that in these latitudes the region of constant frost is at 8066 feet. Mr. S. Williams, who must not be confounded with Jonathan, was formerly professor of mathematics at Cambridge, near Boston, and a clergyman, but at present lives retired in the state of Vermont.

Mr. Belknap estimates from the accounts of travellers at 10,000 feet.\*

The Alleghany chain therefore can be considered only as a rampart of the mean height of 2000 or 2400 feet, about 350 or 400 toises, which differs altogether from the grand chains of our globe, as for instance :

The Alps, estimated at	-	-	1500 toises
The Pyrenees	-	-	1350
The Andes†	-	-	2500
Libanus	-	-	1453

And it is obvious, that this circumstance must have considerable influence on the meteorology of the United States and the whole of their continent, as shall be shown more particularly hereafter.

All European travellers remark with surprise, that the American mountains have more regularity in their direction, greater continuity in their ridges, and less inequality in the line of their summits, than the mountains of their continent. These characteris-

\* History of New Hampshire, by Belknap, vol. III, p. 49. See also S. Williams's Work, p. 23.

† Agreeably to a very interesting geological delineation of South America, published by Baron Humboldt, since Volney wrote, it appears that Don Ulloa's measurement referred to the chain of the Andes running north and south; but Humboldt observes, that South America exhibits other cordilleras of primitive mountains, extending east and west, parallel to the equator. Of these, that of Venezuela, is the highest, but the most narrow. Its greatest height is at the Sierras de St. Merida, in lat. 8 deg. 30 min. 14,000 English feet above the sea.

tics are particularly striking in Virginia and Maryland in the chain called Blue Ridge. This chain, which I have traversed or pursued the direction of from the frontier of Pennsylvania to James river, always exhibited to me the appearance of a terrace elevated ten or twelve hundred feet above the plain, with a very steep ascent, and a summit so even, that we scarcely perceive its undulations, or the few gaps that serve for passages across it. The base of this mass is only from four to six miles broad. Approaching the north the height of this chain, as well as of those that are parallel to it, decreases; and as some of its ramifications have occasioned in Pennsylvania a confusion of names, by which even geographers are perplexed, I will endeavour in the first place to elucidate them.

In Virginia three principal well-marked ridges are clearly to be distinguished.

First, Blue ridge, situate most easterly, which derives its name from its blueish appearance at a distance to those who come from the flat maritime country. It bears the name of South mountain in the maps of Evans and other geographers, without any good reason being assignable for the term. Indeed the mountains of the United States in general, named at hap hazard by the colonists of each district, have but unmeaning and frequently whimsical names. However this may be with respect to Blue ridge, it branches off from the grand arch or knot of the Alleghanies, and is even the most direct prolongation of that chain, as you come from the south: it crosses James river below the junction of its two superior branches, the Potowmac below the She-

nando, the Susquehannah below Harrisburg, and travellers observe, that the bed of this river, navigable so far on a calcareous bottom, becomes impassable in consequence of the rocks and sandstone of Blue ridge. In Pennsylvania this ridge, less continuous and of inferior elevation, assumes in different districts the various names of Trent, Flying, and Oley hills; but it is nevertheless the same branch, which crosses the Schuylkill below Reading, the Delaware below its western branch and the town of Easton, and proceeds to lose itself in the Kaats Kill group towards the banks of Hudson's river.

The second chain, called North mountain with as little reason as the preceding is named South, branches off likewise from the grand arch of the Alleghanies, and running parallel with Blue ridge, but west of it, crosses the upper branches of James river twelve or fourteen miles above their junction, and the Potowmac four and twenty miles above the Shenando; but when it reaches the west branches of Conegocheague creek, it divides into several ramifications, which render its remaining part doubtful. Some geographers look on the Tuscarora chain, though divergent, as its continuation; which, after having crossed the river Juniata, loses itself in the rocky and marshy deserts north-east of the Susquehannah. Others follow North mountain in the chain of Kittatinny, which, continuing in a more direct line, runs parallel with Blue ridge as far as the Delaware, which it passes above its west branch and the town of Nazareth, then proceeding along the east bank of that river, and termi-



uating with the branches of Blue ridge in the Kaats Kill group, and the mountains that separate the sources of the Delaware from the course of Hudson's river.

In Pennsylvania, Blue ridge and North mountain, are pretty commonly confounded together; because, as the characteristics of the two are not very distinctly marked, each district applies the epithet of Blue to its most elevated chain, and a particular name to each different ramification: but the geographical continuity of North mountain in the Kittatinny, and of Blue ridge in the Flying and Oley hills, as I have traced them, appears to be best established by the general direction of these chains, by the nature of their stones, and by their concurrence in forming a calcareous valley, which is prolonged uninterruptedly between them from the Delaware and the townships of Easton and Nazareth to the sources of the Shenando beyond Staunton.\*

The third principal chain, that of the Alleghanies properly so called, is the highest ridge to the west, which, separating all the rivers, without being cut by any one, has properly received the name of Endless. This chain, taking it at its southern extremity, comes from the angle of Georgia and Carolina, where it receives the various names of White Oak, Great Iron, Bald, and even Blue mountains. There it sends off to the west some branches of the

\* It is not without a careful examination of this question, on good authority, that I differ from the projection of Mr. Arrowsmith, who, totally neglecting the ridge of Oley hills and Flying hills, turns off the chain of Blue ridge into the Kittatinny below Harrisburg.

river Tennessee, and to the east the rivers of the two Carolinas, of which it forms the western frontier. On reaching Virginia it forms the arch above mentioned, by bending toward the north-west, and enveloping the preceding ridges: it then resumes its course north-east, and sends to the Ohio the waters of the great Kanaway and Monongahela, to the Atlantic those of the rivers James, Potomac, Susquehannah, &c.; but toward the sources of the western branch of the latter it divides into several ramifications, the most considerable of which proceed to the eastward, and, crossing all the streams of the Susquehannah, terminate in the Kaats Kill mountains, and at the sources of the Delaware and Hudson; while other ramifications to the east surround the sources of the Susquehannah itself, and proceed to Tioga to furnish those of the lakes of the Iroquois or Genessee country: unless indeed it should be thought proper to assign these branches to a ridge farther west, which, under the names of Gauley, Laurel, and Chesnut ridge, likewise terminates in this country.

Beside the three principal chains of Virginia, which is just described, there are still several intermediate ridges, which frequently equal them in height, steepness, and continuity; as those of Calpasture, Cowpasture, and Jackson, which I crossed in travelling to Staunton by the way of Green Briar. In the latter mountains are thermal waters of different qualities, celebrated in Virginia for their virtues, and known by the names of Warm spring, Hot spring, Red spring, &c. Warm spring,

which I have visited, is an ammoniacal sulphureous water, about 20 degrees (77 deg. Fah.) of heat. It rises in the bottom of a deep valley, shaped like an inverted cone, which has every indication of having been the crater of a volcano now extinct.

West of the Alleghanies, toward the basin of the Ohio, there are likewise several remarkable ridges. I crossed one known by the name of Reynick\* and High Ballantines, eight miles west of the town or village of Green Briar, and it appeared to me as lofty as Blue ridge, but much broader. From the plain on its summit I saw a number of others toward the south-west and north-east. Fifteen miles farther on I entered by a winding road into a series of other chains, eight or ten of which I crossed in the space of thirty-eight miles, till I reached Gauley, the highest and steepest of all, and the narrowest on its ridge. This whole space of thirty-eight miles I consider as one lofty terrace. Beyond the Gauley hills we cross no other high chain, except with the course of the rivers, the direction and often indeed the bed of which we follow; but I have observed, that the bed of the great Kanhaway often makes its way through one of the roughest countries I ever saw. Many of these ridges direct their course to the Ohio, and we shall see, that some must have crossed it. This Gauley ridge commences with the sources of the great Kanhaway to the south-west of the Alleghany arch, and under the names of Laurel hill and

\* The name of the earliest or principal settler on the road. Almost all the names of places in the United States have a similar origin.

Chesnut ridge, proceeds northward, to terminate at the head of the Susquehannah. Southward the settlers in Kentucky and Tennessee have extended the name of Great Laurel to the principal branch, that separates Kentucky from Virginia; and have given the name of Cumberland to its continuation, which accompanies and bounds Cumberland river as far as its mouth. I have not sufficient documents with respect to this part.\*

From the earliest settlement of the country, the white mountains have attracted the attention of all sorts of persons. They are undoubtedly the highest land in New England, and in clear weather, are discovered before any other land, by vessels coming in to the eastern coast; but by reason of their white appearance, are frequently mistaken for clouds. They are visible on the land at the distance of eighty miles on the south and south-east sides; they appear higher when viewed from the north-east, and it is said they are seen from the neighbourhood of Chamble and Quebec. The Indians gave them the name of Agiockook: They had a very ancient tradition that their country was once drowned, with all its inhabitants, except one Powaw and his wife, who, foreseeing the flood, fled to these mountains, where they were preserved, and that from them the country was re-peopled.† They had a superstitious veneration for the summit, as the habitation of invisible beings; they never ventured to ascend it, and

\* Volney's View of the United States.

† Josselyn's Voyage to New England, p. 135.

always endeavoured to dissuade every one from the attempt. From them, and the captives, whom they sometimes led to Canada, through the passes of these mountains, many fictions have been propagated, which have given rise to marvellous and incredible stories; particularly, it has been reported, that at immense and inaccessible heights, there have been seen carbuncles, which are supposed to appear luminous in the night. Some writers, who have attempted to give an account of these mountains, have ascribed the whiteness of them, to shining rocks, or a kind of white moss; and the highest summit has been deemed inaccessible, on account of the extreme cold, which threatens to freeze the traveller, in the midst of Summer.

The White mountains are the most elevated part of a ridge, which extends north-east and south-west to an immense distance. The area of their base, is an irregular figure, the whole circuit of which is not less than sixty miles. The number of summits within this area, cannot at present be ascertained, the country round them being a thick wilderness. The greatest number which can be seen at once, is at Dartmouth, on the north-west side, where seven summits appear at one view, of which four are bald. Of these the three highest are the most distant, being on the eastern side of the cluster; one of these is the mountain which makes so majestic an appearance all along the shore of the eastern counties of Massachusetts. It has lately been distinguished by the name of Mount Washington.

To arrive at the foot of this mountain, there is a continual ascent of twelve miles, from the plain of Pigwacket, which brings the traveller to the height of land, between Saco and Amariscoggin rivers. At this height there is a level of about a mile square, part of which is a meadow, formerly a beaver pond, with a dam at each end. Here, though elevated more than three thousand feet above the level of the sea, the traveller finds himself in a deep valley. On the east is a steep mountain, out of which issue several springs, one of which is the fountain of Ellis river, a branch of Saco, which runs south; another, of Peabody river, a branch of Amariscoggin, which runs north. From this meadow, towards the west, there is an uninterrupted ascent, on a ridge, between two deep gullies, to the summit of Mount Washington.

The lower part of the mountain is shaded by a thick growth of spruce and fir. The surface is composed of rocks, covered with very long green moss, which extends from one rock to another, and is, in many places, so thick and strong, as to bear a man's weight. This immense bed of moss, serves as a sponge, to retain the moisture brought by the clouds and vapours, which are frequently rising and gathering round the mountains; the thick growth of wood, prevents the rays of the sun from penetrating to exhale it; so that there is a constant supply of water deposited in the crevices of the rocks, and issuing in the form of springs, from every part of the mountain.

The rocks which compose the surface of the

mountain, are, in some parts, slate, in others flint; some specimens of rock crystal have been found, but of no great value. No limestone has yet been discovered, though the most likely rocks have been tried with aqua fortis. There is one precipice, on the eastern side, not only completely perpendicular, but composed of square stones as regular as a piece of masonry; it is almost five feet high, and from fifteen to twenty in length. The uppermost rocks of the mountain, are the common quartz, of a dark-grey colour; when broken they shew very small shining specks, but there is no such appearance on the exterior part. The eastern side of the mountain rises in an angle of 45 degrees, and requires six or seven hours of hard labour to ascend it. Many of the precipices are so steep, as to oblige the traveller to use his hands, as well as feet, and to hold by the trees, which diminish in size, till they degenerate to shrubs and bushes; above these are low vines, some bearing red, and others blue berries, and the uppermost vegetation is a species of grass, called Winter-grass, mixed with the moss of the rocks.

Having surmounted the upper and steepest precipice, there is a large area, called the plain. It is a dry heath, composed of rocks covered with moss, and bearing the appearance of a pasture, in the beginning of the Winter season. In some openings between the rocks there are springs of water, in others dry gravel. Here the grouse or heath bird resorts, and is generally out of danger; several of them were shot by some travellers in October, 1774. The extent of this plain is uncertain; from the eastern side to the foot of the Pinnacle, or Sugarloaf, it is

nearly level, and it may be walked over in less than an hour. The Sugarloaf is a pyramidal heap of grey rocks, which, in some places, are formed like winding steps. This Pinnacle has been ascended in one hour and an half. The traveller having gained the summit, is recompensed for his toil, if the sky be serene, with a most noble and extensive prospect. On the south-east there is a view of the Atlantic ocean, the nearest part of which is 65 miles, in a direct line. On the west and north the prospect is bounded by the Highlands, which separate the waters of Connecticut and Amariscoggin rivers, from those of lake Champlain and St. Lawrence. On the south it extends to the southernmost mountains of New Hampshire, comprehending a view of the lake Winipiseogee. On every side of these mountains are long winding gullies, beginning at the precipice below the plain, and deepening in the descent. In Winter the snow lodges in these gullies; and, being driven by the north-west and north-east wind from the top, is deepest in those which are situated on the southerly side. It is observed to lie longer, in the Spring, on the south, than on the north-west side, which is the case with many other hills in New Hampshire.

A ranging company, who ascended the highest mountain, on the north-west part, April 29th, 1725, found the snow four feet deep on that side; the summit was almost bare of snow, though covered with white frost and ice, and a small pond of water near the top was hard frozen.

In the year 1784, snow was seen on the south side of the largest mountain, till the 12th of July; in 1790



it lay till the month of August. During this period, of nine or ten months, the mountains exhibit more or less of that bright appearance, from which they are denominated white. In the Spring, when the snow is partly dissolved, they appear of a pale blue, streaked with white; and after it is wholly gone, at the distance of sixty miles, they are altogether of the same pale blue, nearly approaching a sky colour; while, at the same time, viewed at the distance of eight miles or less they appear of the proper colour of the rock. These changes are observed by people who live within constant view of them; and from these facts and observations it may, with certainty, be concluded, that, the whiteness of them is wholly caused by the snow, and not by any other white substance, for, in fact, there is none. There are indeed in the Summer months, some streaks which appear brighter than other parts; but these, when viewed attentively with a telescope, are plainly discerned to be the edges of the long deep gullies, enlightened by the sun, and the dark parts are the shaded sides of the same; in the course of a day these spots may be seen to vary, according to the position of the sun.

These vast and irregular heights, being copiously replenished with water, exhibit a great variety of beautiful cascades; some of which fall in a perpendicular sheet or spout, others are winding and sloping, others spread, and form a bason in the rock, and then gush in a cataract over its edge. A poetic fancy may find full gratification amidst these wild and rugged scenes, if its ardour be not checked by the fatigue of the approach. Almost every thing in

nature, which can be supposed capable of inspiring ideas of the sublime and beautiful, is here realized: aged mountains, stupendous elevations, rolling clouds, impending rocks, verdant woods, crystal streams, the gentle rill, and the roaring torrents, all conspire to amaze, to soothe, and to enrapture.

On the western part of the mountains is a pass, commonly called the Notch, which, in the narrowest part, measures but twenty-two feet, between two perpendicular rocks. From the height above it, a brook descends, and meanders through a meadow, formerly a beaver pond. It is surrounded by rocks, which, on one side, are perpendicular, and on the other rises in an angle of 45 degrees.....a strikingly picturesque scene! This defile was known to the Indians, who formerly led their captives through it to Canada; but it had been forgotten or neglected, till the year 1771, when two hunters passed through it, and from their report, the proprietors of lands, on the northern parts of Connecticut river, formed the plan of a road through it to the upper Cohos, from which it is distant twenty-five miles. Along the eastern side of the meadow, under the perpendicular rock, is a causeway of large logs, sunk into the mud by rocks, blown with gunpowder, from the mountain. On this foundation, is constructed a road, which passes through the narrow defile, at the south end of the meadow, leaving a passage of the rivulet, which glides along the western side. This rivulet is the head of the river Saco; and on the north side of the meadow, at a little distance, is another brook, which is the head of Amonoesuck, a large branch of

Connecticut river. The latitude of this place is 44 deg. 12 min. north.

The rivulet which gives rise to Saco, descends towards the south; and at a little distance from the defile, its waters are augmented by two streams from the left, one of which descends in a trench of two feet wide, and is called the Flume, from the near resemblance which it bears to an artificial flume. Over these are thrown stone-bridges; and the whole construction of this road is firm and durable; much labour has been expended upon it, and the nett proceeds of a confiscated estate were applied to defray the expense. In the descent, the pass widens, and the stream increases; but for eight or ten miles from the Notch, the mountains on each side are so near, as to leave room only for the river and its intervals; which are not more than half a mile wide. In the course of this descent several curious objects present themselves to view. On the side of one mountain is a projection, resembling a shelf, on which stand four large square rocks, in form resembling as many huge folio volumes. In two or three places, at immense heights, and perfectly inaccessible, appear rocks of a white and red hue, the surface of which is polished like a mirror, by the constant trickling of water over them. These being exposed to the west and south, are capable, in the night, of reflecting the moon and star beams to the wandering traveller in the deep, dark valley below, and by the help of imagination, are sufficient to give rise to the fiction of carbuncles.\*

\* Belknap's Hist. New Hampshire, vol. iii.

## INTERNAL STRUCTURE OF THE SOIL.

1. *Granitic region.*

The first, which is that of granites, is bounded by the Atlantic ocean, reckoning from Long Island to the mouth of the St. Lawrence; thence by a line proceeding up that river to lake Ontario, or rather to Kingston, formerly Frontenac, and the place called Thousand Isles, passing by the sources and course of the Mohawk to Hudson's river, along which it returns to the point of departure, Long Island. Throughout the whole of this space the soil rests on beds of granite, which form the skeletons of the mountains, and admit beds of a different nature only as exceptions. The granite exposes itself to view in all the environs of the city of New York: it is the nucleus of Long Island, where sands have been accumulated round it, and worn by the sea;\* and it may be traced without interruption on all the coast of Connecticut, Rhode Island, and Massachusetts, excepting cape Cod, which is formed of sand brought by the great current of the Gulf of Mexico and the

\* The editors of the Med. Repository notice this position as erroneous. Long Island, say they, has no nucleus. It contains no stratified granites, except for a small space about Hell Gate. The ridge of hills running through it is composed of sand, gravel, and loam, with lime stones and rocks.

Bahamas. The granite extends likewise along the coast of New Hampshire and Maine, where it is mixed with some sandstone, and likewise with limestone, with which Boston is supplied from Maine. It composes the numerous shoals on the coast of Nova Scotia, and the nucleus of the mountains, called Notre Dame and Magdalen, on the right of the mouth of the St. Lawrence. The banks of this river are in general schistus, but this does not prevent the granite from showing itself frequently in detached masses, and in shoals fixed in the bed of the river. It is found again throughout the environs of Quebec; in the mass of rock, that supports its citadel; in the tolerably lofty mountains north-west of the city; and lastly under the falls of Montmorenci, a small river, which comes from the north, and precipitates itself into the St. Lawrence down a precipice of a hundred and eighty feet. The immediate bed of this cascade is a horizontal calcareous shelf, of a black grey colour, and of the kind termed primitive or crystallized: but it is supported by strata of brown-grey granite, of a very close grain, and nearly perpendicular to the horizon. Wherever these strata show themselves along the St. Lawrence; they are more or less inclined to the horizon, never parallel with it. A granite of a red, black, and grey colour abounds on the right bank of the river, opposite Quebec, resembling that of the State-house at Boston, which was drawn from the neighbourhood of the city; both being similar to the block that was brought from lake Ladoga to Petersburg, to serve as a pedestal for the statue of Peter I. The isle in which stands the city of Montreal is calcareous; but

all the shore about it exhibits stones of rounded granite, brought down, no doubt, from the adjacent heights. The summit of mount Bel-œil is of granite, as is the chain of the White mountains in New Hampshire, to which it may be said to belong. The branches in New England are likewise of granite, except the environs of Middleton and Worcester, which are of sandstone. I am informed, that the west branch of the Green mountains, and the greater part of lake Champlain, which it skirts, are calcareous, though the rocks of Ticonderoga are of sandstone; and the east branch, which traverses the state of Vermont, is of granite. It appears then, that the granite traverses lake George,\* or the isthmus that separates it from Hudson's river, to ascend to the sources of this and Black river: thence it proceeds as far as the St. Lawrence, at Thousand Isles and Kingston, where it is always found of a reddish hue, formed in large crystals, and surcharged with feldt-spar. Mr. Alexander Mackenzie, in his Travels lately published, observes, that a dull grey granite is found throughout all the country, from lake Winnipeg to Hudson's bay; and that he has even been informed, it extends in like manner from Hudson's bay to the coast of Labrador. †

\* The mountains on the side of the lake and those about Ticonderoga, are composed of sandstone. And the whole valley where Fort George is situated, some of the islands in the lake, and the region around the great falls of the Hudson, for several miles, are underlaid with limestone. *Med. Repos. Hexade 2d, vol. ii, p. 190.*

† This must rest on very slight authority, by reason of the district mentioned having been as yet unexplored by a naturalist.

From the whole of his description, it follows, that the region of these calcareous stones, which we shall find prevailing every where west of the Alleghénies, extends in a line north-west beyond Lake Michigan as far as the sources of the Mississippi, and thence to those of the Saskachawan, thus joining the grand chain of the Stony or Chipewan mountains, which is itself a continuation of the cordillera of the Andes: "and it must be observed," says Mr. Mackenzie, that all the great lakes of North America are placed in the line of contact between these vast chains of granite and of limestone." This is a fact in physics, that merits the attention of the philosophical geologist.

Returning to the southward from the river St. Lawrence, granite prevails throughout Steuben county, as far as the Mohawk, the course of which it accompanies, though I cannot affirm, that it crosses it, except at its little fall above Skenectady. We see none at its great fall, that of Cohoz, the bed of which is a serpentine, of the same species as I found at Monticello in Virginia, a species very widely diffused throughout the whole of the chain called South-west Mountain; but it reappears immediately below Albany, on the east bank of Hudson's River, which constantly flows between two rugged declivities, covered with thin copses of oaks and firs.\*

\* Mr. Volney says that the bed of the Mohawk appears to separate the granite from the sandstone country: but the editors of the *Medical Repository* say, this is a mistake, for there is no granite towards the north on the east of the Hudson, in New York; except in that tract called the Oblong or on the western line of Connecticut. Along the eastern part of New York, and western part of Massachusetts, the rock is calcareous, extending from Stockbridge to Vermont.

Twenty miles below Poughkeepsie begin rocky, barren ridges, in a transverse direction, which recalled to my remembrance Corsica and the Vivarais. The road is broken by these for the space of five and twenty miles, and every where they display blocks of greyish granite, disposed in shelves inclined to the horizon at angles of 45 or 50 degrees, and covered with mosses, firs, and other stunted evergreens. The river runs between similar banks as far as West Point, where it has forced the barrier of rocks opposed to its current by the last of these transverse ridges, at the foot of which the Highlands terminate, and are succeeded by the Lowlands, or maritime country.

In the latter, forming a plain as far as New York, the left bank of the river is continually exhibiting ledges of reddish or greyish granite, projecting out of the ground in such a manner, as leads us to presume they run very deep into it.

The mineralogical researches undertaken by Dr. Mitchell,\* sufficiently prove, that the granite traverses the city of New York, and the rivers Hudson and Harlem, and extends to all the first rank of hills in New Jersey. The direction of these ledges, particularly from the boundaries of Connecticut, is from north-east to south-west, being parallel to the coast; their inclination is nearly vertical to the horizon, and their chain is supposed to continue as

They also say, that Mr. Volney may rely upon it, that the bed of the river at the Cohoz is shattered or fragile slate: that the Hudson at the rapids of Fort Miller, and the falls near Fort Edward, descends over rocks of schistus. Even at the Ballstown springs, the Kyaderossas runs over slate.

\* See *Med. Repos.* vols. i. and iii.



far as Vermont. Dr. Mitchell further observes, that the granitic region terminates abruptly on the bank of the Hudson, at Polliples Island, opposite a large rock in Fishkill, twenty miles below Poughkeepsie; and that forty rods farther on commences a schistous region, the schist coming out of the ground on the bank of the river, as if it there formed a bed to the granite. This schist, he adds, serves likewise as a bed to the calcareous strata scattered throughout the country; and mentions a block of this kind a mile from Claverack, and four miles from the city of Hudson on the river of the same name, presenting a prominent mass eight hundred acres in superficies, filled with shells, none resembling which are to be found in the nearest sea, distant a hundred and forty miles!

Dr. Mitchell mentions several calcareous ledges near New York, at the place where the streams separate, some running into the Hudson, others into the Sound, or that arm of the sea that faces Long Island. He imagines, that at a period unknown in history the ocean covered this ground, and his opinion is supported by all the facts he mentions respecting the Kaats Kill Mountains.

These mountains he has found to consist of the same sandstone as Blue Ridge, of which he deems them a continuation. He first imagined these mountains to be of primitive formation, because the granites and sandstones contained no fossils; but he soon found contrary indications: as, 1st, the aspect of rocks containing pebbles or small stones of red and white quartz, sandstone, and red jasper, all evidently rolled and worn by the waters: 2dly, horizontal and very

regular strata of these rocks : 3dly, fossil shells unknown in these seas, the clam and scallop excepted, and found on their summits in an argillaceous or in a siliceous bed.

Out of the granitic region, some exceptions exist, the most remarkable of which are : 1st, the mountains between Harrisburgh and Sunbury on the Susquehannah, composed in great part of granite ; 2dly, a vein of talky granite, or Muscovy glass ; 3dly, numerous blocks at the foot of the south-west chain in Virginia, particularly near Milton on the Rivannah.

## *2. Region of Sandstone.*

The sandstone of Kaats Kill forms the distinguishing character of the second region or diversity of soil, which comprises all the mountainous country of Blue Ridge, Alleghany, and Laurel Hill, the sources of the great Kanhaway, the knot or arch of the Alleghanes, and in general all their chain to the south as far as the angle of Georgia and the Apalachians. The traces of it are lost to the west in the state of Tennessee, and the chain of Cumberland, and its contiguity to the calcareous region cannot be assigned with precision. In the north and north-east its limits appear to be the sources of the Susquehannah, even those of the lakes of Genessee, and in general the right banks of the Mohawk and Hudson. Dr. Barton, who on his return from a journey to Niagara, in 1797, crossed the whole of upper Pennsylvania, never lost sight of sandstone from Tioga to within

nine miles, of Nazareth. Mr. Guillemard, in his journey from Philadelphia to Pittsburg by the way of Sunbury, found it every where till he came to the west of the Alleghanies, called in that district Blue Hills, except in a few calcareous vallies. Lastly, in Virginia, from Charlottesville to the river Gauley, Mr. Volney found it in abundance on the ten or twelve chains he crossed successively, excepting likewise the calcareous valleys of Staunton and Green Briar. Sometimes the sandstone admits the mixture of a milky white quartz, called arrowstone, much of which he found on Blue Ridge going from Frederick Town to Harper's Ferry; and sometimes also with grey quartz, which is the nucleus of Blue Ridge, at the gap made in it by the Potowmac below Harper's Ferry. Some of the rocks of this gap are of granite, but these are few in number.

These mountains of sandstone are not so bare, as the nature of this stone might lead us to suppose. Their loftiest summits in Virginia between the rivers of Green Briar and Gauley are covered with fine trees, and tall perennial plants, growing in the excellent black Kentucky mould, which is the distinguishing characteristic of the Western country. The lofty region, that extends above Fort Cumberland beyond the sources of the Potowmac to those of the Yohogany, and which is known by the name of Green Glades, is a real Switzerland, very rich in pastures, the vigour of which is maintained throughout the summer by clouds, mists, and drizzling rain, which at this season are wanting in the plain. This advantage is owing to an elevation of about 700 yards, as was before observed; but it does not extend to

the chains of Gauley and Laurel Hill, which are rocky and dry.

Toward the north-west, that is on the side of the lakes of Genessee, Ontario, and Erie, the sandstone terminates in a region of slaty schist and blue marle, which is pretty extensive, for it appears to form the bed of these lakes, as appears from soundings taken in them, and the stones at their bottom and in their banks. They extend even over the beds of coal in West Pennsylvania. This marle is full of fossil shells. Ledges of these schists are found again at Niagara, and all along the St. Lawrence, as far as Quebec. We have seen too, that they pave the bed of the upper part of the Hudson. These are their most extensive known domains; elsewhere they are seen only in small patches.

Besides this vast region of sandstone, some districts of the same nature may be mentioned dispersed through the granitic and calcareous regions; but there in turn they form exceptions. Such is that of the county of Worcester in Massachusetts, the most extensive of the kind known. This cannot be referred to the Alleghanies, unless its continuity across the rivers and country of Connecticut and the Hudson could be shown.

### 3. *Calcareous Region.*

The third region, that of calcareous earth, includes all the Western or Back Country, lying behind the Alleghany mountains, and extends north-west, according to the information of Mr. Mackenzie, across the rivers and lakes to the sources of the Sakatchie, and the chain of the Chipewyan mountains. All of

this country from the Tennessee to the St. Lawrence, between the mountains and the Mississippi, has for its nucleus an immense stratum of limestone, disposed nearly in a horizontal direction, in laminæ of one or more inches thick, of a close smooth grain, and generally of a grey colour. In the north the limestone is of the crystallized kind, called primitive.

It is shallowest on the risings and heights, where it occasionally does not exceed six or eight inches. This circumstance, as well as the laminated structure of the stone, evidently indicate an anterior operation of the waters of the ocean.

In the country about Pittsburg on the Ohio, in the county of Green Briar on the Kanhaway, and throughout Kentucky, this fundamental stratum is found on boring; and it is seen bare in the beds of all the rivers and brooks of Kentucky, from the Kanhaway to the falls or rapids of the Ohio near Louisville.

From Louisville to White River, where it abruptly terminates, Mr. Volney likewise found all the rivers and brooks flowing over the bare limestone stratum of Kentucky. Some American travellers, on seeing his specimens, have assured him, that the Holston, or north branch of the Tennessee, had a similar bed.

The rocks that form the falls or rapids of the Ohio below Louisville belong to this great limestone stratum, on the surface of which many petrifications have been collected at low water, but they were brought thither, and not imbedded in it.\* Mr. Vol-

\* See the account of the river Ohio for a correction of this error.

ney never saw any fossils encrusted in the substance of the great subterranean stratum, a fact at which he was the more astonished, as, at Francfort, walking on the summit of a chain about a hundred feet above the level of the little river Elkhorn, which pierces it, he found in the wood a number of large stones, entirely made up of fossil shells, which, according to the celebrated Lamarck, uniformly live in the depth of the ocean, and never on its shores! At Cincinnati, on the second bank of the Ohio, he found more such stones full of shells: and Dr. Barton collected similar stones on the heights of Onondago, in the state of New York, at the distance of near six hundred miles.

Beside the region just described, there exist only two calcareous districts, that are of sufficient extent to be worth mentioning as exceptions: one in the long valley formed by the chains of Blue Ridge and North Mountain, from the Delaware above Easton and Bethlehem to the source of the river Shenando, and even beyond James River, to the great arch of the Alleghanies; for the county of Botetourt, which occupies the part last mentioned, is called the Lime County, in consequence of its supplying with lime all the country east of Blue Ridge, where there is none. Rockbridge too is in great part calcareous, as well as all the country from the Shenandoah to the Potowmack.

Another part of the valley, that which extends from the Potowmack to the Susquehannah, comprises the basin of the rivers Great Connegocheague and Conedogwinet, in which are the territories of Chambersburg, Shippensburg, and Carlisle, celebrated for

their fertility. A third portion, reaching from the Susquehannah to the Delaware, occupies the basin of the river Swatara; traverses, with some interruptions, the branches of the Schuylkill; and terminates near Easton and Nazareth, the land about which is likewise in repute. Its mountainous boundary to the north east is the ridge of Kittatinny, a continuation of North Mountain; and to the south-east the ridge known in that country by the several names of South Mountain, Flying Hills, and Oley Hills, but which is a direct continuation of Blue Ridge. This circumstance of their bounding one and the same calcareous valley, from the Alleghany arch to Easton, by two lateral chains, is itself a proof of their continuations.

The other calcareous district, which is contiguous to this, extends along the back of Blue Ridge on the east, from the gap made by the Potowmack to the neighbourhood of the Schuylkill in the county of Lancaster. It is limited precisely on the south-west and south by the Potowmack and the bed of the great Monocacy, which it does not cross to the east: comprises the territory of Frederickstown, the greater part of the course of the Patapsco, and the counties of York and Lancaster, which are justly considered as the granaries of Pennsylvania: and lastly appears to lose itself between Norristown and Rocksbury on the Schuylkill. The remainder of its boundary, from the Monocacy to the Schuylkill, is not marked by heights, though it is a point of division of several waters, and does not give this district the appearance of a valley, which is observed in the other calcareous regions.

There are two striking differences between the

limestone of the west, and that of these two districts to the east: the first is, that the substance of the calcareous strata in the east is generally of a pretty deep blue colour, interspersed with numerous white veins of quartz; while the substance of the great calcareous stratum in the west, particularly in Kentucky, is of a grey colour, and a homogenous and foliated texture.

The second difference is, that the stratum in the west is nearly horizontal, forming a kind of general table under the whole country: on the contrary in the east, there is in the counties of Botetourt, Rockbridge, Staunton, Frederick, York, Lancaster, and as far as Nazareth, the limestone generally lies in a state of confusion, and as it were jumbled together by violence: with this singular trait, that in the valley between the North Mountain and Blue Ridge the angle is always less, that is below 45 deg. while in the counties of Lancaster, York, and Frederick, the mountains excepted, it is more habitually above 45 deg.; which refers also to all the other strata, whether of granite or sandstone, viz. being less inclined in the mountains, than as they approach the sea. At the cascade of the Schuylkill, near Philadelphia, the inclination of the strata of talcky granite is 70 deg. on the Hudson it reaches as far as 90 deg.\*

From these last-mentioned facts we are authorised to conclude, that the whole of the Atlantic coast has been deranged by earthquakes, while the country west of the Alleghanies has not been disturbed. Dr.

\* The difference in the position of the strata on the east and west sides of Alleghany has been often mentioned before Volney, and is particularly noticed in the *Columbian Mag.* Philad. 1786.



Barton too informs us, that the aboriginals of the west have no words in their languages to express earthquakes and volcanoes, while equivalent terms are common and familiar in the dialects of the east.\* With earthquakes volcanoes are commonly connected, and in fact, abundance of basaltes is found in the Alleghany mountains and their valleys.

Fossil shells too, have been observed in the primitive limestone in the environs of lake Ontario and Niagara.†

Veins and ramifications of limestone might be mentioned also out of these principal regions. There are some in the district of Maine, which supply Boston with lime. Rocky Point, in lake Champlain, is of limestone, as are no doubt other parts in that lake: so are several districts in the neighbourhood of New York: but the most singular instance I am acquainted with in the southern states is that of a ridge, the breadth of which is not above fifteen yards at a medium, and sometimes does not exceed three, though it extends above two hundred miles, from the Potowmack to the Roanoke. As this vein is commonly on the surface, it may be traced with the more certainty, because it is the only one that supplies all the flat country with lime. Its distance from Red Ridge or South-west Mountain, to which it runs parallel, does not exceed from three to five miles.

\* It is well known that an earthquake happened in the Kaskaskias in 1795, the year Mr. Volney arrived in the United States. Pumice stone too, which is undoubtedly a volcanic production, (see 2d vol. of this work, p. 49,) has been found floating down the Missouri, and travellers assure us, that a volcano actually exists up that river. On the Ouachita volcanic productions are very common.

† Liancourt's Travels, vol. ii.

#### 4. *Region of Sea-sand.*

The fourth region, formed of sea-sand, comprises all the shore from Sandy Hook, facing Long Island, as far as Florida. Its inland boundary is a stratum or ridge of talcky granite, called foliated stone, or Muscovy glass, or glimmer, which runs constantly in the direction of the coast, that is to say north-east and south-west. This ridge or stratum commences from the extremity of the granitic chains on the right bank of the Hudson, perhaps even from the shore facing Long Island, whence I presume the rocks are continued underneath the sea; and it extends as far as North Carolina beyond the Roanoke, in the form of a slender ridge, from two to six miles broad, and nearly five hundred long. This ridge, as Evans very justly observed, every where marks its course, by the falls, which it occasions in the rivers before they reach the sea; and these falls are the extreme limits of the tide. Thus this talcky ridge cuts the Delaware at Trenton, the Schuylkill four miles above Philadelphia, the Susquehanna above Octorara creek, the Gunpowder above Joppa, the Patapsco above Elk Ridge, the Potowmack at George Town, the Rapahannock above Fredericksburg, the Pamunky below its two branches, fifty miles above Hanover, the James at Richmond, the Appamatox above Petersburg, and the Roanoke above Halifax. No fossils have been observed throughout this stratum.\*

\* The river Hudson is a remarkable instance of the reverse of Mr. Volney's position: for, according to the editors of the *Med. Reges*, of

The land between it and the sea, varying in breadth from thirty to a hundred miles, is evidently sand brought by the ocean, which formerly had for its shore this ridge itself. At the mouths of the rivers, and on their banks, some argillaceous earths, brought down from the mountains by their inundations, form with this sand a fertile mixture. Evans the geographer has even discovered a subterranean stratum of yellow clay, three or four miles broad, placed longitudinally between the ridge and the shore, which, giving firmness to the adjacent sands, renders them fit for making good bricks, as we see at Philadelphia. These two cases excepted, the sand is the same as that of the neighbouring sea, that is to say white, fine, and in depth reaching as far as twenty feet.

Peter Kalm, who travelled through this country in 1742, observes that in Pennsylvania and New Jersey the strata are as follows :

- 1st, Vegetable mould, ten or twelve inches:
- 2d, Sand mixed with clay, six or seven feet:
- 3d, Gravel and smooth pebbles, among which are oysters and clams, such as still exist on the coasts, from three to five feet:

New York, the tide of that river proceeds beyond Albany, 170 miles higher than the layer of granite. Mr. Volney ought not to have included the whole of Long Island in the maritime alluvium: as the true point whence the region of sea-sand and water worn pebbles ought to be reckoned, is its longitudinal hills. The same may be said of Staten island. The well-defined secondary strata begins from the southern part of these hills. These elevations themselves, and all the land to the north of them, belongs to his third division or mountain tract. A similar inattention to the track of the sea coast from New York through Jersey, has been pointed out by the editors of the *Med. Repos.* Hexad. 2<sup>d</sup>, vol. 2<sup>d</sup>, p. 191.

4th, A stratum of black offensive mud, full of osiers and trunks of trees, the thickness of which he does not mention. This stratum is found at Philadelphia between fourteen and eighteen feet deep,\* at Raccoon in New Jersey between thirty or forty feet; at the city of Washington Mr. Volney saw it eighteen feet deep at the house of Mr. Law, whose well it spoiled :

5th, Under all these strata is a bed of clay, by which the waters are retained.

### 5. *Region of river Alluvions.*

In the division of the soil of the United States, Mr. Volney has followed the excellent arrangement of Dr. Mitchell in the survey of the state of New York, but he has omitted, without reason, an account of the slate or schistus which is so abundant and characteristic in many places, particularly in New York, where there is a continuation of schistus from the Highlands to Fort Edward, a distance of one hundred and forty miles.

The fifth and last region, is the country that rises in undulations from the ridge of the falls, to the feet of the mountains of sandstone or granite. Its limit is less easily traced in Georgia, where the talcky ridge does not appear. This region is marked by its undulations, consisting in some places of isolated risings, in others of ridges of little hills; and by its soil being composed of different kinds of earth and stones, in

\* It is to be understood that this is by no means general.

some places jumbled together, in others arranged in strata, which are interrupted or succeed each other several times from the mountains to the coast, but constantly exhibiting the marks of matters rolled down by the waters from the declivities above: and this is in fact the origin of all this country.

When we calculate the bulk, rapidity, and number of all its rivers; the Delaware, the Schuylkill, the Susquehannah, the Potowmack, the Rappahannock, the York, the James, &c.: when we observe, that the streams of most of them are from 1200 to 4000 yards broad, and from twenty to fifty feet deep, long before they reach their mouths; and that in their annual inundations they sometimes overflow the flat country to the depth of twenty feet; it is easy to conceive that such bodies of water must have occasioned prodigious changes in the soil, particularly, when in remote ages loftier mountains gave more impetuosity to their course; when the trees of the forests, swept away by thousands, added force and materials to their ravages; and when ice, accumulated during winters of six or seven months continuance, produced enormous floating masses on its breaking up, such as those of which the Susquehannsh afforded an alarming spectacle in 1784, in which year a mound of ice more than thirty feet high was heaped up at Maccall's Ferry, below Columbia, and was on the point of drowning the whole valley. At the period when the waves of the sea washed the feet of the mountains; as its residua, which are found there universally, prove beyond doubt it once did; these mountains

being loftier, because they had yet lost no part of what the lapse of ages and the repeated fall of waters has taken from them, rendered the action of these waters much more forcible by their height and steepness; their colder summits were covered for a longer time with more copious snows, and larger fields of ice; and when the heat of summer, of less duration certainly, yet not less intense, melted this ice and snow, the torrents thus produced tore up the declivities best furnished with earth, hollowed out deeper gullies, and carried along with them ample spoils, which accumulated on the lowest steps of the mountains. Every succeeding year fresh fragments came to choke up the tracks of former years; and the torrents, stopped by mounds of their own raising, acquired fresh strength as they increased in volume, and, attacking them in several points, forced their way through them in the most feeble. The waters then opened for themselves new and varying tracks through the softest mud, for the heaviest substances would always remain behind for want of slope and impulsive force; and by these processes, repeated for ages, the ancient beds of torrents became valleys; the former shores and alluvions became coasts and plains; and the rivers, descending from level, to level, leaving their heaviest burdens on slope after slope, depositing in succession the lighter and more soluble, incessantly encroached on the domains of the ocean by accumulations of sand, mud, pebbles, and trees, which served to connect the other materials together.

Even in the present day the Mississippi exhibits to

us an instructive spectacle of all these grand operations. It is calculated by Liancourt, that in the space of fourscore years, from 1720 to 1800, it has encroached upon the sea about fifteen miles; thus under the eyes of three generations it has created at its mouth a new country, which it increases every day, and in which it lays up beds of coal for future ages. Such is the celerity of its accumulative process, that at New Orleans, a hundred miles\* above its present mouth, a canal lately cut by the governor, baron Carondelet, from the river to lake Pont-Chartrain, has brought to view an interior bed of earth, formed entirely of black mud and trunks of trees, heaped together several feet deep, which have not yet had time either to rot or to be converted into coal. Both banks of the river wholly consist of trunks of trees thus agglutinated by mud for a space of more than three hundred miles; and the waters have heaped them up to such a height, that they form a mound from twelve to sixteen feet higher than the adjacent land, which is generally lower; and at the annual rise of the river, which is about twenty-four feet, the exuberant water, being unable to re-enter the channel, forms vast and numerous marshes, which will some day become the source of wealth, but are at present an obstacle to agriculture and population.\*

Mr. Dunbar of Natchez, also observes, that in the valley opposite to that town, upwards of thirty miles wide, no other soil is discovered but that which is daily deposited by the waters of the Mississippi, and

\* See Volney's View, p. 74.

hence concludes that this valley has in the beginning been a branch or inlet of the ocean, which received into its bosom this great river. All this prodigious space is now filled with soil more or less solid, and at Natchez is 100 feet above the level of the sea !\*

Of the alluvial nature of the soil of many parts of our continent there are additional proofs.

On the shores of York river the bones of whales abound ; and in walking the sand beach of that river, during the recess of the tide, and looking up at the high cliff or bank above, we find strata of sea shells not yet decomposed, of the same kind as those which lay on the beach under the feet, interposed with strata of earth (the joint result, no doubt, of sand and putrid vegetables), exhibiting at once a sample of the manner in which the adjacent soil had been formed, and proof of the comparatively recent deposition of the waters.†

The noble hill on which the Capitol or Congress House at Washington has been erected, is more than eighty feet above the level of the tide-water, and about sixty or seventy above the level of the adjacent or low ground. In all probability this high ground formerly extended much nearer to the channel where now the Potowmack runs ; and it is equally probable that, in distant ages, the bed of that stream was not near so deep as it is at present, nor capable of containing so much water. Consequently, in the remote ages alluded to, all the low land between the

\* Trans. Amer. Phil. Soc. vol. vi.

† British Spy, let. 2d.



Capitol hill and the Potowmack, including the shores of Goose creek, and the tract along Pennsylvania avenue, towards the elevation on which the President's house stands, may be considered as having been covered by water, and brought by the action of that fluid to its present form. Gradually, however, as the channel deepened, the water withdrew to its bed, narrowed its course, and left the intervening surface bare.

As a proof of this, it is observed that all the strata of earth hereabout are horizontal, and all the stones and pebbles they consist of are rounded, and appear to be water worn. This is the case every where on the eastern branch of the Potowmack, and the parts of the city which have been dug away for the purpose of making streets, avenues, and buildings.

But the most remarkable fact is, that even the base of the Capitol hill is underlaid with a stratum of muddy clay, in which wood and parts of trees have been discovered. During the summer of 1803 a well was dug in New Jersey avenue, to the depth of near fifty feet. After passing through about thirty feet of gravel and sand, and through about eighteen feet of dusty and fine argillaceous mud, trunks and branches of trees were found lying plentifully below. Many pieces of these were broken and hoisted up.

Their vegetable organization is very evident; and their clefts and crevices are filled up with veins of pyrites. The wood, as commonly happens when mixed or impregnated with pyrites, is turned to a blackish colour, somewhat resembling coal. But this carbonated state of the wood, being evidently caused

by sulphuric acid formed from the decaying pyrites, and the sulphur, as far as it is already saturated with oxygen, being no longer inflammable, this mineralized wood burns very slowly, and is wholly unfit for fuel.

Thus, among the curiosities of the high and commanding scite of the Capitol, may be reckoned the existence and discovery of fossil and mineralized wood almost fifty feet below its present surface.

Near the twenty buildings, and within the square on which the new church is erecting, a piece of wood was brought up from the bottom of a well forty-five feet deep. This spot is half a mile distant from the former. The wood is in its entire state, and neither petrified nor mineralized. It is perfectly sound and well seasoned; and on cutting it there appears to be no doubt that it is black walnut.\*

In digging the Santee canal in South Carolina, two sharks teeth were found, one of which is four inches long, by three and 3-4 broad, measured at its base; the other is two inches and 1-8 broad, and the same dimensions in length. They are now in the cabinet of the Philosophical Society of Philadelphia, and while they serve clearly to prove the fact now contended for, they at the same time enable us to shew with what little foundation the scavans of Europe assert that nature has acted upon a contracted scale in this quarter of the world. I have seen smaller teeth of the shark which were dug up near the creek of Mountholly in New Jersey many feet below the surface.

\* Med. Repos.

“ It is a fact well known, says Mr. Morse, that marine shells and other substances, which are peculiar to the sea-shore, are almost invariably found in the southern states, by digging eighteen or twenty feet below the surface of the earth. A gentleman of veracity told the author, that in sinking a well many miles from the sea, he found, at the depth of twenty feet, every appearance of a salt marsh, that is, marsh grass, marsh mud, and brackish water. In all this flat country, until we come to the hilly land, wherever a well is dug, water is found at a certain depth, fresh and tolerably good ; but if we exceed that depth, two or three feet, we come to a saltish or brackish water that is scarcely drinkable ; and the earth dug up resembles, in appearance and smell, that which is dug up on the edges of salt marshes.

On and near the margin of the rivers are frequently found sand hills, which appear to have been drifted into ridges by the force of water. At the bottom of some of the banks in the rivers, fifteen or twenty feet below the surface of the earth, are washed out from the solid ground, logs, branches and leaves of trees ; and the whole bank, from bottom to top, appears streaked with layers of logs, leaves and sand. These appearances are seen far up the rivers and from eighty, to a hundred miles from the sea, where, when the rivers are low, the banks are from fifteen to twenty feet high. As you proceed down the rivers towards the sea, the banks decrease in height, but still are formed of layers of sand, leaves and logs, some of which are entirely sound, and appear to have been suddenly covered to a considerable depth.

It has been observed, that the rivers in the southern states frequently vary their channels; that the swamps and low grounds are continually filling up; and that the land, in many places, annually infringes upon the ocean. It is an authenticated fact, that no longer ago than 1771, at Cape Look-out, on the coast of North Carolina, in about latitude 34 deg. 50 min. there was an excellent harbour, capacious enough to receive a hundred sail of shipping at a time, in a good depth of water. It is now entirely filled up, and is solid ground. Instances of this kind are frequent along the coast.

It is observable, likewise, that there is a gradual descent of about eighteen hundred feet, by measurement, from the foot of the mountains to the sea bound. This descent continues, as is demonstrated by soundings far into the sea.”\*

Whatever may have been the cause of the inequalities at present existing on the surface of the globe, observation teaches, that the hills and mountains are generally in a crumbling condition, and descending gradually to the plains below. The chief agents in this process, which are incessantly changing the face of things, are, 1. The undermining of waters. 2. The washing of rains and torrents; and 3. The irresistible force of frost.

The undermining operation of the ocean water, is very evident on the south side of Monauk point at the east end, and on both sides of Cow-bay on the

\* In confirmation of Mr. Morse's assertion, it may be mentioned, that the gradual descent is very observable from the valley of Natchez to the coast of the bay of Mexico.—See Mr. Dunbar “on the Mississippi.” *Trans, Amer. Phil. Soc.* vol. 6.

north side of Long island, and in many other places which it would be easy to enumerate. Instances of the effect of streams and rivers, in altering the disposition of the solid materials through which they run, occur at Passaic falls, above Second river in New Jersey, where huge masses of rocks are evidently misplaced; at Kaat's Kill, where part of a hill has fallen down; and in various places in the Blue mountains, where, after the more soft, moveable substances that had lain below, have been carried off by the rains and floods, solid fragments of the materials that are deprived of their support, tumble down, and seek the level of the plains.

By the force of waters, descending from hills and mountains, the firm materials forming the channels and sides of the streams, are incessantly wearing away. Sandy and moveable matters washed by rains from the mountain tops, leave the more durable rocks behind, in all their rudeness and nakedness. Whatever of saline, earthy, metallic, or inflammable, the soil of the upland contains, is thus floated or rolled along to the low lands, and constitutes with proportional diversity and mixture, the intermontane soil. The bars of arenaceous matter off Sandy Hook, where the Hudson joins the Atlantic, and, at the disembogement of most great rivers, are plain confirmation of this procedure, as are the shallows between the bays of Tappan and Haverstraw, and the overslaughes in the neighbourhood of Albany. Alluvial deposits of this nature will necessarily be as various as are the ingredients of soil which they wash. Accordingly, where clay, in large quantity, has been suspended in, and diffused through water, it has formed on its

deposition vast strata, which underlay great tracts of level country. Thus the flat, between the Basaltic rocks and Stony point at Haverstraw, appears to be wholly underlaid by argillaceous strata. Much of the level country between Red Hook, and Greenbush, is evidently bottomed on a stratum of clay. The tract between Albany and Schenectady, has a stiff and thick layer of clay beneath. The same remark applies to the space lying for some miles beyond the Mohawk river, toward Ball-town springs; and to the great collection of similar earthy matter, lying westward along the flat country, between the upper falls and fort Stanwix. It would be easy to give other instances of extensive argillaceous alluvia.

In several spots along the shores of the Hudson and the Mohawk, the ferruginous sand which may be collected in considerable quantities, affords evidence enough of the abrasion of iron from the places where iron ore abounds. Bogore (ferrum tubalcane) has evidently been deposited where it now abounds, by the operation of similar causes, rather than from the decomposition of organic matter.\*

\* Dr. Mitchell.

CLIMATE OF THE UNITED STATES,  
IN GENERAL.

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IN a country so extensive as the United States, the various causes which are known to affect the climate, independently of latitude, may necessarily be supposed to operate to a considerable degree; and hence we find as great a diversity in that respect, as is experienced by any country of similar extent, in the world.

Several authors in this country, have given very accurate accounts of the climates of different states, but Mr. Volney is the first person who has attempted to treat the subject of our climate upon a general scale, and as he has exhibited much ingenuity and judgment in his discussion, his division shall be adopted upon the present occasion.

Mr. Volney observes, that a very perceptible gradation is observable in the climate of the United States, with respect to their latitudes, and still more with respect to the level of the surface, in which certain peculiar characteristics lead him to distinguish four principal divisions:

The first, that of the coldest climate, includes the north-eastern states, or New England, the natural boundary of which is traced by the southern side of Rhode Island and Connecticut, on the ocean; and in-

teriorly by the chain of hills, that furnishes the waters of the Delaware and Susquehannah.

The second, or middle climate, applies to the central states, that is, the south of New York, Pennsylvania, and Maryland, as far as the river Potowmac, or more properly, the river Patapsco.

The third, that of the hot climate, comprises the southern states, or the flat country, of Virginia, the two Carolinas, and Georgia, as far as Florida, where frost ceases to be known in the latitude of 29 degrees.

The fourth, is the climate of the western states, Tennessee, Kentucky, and the territory north-west of the Ohio, lying behind the Alleghany chain, and on the west of the preceding states.

To these climates might now be added that of Louisiana, but the description of that country shall be given in a separate article.

It had been commonly remarked by philosophical observers, that the climate of the Atlantic coast was several degrees colder in Winter than that of the same parallels in Europe, or even of Asia and Africa on the basin of the Mediterranean sea; and in Mr. Volney's opinion, the temperature in Summer is generally several degrees hotter there.

In the northern parts of New England, says Mr. Volney, in the mean latitude of between 42 and 43 deg. Observations made at Salem near Boston, during the space of seven years, by Mr. Edward Holyoke, and compared with twenty years observations collected at Manheim, show the climate of Salem to be both colder in Winter, and hotter in Summer, than that of several cities in Europe.



By his table it appears, that at Salem, the difference between the extremes of heat and cold is 51 degrees, while at Rome it is only 24 degrees, at Marseilles 29 degrees, and at Padua 39 degrees.

In general, in the states of Maine, Vermont, New Hampshire, and even Massachusetts, all situated between the latitude of 42 and 45 degrees, that is, corresponding to the south of France and the north of Spain, the ground is sufficiently covered with snow for three or four months in Winter, to render the use of sledges general and habitual.

The thermometer, which varies at that season, from the freezing point to 8 or 10 degrees below, sometimes falls to 12, 14, or even 18 deg. below 0, of Fahrenheit.

In these very states, of Maine, Vermont, New Hampshire, &c. the intensity of the heat, reckoning from the Summer solstice, is equally excessive. For forty or fifty days, the quicksilver is frequently seen to rise to 21 and 22 degrees of Reaumur, and sometimes to 24 or even 26 degrees. There are few years in which it does not rise as high as 30 and 31 degrees at Salem,\* which is the temperature of the Persian gulf, and the coasts of Arabia. It is equally intense in many other parts of New England, where observations have not been made : at Rutland already mentioned, Mr. Williams has seen the quicksilver at 27 degrees of Reaumur.

\* Mr. Volney has no authority for this assertion.

But what will appear more surprising, is, that at Quebec, and even as far north as Hudson's bay, at Prince of Wales' and York forts, in the latitude of 59 degrees, a heat from 28 to 31 degrees is experienced for twenty or thirty days, which is so much the more oppressive as the body is not accustomed to it, and it is accompanied with a dead calm, or a hot and moist breeze from the south which is suffocating. Now, as in Winter the thermometer in these countries falls as far as 30 and 32 degrees below the freezing point, and even to 37 degrees at Prince of Wales's fort, we have here a scale of variation from heat to cold of 60 or 66 degrees of Reaumur.

In the middle states, as the south part of New York, all Pennsylvania, New Jersey, and Maryland, the Winters are shorter, and the snow less copious, and less permanent, seldom continuing more than fifteen or twenty days; but the cold is neither less rigorous nor less piercing. It commonly sets in about the Winter solstice, and continues severe for six or seven weeks, but it begins to be felt as early as the end of October.

At Philadelphia, for instance, in the latitude of 39 deg. 55 min. which answers to that of Madrid, Valencia, Naples, &c. the thermometer is several days, every Winter, at 8 and 10 degrees below the freezing point; and sometimes down to 12 or 14 degrees below it; nay, two Winters following, those of 1796 and 1797,\* it was as low as 17 and 18 degrees, several days successively.

\* Mr. Volney's statement here is correct. On the 6th of December, 1797, after a very stormy day, the Delaware was frozen com-

The cold is, at these times, so piercing, that, notwithstanding the motion of a tide that rises and falls six feet, the Delaware, which is here a mile broad, is frozen over in twenty-four hours; and it continues so obstructed for twenty, thirty, and, sometimes, forty, days; but at two or three different times: for, every Winter, there are two or three thaws, particularly between the thirtieth and fortieth days after the solstice.

In 1788, the thermometer fell, in one night, that of the 4th of February, from 2 1-2 degrees below the freezing point, to 16 1-4 degrees, and the river was frozen hard by the evening following.

In 1764, between ten o'clock at night, on the 31st of December, and eight o'clock the morning following, it was frozen so hard, that people could walk across it. In this almost sudden conversion from a fluid to a solid, a smoke or vapour, says Dr. Rush, was seen to rise from its surface, in such abundance, that people assembled, in astonishment, to contemplate the phenomenon.\*

From these extremes we have a scale of variation for the middle states of 46 or 48 degrees. Dr. Rush was one of the first who observed, that the climate of Pekin was most analagous to it; and on pursuing the

pletely over, for many miles above and below Philadelphia, and remained closed for about three weeks.

\* This *frost smoke* was explained in the account of Greenland, and referred to the difference between the temperature of the air and water. The reader will find a set of original experiments on this curious subject, in the *Med. Repos. Hexade 1st*, vol. iv, and *Hexade 2d*, vol. ii, p. 444, and the principle upon which the appearance depends, reduced to a rule in nature.

comparison, we find, that North America has striking resemblances, not only in climate but in soil, with the north of China, and the adjoining country of Tartary.

In the southern states, as Virginia, the Carolinas, and Georgia, the duration and intensity of the cold diminish, in pretty regular proportion, to the latitude. The course of the Potowmac, or more precisely that of the Patapsco, forms a striking line of demarcation in this respect. Here the domain of snow terminates; and the traveller coming from the north, who had hitherto seen sledges at the door, or in the court of every farm, perceives not another after he has descended the steep hill, at the foot of which the Patapsco flows; but inland, toward the Blue Ridge, the snow prolongs its limits a little; in consequence of the elevation of the ground. This coast, however, has pretty sharp attacks of frost in the forty days succeeding the Winter solstice. On the contrary, on all the coast beyond the Potowmac, the heat, from a month before the Summer solstice, is so great, that, during the space of four months, the quicksilver commonly rises, in the afternoon, to 22 or 24 degrees of Reaumur, notwithstanding a gentle sea-breeze. It rises even to 32 and 33 degrees at Savannah; which is much higher than in Egypt, where 25 degrees is the common term, in the shade; not to mention, that a constant brisk wind, and very dry air, contribute to render this degree of heat supportable there. On the 17th of July, 1758, Mr. Henry Ellis observed the quicksilver at 31 degrees, at Savannah; and he complained, that for several nights it did not sink below 29

degrees. In his cellar it stood at 21 degrees,\* and under his armpit at 29 degrees. Dr. Ramsey, who made a series of observations at Charleston, saw it rise to 28 1-2 degrees only once in five years; but Charleston, built at the mouth of a little river agitated by the tide, enjoys the sea-breezes, and has so much the reputation of a cool place, compared with the rest of the country, that all the planters, in easy circumstances, repair thither in Summer, leaving only the negroes on their estates.†

From these facts, we have, for the southern states, a scale of variation of 32 or 34 degrees; and, no doubt, the reader has observed, that this scale is in a decreasing ratio from north to south. It was 66 degrees at Hudson's bay, 51 degrees in Massachusetts, 48 degrees in Pennsylvania, is reduced to 35 or 36 degrees in Carolina, and, if we were to proceed farther towards the tropics, we should find, in many places, only 18 or 20 degrees, of annual variation. At Martinico, for instance, Porto Rico, and others of the windward islands, the thermometer, owing to the prevailing breezes, does not rise higher than 28 or fall lower than 10 degrees above 0. On the chain of mountains in the province of Caracas, in the latitude of 10 degrees north, at an elevation of more than a mile and a half above the level of the ocean, the quicksilver fluctuates between 10 and

\* See the American Museum, vol. v. p. 151.

† Heat and cold are relative terms. Charlestown is certainly cooler than the country, but the chief inducement for the planter to leave his farm is to avoid the exhalation from the rice swamps.

21 degrees above the freezing point: at Surinam, near the sea-coast, its range is from 15 to 27 degrees. Accordingly, travellers, coming from these latitudes in Summer, find the heat grows more insupportable as they proceed northward.

It is true, that, on approaching the Alleghanies, and still more on ascending their summits, the air, being brisker and more elastic, renders the heat more agreeable, though there it is frequently scorching. But, in general, in what are called the temperate zones, particularly in low and damp places, it is more disagreeable than what are termed hot countries: and it is also a fact, that the climate is more equal in the torrid zone, than in the temperate zones; and would be more favourable to health, and to the vital power, were not the air frequently corrupted by the exhalations from stagnant waters, and from substances in a state of putrefaction; and did not foreigners, in particular Europeans, carry with them that greediness of animal food, and abuse of spirituous liquors, which heat will not allow with impunity.

Mr. Volney objects to the practice, and with propriety, of the English and American meteorologists, who, when they mention these extremes of heat and cold, are accustomed to deduce from them a mean term. A better mode of estimating the fundamental temperature of a country would be that proposed by Mr. Williams, who takes, as the basis of this temperature, the natural and permanent warmth of the earth; the measure of which he seeks in the air and water, either of wells or of the deepest caverns,

and on this occasion he mentions facts that deserve to be noticed.\*

	Reaumur.	Fahrenheit.
At Rutland, in Vermont, he found the temperature of wells, at the depth of 45 feet . . . . .	5 1-4 deg.	44 deg.
In different places in Mas- sachusetts . . . . .	7 1-2	49
At Philadelphia . . . . .	9 1-5	53
In Virginia, according to Mr. Jefferson,† it is . . . . .	11	57
At Charlestown, according to Dr. Ramsay, it is . . . . .	14 ‡	63

In this table we see a gradation proportionate to the parallels of latitude, which agrees with the experiments of Mr. De Saussure, to refute the old doctrine of a mean temperature of 10 degrees throughout the globe, and to prove, that the heat of every place is in the ratio of the latitude, or more precisely of the action of the sun on the ground, to which heat is imparted by its rays.

The daily variations are greater and more abrupt on the Atlantic coast, than in Europe.

The excessive variations on the Atlantic coast, are not confined to the seasons; they take place like-

\* History of Vermont, p. 42. Mr. Volney might have referred to the elder authority of Kirwan for the idea of determining the point by the heat of wells.

† See Notes on Virginia, p. 33.

‡ Humboldt found the same degree in South America.

wise from one day to another, nay, very frequently, in the course of the same day. This is observed particularly in the middle states, as Maryland, Pennsylvania, and the south part of New York, and more in the flat country than on the mountains: no doubt, because these middle states, placed between two opposite atmospheres, that of the pole and that of the tropics, are the theatre of the perpetual contest between the large masses of cold and hot air.

It appears that the climate of Pennsylvania, says Dr. Rush, is a compound of most of the climates in the world. Here we have the moisture of Britain in the Spring, the heat of Africa in Summer, the temperature of Italy in June, the sky of Egypt in the Autumn, the cold and snows of Norway, and the ice of Holland, in the Winter, the tempests, in a certain degree, of the West Indies in every season, and the variable winds and weather of Great Britain in every month of the year.

In the course of our Winters, the Doctor farther observes, particularly in January and February, there frequently happen variations of 14, 18, and even 28 degrees of Fahrenheit, from cold to hot, or from hot to cold, in less than eighteen hours, by which the health is considerably affected. In four and twenty hours between the 4th and 5th of February, 1788, the mercury fell from 37 to 4 1-2 degrees below 0, a difference of 41 1-2 degrees. At other times, the south and south-east winds, bringing on a heat of 54 or 58 degrees, occasion a sudden thaw; and this temperature, continuing for some days, has been known to induce premature vegetation, and occasion peach-trees to blossom in the month of February;



but as the cold does not really finish before April, frosts never fail to come on with north-east and north-west winds, reproducing the alterations I have already mentioned.

Similar variations take place in Summer, and piercing cold succeeds almost every night the violent heats of the day. It is even observed, that the higher the mercury rises in the afternoon, the more it falls in the morning at day-break, for these are the two extremes of heat and cold. After a day in which the mercury has stood at 86 and even 90 degrees, it sometimes falls, in the course of a single night, to 65 or even 60 degrees. The mercury from 80 generally falls to 68 degrees; while it descends when at 60 only to 56 degrees. These falls of the quicksilver occur particularly after storms of rain and thunder; in the Summer of 1775, on such an occasion, it fell 20 degrees, in the space of an hour and a half. In general, there are few evenings on which a fire would not be agreeable, except during the months of July and August. These variations are not so striking in upper Pennsylvania, toward the sources of the Susquehannah, and on the plains of the Alleghanies; there the cold, in Winter, is more settled, the heat, in Summer, is less intense, and, no doubt, the quality of the air renders it more supportable than in our lower country, where the atmosphere is moist and dense.

What Dr. Rush here says of Pennsylvania, which is equally applicable to the southern part of New York, to New Jersey, and to Maryland, is applicable with very little difference, to the coast of Virginia, and the Carolinas.

The countries to the north are not less exposed to these vicissitudes, but there is this difference, in the southern states the sudden variations are chiefly from hot to cold, while in the northern they are more frequently from cold to hot; so that, in the latter, the effects produced on bodies generally arise from dilatation, in the former, they are commonly owing to constriction.

On comparing the thermometrical tables of the different places of which I have just been speaking, and in making daily observations myself on the variations of the atmosphere, I could not avoid perceiving a constant harmony between these variations and certain winds, which are uniformly connected with them. The transitions from cold to heat, I always found, took place with changes of the wind from north-east or north-west to south-east or south; and, on the contrary, the transitions from heat to cold always occurred with changes of the wind from south or south-east to north-east or north-west; and this was the case from Florida to Canada and Hudson's bay.

Hence we have one element of a theory applicable to all the problems of this climate; but as good theories are nothing but a systematic arrangement and combination of all the facts of one kind, I shall not be in haste to solve these problems by isolated facts, but shall proceed to bring forward many singularities, which, at first sight, would appear to be exceptions.

The climate of the basin of the Ohio, and of the Mississippi, is less cold, by three degrees of latitude; than that of the Atlantic coast.

This is one of those singularities, that deserves so much the more attention, as I do not know that it has ever yet been described with all its circumstances. For the principal fact, I shall borrow the words of Mr. Jefferson, in his Notes on Virginia, p. 125.

It is remarkable, (says Mr. Jefferson), that, proceeding on the same parallel of latitude westwardly, the climate becomes colder in like manner as when you proceed northwardly. This continues to be the case, till you attain the summit of the Alleghany, which is the highest land between the ocean and the Mississippi. From thence, descending in the same latitude, to the Mississippi, the change reverses; and if we may believe travellers, it becomes warmer there, than it is in the same latitude on the sea-side. Their testimony is strengthened by the vegetables which subsist and multiply there naturally, and do not on our sea-coast. Thus catalpas grow spontaneously on the Mississippi, as far as the latitude of 37 deg. and reeds as far as 38 deg. Parroquets even Winter on the Scioto, in the 39th deg. of latitude. In the Summer of 1799, when the thermometer was at 90 deg. at Monticello, and 96 deg. at Williamsburgh, it was 110 degrees at Kaskaskia.

Mr. Volney confirms Mr. Jefferson's assertion by his own observations, during a journey from Washington on the Potowmac, to St. Vincent's on the Wabash....

This second line from the Alleghanies (says Volney) does not exhibit the same regularity, in appearance, as the preceding, no doubt in consequence of

the diversity of levels, aspects, and even of latitudes, which here vary more. For instance, if Cincinnati be not so forward as Gallipolis, it is because it lies a little farther north, and in addition is less sheltered from the winds from that quarter, and less open to the south: if the valley of the Kanhaway, though at a higher elevation, be still more early, it may be owing to its closeness, the effect of which is to concentrate the heat, which in fact is found greater there than in other places: and in our gardens we have proofs of this effect, of different aspects, since our espaliers ripen the same kinds of fruit at different periods eight or ten days apart, according as they have an east, west, or south exposure, and likewise according as they are sheltered from the winds, or affected by reverberation from other walls. It is not the less true, that the law of elevations is generally observed in the line described, and that there is a remarkable coincidence in the time of harvest at Kaskaskias and Monticello, both in the same latitude, and at an elevation which I conceive to be nearly the same.

Still I am far from denying, that in the western country, several phenomena of temperature and vegetation occur, which neither the elevation nor the aspect is sufficient to explain. Among the first in rank of these phenomena is one observed within these few years by botanists, which every day confirms: on comparing the places in which certain trees and plants grow spontaneously on the east and on the west of the Alleghanies, they have discovered, that there is a general and uniform difference equivalent to 3 deg. of latitude in favour of the basin

of the Ohio and Mississippi ; in other words, those trees and plants, which require a warm climate, and Winters less cold, and of shorter duration, are found 3 deg. farther north on the west of the Alleghanies, than to the east on the Atlantic coast : thus, cotton, which succeeds at Cincinnati and fort Vincent's, in the latitude of 39 deg. has not yet been found capable of cultivation in the Carolinas farther north than 35 or 36 degrees. It is the same with the catalpa, sassafras, papaw, pacan or illinois nut, and many other trees and plants, a particular enumeration of which would require more skill in this branch of natural history than I possess. \*

The Winter does not commence till the approach of the solstice, and the cold weather is felt only in the forty or fifty days succeeding it. Even then it is not fixed and constant, but there are intervals of temperate and warm days. The thermometer does not fall, in general, lower than 5 or 6 degrees below the freezing point. The frosts, which at first show themselves a few days in October, disappear, return again toward the end of November, cease again, and do not become settled till toward January : the brooks, little rivers, and standing waters, then freeze, but seldom continue frozen over more than from three to fifteen days.

Throughout the year the prevailing wind is the south-west ; being the current that ascends the course of the Ohio, and comes by the way of the Mississippi, where its prevailing direction is south,

\* This is a great mistake. Cotton comes to perfection as far north as New Castle county, Delaware state. The other trees bear the climate of Pennsylvania.

from the Gulf of Mexico. I found this wind hot and stormy, the moment I entered the valley of the Kanhaway, the temperature of which, no doubt, it increases, as it is checked there at the foot of the mountains : it changes its direction according to the windings of the Ohio, and sometimes it would be considered as west or south ; but, always preserving its identity, it prevails ten portions of time out of twelve, leaving only two for all the other winds together. It is equally prevalent throughout Kentucky, but does not there produce the same effects ; for while the valley of Ohio, to the breadth of twelve or fifteen miles, has abundant rain and moisture, the rest of the country is parched with droughts, which continue, sometimes, for three months ; and the farmers have the vexation of seeing, from their hills, an aerial river of fogs, rains, and thunderstorms, winding like that on the earth, the basin of which they never quit.\*

In the western country, according to Mr. Ellicott, and especially in the neighbourhood of the lakes, dews are very heavy. On the Ohio and Alleghany rivers, and their numerous branches, fogs are very common, and of remarkable density ; they do not, however, appear to contain any portion of those noxious miasmata, which are so frequently combined with the fogs on the eastern side of the mountains ; nay, the inhabitants of Pittsburgh consider them as possessed of salubrious qualities. From a variety of observation he is convinced, that the atmosphere in the western country, and particularly in the vicinity of the lakes, contains a greater quan-

\* Volney's View, p. 150.

tity of moisture than in the middle Atlantic states. The wooden works which contained his astronomical instruments, were always uncommonly swelled, and frequently very much injured, in that country, though constantly defended from the rain, and occasionally exposed to the sun ; and the ivory and wood of his sectors with brass joints, always expanded gradually above the metal. Whether this excess of moisture arises from the extensive forests which constantly preserve the earth in a state of humidity, or from more permanent causes, future observations must determine.

Iron is here more susceptible of rust, and brass sooner tarnished, than in the Atlantic states ; but this susceptibility of rust he observed to be greater in the forests, than in those parts of the country that had been cleared for cultivation, and from these circumstances the probable cause is ascertained.\*

At the autumnal equinox rains come on with winds from the north-east, south-east, and even north-west. The coolness these occasion prepares the way for frosts : the whole of the Autumn is serene, temperate, and the most pleasant of the three seasons of the year.

Such is the climate of Kentucky and all the basin of the Ohio. You must go very far north to perceive any considerable difference in it, and particularly to find it in harmony with the same parallels on the Atlantic coast. Even as high up as Niagara it is still so temperate, that the cold does not continue with any severity more than two months, though

\* Trans. Amer. Phil. Soc. vol. iv.

this is the most elevated point of the great platform; a circumstance totally inconsistent with the law of elevations.

The descriptions that have been given me (says Volney) of the Winter throughout Genessee do not correspond with the coldness of this season in the parallel of Vermont, or of New Hampshire, but rather with the climate of Philadelphia, three degrees farther south.\* In the latter city it has been remarked as singular, that frosts occur there in every month of the year, except July; and to meet with a place similarly circumstanced in Genessee, we must go as far as the village of Oneida, in the latitude of 43 deg. while on the east of the mountains, at Albany, no month of the year is exempt from frost, and neither peaches nor cherries will ripen.

Lastly, at Montreal, in the latitude of 45 deg. 20 min. the cold is less severe, and of shorter continuance, than in that part of Maine and Nova Scotia, which is east of the mountains; and the snow does not remain on the ground at Montreal so long, by two months, as at Quebec, though it is higher up the river; which also is contradictory to the law of elevations, and indicates some other cause, that remains to be discovered.

\* Volney was rightly informed. The climate of the Genessee country is much milder than the eastern states. According to a description of the tract, published in 1799, it appears, that cattle are turned out during the Winter...the tender peach-tree is never killed by the frost ...mills are never stopped. If a trifling precaution be used ...and the thermometer, in 1795-7, at Bath, in Steuben county, was from 11 to 13 degrees higher, than at Lancaster, in Pennsylvania.... This superior mildness of climate is owing to the great bodies of fresh water on the north and north-west, without a mountain intervening.



The difference of climate on the east and west of the Alleghanies is accompanied with two circumstances of great importance: the first is, that beyond the latitude of 35 and 36 degrees, as you proceed southward, this difference ceases, and the temperature of the Floridas and the west part of Georgia, from the Mississippi to the river Savannah and the ocean, is subject to the same common law; so that the chain of the Alleghanies, and the turn of the Apalachians, form the actual boundaries of the difference on this side, and thus show themselves to be one of its efficient causes.

The second circumstance is, that this excess, with regard to temperature, ceases again almost suddenly between the latitudes of 43 and 45 degrees north, toward the great lakes. Scarcely have you passed the south shore of lake Erie, when the climate grows colder every minute in an astonishing proportion. At fort Detroit it still resembles that of Niagara, its parallel; but from lake St. Clair, the settlers find the cold much more severe, and of longer duration, than at Detroit. This little lake remains frozen over every year from November to February; the south and south-west winds, by which the temperature at lake Erie is rendered more mild, are here less frequent, and no fruits but Winter pears and apples will ripen.

At fort Michillimackinac, two degrees and a half farther north, observations made in 1797, under the direction of the American general Wilkinson,\* show,

\* See Med. Repos. of New York, vol. i, where is a meteorological table, drawn up by major Swan.

that from the 4th of August to the 4th of September, the thermometer in various places beyond lake St. Clair never was higher at noon than sixteen and an half degrees of Reaumur (69 Fah.), and that in the morning and evening it frequently sunk to five and an half (44 5-10 Fah.), which is colder than at Montreal under the same parallel.

These facts accord perfectly with the general results, lately published by Mr. Alexander Mackenzie, in his interesting account of his travels in the west and north-west parts of America; and by Robson and Umfreville\* at Hudson's bay.

Mr. Volney has taken great pains to prove the difference between the temperature in the Atlantic coast, and that of corresponding latitudes in Europe: and, though it has been already shown, that some of his thermometrical statements are not founded on authority, and although others of them will not apply at present, owing to a change in the climate, yet the fact is, nevertheless, true; and as he has not to account for it, the investigation of the subject shall now be attempted.

The first cause contributing to the great degree of cold in the United States, is, without doubt, the extent of our forests. The effect of clearing a country to render it less cold, was first ably pointed out by our countryman Dr. Williamson, in a paper expressly written to explain the cause why the Winter's cold and Summer's heat, in the United States, are less violent than formerly. † But it is clear that the

\* Present State of Hudson's Bay, 1790.

† Trans. Amer. Phil. Soc. vol.

ground being covered with trees is not the sole cause. Neither can the extensive mountains of North America produce the effect, for other countries have mountains equally extensive, and even higher, and are, nevertheless, noted for their mild temperature, as in Switzerland, and in the vicinity of the Pyrenees. The great lakes in North America have also been supposed to contribute to the coldness of the country, and particularly to the keenness of the north-west wind, but this also is an error; for all the great lakes lie westward of the north-west, and some of them to the southward of the west: and did they even lie in the direction of the north-west wind, they could not increase the cold, because they do not freeze, except near the edges, and large bodies of water we know would rather tend to increase, than lessen, the temperature of the air. Such indeed is the fact, for it has already been mentioned, that the climate on the western sides of the Alleghanies, and particularly near the lakes, is much milder than that of the country on the eastern side of the mountains.

Dr. Barnwell\* has lately attempted to account for the circumstance, upon principles altogether new: viz. the prevalent winds, current of the ocean, and the gulf stream: he shows, by a course of laborious reasoning, how these currents are influenced by the winds; how, in their turn, they re-act upon the air and thus affect the temperature of the adjacent land.

\* Physical Investigation, Philad. 1802, 8vo.

Dr. Barnwell's theory is, that the western winds from the Atlantic approaching the coasts of Europe\* mild and temperate, continue their course to the eastward, over the continent, become more cold from the extent of the elevated and frozen countries of Siberia and northern Tartary, over which they pass; and furnish a reason why Kamschatka and all the eastern parts of Asia, even to the southern extremity of China, are as cold in the Winter as the countries of similar latitudes in the eastern side of the American continent, and even more so; that side of it is scarcely habitable, as far as 50 deg. north, and we have seen in the account of Hearne's tour from Hudson's bay to the North Pacific, that settlements of Indians were found beyond that latitude in the interior of North America. But to the south of 50 deg. north latitude the Pacific ocean becomes very wide, and of course the wind becomes warmer in passing over it, and contributes to the increased temperature of the western coast of America; † but in its progress across the northern part of the American continent, which we have seen from the account of Mackenzie's and Hearne's tour, it is very cold, and blowing over the frozen lakes, and that elevated large tract to the westward of Hudson's bay, it loses a great portion of its heat,

\* Mr. Kirwan remarks that a few days prevalence of a north-east wind, in England, in the Winter, often causes an extreme degree of cold: for the wind may travel from Siberia to England in three days.

† Both Perouse, who had commanded a military and naval expedition against the settlement of Hudson's bay, and Cook, remark the superior warmth of the western coast of America, when compared with the eastern.

so that by the time it has reached that bay the cold is excessive, as in Siberia: its temperature, however, is a little increased in passing over the great fresh water lakes, but it is still cold enough to render it proverbial for its keenness throughout the United States. Passing over the gulf stream and the Atlantic ocean, with increasing temperature, in proportion to its distance from the continent, it causes those short passages which vessels are known to make from North America to Europe, and by the time it arrives at Britain, it becomes very mild, and is one cause why the Winters of that country, although in lat. 50 deg. north, are less cold than those of other countries in 40 deg. A part of this phenomena Dr. B. attributes to the gulf stream, which carries its heat far into the Atlantic, for when it meets the northern current at the banks of Newfoundland, it is turned eastward, as is demonstrated every year by its carrying the seeds of native vegetables of the West Indies, to the shores of the western islands of Scotland and other parts, and by the current of warm water formed along the western coast of Ireland and Scotland.

As an additional cause of the cold of the United States, Dr. Barnwell hints at the immense masses of sea-ice, which are every Spring driven by the polar winds, aided by currents in the same direction, along the coasts of Greenland, and from Davis's and Hudson's straits, past Labrador and Newfoundland; the influence of which is so great as to be perceived to the southward of North Carolina, where the north-east wind, in the Spring, is observed to be

very cold and moist, and the air dense, cloudy, and hazy.

It has been confidently asserted by European writers, and by some of great reputation, that the climates of America, under similar latitudes to those of Europe, are unfriendly to health and longevity; that the general period of human life is from forty-five to fifty; and these pernicious effects are ascribed to putrid exhalations from stagnant waters; to a surface uncleared, uncultivated, and loaded with rank vegetation, which prevents it from feeling the purifying influence of the sun.\*

If such remarks were intended to be confined to the low plains in the southern states, the propriety of them might not, perhaps, be disputed; but a distinction ought to be made between those parts of America, and others in far different circumstances. If authors profess to write as philosophers, they should seek for information from the purest sources, and not content themselves with theorising on subjects, which can be determined only by fact and observation; or with forming general conclusions from partial reports. If they write as politicians, their aim may indeed be answered by stating facts in a delusive light; and by representing America as a grave to Europeans, they may throw discouragement on emigration to this country. It is at the same time amusing to observe the inconsistent con-

\* Robertson's Hist. Amer. vol. ii, p. 17. King's Thoughts on Emigration to America, Political Mag. 1783, p. 261.

clusions of these theorising philosophers; for whilst one condemns the air of woodland as destructive to life and health, another celebrates it as containing *nutritive* particles, and asserts that men who live in the woods consume less food than those who dwell in open countries.\*

But notwithstanding the dreams of European philosophers, or the interested views of European politicians, America can best be described by those who have for a long time resided in it. Those who have not seen it at all, and those who have passed through it with the rapidity of a traveller, can be very inadequate judges; yet unhappily there are many of both these classes of writers, whose accounts have gained more credit than they deserve.†

From the frightful picture drawn by Mr. Volney, of the climate of North America, and of the United States in particular; a foreigner relying on his facts, would readily be prevented from taking up his residence in any part of the continent; but it is fortunate, as well for those whose lot is cast in the country, as for others who wish to remove to it, that there are many circumstances which tend to diminish the supposed bad consequences of the climate he depicts, and that neither health nor longevity are affected thereby.

The variable nature of the climate of Pennsylvania and of the United States, says Dr. Rush, does not render it necessarily unhealthy. Doctor Huxham has taught us, that the healthiest seasons in

\* Abbe Raynal, *Hist. Ind.* vol. iii, p. 278.

† Belknap's *Hist. New Hampshire*, vol. iii.

Great Britain have often been accompanied by the most variable weather. His words upon this subject convey a reason for the fact. "When the constitutions of the year are frequently changing, so that by the contrast a sort of equilibrium is kept up, and health with it; and that, especially, if persons are careful to guard themselves well against these sudden changes,"\* Perhaps no climate or country is unhealthy, where men acquire from experience, or tradition, the art of accommodating themselves to it. The history of all the nations in the world, whether savage, barbarous, or civilized, previously to a mixture of their manners by an intercourse with strangers, seems to favour this opinion. The climate of China appears, in many particulars, to resemble that of Pennsylvania. The Chinese wear loose garments of different lengths, and increase or diminish the number of them, according to the frequent and sudden changes of their weather; hence they have very few acute diseases amongst them. Those inhabitants of Pennsylvania who have acquired the arts of conforming to the changes and extremes of our weather in dress, diet and manners, escape most of those acute diseases which are occasioned by the sensible qualities of the air; and faithful inquiries and observations have proved, that they attain to as great ages as the same number of people in any part of the world.

On this subject Mr. William Barton justly observes, that the climate of much the greater portion of the United States furnishes great degrees of heat and

\* Observations on the air, and Epidemic diseases, vol. i, p. 5.



cold, in their respective seasons; but neither of the extremes is of long continuance. Our climate is also very variable, the temperature of the atmosphere being liable to great and sudden vicissitudes. Nevertheless, taking the whole routine of the seasons, we enjoy a large proportion of fine and moderate weather; with more days of sunshine and serene sky, than perhaps, any part of Europe. A very considerable part of France experiences greater extremes of heat and cold, than the United States, in general: yet we find that country to be more favourable to fecundity and life, than England, where the summers and winters are less intemperate. And in the Swiss Cantons, and Sweden, where the frequent and sudden changes in the temperature of the atmosphere, are very similar to the vicissitudes which prevail in our own climate, the natives are a hardy, vigorous, and healthful people.

The winters, in our own country, brace and invigorate the bodies of the people: and the genial warmth of our summers increases the generative principle of animal nature: the cold is accompanied with a pure and elastic atmosphere; and during the continuance of the greatest heats, the air is frequently corrected by thunder gusts and plentiful showers of refreshing rain. The face of the country, too, is of such a nature, as must contribute to the salubrity of the climate....The United States are, in general, diversified with hills and vallies, mountains and plains: and Aristotle observes, that people do not feel the effects of age so soon, in hilly, as in flat countries.

Mr. Barton's paper concerning the longevity of the inhabitants of these States, is an ample refutation of those writers, who influenced by European prejudices, or considering the subject in a superficial manner, have asserted, that the Americans are not so long lived as the Europeans. He has shown by the fairest comparison, that the probabilities of life *in all its stages*, from its commencement to the utmost possible verge of its duration, are higher in these United States, than in such European countries as are esteemed the most favourable to life.\*

\* Trans. Amer. Phil. Soc. vol. 3d.

## CHAP. II.

### SYSTEM OF THE WINDS IN THE UNITED STATES.

Mr. Volney remarks, that though the inconstancy of the winds is complained of in France, yet that the inconstancy is by no means comparable to that of the air in the United States.

This changeableness of the air is increased by its taking place on a vast extent of country, the same winds displaying themselves, with a few exceptions, almost at the same time throughout the whole extent of the Atlantic coast, from Charleston to Newport, or even Halifax, and from the sea-shore to the Alleghany mountains.

Such is in particular the character of the three principal winds, the north-west, south-west, and north-east, which in the United States appear to have shared the empire of the aerial regions between them. If we suppose the year to be divided into thirty-six parts, we may say, that these three have taken to themselves thirty or two and thirty; the north-west and south-west twelve each, the north-east and east six or eight: the rest are distributed between the south-east, south, and west. Due north may be reckoned almost as nothing.\* Each of these winds being accompanied with particular cir-

\* This observation is very accurate; even in Canada the north wind rarely blows.

cumstances, and becoming successively the cause and effect of considerable and different phenomena, I shall proceed to the particulars necessary to make known their respective course.

### 1. *Of the North, North-east, and East Winds.*

Of all the winds that occur in the United States, none is so rare as due north. To the southward it seems to be more frequent, from the observations made at Williamsburg, and quoted by Mr. Jefferson:\* when it does occur, it is rather moist than dry, rather cloudy than clear, and always cold.

#### *North-east Wind.*

The north-east wind, like most others, as it changes its country, alters its character, or at least its qualities. In Egypt, where it bears the name of *gregale*, I found it cold, cloudy, and oppressing the head with its heaviness: in the Mediterranean, it was rainy, louring, and squally: in France, particularly north of the Cevennes, we complain of it as the driest of all winds; in the United States, on the contrary, it is held in aversion as the wettest, and one of the coldest. The problem of these differences or contrasts is resolvable with facility by an inspection of the map of the World.

In the United States the north-east wind comes

\* See Notes on Virginia, p. 127.

Over a great extent of sea, the surface of which, reaching to the pole, is uninterruptedly saturating it with cold and moisture. Accordingly it displays these two qualities in an eminent degree on all the Atlantic Coast; before it arrives you may foretel its coming within doors by the deliquescent state of your salt, soap, sugar, &c. From Cape Cod to the banks of Newfoundland the north-east wind drives on the coast cold and benumbing fogs.

The qualities of the north-east wind on the Atlantic Coast naturally diminish in intensity as we proceed southward, but they are perceptible even in Georgia; and from Quebec to Savannah the name of this wind excites the ideas of cold, wet, and disagreeable.

But on crossing to the west of the Alleghanies this language is changed; there, to the great astonishment of those who emigrate from Connecticut and Massachusetts, the north-east and east winds are rather dry than wet, rather light and pleasing than heavy and disagreeable. The reason is, because there, as in Norway, these currents of air arrive after having passed a rampart of mountains, where in a lofty region they deposit the vapours, with which they were loaded.

The frequency of north-east winds on the Atlantic coast may be ascribed in part to the direction of the shore and the mountains of that country, which favours the course of the aerial current. Sometimes this wind itself gives evident proofs of it in its course, by covering the sea-shore with snow, which does not extend ten miles from it. This occurred at Norfolk on the 14th of February 1798, when in a single

night more than forty inches of snow fell in that city and its environs, with a north-east wind; while five-and-twenty miles inland it had not even rained, and the wind was rather north-west, as several of the newspapers observed.

When the south-east wind makes its appearance in winter on the Atlantic coast, which happens particularly at the approach of the equinox, it sometimes produces temporary thaws, even as far as Canada, that have the unpleasant effect of spoiling the meat, stores of which are provided for five or six months in cold countries as early as October. Farther south these thaws treacherously deceive the vegetative faculty, calling forth in January or February those flowers, which should not appear till after the equinox, and which the unfailing return of frost inevitably destroys.

Toward the equinoxes, more particularly the vernal, the south-east wind produces short but violent tempests, especially at the mouths of the Hudson and Delaware, and in the bay of Chesapeake. The duration of these is very commonly twelve hours; and they have this singularity, that they exert their fury, like a hurricane, on a limited space of ten or twenty leagues long and four or five broad, without the least commotion being perceptible out of this space.

This violent irruption of a light hot wind is not explicable by the common theory of specific gravities, since every other wind is more cold and dense than the south-east: we must therefore admit the expansion of a considerable mass of this hot air, repelling and driving away the colder air that surrounds it; this impetuosity is occasioned by two

causes, the pressure it experiences on the one hand, and the greater space into which it expands itself on the other, as it issues from its narrow channel. But what is the primary cause of the expansion of the air, which occasions these subsequent phænomena, we have no data to explain. All we know is from its effects; and the problem remains to be solved by some future enquirer.

### *Of the South Wind.*

WHEN the wind blows directly from the south, we should suppose it would be hotter than from the south-east, yet in the United States it is more temperate. During the summer, when it most frequently occurs, it is considered as an agreeable breeze, and almost cooling, in consequence of the moist vapour, with which it impregnates the air. It is for the sake of enjoying this breeze, that a south aspect is preferred for a house throughout the American continent, as in France east and south-east are preferred. In the United States it has this advantage, that in summer the sun is so high above the horizon, as not to enter apartments shaded by porticoes or piazzas, the use of which is general. In winter, being lower, its desirable rays enter the houses, and cheer them with their warmth, in spite of the north-west wind, that too frequently accompanies its shining. In this season, if the south wind be sometimes a little cold, it is in consequence of having passed over the snow, which occasionally covers the ground for a short time, even in Caro-

lina. And if at other times it bring snow itself instead of rain, it is because in its aerial course it meets with clouds from the north-east or east, which had not time to turn back. But such snows melt immediately, or are changed into rain as they fall. Six hours continuance are sufficient to give the south wind that character of heat and moisture, which it derives from the tropical seas, whence it originates. In summer, when it has more velocity than usual, it presently brings on a storm: and it has been remarked at Louisville, as well as other places situate on the Ohio, that, if it continue for twelve hours together, thunder will infallibly ensue. Now reckoning its progress at a mean term of forty-five or fifty miles an hour, a calculation which the experiments made on the velocity of winds render plausible, this is just the time requisite to bring clouds from the centre of the gulf of Mexico, 10 or 12 deg. distant. The frequency of the south wind at this season proves, that a focus of suction then exists in the north of the continent: but it remains to be known, whether this focus lies beyond or on this side of the Algonquin chain,\* which skirts the lakes on the north. This cannot be decided but by corresponding observations on a line extending from the shore of Florida, through Kentucky, Lakes Erie and Huron, and the Algonquin mountains, to the borders of Hudson's bay: and these would throw great

\* This chain of mountains, though represented as of immense length and height by Mr. Volney in the map accompanying his work, and placed between Canada and Hudson's bay has not yet been described. Mr. V. ought to have given his authority for inserting them.



light on the correspondent actions of the polar and tropical regions of the atmosphere, as well as on the conflict and equilibrium of the north-west and south-west currents, which are the principal winds of the United States.

### *Of the South-west Wind.*

The south-west wind, one of the three most prevalent in the United States, is more frequent there during summer than winter, and more constant in the western country than on the Atlantic coast. In winter it seems as if it were unable to pass the barrier of the Alleghanies. Sometimes, however, it shows itself on the Atlantic coast with more impetuosity, and particularly with greater coldness, than are consistent with its habit and origin. But the reason of this is easily perceived, when it is considered, that it has crossed the lofty region of the Alleghanies, frequently covered with snow during winter, and in the west has found the earth drenched with rain, the evaporation of which could not fail to cool it.

In the spring, become more frequent, it brings temporary snows, deluges of rain, and even hail: these however seem rather to belong to the north-east and north-west winds, the clouds of which heaped up on the Alleghanies, it turns back, and drives before it. This chain indeed forms the lists, in which these opposite currents of air visibly contend for the mastery. Frequently the observer stationed on the plain may see the clouds marching

toward Blue Ridge with an east or north-east wind, perfectly stopping there, and remaining stationary, then dissolving into rain, or turning back again, driven by the south-west wind, which in its turn prevails for a few hours. Mr. Volney was a witness of this spectacle the evening he spent at Rock-fish gap on Blue Ridge, and his host, though he was no natural philosopher, accounted for it very satisfactorily.

It is only about the summer solstice, that the south-west wind prevails on the Atlantic coast in a manner more constant than any other. There it becomes the principal agent in those storms, which are frequent in the months of July and August.

The autumnal equinox brings on a change in the direction of the current of air, and then its opposite, the north-east, is predominant forty or fifty days, though it does not exclusively prevail. After this period the south-west wind, which had not been completely extinguished, revives, and shares the remainder of the season with the north-west, that now rouses itself, and with the west, which is the most equable, serene, and pleasant, of all that blow on this continent.

The progress of the south-west in the basin of the Mississippi and Ohio as far as the river St. Lawrence is more regular, and more simple; in few words we may say, that this wind prevails from Florida to the lakes of Montreal during ten months out of twelve. The two months of its being most rare are those of the winter solstice, during which the north-west and north-east rule the sky. From this period it revives in proportion as the sun ad-

vances toward the zenith, and acquires such power, that in July and August it is nearly as constant in Louisiana, Kentucky, and even as far as lake Champlain, forty or fifty days, as the trade-wind is at the equator. It prevails almost equally on the St. Lawrence, and to sail up this river a ship is sometimes obliged to wait a whole month for an east or north-east wind, which after all is of short continuance. It is the south-west wind too, that thaws the St. Lawrence about the 20th of April, as it is the north-west that freezes it at the end of December. The south-west, as well as the south, is the hot wind of Canada, Vermont, and Genessee; but it is very decidedly so only in summer: in other seasons it is cooler in proportion as the sun is nearer the horizon, and as the land is less distant from the pole; being hottest as we advance toward Kentucky, Tennessee, and the gulf of Mexico, which is its original focus.

From the vicinity of this it raises the temperature of Lower Louisiana so high during the four winter months, that notwithstanding the pretty frequent occurrence of north-north-west and east winds, the sugar cane, particularly that of Otaheite, may be cultivated there. But this favour is dearly purchased by oppressive heat during the four summer months, accompanied with extremely violent and almost daily storms, of the same kind as those that are called white squalls in the West Indies.

In fact it is really the trade-wind of the Atlantic, that feeds the atmosphere of the gulf, and produces there most of the phenomena, of which it is the theatre. It enters the gulf with more force, because

after it passes the chain of the Caribbee islands, its stream is more and more contracted, and its strength accumulated within a narrower space. This compression increases its velocity; and as it issues from between them, it expands itself with more force, and forms eddies in their rear, each current contending for the vacuum there.

The trade wind of the Atlantic, when it reaches the Musquito shore, is opposed by the mountains of that isthmus, which are a continuation of the Andes, and passes through the only opening left for it, viz. between Jamaica and the Musquito shore, and enters the sea of Honduras, where it deviates a little, and becomes south-east; and meeting with no obstacle, enters the gulf of Mexico in this direction, when it subdivides into several branches; one crosses the peninsula of Yucatan, proceeds towards the interior of Mexico, and ascends the rivers of that country, as far as the mountains of New Biscay, New Mexico, and Santa Fé. It must be the same branch of the wind, which having reached the mountains of New Mexico, assumes another character, and pours down on the north-west coast, and proves so cold,\* from having passed over the ice and snow that cover the Mexican mountains.

A second branch of the Atlantic trade-wind takes its course towards the shores of Louisiana and Florida; its direction is south-west; yet on the Mississippi, following the bed of the river and its valley, it is due south.

A third branch, towards the peninsula of Florida.

\* Meares's Voyage.

endeavours to pass over it ; but is turned back, by the trade-wind which it meets from the east, particularly in the summer, and it is owing to their union that the south-west wind blows with redoubled strength in the United States.

Lastly, the central portion of the great vortex, kept in equipoise by opposite motions, is the seat and cause of the variable winds, suffocating calms, and consequent storms and waterspouts so peculiar to the Gulf and Florida coast.\* Hence can be understood, how the atmospheric gulf of Mexico, by sending out immeasurable quantities of air from the south-west, along the slopes of the Mississippi, shall stand in need of a corresponding supply from the north, along the coast of the Atlantic. Thus while we are informed of a hurricane in the north of the United States, and particularly on lake Erie, with a north-east or north-west wind, we also hear of a hurricane on the coast of Louisiana and Florida with northerly winds. This singular correspondence of time and action between the hurricanes of the gulf and those of the continents, even in places far to the north, was first explained by Dr. Franklin, who by comparing the times of day at which a hurricane, that traversed the continent from Boston to Florida, in 1757, was felt at different places, found that the disturbance of the air did not commence at Boston till several hours after its commencement on the coast of the gulf, and that from place to place it was earlier or later according to the distance. The hurricane being first felt at the points to which the air was

† See account of Florida in the 12th vol. Wonders of Nat. and Art.

rushing, and terminating at the place whence it proceeded.\*

From the greater prevalence of the south-west wind along the Mississippi, Ohio, and adjacent regions flows a simple and natural solution of the problem, why the temperature of the Western Country is hotter by three degrees of latitude than that of the Atlantic Coast, though only separated from it by the Alleghany mountains. Another consequence of the prevalence of the south-west wind being the cause of a higher temperature, will be, that it will extend the sphere of this temperature so much the farther, the greater the facility with which it can pervade the country. A more speedy improvement of the climate may be therefore expected in this quarter, than in places much farther south on the other side of the mountains: an improvement which will be felt in proportion as the forests are cut down, that now check the course of the aerial stream. And indeed this cause has already begun to produce the effect, since the period of the river's being shut up by ice is near a month later than when Canada was first colonized; and instead of insuring vessels on condition of their leaving the river by the end of Novem-

\* The facts respecting the great snow storm of February, 1802, and January 1805, as collected by Dr. Mitchell, and published in the *Med. Repos.* Hex. i, vol. 5, and Hex. ii, vol. 2d, confirm Dr. Franklin's theory; but it nevertheless happens that storms sometimes commence to windward; this was the case with the dreadful hurricane which desolated our southern coast in September, 1804, which arose to windward in both north-eastern and south-eastern quarters, but it appears that the latter was not near so rapid in its progress as that one which took its origin to leeward. See a very accurate account of the progress and effects of this storm in the *Med. Repos.* Hex. ii, vol. ii, p. 354.

ber; as used to be specified in the beginning of the last century, the clause in the policies is now extended to Christmas-day, or the 25th of December.

### *Of the North-West Wind.*

The north-west wind, the third, and almost the principal, of those that prevail in the United States, differs from the south-west in two respects: it is essentially cold, dry, elastic, violent, and even tempestuous; it is more frequent in winter than in summer, and more habitual on the Atlantic coast than west of the Alleghany mountains, that is, in the basins of the St. Lawrence, Ohio, and Mississippi.

On the Atlantic coast, the north-west wind, having traversed the continent, sometimes too brings with it storms of rain or snow, or even of hail; but these clouds belong rather to other currents of air, as the north-east, and south-west, which it beats back, and robs as it drives them before it. At other times they are the product of the humid surfaces it finds on its way; as the five great lakes that communicate with the river St. Lawrence, the marshes, and even the rivers taken in the length of their course. This is the reason why under the lee of these lakes, and of the long lines of the Mississippi and Ohio, the north-west wind is characterised as wet in winter, and stormy in summer, which it is not in other places: For from Charleston to Halifax the idea annexed to the north-west is that of a violent, cold, unpleasant wind, but healthy, elastic, and reinvigorating the languid powers. It has this degree of treachery only

in winter, that, while a clear sky, and bright sun delight the eye and invite you to enjoy the open air, if you venture out of doors you are assailed by a cutting wind, that makes the face sore and draws tears from the eyes, and the broad impetuous gusts of which render your steps insecure over the icy surface of the ground. Less rude in summer, it is longed for to moderate the violence of the heat; and indeed it pretty frequently shews itself in that season after a heavy storm of rain and thunder. But as it is impossible that the lapse of half an hour is sufficient for it to have come from any distance, it is evident on such occasions it must descend from the superior regions of the atmosphere, which in these latitudes is not more than 3000 or 3200 yards distant: the vacuum being formed near the ground by the condensation of the clouds into rain, the upper stratum sinks down to fill it; and the direction it acquires is from north-west to south-east, because the atmosphere toward the ocean, as far as the tropic, consists of a light warm air, incapable of maintaining an equilibrium against this cold and heavy current; while the reflux of the south-west and of the trade-wind of the tropics, the countercurrent of which comes to fill these middle latitudes, prevents it from taking its course due south. All the e currents appear to unite together, to form on the Atlantic ocean, from the latitude of 35 deg. to 48 deg. and 50 deg. that westerly wind, which we find almost perpetually prevailing on the coasts of England, France, and Spain.

This attraction or suction of the Atlantic atmosphere is confirmed by the following observation of



Mr. Williams. It is remarked, that our north-west and west winds always begin on the sea side: that is, if several ships be in a line, that farthest out at sea feels the wind first, and so in succession to that nearest the shore, which it reaches last.

Sailors' daily make the same observation on the breezes along the shore, that of the day, called the sea breeze, beginning always inland, on the summits of the mountains and hills, which about noon become the focus of the heat, so that the wind is felt there a quarter or half an hour before it is on the shore, in proportion to the distance between the two places: and the land breeze beginning also on the same summits, because there refrigeration first takes place, and the air by its weight flows down the mountains toward the sea like a current of water.\*

One curious fact respecting the north-west wind still remains to be mentioned, it is, that in the United States the mortar and plaster of walls exposed to its direct action are always harder, and more difficult to demolish, than those with any other exposure, no doubt on account of its extreme dryness. In the forests, too, the bark of the trees is thicker and harder on the side exposed to it, than on the other; and this observation is one, among others, by which the savages are guided in their travels through the woods, even in the foggy weather.

\* These descents of the cold air of the middle or upper region are attested by Belknap, who mentions a place in New Hampshire where the wind seems always to fall from above like the water of a mill: there is also a remarkable instance in France, on the mountains of Forez, which separate the basin of the Rhone from that of the Loire.

*Remarks upon Mr. Volney's theory, and upon the supposed change of Climate in the United States.*

However conformable the principle of the influence of the south-west wind may be to fact, when applied to the country watered by the river St. Lawrence; it will not account for a contrary change in the climate of the river Mississippi, which, instead of being milder, has actually become not only warmer in Summer, but colder in Winter. Orange-trees, (says Mr. Dunbar of Natchez),\* and other tender exotics, have suffered much more in the neighbourhood of New Orleans, within these four or five years, than before that period: the sugar-cane also has been so much injured by the frost of the two last Winters, as greatly to discourage the planters. In former years (Mr. D. continues) I have observed the mercury of the thermometer not to fall lower than 26 or 27 degrees; but, for a few years past, it has generally once or twice in the Winter, fallen as low as from 17 to 20 degrees: and on the 12th December, 1800, it sunk to 12 degrees, which has no parallel in this climate, and indicates a degree of cold, which, in any country, would be considered considerable, and, probably, may never be again produced, by natural means, in lat. 31 1-2 deg.

\* Trans. Amer. Phil. Soc. vol. viii.

By a reference to the meteorological table of Mr. Dunbar, it appears, that during the first fifteen days of the month of February, 1799, the east wind blew part of four days, and the north-west wind part of five days; one day it blew from that quarter strong and steadily; the north-east, east-north-east, and west winds, nearly shared the rest of the time; and the east-south-east, south, and south-west, are marked as having blown only part of two days. During the remainder of the month, the south-west wind blew two whole days, but not in succession; the wind being chiefly north-west and east-north-east. In the month of March, the prevalent winds were north-north-west, north-east, and west. The south-west wind blew only part of one day. In April, southern winds appear more frequently.

As the Spring and Summer advance, the winds chiefly blow from the south-east and south-west with variations from all parts of the compass. During the hot season, the winds are frequently remarked to follow the progress of the sun, being found a north-east in the morning, and, shifting round, die away in the evening at south-south-west.

The increase of cold in the Mississippi Territory is a fact so extraordinary, and so opposite to the general belief of the people of this country, with respect to other parts of the continent, that it deserves the serious consideration of the philosophical inquirer. Mr. Dunbar says, that the change cannot be traced to any natural or artificial cause: and it certainly tends to call in question the modern theories on the subject. It is evident, that the explanation of Mr. Volney, respecting the increased temperature of the

south-west wind, and its general prevalence in the territory, will not account for it, neither will the supposed influence of clearance and cultivation of the country, explain the occurrence: nay, the increase of cold might with great reason be ascribed to the very cause, which has been supposed to produce an opposite effect; for we know that the whole Mississippi Territory has undergone very increased cultivation, within a few years past, and it is annually extending.

In other parts of the continent, an opinion prevails very generally, that our climate has undergone a very considerable change, for the better. That our Winters are much more moderate, and our Summers less hot. A similar opinion prevails with respect to the amelioration of the climate of Europe, and the Abbe Man has written a learned paper on the subject, in which he cites numerous facts from ancient authorities, to prove the greater coldness of the Winters in former times, in every part to the northward of 44 degrees, than at present. Allowing the accuracy of the facts which he quotes, respecting particular severe Winters, it does not follow, that the countries he mentions were uniformly cold; for even now we have occasionally very cold weather; and we also know that the shores of the Baltic were the grand store-house of the world. With regard to our own country the want of a regular series of observations prevents our ascertaining the point, with great accuracy, but we have some data to allow the formation of the opinion, that the same variation in the Winters were noticed at an early period of the settlement of the country, as at present. The second ship

from England, that arrived in the Delaware, came to Chester on the 11th December, 1681, where she was frozen up the same night, and it is remarked, the passengers remained there all Winter. William Penn arrived at New Castle 24th October, 1682, and in a letter which he wrote to his friends on the 16th of August, in the following year, he remarks, that, "from December to the beginning of March we had sharp frosty weather, a sky as clear as in Summer, and the air dry, cold, piercing, and hungry. The Winter before was as mild, scarce any ice at all, while this, for a few days, froze up our great river Delaware."\*

Here is some apparent difference in these accounts: but the true state of the case may have been, that, although a ship had been frozen up the preceding Winter at Chester, yet that the river opened some time afterwards.

In the year 1714, according to the record of the Swedish mission, the winter was so mild in Philadelphia, that flowers were seen in the woods in February. Since that time we have experienced occasional very mild Winters, as 1789-1790, 1801-1802, and 1805-1806, and some very cold seasons, as in 1739-1740, 1779-1780, 1784-1785, 1795-1796, 1804-1805.

Dr. Rush does not believe that the mean temperature of the air has altered in Pennsylvania, but that the principal change of our climate consists in the heat and cold being less confined, than formerly, to their

\* Proud's Hist. of Penn, p. 193.

natural seasons. For he thinks the Springs are much colder, and the Autumns more temperate, than in earlier times, insomuch that cattle are not killed so soon, by one month, as they were in former years: He refers the opinion of the amelioration of our climate, to the difference of clothing and sensation between youth and old age, in Winter and Summer: He adopts the opinion of Dr. Williamson\* respecting the diminution of the cold in the southern, being occasioned by the cultivation of the northern, parts of Europe; but, he says, no such cultivation has taken place in the countries which lie to the north-west of Pennsylvania, nor, in his opinion, do the partial and imperfect improvements in the north-western parts of the state, appear to be sufficient to lessen the cold, even in Philadelphia. He says, finally, that he has been able to collect no facts which dispose him to believe, that the Winters were colder before the year 1740, than they have been since.

Besides that there is some other cause operating to affect the climate, independently of the clearing of the country, is evident, from the fact already mentioned from Mr. Dunbar, viz. the increasing coldness of the Mississippi Territory in Winter, and greater heat in Summer.

Dr. Mitchell objects to Mr. Volney's theory of the north-west wind of North America, and offers the following to supply the defect:

The great expanding power (he observes) acting upon the atmosphere is caloric. This is more pow-

\* Rush's Works, vol. i.

† Amer. Phil. Trans. vol. i

erful between the tropics than elsewhere. Hence, if the earth was an even and solid plain, it is probable, that there would be a regular circulation in both hemispheres, of heated and rarefied air, in the upper parts of the atmosphere, from the equator toward the polar regions; and from these, in return, an equal supply of refrigerated and condensed air, is attracted over the earth's surface, toward the zone, where the sun is vertical. If there was no collateral or counteracting force, the columns of cold and heavy air, from the poles, would move towards the equator in lines as straight as meridians. The directions in which such a chilled and ponderous air ought to move, would be south. But there is a collateral or counteracting force. This is the Atlantic ocean, which stretches from one end of the continent to the other. The mean temperature of this immense body of waters, may be estimated, at least, as high as 60 deg. of Fahrenheit; while the mean temperature of the snow and ice, lying far inland, may be estimated as very far below the freezing point of water, and often in high latitudes as low as 0, or lower. Here then is a great disparity between the heat of the Atlantic ocean, and that of the great continent, lying to the west of it; and stretching an immeasurable extent in that direction. A consequence of this must be, that the refrigerated and condensed air, of the interior and mountainous country, will be attracted, over the earth's surface, toward the warmer spaces, occupied by the ocean. If there was no counteracting force, the columns of cold and heavy air, from the mountains and gelid

region of the interior, would move toward the ocean in lines parallel to the equator. The direction in which such a chilled and ponderous air ought to move would be east. Here then the atmosphere of North America is acted upon by two forces, drawing in the direction of the two sides of a parallelogram; one of them pulling south toward the equator, and the other east toward the ocean. Now, the consequence of these two forces exerting themselves, as before-mentioned, will be, to draw the *moles movenda* neither south nor east, but in an intermediate direction between the two. This will be the diagonal of the parallelogram, and its course will be, necessarily, from north-west to south-east. But, the air which is moved thus toward the south-east, must come from the opposite point, and, of course, be a north-wester.



*The Climate of the United States compared with that of Europe in respect to the Winds, the quantity of Rain, Evaporation, and Electricity.*

After all that has been said of the winds, it becomes easier to form a clear and general idea of the climate of this extensive country. Since we know, that the predominant winds here come almost directly from the torrid zone or the frigid, we conceive why we have such striking contrasts of heat and cold, and why the climate is so variable and capricious: as we understand, that one of the prevailing winds, the south-west, blows from a warm sea, another, the north-east, from a very cold ocean, and the third, the north-west, from frozen deserts, we perceive the reason why these are clear and dry, wet, or foggy. We even divine the exceptions, that certain local circumstances can and must occasion to these general rules; and we naturally infer, that a dry wind may become rainy, if in its course it meet with watery surfaces, as those of lakes, marshes, and the extended lines of rivers; as occurs in the country of Genessee, where it rains with a north-west wind, on account of the lakes Ontario and Huron, and with a south-west wind, in consequence of lake Erie; while the north-east and east, so rainy on the coast, are there dry.\* On the contrary, a rainy wind may

\* In like manner, at the sources of the Wabash and of the two great Miamis it rains with every wind: at Gallipolis, on the Ohio, it rains particularly with a west and south-west wind, while lower down, at Cincinnati, the west wind is dry, and it rains with the north west.

become dry, by depositing on the mountains the humidity it brings: finally, in violent agitations of the atmosphere, as the currents mingle, their qualities may be temporarily changed and confounded together.

On the other hand, when we consider, that the territory of the United States is traversed only by mountains of an inferior order, which do not oppose to the currents of air an obstacle sufficient to interrupt their course, we perceive why the winds here, are and must be almost always general. In fact there is no striking exception to this general rule but the sea and land breezes, which take place during the six summer months, and which are governed by the direction of the coast or the beds of rivers, and by the distance, slope, and aspect of the chains and ridges of mountains. For instance, from Florida to New Jersey the breeze inclines to the south-east, and we see the land slopes and the coast turns to that quarter. On the contrary, from New York to Cape Cod the breeze is due south; and from Cape Cod to Nova Scotia it comes from the east and north-east, the same principle still applying to these different cases. In like manner too it is more languid or more brisk, stronger or weaker, earlier or later, according to the greater or less intensity of the heat, the greater or less slope of the land, and the distance or proximity of the heights, where the focus of suction is formed, as the seaman well knows by experience.

From these facts arise two corollaries, that throw great light on physical geography.

One, that the temperature or climate of a country

is determined by its habitual currents of air, or its *winds*.

The other, that the topography of the land has commonly a decisive influence on the direction of these currents, and then becomes an effective cause of the climate, and a constituent part of it.

*Of the quantity of rain that falls in the  
United States.*

Numerous and accurate observations, made by various intelligent Americans on different parts of the Atlantic coast, have ascertained, that the annual and mean quantity of rain falling in the United States is much greater than in most countries of Europe, excepting certain mountainous regions,\* or heads of gulfs. The following table affords a proof of this.

	inches
At Charlestown, according to Ramsay, in 1795 - - - - -	71 4-5
At a medium, from 1750 to 1759, accord- ing to Chalmers - - - - -	41 3-4
At Williamsburg, according to Jefferson	47
At Cambridge, near Boston, according to Williams - - - - -	47 1-2
At Andover, in Massachusetts † -	51
At Salem † - - - - -	35
At Rutland, in Vermont ‡ - -	41
At Philadelphia    - - - - -	30

\* For instance, Udina, where the annual quantity is 66 inches, and Garsagnana, where it is 98. In the West Indies it exceeds 106 inches.

† Since Mr. Volney's work was published, Mr. Dunbar states the quantity of rain that fell in 1799 at Natchez, to be 39 2-3 inches.

‡ S. Williams, History of Vermont.

|| Dr. Rush.

To the preceding statement of Mr. Volney, may be added the following.

According to governor Drayton,\* the quantity of rain in Charleston, in seven successive years, was as follows.

						inches	tenths.
1795,	-	-	-	-	-	71	8
1796,	-	-	-	-	-	58	1
1797,	-	-	-	-	-	55	
1798,	-	-	-	-	-	45	2
1799,	-	-	-	-	-	75	4
1800,	-	-	-	-	-	51	6
1801,	-	-	-	-	-	42	9
1802,†	-	-	-	-	-	39	1

In Europe, on the contrary, the quantities are only as follows.

						inches
At Petersburg	-	-	-	-	-	19 4-5
At Upsal	-	-	-	-	-	15
At Abo	-	-	-	-	-	25 3-5
At London	-	-	-	-	-	22 2-5
At Paris	-	-	-	-	-	21 2-5
At Utrecht	-	-	-	-	-	28 4-5
At Marseilles	-	-	-	-	-	21 2-5
At Rome	-	-	-	-	-	30 2-5
At Naples	-	-	-	-	-	37 1-5
At Algiers	-	-	-	-	-	29 1-5
At Padua	-	-	-	-	-	35 1-5
At Bologna	-	-	-	-	-	25 3-5
At Vienna	-	-	-	-	-	44 4-5

\* View of South Carolina, 1802.

† Ramsay's Medical Register, 1803.

Hence it follows, that in Europe, at a medium, one third less rain falls than in North America: yet in his memoir already quoted, Mr. Holyoke mentions twenty cities in Europe, which, at a mean of twenty years have had 122 days of rain, while

Cambridge has had but	-	-	-	88
And Salem	-	-	-	95

Thus a greater quantity of rain in fewer days evidently indicates, that in America it falls in heavier storms, in Europe in gentler showers; and we have seen, that facts accord with this reasoning.

In addition to the facts here given by Mr. Volney, it may be stated, that the quantity of water which fell at Springmill, 15 miles N. N. W. of Philadelphia, on the Schuylkill, in the year 1787, was 32 inches. By accounts taken at Paris during 66 years, viz. from 1689 to 1754, inclusive, 92 feet 10 inches fell, which makes the mean quantity of water that fell yearly, amount to 16 inches 10 1-3 lines, only half the quantity that fell in Pennsylvania in 1787, and almost only one third of the quantity that fell in 1788, which was 45 6.

Within a few years however, the quantity of rain has certainly diminished in the United States. Our farmers experience this change to their cost; even well-timbered and mountainous countries, suffer by its deficiency. Thus, during the past season in Virginia and North Carolina, great distress has been occasioned by the absolute failure of springs, and lowness of the waters, which obliged the farmers to carry their grain in some cases to a distance of forty miles to be ground. The lead-mines of Virginia ten years since, were so filled with water, as to cause new

shafts to be frequently opened; but the person who now rents them, experiences no difficulty on that head, and ever since he engaged in them, has had no occasion to open a new place for ore. It is highly probable, our climate is undergoing a change with regard to the quantity of rain.

*Of the evaporation and dryness of the air.*

On the other hand, observations equally accurate and numerous testify, that the evaporation of these rains proceeds much more quickly in the United States than in Europe, and that consequently the air there is habitually drier and less calm. Franklin had already made and published this observation, so contrary to the assertions of Pauw, mentioning the circumstance of a mahogany box with drawers, executed with the greatest care by the celebrated Nairne. The drawers of this box, which fitted exactly, and even tight at London, were found to be too loose at Philadelphia; and when it was sent back to London, they became as close and tight as before. Hence Franklin justly inferred, that the air at Philadelphia was drier than at London: but the case of these two cities was not sufficient to found a general rule. Mr. J. Williams has farther illustrated and established it by some striking facts.

Thus, generally speaking, more rain falls in the United States in fewer days than in Europe; and there are fewer cloudy days, more fair days, and more evaporation. Now the cause of these different facts appears perfectly simple and unequivocal: it exists in the peculiar state of the atmosphere in

each of the two continents, as it is modified by their respective topographical circumstances.

Thus, if in the United States it rain more than in Europe, it is because all the winds there, except the north-west, and particularly those that are most prevalent, come from some sea, and consequently arrive loaded with moisture.

If the rain here be more heavy and sudden, it is because the winds differ widely in the degrees of heat and cold, which in the first instance is a cause of solution; and the mixture of these hot and cold currents is very frequent, which in the next place occasions heavy and copious rains. The gentle showers of Europe are so rare in the United States, that the Americans call them *English rains* or *English weather*.

In the Europe, on the contrary, lofty mountains break the currents of air; the atmosphere is more calm, more stationary; the mixtures of cold and hot winds are less easy, and less frequent; consequently dissolution takes place with less rapidity, the rains are more slow and gentle, the air remains more loaded with vapours and humidity, there are more fogs and cloudy days, &c. and evaporation is more tardy.

If evaporation be more rapid in the United States, it is because the winds are free, in consequence of the general plainness of surface, and because one of these, the north-west, which is extremely dry, prevails for two-fifths of the year.

In Europe, on the contrary, the grand prevailing wind is the west, which is also the most wet.

Finally, it is this powerful evaporation in the United States likewise, that causes these immense dews, unknown in the temperate climates. And if the winds here be more rapid, and hurricanes more frequent than in Europe, it is not only because the tropic is less remote, but because the currents of air find no bar to check and fix them.

*Of the electricity of the air.*

The last meteorological circumstance, in which the air of the American continent differs from that of Europe, is the quantity of electric fluid, with which the former is much more highly charged. There is no occasion for any philosophical apparatus, to render this fact evident to the senses: it is sufficient to draw a silk ribbon briskly over a piece of woollen cloth, to see it contract with a promptitude never observed in France. Storms too afford terrifying proofs of it in the loudness of the claps of thunder, and the prodigious vividness of the flashes of lightning. They frequently occasion melancholy accidents, particularly in the country, underneath trees; and the people are not sufficiently acquainted with the efficacy of oiled or varnished silk or cloth, which are the best preservatives on such occasions, while at the same time they are a defence against the rain.

This abundance of the electric fluid is an additional proof of the dryness of the air, as its inferior quantity in France and in Europe is a proof of humidity.



Among other absurd reveries of European authors respecting North America, none is more ridiculous than that respecting the recent formation of the continent, which is by some strenuously maintained. The geological reader will find many proofs to support a contrary opinion, in the account of the structure of the mountains of North America, which is detailed in the preceding pages, and it may be well to furnish a few more.

We have every reason to believe that our continent was totally metamorphosed by the first convulsion of nature, at the time of the deluge; and that the *fountains of the great deep were broken up*. Hence vast piles of mountains were thrown together from the floating ruins of the earth; and hence the fossil shells and marine exuviae found on the tops of our mountains. Petrified marine shells and coralline substances are found on the west bank of the Mississippi, between St. Genevieve and St. Louis. These various animal exuviae are connected by a calcareous cement.

From the vicinity of the great salt works, five miles below St. Genevieve, on the hills, and at the bottoms of the brooks which run from them, a very curious *siliceous* stone, full of animal remains, has been brought. It strikes fire with steel, is of a whitish colour, and of a quality intermediate between quartz and flint. It is perforated with conical holes, some of which are empty, and others apparently filled up with the remains of some pelagian animal, probably the belemnites.\*

\* The country up the Mississippi, (as Mr. Ayres who visited it,

Calcareous incrustations, and petrifications, shells and different animal relicks, are likewise found in the neighbourhood of Cincinnati, in Mill-creek. They have been discovered on digging wells between Cincinnati, and Lexington; and in the bottoms of most of the creeks running through that country for twenty or thirty miles on each side.

During the spring of 1802, a gentleman in the neighbourhood of Williamsburg, in digging a ditch on his farm, discovered, about four or five feet below the surface of the earth, a considerable portion of the skeleton of a whale. Fragments of the ribs and other parts of the body were found; and all the vertebræ regularly arranged, and very little impaired as to their figure. The spot on which this skeleton was found lies about two miles from the nearest shore of James river, and fifty or sixty from the Atlantic ocean. The whole of the circumstances led strongly to the belief, that this animal had died in his native element, and had afterwards been buried in the sand at its bottom.†

In Richmond, glossopetræ, or teeth of sharks, have been found, several times, in digging wells, at

relates,) has probably been overflowed by the waters above being dammed up by the hills and mountains below; and this for a considerable length of time. The water being in part saturated with the lime and salt which are found there, would afford support and nourishment to testaceous animals similar to those of the ocean. The salt licks are near great bodies of lime-stone. This would make one suppose the bottom of the ocean to abound with regular layers of lime-stone and salt rocks; otherwise how would shell fish multiply in such numbers, if the water of the sea was not pretty well saturated with lime as well as salt?

† Med. Repos, Hexade 2d, vol. 2d.

the depth of sixty, ninety, and an hundred feet below the surface of the earth.\*

As far west as the Blue Ridge, marine shells, and other exuvixæ of the ocean are found, which shew that that region was one day immersed in the deep.

On the banks of the Savannah river, 15 miles below silver bluff, about ninety miles from the sea, in a direct line, and one hundred and fifty or two hundred as the river runs; there is a very remarkable collection of oyster shells of an uncommon size. They run in a north-east and south-west direction, nearly parallel to the sea-coast, in three distinct ridges, which together occupy a space of seven miles in breadth. The ridges commence at the Savannah river, and have been traced as far south as the northern branches of the Alatomaha river. They are found in such quantities, as that the indigo planters carry them away in large boat loads for the purpose of making lime water, to be used in the manufacturing indigo. There are thousands and thousands of tons still remaining.

The shells, says Mr. Bartram, are from 15 to 20 inches in length, from 6 to 8 wide, and from 2 to 4 inches thick, and their hollows sufficient to receive an ordinary man's foot. Such shells are not now found on our coast. Fossil shells were found by Dr. Barton, as already noticed, on the heights of Onondago, in the state of New York, and by Volney at Cincinnati, on the Ohio, and on the summit of a chain about one hundred feet above the level of the river Elkhorn, all which are shown by Lamarck of

† See Mr. Latrobe's Memoir, Am. Phil. Tran. vol. 5.

Paris, to belong to the genus *Terebratula*, or ocean shells, "which live uniformly in the great depths of the ocean, and never on its shores."

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#### LAKES.

IT may in truth be said, that no part of the world is so well watered with springs, rivulets, rivers and lakes, as the territory of the United States. By means of these various streams and collections of water, the whole country is checkered into islands and peninsulas. The United States, and indeed all parts of North America, seem to have been formed by nature for the most intimate union. The facilities of navigation render the communication between the ports of Georgia and New Hampshire far more expeditious and practicable, than between those of Provence and Picardy in France; Cornwall and Caithness in Great Britain; or Galicia and Catalonia in Spain. The canals opening between Susquehannah and Delaware, between Pasquettank and Elizabeth rivers, in Virginia, and between the Schuylkill and Susquehannah, will open a communication from the Carolinas to the western counties of Pennsylvania and New York. The improvement of the Potowmack, will give a passage from the southern states to the western parts of Virginia, Maryland, Pennsylvania, and even the lakes. From Detroit to Alexandria on the Potowmack, six hundred and seven miles, are but two carrying places.

which together do not exceed the distance of forty miles. The canals of Delaware and Chesapeake will open the communication from South Carolina to New Jersey, Delaware, the most populous parts of Pennsylvania, and the midland counties of New York. Were these, and the canal between Ashley and Cooper rivers, in South Carolina, the canals in the northern parts of the state of New York, and those of Massachusetts and New Hampshire, all opened, and many of them are in great forwardness, North America would thereby be converted into a cluster of large and fertile islands, communicating with each other with ease and little expense, and in many instances, without the uncertainty or danger of the seas.

There is nothing in other parts of the globe which resembles the prodigious chain of lakes in this part of the world. They may properly be termed inland seas of fresh water; and even those of the second or third class in magnitude, are of larger circuit than the greatest lake in the eastern continent, the Caspian sea excepted. Some of the most northern lakes belonging to the United States have never been surveyed, or even visited till lately, by white people; of course we have no description of them which can be relied on as accurate. Others have been partially surveyed, and their relative situation determined. The best account of them which we have been able to procure is as follows.\*

\* Morse.

*The Lake of the Woods.*

The Lake of the Woods, the most northern in the United States, is so called from the large quantities of wood growing on its banks; such as oaks, pines, firs, spruce, &c. This lake lies nearly east of the south end of lake Winnepeck, and is supposed to be the source or conductor of one branch of the river Bourbon, if there be such a river. Its length from east to west is said to be about 70 miles, and in some places it is 40 miles wide. The Killisteneaux Indians encamp on its borders to fish and hunt. This lake is the communication between the lakes Winnepeck and Bourbon, and Lake Superior.\*

The Lake of the Woods, according to M'Kenzie is nearly round, and the canoe course through the center of it among a cluster of islands, some of which are so extensive that they may be taken for the main land. The reduced course would be nearly south and north; but following the navigating course, Mr. M'Kenzie makes the distance seventy-five miles, though in a direct line it would fall very short of that length. At about two thirds of it there is a small carrying place when the water is low. The carrying place out of the lake is on an island, and named Portage du Rat, in lat. 49 deg. 37 min. north, and long. 94 deg. 15 min. west, and is about fifty paces long. The lake discharges itself at both ends of this island, and forms the river Winnipic, which is a large body of water interspersed with numerous islands, causing various channels, and interruptions of portages and rapids.

\* MORSE.

*Rainy, or Long Lake.*

Rainy, or Long Lake, lies east of the Lake of the Woods, and is said to be nearly a hundred miles long, and in no part more than twenty miles wide.

Eastward of this lake lie several small ones, which extend in a string to the great carrying place, and thence to Lake Superior. Between these little lakes are several carrying places, which render the trade to the north-west difficult, and exceedingly tedious, as it takes two years to make one voyage from Michilimackinack to these parts.

*Lake Superior.*

Lake Superior justifies the name which it has received, it being the largest and most magnificent body of fresh water in the world: the falls of St. Mary, its northern extremity, being in lat. 46 deg. 31 min. north, and in long. 84 deg. west; where there is no variation of the compass, while its southern extremity, at the river St. Louis, is in lat. 46 deg. 45 min. north, and long. 92 deg. 10 min. west; its greatest breadth is one hundred and twenty miles, and its circumference, including its various bays, is not less than one thousand two hundred miles!

It is clear, of great depth, and abounds in a great variety of fish, of an excellent kind. It may be denominated the grand reservoir of the river St. Lawrence; as the great extent of country, from which other rivers flow in any direction, do not admit of their flowing into it, by reason of the ridge that separates them from the rivers that empty into Hudson's bay, the gulf of Mexico, and the waters that

fall into Lake Michigan, which afterwards become a part of the St. Lawrence.

This vast collection of water is often covered with fog, particularly when the wind is from the east, which driving against the high barren rocks on the north and west shore, dissolves in torrents of rain. It is generally said, that the storms on this lake are denoted by a swell on the preceding day; but this circumstance did not appear to Mr. M'Kenzie to be a constant phenomenon, as the swells more regularly subsided without any subsequent wind.

Along the surrounding rocks of this immense lake evident marks appear of the decrease of its water, by the lines observable along them. The space, however, between the highest and the lowest, is not so great as in the smaller lakes, as it does not amount to more than six feet, the former being very faint.

The bottom of the bay which forms an amphitheatre, is cleared of wood and inclosed; and on the left corner of it, beneath a hill, three or four hundred feet in height, and crowned by others of a still greater altitude, is the fort, picketed in with cedar palisades. The soil immediately bordering on the lake has not proved very propitious, as nothing but potatoes have been found to answer the trouble of cultivation. This circumstance is probably owing to the cold damp fogs of the lake, and the moisture of the ground, from the springs that issue from beneath the hills. There are meadows in the vicinity that yield abundance of hay, but agriculture has not hitherto been an object of serious consideration.

On the north side of the lake, in lat. 48 deg. north, long. 90 deg. west from Greenwich, in a plea-



sant bay, is the Grande Portage, in the route to the Canadian fur depot viz. Fort Chepewyan. At the entrance of the bay is an island which screens the harbour from every wind except the south ; but the shallowness of the water renders it necessary for the vessel to anchor near a mile from the shore, in fourteen feet water,\*

There are many islands, says Dr. Morse, in this lake: two of them have each land enough, if proper for cultivation, to form a considerable province ; especially Isle Royal, near the north-west coast of the lake, which is not less than a hundred miles long, and in many places forty broad. The natives suppose these islands are the residence of the Great Spirit.

Two large rivers empty themselves into this lake, on the north and north-east sides ; one is called the Nipegon, which leads to a tribe of the Chippeways, who inhabit a lake of the same name, and the other is the Michipicoton river, the source of which is towards James's bay, from whence there is said to be but a short portage to another river which empties itself into that bay.

There are upwards of thirty other rivers which empty themselves into this lake, some of which are of a considerable size. On the south side of it is a remarkable point or cape, of about sixty miles in length, called Point Chegomegan. About a hundred miles west of this cape a considerable river falls into the lake, the head of which is composed of a great assemblage of small streams. This river is remark-

\* M'Kenzie's Voyage.

able for the abundance of virgin copper that is found on and near its banks. Many small islands, particularly on the eastern shores, abound in copper ore lying in beds, with the appearance of copperas.

Storms affect this lake as much as they do the Atlantic ocean ; the waves run as high, and the navigation is equally dangerous. It discharges its waters from the south-east corner, through the straits of St. Marie, which are about forty miles long. Near the upper end of these straits is a rapid, which, though it is impossible for canoes to ascend, yet, when conducted by careful pilots may be descended without danger.

Though Lake Superior is supplied by near forty rivers, many of which are large, yet it does not appear that one-tenth part of the waters which are conveyed into it by these rivers, is discharged by the above-mentioned straits. Such a superabundance of water can be disposed of only by evaporation. The entrance into this lake from the straits of St. Marie, affords one of the most pleasing prospects in the world. On the left may be seen many beautiful little islands that extend a considerable way before you ; and on the right, an agreeable succession of small points of land, that project a little way into the water, and contribute with the islands to render this delightful bason calm, and secure from those tempestuous winds by which the adjoining lake is frequently troubled.

A very curious occurrence, according to M'Kenzie, was observed some years ago at the grand portage on this lake, for which no obvious cause has been assigned. The water withdrew with great

precipitation, leaving the ground dry that had never been visible before; the fall being equal to four perpendicular feet, and rushing back with great velocity above the common mark. It continued to fall and rise for several hours, gradually decreasing till it stopped at its usual height. There is frequently an irregular influx and deflux, which does not exceed ten inches, and is attributed to the wind.

The inhabitants on the borders of this lake are all of the Algonquin nation; and do not exceed one hundred and fifty families. They live chiefly on fish, for the country being destitute of shelter, cannot be expected to abound in animals. The rocks appear to have been overrun with fire, and the stunted timber which once grew there, is frequently seen lying along the surface of them: between the fallen trees there are briars, hurtle berries, gooseberry and raspberry bushes, which invite bears in great numbers: beyond these rocky banks are found a few moose and fallow deer. The waters alone are abundantly inhabited. The particular fish are trout, weighing from five to fifty pounds, sturgeon, pickerel, pike, red and white carp, black bass, and best of all the tiscamany or white fish, which weighs from four to sixteen pounds, and is of a superior quality.

### *Lake Huron.*

Lake Huron, into which you enter through the straits of St. Marie, is next in magnitude to Lake Superior. It lies between lat. 43 deg. 30 min. and 46 deg. 30 min. north, and between long. 80 deg. and 84 deg. 30 min. west from London. Its circumference is about one thousand miles. On the north

side of this lake is an island called Manatou, signifying a place of spirits, and is considered as sacred by the Indians. On the south-west part of this lake is Saganaum bay, about eighty miles in length, and about eighteen or twenty miles broad. On its banks are great quantities of sand cherries. Thunder bay, so called from the thunder that is frequently heard here, lies about half way between Saganaum bay and the north-west corner of the lake. It is about nine miles across either way. The fish are the same as in Lake Superior. At the north-west corner this lake communicates with Lake Michigan, by the straits of Michilimackinack.

The Chippeway Indians live scattered around this lake; particularly near Saganaum bay. Their country, however, is to the eastward of this lake.

#### *Michigan Lake.*

Michigan lake lies between latitude 42 deg. 10 min. and 46 deg. 30 min. north; and between 11 deg. and 13 min. west long. from Philadelphia. Its computed length is 280 miles from north to south; its breadth from 60 to 70 miles. It is navigable for shipping of any burthen; and at the north-eastern part communicates with lake Huron, by a strait six miles broad, on the south side of which stands fort Michilimackinack, which is the name of the strait. In this lake are several kinds of fish, particularly trout of an excellent quality, weighing from 20 to 60 pounds, and some have been taken in the straits of Michilimackinack of 90 pounds. Westward of this lake are large meadows, said to extend to the Mississippi. It receives a number of rivers from the

west and east, among which is the river St. Joseph, very rapid and full of islands. It springs from a number of small lakes, a little to the north-west of the Miami village, and runs north-west into the south-east part of the lake. On the north side of this river is fort St. Joseph, from which there is a road, bearing north of east, to Detroit. The Powtewatamie Indians, who have about two hundred fighting men, inhabit this river opposite fort St. Joseph.

Between lake Michigan on the west, and lakes Huron, St. Clair, and the west end of Erie on the east, is a fine tract of country, peninsulated, more than 250 miles in length, and from 150 to 200 in breadth. The banks of the lakes, for a few miles inland, are sandy and barren, producing a few pines, shrub-oaks and cedars. Back of this from either lake, the timber is heavy and good, and the soil luxuriant.

### *Lake St. Clair.*

Lake St. Clair lies about half way between lake Huron and lake Erie, and is about ninety miles in circumference. It receives the waters of the three great lakes, Superior, Michigan and Huron, and discharges them through the river or strait (called Detroit) or (the Strait) into lake Erie. This lake is of an oval form, and navigable for large vessels. The fort of Detroit is situated on the western bank of the river of the same name, about nine miles below lake St. Clair. The settlements are extended on both sides of the strait or river for many miles towards lake Erie, and some few above the fort.

*Lake Erie.*

Lake Erie is situated between 41 and 43 deg. of north latitude, and between 3 deg. 40 min. and 8 deg. west longitude. It is nearly 300 miles long, from east to west, and about forty in its broadest part. A point of land projects from the north side into this lake, several miles towards the south-east, called Long Point. The islands and banks towards the west end of the lake are so infested with rattlesnakes, as to render it dangerous to land on them. The lake is covered near the banks of the islands with large pond lily, the leaves of which lie on the surface of the water so thick, as to cover it entirely for many acres together; on these, in the summer season, lie myriads of water-snakes, basking in the sun. This lake is of more dangerous navigation than any of the others, on account of the craggy rocks which project into the water, in a perpendicular direction, many miles together from the northern shore, affording no shelter from storms.

Presque Isle is on the south-east shore of this lake, about lat. 42 deg. 10 min. From this to fort Le Beuf, on French creek, is a portage of 15 1-2 miles. About 20 miles north-east of this is another portage of 9 1-4 miles, between Chataughque creek, emptying into lake Erie, and Chataughque lake, a water of Alleghany river.

Fort Erie stands on the northern shore of lake Erie, and the west bank of Niagara river in Upper Canada. This lake, at its north-east end communicates with lake Ontario, by the river Niagara, which runs from south to north, about 30 miles, in-

cluding its windings, embracing in its course, Grand Island, and receiving Tonewanto creek, from the east.\*

Mr. Elicott informs us, that fogs are seldom observed in summer on the margin of the lake. The horizon is clear, and the stars shine with remarkable lustre. The most common winds resemble the sea and land breezes in the West Indies. From the end of spring, till the beginning of autumn, they blow, except at the time of storms, from the lake upon the land, during the greater part of the day, and from the land upon the lake during the night. These breezes render the vicinity of the lake very pleasant during the summer, and have most probably a salutary influence upon the atmosphere.

A strong east wind occasions a considerable depression, and a strong west wind a considerable swell of the waters in Presqu'isle bay. To these causes we are to attribute the ebbings and flowings which have frequently been mistaken for regular tides. When the wind ceases, the waters restore the equilibrium.

The southern shores of the lake are generally high: in many places they are perpendicular, and various strata of stone are considerably elevated above the surface of the water. The streams which discharge into the lake over these strata, form a great variety of cascades of romantic appearance, which increase the beauty of the country, and must at some future period enhance the value of the lands. At the lower end of the lake, and for some distance up it, these strata consist of limestone intermixed

\* Morse.

with flint and marine petrefactions, but the other strata are generally slate and excellent free-stone. In 1795, the variation of the magnetic needle at the town of Erie, was 0 deg. 43 min. east.

### *Lake Ontario.*

Lake Ontario is situated between forty-three and forty-five degrees north latitude, and between one and five degrees west longitude from Philadelphia. Its form is nearly oval. Its greatest length is from south-west to north-east, and its circumference about six hundred miles. It abounds with fish of an excellent flavour, among which are the Oswego bass, weighing three or four pounds. Its banks in many places are steep, and the southern shore is covered principally with beech trees, and the lands appear good. It receives the waters of the Chenesee river from the south, and of Onendoga, at fort Oswego, from the south-east by which it communicates, through lake Oneida and Wood Creek, with Mohawk river. On the north-east, this lake discharges itself through the river Cataraqui, (which at Montreal takes the name of St. Lawrence) into the Atlantic ocean. It is asserted, that these lakes fill once in seven years, and that 1794 was the year when they would be full; but as we are unacquainted with any laws of nature, by which this periodical effect should be produced, we may with propriety doubt the fact.

About 8 miles from the west end of lake Ontario, is a curious cavern, which the Messisaugas Indians call *Manito ah wigwam*, or *house of the devil*. The mountains which border on the lake, at this place break off abruptly, and form a precipice of 200 feet



perpendicular descent; at the bottom of which the cavern begins. The first opening is large enough for three men conveniently to walk abreast. It continues of this bigness for 70 yards, in a horizontal direction. Then it falls almost perpendicularly 50 yards, which may be descended by irregular steps from one to four feet distant from each other. It then continues 40 yards horizontally, at the end of which is another perpendicular descent, down which there are no steps. The cold here is intense. In spring and autumn, there are, once in about a week, explosions from this cavern, which shake the ground for sixteen miles round.\*

### *Lake Champlain.*

Lake Champlain is the largest collection of waters in the northern States. Reckoning its length from Fairhaven to St. John's, a course nearly north, it will amount to about two hundred miles. Its width is from one to eighteen miles, being very different in different places; the mean width may be estimated at five miles. This will give one thousand square miles, or six hundred and forty thousand acres, as the area of its surface. Its depth is sufficient for the navigation of the largest vessels. It contains several islands; one of them, the Grand Isle, is twenty-four miles long, and from two to four miles wide.

The waters which form this lake, are collected from a large tract of country. All the streams, which arise in more than one half of Vermont, flow into it. There are several, which also fall into its eastern side, from the province of Canada. It is

\* Morse.

probable the rivers which flow into the west side, are as large, numerous, and extensive, as those on the east. The waters, therefore, from which lake Champlain is formed, seem to be collected from a tract of country of a larger extent, than the whole state of Vermont.

There are many marks and indications that the surface of this lake, was formerly thirty or forty feet higher than it is now. The rocks, in several places, appear to be marked, and stained, with the former surface of the lake, many feet higher than it has been, from its first discovery by Sir Samuel Champlain, in 1608. Fossil shells, the limbs and bodies of trees, are frequently found at the depth of fifteen or twenty feet in the earth; this is the case not only along the shores, but in the low lands at the distance of two or three miles from them. The soil in many places near the shore, is evidently of the same factitious kind, as the intervals formed by the rivers. These, and other circumstances, have left no doubt on the minds of the inhabitants along the lake shore, that the waters of it were formerly much higher, and spread to a much greater extent, than they now are.

The operations of nature with respect to the lake, must have been the same that they were in relation to the rivers. When the waters discharged by the streams amounted to such a collection, as to rise above the shores of the lake, they would overflow at the lowest part. There, the channel would begin; and being formed, it would become more and more deep, in the same manner as the channel of a river. The channel which this lake found, and formed,

was to the northward; into the river St. Lawrence; and through that into the ocean. When this channel, by the constant running of the water, was worn down thirty or forty feet, the surface of the lake would naturally subside the same space.

At present there is but little alteration in the height of the waters, through the year. They generally rise from about the twentieth of April until the twentieth of June. Their rise is commonly from four to six feet, the greatest variation is not more than eight feet. The lake is early frozen round the shores, but it is not commonly wholly shut up with the ice, until the middle of January. Between the 6th and the 15th of April, the ice generally goes off; and it is not uncommon for many square miles of it to disappear in one day.

The north line of Vermont passes over the south part of the lake Memphremagog. This lake is about forty miles in length, and two or three miles wide. It lies chiefly in the province of Canada, and has a northerly direction. The river St. Francis forms a communican between the lake Memphremagog, and the river St. Lawrence. Round this lake, there is a rich soil, and a fine level country.

### *Lake George.*

Lake George lies to the southward of lake Champlain, and is a most clear, beautiful collection of water, 36 miles long, and from 1 to 7 miles wide. It embosoms more than 200 islands, some say 365; very few of which are any thing more than barren rocks, covered with heath, and few cedar, spruce and hemlock trees and shrubs, and abundance of

rattle-snakes. On each side it is skirted by prodigious mountains, from which large quantities of red cedar are every year carried to New York for ship timber. The lake is full of fishes, and some of the best kind; among which are the black or Oswego bass, and large speckled trouts. The water of this lake is about 100 feet above the level of lake Champlain. The portage between the two lakes is one mile and a half, but with a small expence might be reduced to 60 yards; and with a sufficient number of locks might be made navigable through, for batteaux. This lake, in the French charts, is called lake St. Sacrament; and it is said that the Roman Catholics in former times, were at the pains to procure this water for sacramental uses in all their churches in Canada; hence probably it derived its name.\*

\* Morse.

## RIVERS.

*Mississippi.*

According to the information of Mr. Lewis, who has lately returned from the voyage of discovery, ordered by the present government of the United States, the river Mississippi takes its rise, south, a little westwardly, of the Lake-of-the-Woods; and receives the grand river Missouri, about five leagues above the town of St. Louis, the capital of Upper Louisiana, in about the 40th degree of north latitude. After this junction it runs about 1200 miles before it falls into the gulf of Mexico: and, in its course, receives the waters of many rivers.

The great length of this river (says the late Mr. Hutchins)\* and the excessive muddiness and salubrious quality of its waters, after its junction with the Missouri, are very singular.† The direction of the channel is so crooked, that, from New Orleans to the mouth of the Ohio, a distance which does not

\* Hist. Narrat. and Topog. Desc. of Louisiana. Phil. 1784.

† In a half pint tumbler of this water has been found a sediment of two inches of slime. It is, notwithstanding, extremely wholesome and well-tasted, and very cool in the hottest seasons of the year; the rowers, who are then employed, drink of it when they are in the strongest perspiration, and never receive any bad effects from it. The inhabitants of New Orleans use no other water than that of the river, which, by keeping in jars, becomes perfectly clear.

exceed 460 miles in a straight line, is about 856 by water. It may be shortened, at least 250 miles, by cutting across eight or ten necks of land, some of which are not 30 yards wide. Charlevoix relates, that in the year 1722, at point Coupeé or Cut point, the river made a great turn, and some Canadians, by deepening the channel of a small brook, diverted the waters of the river into it. The impetuosity of the stream was so violent, and the soil of so rich and loose a quality, that, in a short time, the point was entirely cut through, and travellers saved fourteen leagues of their voyage. The old bed has no water in it, the times of the periodical overflowings only excepted. The new channel has been since sounded with a line of thirty fathoms, without finding bottom.

In the Spring-floods the Mississippi is very high, and the current so strong that with difficulty it can be ascended; but that disadvantage is compensated by eddies or counter-currents, which always run in the bends, close to the banks of the river, with nearly equal velocity against the stream, and assist the ascending boats. The current, at this season, descends at the rate of about five miles an hour. In Autumn, when the waters are low, it does not run faster than two miles, but it is rapid in such parts of the river which have clusters of islands, shoals, and sand-banks. The circumference of many of these shoals being several miles, the voyage is longer, and, in some parts, more dangerous, than in the Spring. The merchandize, necessary for the commerce of the upper settlements on, or near, the Mississippi, is conveyed, in the Spring and Autumn,

in batteaux, rowed by eighteen or twenty men, and carrying about forty tons. From New Orleans to the Illinois, the voyage is commonly performed in eight or ten weeks. A prodigious number of islands, some of which are of great extent, intersperse that mighty river.

Below New Orleans the land begins to be very low on both sides of the river, across the country, and gradually declines as it approaches nearer to the sea. This point of land, which, in the treaty of peace in 1762, is mistaken for an island, is, to all appearance, of no long date; for in digging a little below the surface we find water and great quantities of trees. The many beaches and breakers, as well as inlets, which arose out of the channel within the last half century, at the several mouths of the river, are convincing proofs that this peninsula was wholly formed in the same manner. And it is certain, that, when La Salle sailed down the Mississippi to the sea, the opening of that river was very different from what it is at present.

The nearer we approach to the sea, this truth becomes more striking. The bars that cross most of these small channels, opened by the current, have been multiplied by means of the trees carried down with the streams; one of which stopped by its roots or branches, in a shallow part, is sufficient to obstruct the passage of thousands more, and to fix them at the same place. Such collections of trees are daily seen between the Balize and the Missouri, which, singly, would supply the largest city in Europe with fuel for several years. No human force being sufficient for removing them, the mud carried

down by the river serves to bind and cement them together. They are gradually covered, and every inundation, not only extends their length and breadth, but adds another layer to their height. In less than ten years time, canes and shrubs grow on them, and form points and islands, which forcibly shift the bed of the river.

From St. Anthony's falls,\* in latitude 45 deg. it glides with a pleasant clear stream, and becomes comparatively narrow before its junction with the Missouri, the muddy waters of which immediately discolour the lower part of the river to the sea. Its rapidity, breadth, and other peculiarities, then begin to give it the majestic appearance of the Missouri.

From the Missouri river to nearly opposite the Ohio, the western bank of the Mississippi is (some few places excepted) higher than the eastern. From Mine au fer to the Ibberville, the eastern bank is higher than the western, on which there is not a single discernable rising or eminence, the distance of 750 miles. From the Ibberville to the sea, there are no eminences on either side, though the eastern bank appears rather the higher of the two, as far as the English turn. Thence the banks gradually diminish in height to the mouths of the river, where they are not two or three feet higher than the common surface of the water.

The slime, which the annual floods of the river Mississippi leaves on the surface of the adjacent

\* 300 leagues above the union of the Mississippi and Missouri.



shores, may be compared with that of the Nile, which depo its a similar manure, and for many centuries past has insured the fertility of Egypt. When its banks shall have been cultivated as the excellency of its soil and temperature of the climate deserve, its population will equal that, or any other part of the world. The trade, wealth, and power, of America, will, at some future period, depend, and, perhaps, center, upon the Mississippi. This also resembles the Nile in the number of its mouths, all issuing into a sea that may be compared to the Mediterranean, which is bounded on the north and south by the two continents of Europe and Africa, as the Mexican bay is by North and South America. The smaller mouths of this river might be easily stopped up, by means of those floating trees, with which the river, during the floods, is always covered. The whole force of the channel being united, the *only* opening then left would probably grow deep, and destroy the bar.

On the subject of this great river, Mr. Dunbar, of Natchez, observes: The multiplicity of the rivers which are tributary to the Mississippi, extending themselves over an immense tract, comprehending nearly 20 deg. in lat. and 30 deg. in long. must render this river, at all seasons, one of the most considerable on the globe. The annual inundation, being supplied from so great a variety of climates, must naturally be expected to be of long duration; and may be estimated at nearly half the year; beginning, generally, to rise in January, and falling in June.

At the landing of the Natchez (380 miles from the mouth of the river) the perpendicular ascent of the waters of the Mississippi, from the lowest ebb to the highest inundation, may be estimated at 50 feet. At Baton Rouge (200 miles distant) it was found to be 30 feet. At New Orleans (80 miles above the mouth) it is about 12 feet. And at the mouth of the river, scarcely any perceptible change is observed, excepting by a stronger current, charged with earthy matter, rolling into the ocean, during the season of inundation; at which time all the lakes and communications with the sea, are replenished with water, and the ocean itself is often repelled to such a degree, that fresh water has been drawn up, out of sight of land. This great difference in the perpendicular rise of the waters of the inundation, is to be accounted for, from the prodigious number of natural canals issuing from the Mississippi, and those immense sheets of water flowing over the banks, inundating vast tracts of country, which owe their existence to the creative power of this grand river, and which finally discharge themselves into the Mexican gulf, by an infinite number of mouths, many of which are, in apparent magnitude, equal to the Mississippi itself; the space embraced by the Delta of this river on the sea-coast being, from information, not less than 3 deg. of long.

## TABLE

*Of the mean Altitude of the Waters of the Mississippi at Natchez, from the lowest Ebb to the highest Elevation.*

	Days.	Alt. feet.
January . . . . .	1 . . . . .	25
. . . . .	15 . . . . .	30
February . . . . .	1 . . . . .	35
. . . . .	15 . . . . .	40
March . . . . .	1 . . . . .	45
. . . . .	15 . . . . .	47
April . . . . .	1 . . . . .	48
. . . . .	15 . . . . .	48 1-2
May . . . . .	1 . . . . .	49
. . . . .	15 . . . . .	50
June . . . . .	1 . . . . .	50
. . . . .	15 . . . . .	48
July . . . . .	1 . . . . .	45
. . . . .	15 . . . . .	40
August . . . . .	1 . . . . .	20
. . . . .	15 . . . . .	10
September . . . . .	1 . . . . .	7
. . . . .	15 . . . . .	5
October . . . . .	1 . . . . .	0
. . . . .	15 . . . . .	0
November . . . . .	1 . . . . .	5
. . . . .	15 . . . . .	10
December . . . . .	1 . . . . .	15
. . . . .	15 . . . . .	20

It is not to be understood that the rise and fall of the Mississippi, in any one year, ever arrives to the extent of the above table ; it is found, that years of least elevations will generally be those of greatest depressions. The table is calculated only to convey some idea of the extremes which have been noted in a series of years, and of the general progress of the inundation, both in its advancement and its retreat.

The Mississippi overflowed its banks for three years preceding 1774, and did great mischief to the planters. Since that period, from year to year, it has continued to rise higher and higher, in so much, that embankments of five or six feet perpendicular are now required, where as many inches were formerly sufficient. This increasing ascent of the inundation, may be naturally accounted for, by the gradual extension of the levees, or embankments, on both sides of the river, which became, each succeeding year, more necessary for the defence of the new settlements, against the encroachments of this great river. Those establishments are now extended, on either bank, to the distance of 60 leagues above the capital.

The Mississippi has ceased to rise to its usual heights for these three years past ;\* the defect at Natchez has not been less than from eight to twelve feet, and proportionably in the lower country.

It does not appear, that we can assign any physical cause, why the Mississippi should have certain

\* This account was commenced in 1800.

periods of years, in respect to its inundations? The late period of great inundations, which have fallen chiefly under my observations, (says Mr. Dunbar), has been about 27 years, not much short of a cycle of the sun; but whether the inundations of this great river are subject to the influence of any regular cause, must be left to the investigation of future philosophers.

The extreme turbidness of the water is to be attributed principally to the falling in of the mud banks, either newly formed beneath the influence of the current of the river; or undermined by its rapidity, perpetually changing its bed, by enlarging the concavity of its bends, and projecting its points or head lands: this operation has a natural tendency to lengthen the circuitous course of the river; but the effect is amply compensated by its own progress; for the enlargement of the bends frequently brings them so near each other, that the weight of the waters burst at once through the solid soil, forming in a few days a new bed capable of conveying the whole waters of this mighty river, and shortening thereby its course many leagues. The disruption which took place at Point Coupée, cut off ten leagues, and within this territory the cut-off at the Homichito has thrown to the east of the Mississippi an island of seven leagues in circuit, and at the Yazooz a similar effect has been produced on the west side by the formation of an island of five leagues in circumference.

Those islands are now both converted into peninsulas, by the formation of new land across one of the mouths of the old channel, while the other is

partially kept open by the discharge of the (comparatively) small rivers of Yazooz and Homochito; the former of these, nevertheless, is not inferior in magnitude to that great commercial river the Thames. The consequence of those disruptions, is the formation of lakes, which, in process of time, may be far removed from the actual channel of the river, and in effect are now found to be scattered in all situations over the immense valley of the Mississippi.

When those lakes are first approached, they present so perfect a resemblance of the Mississippi, with regard to breadth, the appearance of the banks, and the natural serpentine form of its course, that many persons have been deceived thereby, and recognized their error only by the discovery of the stagnant state of the water, the appearance on its borders of the *nympheæ nelumbo*, and other aquatic plants.

When the inundation is at its height, the whole valley is replenished with water, every where in motion towards the ocean: so that the river may then be said to be 30 miles wide; that is the breadth of the valley at Natchez. The waters which pass over the west bank of the main channel never return: on the east, a chain of high land compels its waters to rejoin the primitive stream; but from Baton Rouge, the high land diverges to the southeast: and all the waters escaping to the eastward, between Baton Rouge and Manshoc (15 miles), are collected by the Iberville, which passing through a breach in the high land of about 80 yards wide, delivers its contents into the river Amit, which emp-

ues into lake Maurepas, communicating with the ocean by the intervention of the more considerable lake Pontchartrain.

The perpendicular height of the high lands above the level of the inundation, is from 200 to 300 feet at Natchez: but declines at Baton Rouge to 25, and on the island of New Orleans, it is frequently lost under the accumulations of the soil deposited by the waters.

The principal channel is rarely a mile in width below the Ohio; and often it is less than half a mile. From New Orleans to the mouth, it is from 50 to 70 fathoms deep, but its depth diminishes considerably as we advance upwards; at Natchez, when the waters are low, it is about 12 fathoms, and there are situations below the Ohio, where the ordinary boats have been embarrassed to find a passage; a moderate fresh, nevertheless, renders the river navigable up to the falls of St. Anthony, 2000 miles from its mouth. But the great obstruction to its navigation is the bar at its mouth, which is formed by the deposition of the sediment of the water, in the form of a crescent, in a depth of 15 feet. If this impediment were removed, a ship of the line might find at all times sufficient water, six or seven hundred miles up the river.

The fish of this river are sturgeon, pike, perch, eels, and catfish, of a monstrous size. Craw-fish abound in the country, in every part of the earth, and are obtained by raking a pond dug for the purpose. Shrimps are caught by sinking a small canvass bag with a piece of meat in it, for a few hours.

The falls of St. Anthony in the Mississippi are a pleasing sight. The whole river, which is more than

250 yards wide, falls perpendicularly about thirty feet. The descent being considerably increased by the rapids below, the falls appear higher than they really are, when viewed at a distance.

### *The Illinois.*

The river Illinois is a noble branch of the Mississippi, and, according to capt. Hutchins, furnishes a communication with lake Michigan, by the Chicago river, and by two portages between the latter and the Illinois river, the longest of which does not exceed four miles. The country through which it flows is extremely rich. It empties into the Mississippi in lat. 38 deg. 40 min. long. 93 deg. 12 min. one hundred and seventy-six miles above the Ohio.

### *The Ohio*

Is formed by the confluence of the Alleghany and Monongahela, below Pittsburg.

From Pittsburg, it takes a north-west course for about twenty-five miles, then turns gradually to west-south-west, and pursuing that course for about five hundred miles, winds to the south-west for nearly one hundred and sixty miles, and, at length, empties into the Mississippi (according to Hutchins) eleven hundred and eighty-eight miles below Pittsburg, and nearly the same distance above New Orleans, in lat. 36 deg. 45 min. north. It is very crooked, but its general direction is south 60 deg. west. Its common width is from five to fifteen hundred yards; but, at the rapids and near the mouth, it is considerably wider.

The numerous islands interspersed in this river,



in many places, add much to the beauty of the appearance, but embarrass the navigation, particularly in low water; as they occasion shoals and sand bars. The extent of some of them is considerable. The soil of which they are formed is very rich, and they are covered with a fine growth of trees.

In common Winter and Spring floods, the river affords thirty or forty feet of water, from the Mississippi to Louisville; twenty-five or thirty feet, to La Tarté's rapids; forty, above the mouth of the great Kanhaway; and a sufficiency, at all times, for flat bottomed boats and canoes.\*

The greatest impediment in the navigation of the Ohio river, is the rapids, which are situated in 33 deg. 8 min. north lat. they are occasioned by a ledge of rocks, which stretch across the river from one side to the other, in some places projecting so much as to be visible when the water is not high, and in most places when the water is extremely low. On levelling the descent, it has been found to be twenty-two and a half feet in two miles. The rock which forms the bed of the river is divided into three branches, which are vulgarly called the main Chute, the middle Chute, and the town Chute....The main Chute is passable for batteaux and flat-bottomed boats, drawing from one and a half to two and a half feet water, at least nine months in the year; the middle Chute, the bottom of which is even and unobstructed by detached pieces of rocks, which is not the case in the main Chute, is only passable during swells in the river, though it has never less than four

\* Harris's Tour to Ohio,

inches depth of water running in it. The town Chute, or southern arm, which may be two hundred yards wide, would, on account of the trouble or difficulty of rowing boats, which have landed at the mouth of Bear-Grass creek, which empties in just above the town of Louisville, some distance up the river, in order to get them into the current of either the middle or main Chute, be preferable to the other two arms, were it not dry the most of the year. During a fresh, which happened about five years since, said to be eight feet higher than any observed prior to it, the southern or town Chute was sounded, by a person of accuracy and intelligence, and the water found to be thirty-five feet deep. The cutting of a canal from the mouth of Bear-Grass, which is on the upper side of the rapids, to below the reef of rocks, which is not quite two miles, and the ground a gentle declivity, has been long contemplated, in order to make the river, in this place, passable, at all times, without difficulty; but, as the river is very shallow on the Louisville shore, for at least four miles above the mouth of Bear-Grass, it is supposed, that the opposite shore will be found preferable for this undertaking, both on account of the main body of water pressing to that shore, and the natural situation of the ground through which the canal must pass. Time, however, will show, to which the preference will be given, as, doubtless, the day is not far distant, when this impediment in the navigation of one of the finest rivers in the world, will be removed, by cutting a canal on either one side or the other of it.

The situation of the rapids is truly delightful. The river is full a mile wide, and the fall of water, which is an eternal cascade, appears as if nature had designed it to show how inimitable and stupendous are her works....Its breadth contributes to its sublimity; and the continually rumbling noise tends to exhilarate the spirits, and gives a cheerfulness even to sluggards....The view up the river is terminated, at the distance of four leagues, by an island in the centre, which is contrasted by the plain on the opposite shore, that extends a long way into the country; but, the eye receding, finds new beauties, and ample subject for admiration, in the rising hills of Silver creek, which, stretching obliquely, to the north-west, proudly rise higher and higher as they extend, until their summits are lost in air.....Clarksville, on the opposite shore, completes the prospect, and from its neighbourhood, and from the settlement forming upon the officers' lands, in a few years must afford us a cultivated country, to blend appropriate beauty with the charms of imagination. There lies a small island in the river, about two hundred yards from the eastern shore; between which and the main is a quarry of excellent stone for building, the greater part of which is dry the latter end of Summer. The banks of the river are never overflowed here, they being fifty feet higher than the bed of the river.

The disposition of the waters of this river to petrify, is well known: at the falls in particular these petrifications abound. In Mr. Volney's opinion, as noted in the preceding pages, these petrifications are only on the surface of the rock, and are not imbedded in it. He concludes, therefore, that the sub-

stances so petrified, must have been brought to the spot. But col. Williams, of the American army, in a recent communication to the author on the subject, observes, that in August, 1801, when the waters were unusually low, he examined the obstructions forming the falls, and found the whole mass to be a smooth homogenous stone, on the surface of which were scattered small petrified substances, which, in consequence of their looking like the superficial roots of trees, were traced backwards, until a great many trees were found, which were worn to a level with the surrounding mass. The concentric annulars were as visible as in a new sawed log, and in many instances, where the stumps were in an inclined plain, they were elliptical: on being broken off they gave the appearances peculiar to the several trees; thus, the red cedar was like a blossom-coloured marble, the beech was more compact, while the oak exhibited greater spaces between the annulars. The specimens, in proof of this opinion, are lodged in the cabinet of the Amer. Phil. Soc.

#### *Fish of the Ohio.*

Mr. Harris informs us, that the fish in the Ohio, and the rivers that flow into it, are numerous, and all of them different from those which are found in the waters of the northern states.

I am not enough acquainted with ichthyology (he says) to describe them scientifically, and can, therefore, only set down the common names of some of them. These names were given them by the new settlers, and were generally suggested by the resem-

blance they bore to fish they had been acquainted with before.

The black cat-fish are caught weighing from six to one hundred and ten pounds; the yellow cat-fish, which resemble the pout, are sometimes of five pounds weight; pike, from eight to thirty-five pounds weight; bass; salmon, very different from the fine fish of that name in the rivers of the northern states, but somewhat resembling the salmon-trout; perch; sturgeon, of two kinds; and buffalo-fish, so called by the Indians and Europeans, on account of its being heard sometimes to bellow in the water. There is also a curious fish called the spade-fish; it is furnished with a bony weapon projecting from the nose, from six to ten inches in length, and from two to five in width; thin, and like a narrow shovel; this appears designed to enable its possessor to dig up its prey from the mud. The fish have been caught with a seine, and sometimes they will bite at a hook. They are from five to twelve pounds weight: the body is long and slender.

On the banks of the rivers and creeks are a great many cray-fish. This is a mischievous little creature to dams and water-courses, by digging holes, which let off the water.\*

### *Navigation, &c.*

The navigation of the Ohio in a dry season is rather troublesome from Fort Pitt to the Mingo town, (about seventy-five miles) but from thence to the Mississippi, there is always a sufficient depth of

\* Harris's Tour to Ohio.

water for barges, carrying from 100 to 200 tons burthen, from 100 to 120 feet in the keel, sixteen to eighteen feet in breadth, and four feet in depth, and when loaded, drawing about three feet water.

The rapids, in a dry season, are difficult to descend with loaded boats or barges, without a good pilot; it would be adviseable therefore for the bargemen, in such season, rather than run any risk in passing them, to unload part of their cargoes, and reship it when the barges have got through the rapids. It may, however, be proper to observe, that loaded boats in freshes, have been easily rowed against the stream, up the rapids, and that others by means only of a large sail have ascended them.

In a dry season the descent of the rapids, in the distance of a mile, is about 12 or 15 feet, and the passage down would not be difficult, except, perhaps, for the following reasons. Two miles above them the river is deep, and three quarters of a mile broad; but the channel is much contracted, and does not exceed 250 yards in breadth; near three-fourths of the bed of the river, on the south-eastern side of it being filled with a flat limestone rock, so that in a dry season there is seldom more than six or eight inches water, it is upon the northern side of the river; and being confined, as above-mentioned, the descending waters tumble over the rapids with a considerable degree of celerity and force. The channel is of different depths, but no where less than five feet; it is clear, and upon each side of it are large broken rocks, a few inches under the water.

*The Monongahela.*

Monongahela is a large river, and at its junction with the Alleghaney river stands Fort Pitt. It is deep and gentle, and navigable with batteaux and barges beyond Red Stone Creek, and still farther with lighter craft. At sixteen miles from its mouth is Youghiogeny; this river is navigable with batteaux and barges to the foot of Laurel hill. This river is four hundred yards wide at its mouth. From thence to the mouth of the Youghiogeny, where it is three hundred yards wide. Thence to Red Stone by water is fifty miles, by land thirty. Then to the north of Cheat river, by water forty miles, by land twenty-eight; the width continuing at three hundred yards, and the navigation good for boats. Thence the width is about two hundred yards to the western fork, fifty miles higher, and the navigation is frequently interrupted by rapids; which, however, with a swell of two or three feet, become very passable for boats. It then admits light boats, except in dry seasons, sixty-five miles farther, to the head of Tygart's valley, presenting only some small rapids and falls, of one or two feet perpendicular, and lessening in its width to twenty yards. The western fork is navigable in winter, ten or fifteen miles towards the north of the little Kanhaway, and will admit of a good waggon road to it. The Youghiogeny is the principal branch of this river. It passes through the Laurel mountain, about thirty miles from its mouth; is so far, from three hundred to one hundred and fifty yards wide, and the navigation much obstructed in dry weather by rapids and shoals.

In its passage through the mountain it makes very great falls, admitting no navigation for ten miles, to the 'Turkey foot. Thence to the Great Crossing, about twenty miles, it is again navigable, excepting in dry seasons, and at this place is two hundred yards wide. The sources of this river are divided from those of the Potowmac by the Alleghany mountain. From the falls, where it intersects the Laurel mountain, to Fort Cumberland, the head of the navigation on the Potowmac, is forty miles of very mountainous road. Wills creek, at the mouth of which was Fort Cumberland, is thirty or forty yards wide, but affords no navigation as yet. Cheat river, another considerable branch of the Monongahela, is two hundred yards wide at its mouth, and one hundred yards at the Dunkards' settlement, fifty miles higher. It is navigable for boats, excepting in dry seasons. The boundary between Virginia and Pennsylvania crosses it about three or four miles above its mouth.

#### *Muskingum River.*

Muskingum is a fine gentle river, confined by high banks, which prevent its floods from overflowing the surrounding land. It is two hundred and fifty yards wide at its confluence with the Ohio, and navigable, without any obstructions, by large batteaux or barges to the Three Legs, and by small ones to a little lake at its head.

From thence to Cayuga, the creek that leads to Lake Erie, the Muskingum is muddy, and not very swift, but no where obstructed with falls or rifts. Here are fine uplands, extensive meadows, oak and



mulberry trees fit for ship building, and walnut, chesnut, and poplar trees suitable for domestic services. Cayuga furnishes the best portage between Ohio and Lake Erie; at its mouth it is wide and deep enough to receive large sloops from the lake. It will hereafter be a place of great importance.

Muskingum, in all its wide extended branches, is surrounded by most excellent land, and abounds in springs, and conveniences particularly adapted to settlements remote from sea navigation; such as salt springs, coal, clay, and freestone. In 1748 a coal mine opposite to Lamensicola mouth took fire, and continued burning above twelve months, but great quantities of coal still remain in it. Near the same place are excellent whetstones, and about eight miles higher up the river, is plenty of white and blue clay for glass works and pottery.

Hockhocking is navigable with large flat bottom boats between seventy and eighty miles; it has fine meadows with high banks, which seldom overflow, and rich uplands on its borders. Coal and quarries of freestone are found about fifteen miles up this creek.

### *Big Kanhawa.*

Big Kanhawa falls into the Ohio upon its southeastern side, and is so considerable a branch of this river, that it may be mistaken for the Ohio itself by persons ascending it. It is slow for ten miles to Little Broken Hills; the low land, is very rich, and of about the same breadth, from the Pipe hills to the falls, as upon the Ohio. After going ten miles up the Kanhawa the land is hilly, and the water a little

rapid for fifty or sixty miles farther to the falls, yet batteaux or barges may be easily rowed thither. These falls were formerly thought impassable; but late discoveries have proved, that a waggon road may be made through the mountain which occasions the falls, and that by a portage of a few miles only, a communication may be had between the waters of Great Kanhawa and Ohio, and those of James river in Virginia.

### *Tottery River.*

Tottery lies upon the south-eastern side of the Ohio, and is navigable with batteaux to the Ouasioto mountains. It is a long river, has few branches, and interlocks with Red creek, or Clinche's river, a branch of the Cherokee, and has below the mountains, especially for fifteen miles from its mouth, very good land. Here is a perceptible difference of climate between the upper and this part of Ohio. Here the large reed or Carolina cane grows in plenty, even upon the upland, and the winter is so moderate as not to destroy it. The same moderation of climate continues down Ohio, especially on the south-east side to the rapids, and thence on both sides of that river to the Mississippi.

Great Salt Lick creek is remarkable for fine land, plenty of buffaloes, salt springs, white clay, and limestone. Small boats may go to the crossing of the War path without any impediment. The salt springs render the waters unfit for drinking, but the plenty of fresh springs in their vicinity, make sufficient amends for this inconvenience.

Kentucke is larger than the preceding creek; it is

surrounded with high clay banks, fertile lands, and large salt springs. Its navigation is interrupted by shoals, but passable with small boats to the Gap, where the War path goes through the Ouasioto mountains.

### *The Scioto.*

Scioto is a large gentle river, bordered with rich flats or meadows. It overflows in the spring, and then spreads about half a mile, though when confined within its banks it is scarce a furlong wide.

If it floods early, it seldom retires within its banks in less than a month, and is not fordable frequently in less than two months.

The Scioto, besides having a great extent of most excellent land on both sides of the river, is furnished with salt on an eastern branch, and red bole on Ne-cunsia Skeintat. The stream of Scioto is gentle and passable with large batteaux or barges for a considerable way, and with smaller boats near two hundred miles, to a portage of only four miles to Sandusky.

### *Sandusky River.*

Sandusky is a considerable river, abounding in level land, its stream gentle all the way to the mouth, where it is large enough to receive sloops. The Northern Indians cross Lake Erie here from island to island, land at Sandusky, and go by a direct path to the lower Shawanoe town, and thence to the gap of the Ouasioto mountain, in their way to the Cut-tawa country.

*Little Mineami.*

Little Mineami river is too small to navigate with batteaux. It has much fine land, and several salt springs; its high banks and gentle current prevent its much overflowing the surrounding lands in freshes.

*Great Mineami.*

Great Mineami, Assereniet or Rocky river, has a very stony channel; a swift stream, but no falls. It has several large branches, passable with boats a great way; one extending westward towards the Wabash river, another towards a branch of Mineami river, which runs into Lake Erie, to which there is a portage, and a third has a portage to the west branch of Sandusky, besides Mad creek, where the French formerly established themselves. Rising ground, here and there a little stony, which begins in the northern part of the peninsula, between the lakes Erie, Huron, and Michigan, and extend across Little Mineami river below the forks, and southwardly along the Rocky river to Ohio.

*Buffaloe River.*

Buffaloe river falls into the Ohio on the eastern side of it, at the distance of 925 computed miles from Fort Pitt. It is a very considerable branch of the Ohio; is two hundred yards wide, navigable upwards of one hundred and fifty miles for batteaux or barges, of thirty feet long, five broad, and three deep, carrying about seven tons, and can be navigated much far-

ther with large canoes. The lands on both sides of this river are of a most luxuriant quality, for the production of hemp, flax, wheat, tobacco, &c. They are covered with a great variety of lofty and useful timber; as oak, hickory, mulberry, elm, &c. Several persons who have ascended this river, say, that salt springs, coal, lime, and freestone, &c. are to be found in a variety of places.

### *The Wabash River.*

The Wabash is a beautiful river, with high and upright banks, less subject to overflow than any other river, the Ohio excepted, in this part of America. It discharges itself into the Ohio, one thousand and twenty-two miles below Fort Pitt, in lat. 37 deg. 41 min. at its mouth it is 270 yards wide; is navigable to Ouiatanon, four hundred and twelve miles, in the spring, summer, and autumn, with bateaux or barges, drawing about three feet water. From thence, on account of a rocky bottom and shoal water, large canoes are chiefly employed, except when the river is swelled with rains, at which time it may be ascended with boats, such as have been described, one hundred and ninety-seven miles further, to the Miami carrying place, which is nine miles from the Miami village, and this is situated on a river of the same name that runs into the south-south-west part of Lake Erie. The stream of the Wabash is generally gentle to fort Ouiatanon, and no where obstructed with falls, but is by several rapids, both above and below that fort, some of which are pretty considerable. There is also a part of the river for about three miles, and thirty miles from the carry-

ing place, where the channel is so narrow that it is necessary to make use of setting poles instead of oars. The land on this river is remarkably fertile, and several parts of it are natural meadows, of great extent, covered with fine long grass. The timber is large and high, and in such variety, that almost all the different kinds growing upon the Ohio, and its branches, but with a greater proportion of black and white mulberry trees, may be found here. A silver mine has been discovered about twenty-eight miles above Ouiatanon, on the northern side of the Wabash, and probably others may be found hereafter. The Wabash abounds with salt springs, and any quantity of salt may be made from them, in the manner now done at the Saline in the Illinois country: the hills are replenished with the best coal, and there is plenty of lime and freestone, blue, yellow, and white clay, for glass works and pottery. Two French settlements are established on the Wabash, called Post Vincient and Ouiatanon; the first is 150 miles and the other 262 miles from its mouth. The former is on the eastern side of the river, and consists of sixty settlers and their families. They raise Indian corn, wheat, and tobacco of an extraordinary good quality; superior, it is said, to that produced in Virginia. They have a fine breed of horses, brought originally by the Indians from the Spanish settlements on the western side of the river Mississippi, and large stocks of swine and black cattle. The settlers deal with the natives for furs and deer skins, to the amount of about 5000*l.* annually. Hemp of a good texture grows spontaneously in the low lands of the Wabash, as do grapes in the greatest

abundance, having a black thin skin, and of which the inhabitants in the autumn make a sufficient quantity, for their own consumption, of well-tasted red wine. Hops, large and good, are found in many places, and the lands are particularly adapted to the culture of rice. All European fruits, apples, peaches, pears, cherries, currants, gooseberries, melons, &c. thrive well, both here, and in the country bordering on the river Ohio.\*

Before taking leave of the western waters, we will take a view of their principal connexions with the Atlantic. These are three; the Hudson's river, the Patowmac, and the Mississippi itself. Down the last will pass all heavy commodities. But the navigation through the gulf of Mexico is so dangerous, and that up the Mississippi so difficult and tedious, that it is thought probable that European merchandise will not return through that channel. It is most likely that flour, timber, and other heavy articles will be floated on rafts, which will themselves be an article for sale, as well as their loading, the navigators returning by land, or in light batteaux. There will therefore be a competition between the Hudson and Patowmac rivers for the residue of the commerce of all the country westward of lake Erie, on the waters of the lakes, of the Ohio, and upper parts of the Mississippi. To go to New York, that part of the trade which comes from the lakes, or their waters, must first be brought into lake Erie. Between lake Superior and its waters and Huron are the rapids of St. Mary, which will permit boats to pass, but not larger vessels. Lakes Huron and Michigan afford communicatton with lake Erie by vessels of

\* Hutchins.

eight feet draught. That part of the trade which comes from the waters of the Mississippi must pass from them through some portage into the waters of the lakes. The portage from the Illinois river into a water of Michigan is of one mile only. From the Wabash, Miami, Muskingum, or Alleghany, are portages into the waters of lake Erie, of from one to fifteen miles. When the commodities are brought into, and have passed through lake Erie, there is between that and Ontario an interruption by the falls of Niagara, where the portage is of eight miles; and between Ontario and the Hudson's river are portages at the falls of Onondago, a little above Oswego, of a quarter of a mile; from Wood creek to the Mohawks river two miles; at the little falls of the Mohawks river half a mile, and from Schenectady to Albany sixteen miles. Besides the increase of expense occasioned by frequent change of carriage, there is an increased risk of pillage produced by committing merchandise to a greater number of hands successively. The Patowmac offers itself under the following circumstances. For the trade of the lakes and their waters westward of lake Erie, when it shall have entered that lake, it must coast along its southern shore, on account of the number and excellence of its harbours, the northern, though shortest, having few harbours, and these unsafe. Having reached Cayahoga, to proceed on to New York it will have 825 miles and five portages: whereas it is but 425 miles to Alexandria, its emporium on the Patowmac, if it turns into the Cayahoga, and passes through that, Bigbeaver, Ohio, Yohogany,



(or Monongahela and Cheat) and Patowmac, and there are but two portages; the first of which, between Cayahoga and Beaver, may be removed by uniting the sources of these waters, which are lakes in the neighbourhood of each other, and in a champaign country; the other, from the waters of Ohio to Patowmac, will be from fifteen to forty miles, according to the trouble which shall be taken to approach the two navigations. For the trade of the Ohio, or that which shall come into it from its own waters or the Mississippi, it is nearer through the Patowmac to Alexandria than to New York by 580 miles, and it is interrupted by one portage only. There is another circumstance of difference too. The lakes themselves never freeze, but the communications between them freeze, and the Hudson's river is itself shut up by the ice three months in the year; whereas the channel to the Chesapeak leads directly into a warmer climate. The southern parts of it very rarely freeze at all, and whenever the northern do, it is so near the sources of the rivers, that the frequent floods to which they are there liable, break up the ice immediately, so that vessels may pass through the whole winter, subject only to accidental and short delays. Add to all this, that in case of a war with our neighbours, the Anglo-Americans or the Indians, the route to New York becomes a frontier through almost its whole length, and all commerce through it ceases from that moment....But the channel to New York is already known to practice; whereas the upper waters of the Ohio and the Patowmac, and the great falls of

the latter, are yet to be cleared of their fixed obstructions.\*

To the above mentioned connecting links between the western waters, and the Atlantic Ocean, may be enumerated two others, viz. that by the great river St. Lawrence; and that by the intended canal connecting the Susquehannah and Delaware.

The experience of the Indian traders for many years, has shewn that, exclusively of the trade engrossed by the British North-west Company, merchandise taken up the St. Lawrence, and to the Illinois by way of the lakes, may be sold on the river Mississippi, so much cheaper than goods taken up the last river, as to cause a decided preference to be given to them, even as far down the Mississippi as the river Ohio. The cause of the increased expense of the Mississippi rout, is the greater rapidity of its stream, when compared to that of the St. Lawrence. To remedy this evil, the government of the United States are at present engaged in making a road from the Patowmac, through the mountains and rugged space lying between the seat of government, and the western country, a measure which will be of infinite consequence to the United States.

The rout recommended by a gentleman well acquainted with the country, (Mr. Elie Williams) is from Cumberland on the Patowmac, to the mouth of George's creek on the Monongahela; as such a rout embraces the largest possible latitude in the calculation of general utility, whether the accommodation of the country already settled, or capable of

\* Jefferson's Notes on Virginia.

settlement, be considered. In this direction, the road by being extended to the nearest point on the Ohio, at or below Whelung, from the circuitous rout of the rivers Monongahela and Ohio, would pass through the centre of the richest and best settled parts of the country watered by the former stream, and would afford an important accommodation to an establishment in the vicinity of the Laurel Hill, a situation which commands in a high degree the resources of a public arsenal and laboratory; whence, ordnance and military stores might be transported to the seat of government, or any part of the Mississippi; the Laurel Hill abounding in iron ore of various qualities, and the copper and lead of the Illinois, and the sulphur and saltpetre of Kentucky being readily obtained.

By the completion of such a road in Mr. Williams' opinion, goods could be transported at less expense from the seat of government to the mouth of the Ohio, than from Orleans to the latter place.

The canal destined to connect Philadelphia with Pittsburgh, and all the Ohio waters, by the Schuylkill, the Swetara and Juniata branches of the Susquehanna; and the Kiskeminitas branch of Alleghany, is by uniting the Swetara creek which empties into the Susquehanna, with the Quitipahilla; a distance of thirty-five miles; and the latter to the canal intended to be carried down to Schuylkill, at the mouth of the Tulpehocken, near Reading, in Berks county; a distance of thirty miles. In the whole route from Philadelphia to lake Erie, a distance of five hundred and sixty-one and a half miles, only two portages occur; viz. one from Juniata to

Conemaugh of eighteen miles, and another from Le Bœuf to Presqu' isle of fifteen miles: every one must rejoice, that this canal which was commenced fourteen years since, and suspended, owing to a variety of causes, is now in a train of being completed; it will be productive of incalculable advantages to Pennsylvania, as it will pass through the most inhabited and central parts of the state, and will open such numerous sources and channels of inland trade all leading to Philadelphia, as perhaps no other seaport can boast of: for the communication with the immense territories connected with the Ohio and Mississippi waters, and the lakes, is as easy, and may be as cheap as to any other port on the Atlantic.

#### *Piscataqua River.*

The Piscataqua is the only large river whose whole course is in New Hampshire. Its head is a pond in the north-east corner of the town of Wakefield; and its general course thence to the sea is south-south-east, about forty miles. It divides New Hampshire from York county, in the district of Maine, and is called Salmon Fall river, from its head to the lower falls at Berwick; where it assumes the name of Newichawannock, which it bears till it meets with Cochecho river, which comes from Dover, when both run together in one channel to Hilton's point, where the western branch meets it. From this junction to the sea, the river is so rapid that it never freezes; the distance is seven miles, and the course generally from south to south-east.

The western branch is formed by Swamscot river, which comes from Exeter, Winnicot river, which comes through Greenland, and Lamprey river, which divides New Market from Durham; these empty into a bay four miles wide, called the Great bay. The water in its further progress is contracted into a lesser bay, and then it receives Oyster river, which runs through Durham, and Back river, which comes from Dover, and at length meets with the main stream to Hilton's point. The tide rises into all these bays, and branches as far as the lower falls in each river, and forms a most rapid current, especially at the season of the freshes, when the ebb continues about two hours longer than the flood; and were it not for the numerous eddies formed by the indenting of the shore, the ferries would then be impassable.

At the lower falls in the several branches of the river, are landing places, whence lumber and other country produce is transported, and vessels or boats from below discharge their lading: so that in each river there is a convenient trading place, not more than twelve or fifteen miles distant from Portsmouth, with which there is a constant communication with every tide. Thus the river from its form, and the situation of its branches, is extremely favorable to the purposes of navigation and commerce.\*

\* Belknap's Hist. N. Hamp, vol. 3d.

*Connecticut River.*

The river Connecticut rises in a pond in the high lands which divide the waters falling southward into the Atlantic, from those which fall into the St. Lawrence. Another eastern principal branch rises in New Hampshire, and runs in a serpentine course to Hartford, and thence south-easterly to Saybrook, where it empties into the sound. Its length, from its source to the sea is nearly four hundred miles, and crosses four parallels of latitude. It receives 14 rivers from the east.

At its mouth is a bar of sand, which considerably obstructs the navigation. Ten feet water, at full tides, is found on this bar, and the same depth to Middletown. The distance of the bar from this place, as the river runs, is 36 miles. Above Middletown are several shoals which stretch quite across the river. Only six feet water is found on the shoal at high tide, and here the tide ebbs and flows but about eight inches. About three miles below Middletown the river is contracted to about 40 rods in breadth, by two high mountains: almost every where else the banks are low, and spread into fine extensive meadows. In the spring floods, which generally happen in May, these meadows are covered with water. At Hartford the water sometimes rises 20 feet above the common surface of the river, and having all to pass through the above-mentioned strait or *narrows*, it is sometimes two or three weeks before it returns to its usual bed. These floods add nothing to the depth of water on the bar

at the mouth of the river ; this bar lying too far off in the sound to be affected by them.\*

*The Hudson.*

Hudson's river is one of the largest and finest rivers in the United States. It rises in the mountainous country between the lakes Ontario and Champlaine. In its course south-easterly it approaches within six or eight miles of Lake George ; then after a short course east, turns southerly, and receives the Socondaga from the south-west, which heads in the neighbourhood of Mohawk river. The course of the river from Fort Edward to New York, where it empties into York bay, is very uniformly a little west of south. Its whole length is about 250 miles. From Albany to Fort Edward is fifty miles. This distance, the river is navigable at present only for batteaux, and has two portages, occasioned by falls, of half a mile each.

The banks of Hudson's river, especially on the western side, as far as the high lands extend, are chiefly rocky cliffs. The passage through the highlands, which is sixteen miles, affords a wild romantic scene. In this narrow pass, on each side of which the mountains tower to a great height, the wind, if there be any, is collected and compressed, and blows continually as through a bellows. Vessels in passing through it are often obliged to lower their sails. The bed of this river, which is deep and smooth to an astonishing distance, through a hilly rocky country, and even through ridges of some

\* Morse

very high mountains, must undoubtedly have been produced by some mighty convulsion of nature. The tide flows a few miles above Albany, which is 160 miles from New York. It is navigable for sloops of 80 tons to Albany, and for ships to Hudson. Ship navigation to Albany is interrupted by a number of islands, six or eight miles below the city, called the Overslaugh. It is in contemplation to confine the river to one channel, by which means the channel will be deepened, and the difficulty of approaching Albany with vessels of a large size be removed. About sixty miles above New York the water becomes fresh. The river is stored with a variety of fish, which renders a summer passage to Albany delightful, and amusing to those who are fond of angling.\*

In the Hudson the impulse of the ocean is so powerful as to make the tide progress upwards at the rate of about twenty-five miles an hour. Hence a swift sailing vessel, starting from New York at young flood, with a fair and strong wind, may carry the flood tide with her quite through to Albany. This, it is said, has been repeatedly performed. The vessel in this case going at the rate of perhaps fifteen miles an hour, will so far keep pace with the progress of the young flood as to make good her arrival before the tide, after high water, shall run ebb.

A consequence of this superior oceanic influence is, that a vessel can sail into the river more rapidly than she can come out. Though this sounds like a

\* Morse



paradox, it is nevertheless true. It is impossible for her to bring the current with her all the way outwards; for though the wind should be both brisk and favorable, she must necessarily meet the flood tides, and stem their opposing forces. As she proceeds toward the great moving cause, the ocean, she meets its rising wave sooner and earlier, and then, if unable to stem it, must cast anchor and wait. And the nearer she approaches the sea, the more she anticipates the resisting power of the water, which it impels along the rivers, and whose undulations there constitutes the tide.\*

The descent of the river towards Waterford and Troy is interrupted by several smaller falls and rapids, running over strata of slaty rock. Of these, the most considerable is near fort Miller, above Stillwater. After passing many such declivities and steps, the Hudson, travelling from the north, receives the waters of the Mohawk approaching to meet it from the west. This addition determines nearly, how high the Hudson is navigable. After its fall at the Cohos, about a mile before the junction, the Mohawk is divided into several streams by a few small islands, lying opposite to Lansingburg and Troy. Its southern branch comes within about seven miles of Albany, joining its stream to the North river exactly opposite to Troy. The influence of this body of water is immediately perceptible. For though Albany and Troy are so aided by them, as to be accessible by sloops of convenient ton-

\* Dr. Mitchell.—Med. Repos.

nage and capacity, for the extensive business those settlements have to transact; it has been found necessary to deepen the bed of the rivers, by a very laborious and expensive undertaking, in order to render it navigable to Lansingburg and Waterford. The Hudson thus will be navigable from Sandy Hook to the Half-Moon Point, adjacent to the northern branch of the Mohawk. In this long course of about two hundred miles, there is not a single cataract, nor even a rapid. At Albany the tide flows about one foot. The chief impediments to navigation are some bars of sand and flats of mud, with here and there rocks; such as are common in most rivers.

But, between Albany and New York, the Hudson passes two ranges of mountains; and yet neither the Blue mountains nor the Rockland chain give any impediment to its course.

A few observations may explain this remarkable circumstance. The Blue mountains do not exist on the east side of the Hudson, unless the Taconick hills, bordering on the western extremity of Massachusetts, may be considered as belonging to them. But, admitting this, there is still a tract of level country extending from one of these heights to the other. Through this the Hudson finds its way; and, as the Blue mountains rise seven miles to the westward of the river, it rather passes by than through them.

Thus it glides along, until the width to which it spreads at New Windsor, is contracted to the narrow bounds which restrain it as it holds its almost unchanging course to the south, through the moun-

tains which lie in the counties of Orange, Dutchess, Westchester, and Rockland. These seem, in ancient days, to have opposed a dam of granite, sixteen miles wide, to the Hudson's progress; and formerly to have raised the waters above the lands of the upper country to such a height, as to have formed a lake. And there are traces on both sides of its present channel, showing where the probable outlets of the lake used to be, but which are now dry, and greatly elevated above the present level.

In the lapse of ages, this mound of mountains appears, either by attrition, undermining, forcible impulse, or some other cause, to have given way to the confined waters, and opened for them a free passage to the ocean. And this has been so completely done, that the mountains between Pollepel's Island and Stoney Point have been cleft to their foundations, leaving a free, profound, and sufficient channel between them. On the rugged and ruinous sides of this, the traveller explores the internal stratification of the region to great advantage, while his eye ranges over the picturesque and sublime landscape-scenery, above and below West Point, with uncommon delight. He beholds marine plants growing near the river's edge, and salt water, in this inland situation, bathing the feet of the mountains. He becomes convinced that the deep channel this river has formed for itself, through the rocky obstacles, is a greater and more admirable work of nature than all the cataracts afford.\*

\* Dr. Mitchell. *Med. Repos.* Hex. 2d, vol. i.

*Delaware.*

The river Delaware rises in the state of New York, and is formed by the union of the Mohawk and Popachton branches, and flowing south it divides the states of New York and New Jersey on the east from Pennsylvania on the west: in lat. 41 deg. 24 min. it strikes the north-west corner of New Jersey, and then enters the Atlantic, between cape May in New Jersey, and cape Henlopen in the state of Delaware, on the west.

From the line between the states of Pennsylvania and New York, down to the falls of the Cushicton, the stream is very regular, and contains very few obstructions to the navigation: all the rocks in that distance, of any consequence, might be removed for less than two hundred dollars: this part of the river would then, in times of freshes, be completely navigable; but, in times of very low waters, it cannot be navigated with boats of any burthen.

At the Cushicton falls the river is divided into three channels. Two large rocks lie loose upon the point above the falls, which cause the currents to shoot across, with great violence, into the winding channel, on the east side of the river. These rocks, being removed, a sufficient body of water would enter the channel west to Pennsylvania, where the passages must direct. From the Cushicton falls to the Narrows, the river continues in a fine stream, but below the Narrows the bed of the river is more rocky, and the stream more rapid. At a place called the Foul-rift, the water passes through with very great

velocity, and the current in the channel, between the island and the fast land of Pennsylvania, being thrown off the projecting rock below the island, crosses an extremely rugged bottom, and meeting the current from the east side of the island, is thrown into great confusion, and often causes the destruction of deeply laden boats; and rafts of boards acquiring very great velocity in a diagonal direction, become ungovernable, and sometimes rush upon the rocks, near the foot of the falls, upon the Jersey shore, and are broken to pieces.

The Delaware receives the Lehigh at the town of Easton, about 60 miles north of Philadelphia, and the Lexawacin in Wayne county, 114 miles above Easton, at Cedar falls; besides many creeks. Six miles below the city of Philadelphia, it receives the river Schuylkill, about one mile north of fort Mifflin.

The bay and river Delaware are navigable from the sea up to the great or lower falls at Trenton, 155 miles; and are accommodated with a lighthouse on cape Henlopen, and with buoys and piers, for the direction and safety of ships. The distance of Philadelphia from the sea is about 60 miles across the land, in a south-east course, to New Jersey coast; and 120 miles by the ship channel of the Delaware. So far it is navigable for a seventy-four gun ship. Sloops go 35 miles farther to Trenton falls. The river is navigable for boats that carry eight or nine tons, 100 miles further; and for Indian canoes, except several small falls or portages 150 miles. The tide sets up as high as Trenton falls, and at Philadelphia rises generally about five or six feet. A north-east and east wind rises it higher.

Between cape Henlopen and cape May, is the entrance into the Delaware bay : the entrance into the river is 40 miles farther up, at Bombay Hook, where the river is four or five miles wide. From Bombay Hook to Reedy Island is 20 miles. This island is the rendezvous of outward bound ships in Autumn and Spring, waiting for a favourable wind. The course from this to the sea is south-south-east, so that a north-west wind, which is the prevailing wind in these seasons, is fair for vessels to put out to sea. This river is generally frozen one or two months in the year at Philadelphia, so as to prevent navigation; but vessels may, at all times, make a secure harbour at Port Penn, at Reedy Island, where piers have been erected by the state. Vessels are generally from twelve to twenty-four hours in ascending this river to Philadelphia. From Chester to Philadelphia, 20 miles by water and 15 by land, the channel of the river is narrowed by islands of marsh, which are generally banked and turned into rich and valuable meadows.\*

The shores of the bay and of the river Delaware, for a very considerable distance upwards, are low; and they are covered, like the coast, with one vast forest, excepting merely in a few places, where extensive marshes intervene. Nothing, however, can be more pleasing, than the views with which the stranger is entertained in sailing up to Philadelphia, during those months in the year that the trees on each side are in bloom; and in the Autumn, the

\* Morse,

great variety of rich tints which are suffused over the leaves of the oaks, poplars, and other trees, and which are equalled in no other country, blended with the sombre green of the lofty pines, have a most pleasing effect.

As we approach towards Philadelphia, the banks of the river become more elevated; and on the left hand side, where they are much cleared, they are interspersed with numberless neat farm-houses, with villages and towns; and are in some parts cultivated down to the very edge of the water. The New Jersey shore, on the right hand side, is thickly wooded even as far as the city. The river flows about four miles in an hour. Its width near the city is about one mile.

The Lehigh is navigable 30 miles from its mouth. But this river being the drain of a hilly country, from which the waters pour in mighty torrents, has its bed widely extended in proportion to the quantity of water issuing from the regular spring of the country, and consequently the water, when not increased by rains or melting snow, is shallow. But no channel can exceed, in regularity, the bottom of this river, both as its equal rise and smooth surface, throughout the whole space, Bowman's falls excepted, which are above the Blue mountains. A company is incorporated to remove the impediments to the navigation, with the view chiefly of enabling them to bring down the excellent coal, which abounds near its banks.

Bridges have lately been erected over the Delaware at Easton, and opposite to Trenton, which, together with the passage of the river Lehigh through the Blue mountains, shall be noticed hereafter.

*Schuylkill.*

The river Schuylkill rises in Luzerne county, Pennsylvania, north-west of the Kittatiny mountains, through which it passes, and, after a course of 140 miles, empties into the Delaware; it is navigable for boats 90 miles from its mouth. The creek Tulpehocken empties into it at Reading: this creek constituted part of the great plan of inland navigation, which was formed some years since, and destined to connect the western and eastern waters, and which, though suspended for some time, is now fortunately in a train of being completed.

The Schuylkill exhibits many fine prospects, from its banks, which are in many places high, and “were they adorned by European taste and magnificence, would not be excelled either by the Seine or the Thames.” But near Reading the banks are exquisitely beautiful. On the side opposite to the town arise a range of highly cultivated hills, covered with houses; and beyond these are mountains of more considerable elevation: back of these are seen the lofty Blue mountains: the whole forming a prospect at once pleasing and sublime.

\* Liancourt's Travels, vol. I.



*The Susquehannah.*

The north-east branch of the river Susquehannah, takes its rise from lake Otsego, in a central part of the state of New York, about sixty miles west by north from the city of Albany, and from fifteen to twenty miles south of the Mohawk river, in lat. 42 deg. 55 min. north. This lake is about nine miles long, and perhaps not more than a mile wide, situated in a tract of country extremely fertile, and easy of cultivation. Six miles to the west of Otsego, lies Caniaderago lake, which is nearly as large as the other. From this last mentioned lake, a stream, called Oaks' Creek, falls into the Susquehannah, nearly five miles to the south of Otsego. On this creek, the best cheese in the state of New York is said to be made. These lakes lie so near the Mohawk river, and the creeks which flow into it from this direction, that a complete water communication could doubtless be made between them. At present the distance is not twenty miles, and is capable of good roads. From lake Otsego, to which batteaux pass up the stream, the Susquehannah is navigable to its mouth in the bay of Chesapeak. It is a noted fact, that during the last war, a detachment of general Sullivan's troops passed in boats from lake Otsego, quite down the river. From lake Otsego the Susquehannah runs in a southerly direction, through Cherry valley, about twenty miles. Thence it takes a general south-west course, with many meanders, until it comes within eight or ten miles of the Pennsylvania line, to which it flows in a winding direction to the south, where it crosses it about twelve miles

west of the north-east corner of that state. In this part of its current, about forty miles from Otsego, the Susquehannah receives the Unadilla, with a considerable accession of water, and a number of smaller streams, which it would be useless to enumerate.

At Harmony, which is situated at the point where this river crosses the line of the two states, there is a portage of twenty miles to the waters of the Delaware. The distance of Harmony, by the course of the Susquehannah, to its source in Otsego lake, is computed about seventy miles. Along the Mohawk river (from which a water communication to the lakes Ontario and Seneca is about being established by a canal company, holding a charter under the state of New York), and the course of the Susquehannah in the same state, the land is rich, and heavily timbered, and selling at such reduced prices as must engage a rapid settlement of that country. After passing the Pennsylvania line, the Susquehannah runs a small distance to the south, and winding at the great bend in a course to the north of west, it again crosses that line, seven or eight miles farther (on a straight course) in a direction nearly north-west, receiving in Pennsylvania a number of small creeks. Meandering then to the westward through the state of New York, it is increased by the Tioughnioga and Chenengo river, in a joint current, and other waters of less importance. It then crosses the line of the two states a third time, thirty-five or forty miles from the last place of crossing, reckoning in a direct west course. Flowing hence to the south, the Susquehannah is joined at Tioga point below Lockartsburg by the Cayuga, or Tioga river,

three or four miles from the said boundary line, with a considerable increase of water. From Harmony, at the great bend of the Susquehannah to Tioga Point by the course of the river, the distance is estimated at about sixty-five miles. The Tioga is navigable from its mouth for batteaux to the distance of fifty miles, and its north-westernmost sources are but a few miles from the Chenessee river, which runs into lake Ontario. With this lake it is also nearly connected by many streams which flow into it from the north, and the numerous smaller lakes which are situated between the Ontario, Chenessee, and north-east branch of the Susquehannah, watering large tracts of some of the richest land in the United States. The Tioga is thus very conveniently connected with lake Ontario, by a communication, which at a small expense, may be made completely a water communication. From the mouth of the Tioga to Newtown is eighteen miles. The portage thence to Connedessago, or Seneca lake, which may be turned wholly into a lock navigation by Newtown creek, is eighteen miles further, down Connedessago lake thirty-six, down Seneca, or Onondago river to Oswego, or Ontario, eighty-six; in the whole, one hundred and fifty-eight miles.

At the painted post, within twenty miles of the mouth of Newtown creek, in the state of New York, the Tioga is separated into two branches, the north-west and the south-west branch. The first has been already mentioned and described. To this point of separation, the south branch flows through the state of Pennsylvania from a considerable distance. Between this branch, and a branch of the

Alleghany, there is said to be a practicable communication; indeed their head waters are but a short distance from each other. The Seneca Indians say they can walk four times in a day, from the boatable waters of the Alleghany to those of the Tioga; Making a rational computation from this, the distance cannot be more than ten or twelve miles. When the sources of the Tioga and Alleghany shall be explored at a future day, perhaps a communication may be made between them, which will open a new and unexpected course of internal navigation.

From the junction of the Tioga, and the north-east branch of the Susquehannah at Tioga point, the river flows in a general south-east course, with very considerable meanderings, nearly to Wioming, without any obstruction by falls. To the north-east of this part of Susquehannah, comprehending the north-east corner of the state, lies an immense tract of country abounding with the sugar maple tree, which must at a future day, when the manufacture of maple sugar is better understood, and more generally undertaken, make a valuable addition to the trade of Pennsylvania and this river.

In the course of its passage from Tioga point to the Wioming falls, the Susquehannah is increased by a number of large creeks...Sugar creek, Wysaukin, Tawandee, Wyalusing, Meshoppen, Tunkhannock, Bowman's creek, Lawahannock, and others.

At a small distance above the Wioming falls, the Susquehannah turns to the south-west, and running in that course to Sunbury, and Northumberland, passes Wilkesbarre, the county town of Luzerne, and Catawissey town, the principal part of a settle-

ment now rapidly completing, at the mouth of Catawiskey creek, in the county of Northumberland. At Sunbury, the north-east branch of the Susquehannah, which we have thus traced, is joined by the west branch of that river. Mr. Cooper, in describing some views along the Susquehannah, observes: "At this distance you look down upon the Susquehannah, about three or four miles off, a river about half a mile broad, running at the foot of bold and steep mountains, through a valley not much above three miles broad in that part, rich, beautiful, and variegated; at the distance of about four miles, on the banks of the river, you catch the town of Sunbury, and on the opposite side of the river, about two miles further, Northumberland. The Susquehannah opposite to Sunbury is about half a mile broad, at the ferry opposite Northumberland, it seems full three quarters of a mile over, and when we crossed it, December the 17th, the ferryman reckoned it about ten feet deep midway, the creeks were then low."

The west branch of the Susquehannah takes its rise somewhere in the county of Westmoreland, to the west of the Alleghany mountains, and runs, with many considerable windings, in a north-east course, until it meets, about one hundred and six miles from its mouth at Sunbury, the Sinnemahoning, by which it nearly communicates with the two branches of the Alleghany, by the two branches of this creek. Through these two branches, either or both of which may be taken, the navigation of the Susquehannah is connected with the trade of lake Erie, and the surrounding country, almost by a water communication.

From the mouth of the Sinnemahoning, the Susquehannah turns, with many windings, to the east, until it reaches the mouth of Muncy creek, receiving in its course many considerable streams, and then turns southerly till it meets the north-east branch at Sunbury. The west branch is navigable, about 150 miles from its mouth at Sunbury, for boats of ten tons. From the forks at Sunbury, the river proceeds southerly, as far as Middletown, without falls, first receiving the Juniata, and passing Harrisburg, the capital of Dauphin county. By the Juniata the Susquehannah is connected with the Ohio at Pittsburg, almost the whole course by water; the distance is 262 miles; thus forming the most important of all the communications between lake Erie with the western Country and the Atlantic. It is navigable 120 miles from its mouth. Middletown, at the mouth of the Swatara, is a place of extensive inland trade. From this place, the Susquehannah winds in a south east course to its mouth, at Havre de Grace, in the bay of Chesapeak, above which the tide-water flows five or six miles. The Conewago falls, four miles below Middletown, before the completion of the canal, formed a considerable obstruction to the navigation of the river.\*

At Columbia, ten miles from Lancaster, the Susquehannah is somewhat more than three-quarters of a mile wide; and for a considerable distance both above and below the ferry, it abounds with islands and large rocks, over which last the water runs with prodigious velocity: the roaring noise that it makes is heard a great way off. The banks rise

\* Adlum's Account of the Susquehannah, Phil, 1796.

very boldly on each side and are thickly wooded; the islands also, are covered with small trees, which interspersed with the rocks, produce a very fine effect. The scenery in every point of view is wild and romantic. In crossing the river it is necessary to row up against the stream under the shore, and then strike over to the opposite side, under the shelter of some of the largest islands. As these rapids continue for many miles, they totally impede the navigation, excepting when there are floods in the river, at which time large rafts may be conducted down the stream, carrying several hundred barrels of flour.

The account of the river Susquehannah has been more particularly given, because to Pennsylvania it is highly interesting, as being one of the chief instruments destined by nature to diffuse incalculable wealth throughout the state, by forming a grand link in the chain of inland navigation with the western world, and which must ere long be opened.

#### *The Patowmac.*

This river is seven miles and a half wide at its mouth, with seven fathoms of water, but at the town of Alexandria, it is only one mile and a quarter wide, with three fathoms of water; thence up to the falls thirteen miles above Alexandria, the water is only ten feet deep. From the capes of the Chesapeake to the city of Washington, is upwards of 300 miles, but the navigation is easy and safe. A vessel of 1200 hhds. of tobacco has loaded at, and sailed from Alexandria; and one of 700 hhds. at

Georgetown, above the city; at which place the water rises four feet in a common tide.

The obstruction of the navigation of this great river, which flows through a thickly settled country, arose chiefly from four falls:

1st. The little falls three miles above tide water, in which distance there is a fall of 36 feet.

2d. The great falls, six miles higher, where is a fall of 76 feet in one mile and a quarter.

3d. The Seneca falls, six miles above the former, which form short irregular rapids, with a fall of about 10 feet; and,

4th. The Shenandoah falls, sixty miles from the Seneca, where is a fall of about 50 feet in 3 miles; from which last, fort Cumberland is about 120 miles distant. The obstructions, which are opposed to the navigation above and between these falls, are not great. The force of the current is such, that boats ascend only at particular times. At fort Cumberland in a dry season, it is but a mill stream, but boats go 20 miles higher to Paddytown. The boatmen say the descent in some places is eleven feet in three-quarters of a mile.\* In the year 1784, a company was formed for the purpose of removing the obstructions and opening the navigation of the river from its source, down to tide-water, and an act of incorporation, passed by the assemblies of *Virginia* and *Maryland*, authorising the company to take the necessary measures for carrying into effect the object for which they were incorporated, and granting to them, *forever*, the tolls which may arise therefrom; which tolls are fixed by the same

\* Morse.



law that empowers the company to undertake the business. The sum agreed upon to complete the navigation was fifty thousand pounds sterling, divided into five hundred shares, of one hundred pounds each, to be paid by instalments.

More than half a million of dollars have been expended upon this great enterprise. Of the whole distance of inland navigation, west of the city of Washington, computed at 800 miles, including the main branch of Patowmac, and such of its tributary streams as are susceptible of improvement by navigation, may now be counted upon as completed, at least partially completed, about three hundred and sixty miles, *viz.*

*Miles.*

The main branch of Patowmac, from the tide, to New Creek, 17 miles above Cumberland,	230
The Shenandoah from its junction with Patowmac,	100
The Monocacy,	30

There are still obstructions between Harper's Ferry and New Creek, which forbid the use of that part of the river more than two or three months in ordinary years; but from Harper's Ferry to the tide, and for about 75 miles of the Shenandoah, and 20 of the Monocacy, may be safely calculated on tolerable navigation, from four to six months in the year.

The passage of this river through the Blue Ridge, which is a very grand sight, shall be described in a subsequent chapter.

*The James.*

James River affords harbour for vessels of any size in Hampton roads, but not in safety through the whole winter; and there is navigable water for them as far as Mulberry Island. A forty gun ship goes to James Town, and lightening herself, may pass to Harrison's bar, on which there is only 15 feet water. Vessels of 250 tons may go to Warwick; those of 125 go to Rockets, a mile below Richmond; from thence it is about seven feet water to Richmond; and about the centre of the town, four feet and a half, where the navigation is interrupted by falls, which in a course of six miles, descend about 80 feet perpendicular. A company has been incorporated to cut a canal round these falls, and to clear the river through the mountains. The canal which terminates in a large bason in the city of Richmond, is completed, and much has been done towards clearing the river through the mountains, so that a great part of the produce of the country as high up as Lexington, which formerly was carried to market in waggons, is now transported in boats to the great accommodation of the inhabitants. The expense would not be great when compared with its object, to open a tolerable navigation up Jackson's river, and Carpenter's or Dunlap's creek, to within 25 miles of Howard's creek, or Greenbriar, both of which have then water enough to float vessels into the great Kanhawa. In some future state of population, it is possible that its navigation may also be made to interlock with that of the Patowmac, and through that to communicate, by a short portage,

with the Ohio. Formerly, from the junction of the Cow pasture and Jackson's river, to its confluence with the Rivannah, it was called Fluvannah river, and bestowed its name on the county of Fluvannah. This appellation of the river has grown into disuse; James river being that by which it is generally distinguished.

*The York.*

York river, at York town, affords the best harbour in the state for vessels of the largest size. The river there narrows to the width of a mile, and is contained within very high banks, close under which vessels may ride. It holds four fathoms of water at high tide for twenty-five miles above York, to the mouth of the Poropotank, where the river is a mile and a half wide, and the channel only seventy-five fathoms, passing under a high bank. At the confluence of Pamunkey and Mattapony, it is reduced to three fathoms depth, which continues up Pamunkey to Cumberland, where the width is one hundred yards, and up Mattapony to within two miles of Frazier's ferry, where it becomes two and a half fathoms deep, and holds that about five miles. Pamunkey is then capable of navigation for loaded floats to Brockman's bridge, 50 miles above Hanover town, and Mattapony to Downer's bridge, 70 miles above its mouth.

A further description of the rivers of the United States would be unnecessary, and not consistent with the nature of this work; especially too as they are so fully described in the excellent geography of the Rev. Dr. Morse, whose work should be in the hands of every one who wishes to become accurately ac-

quainted with this country.\* It may be however remarked with propriety, that there is no country of equal extent on the face of the globe, better or indeed so well watered as the United States. There are few rivers in other quarters of the world, whose sources are so distant from their mouths, or which are navigable for so long a course.

A fortunate peculiarity also attends our rivers, viz. that though they may take their sources in one state, they almost invariably pass through others; the same state sometimes commanding one, and sometimes both banks; these forming the strongest ties of union; inasmuch as both states are equally interested in their undisturbed navigation. Thus the river Connecticut passes through the states of Connecticut, New Hampshire, Massachusetts, and Vermont. The North river, through New York and New Jersey, and can easily be united with the lakes in Vermont, Pennsylvania, and Ohio. The Delaware passes through Pennsylvania, New Jersey, New York, and past Delaware. The Potowmac, through Maryland, and Virginia; and the Ohio through New York, Pennsylvania, Virginia, and Kentucky, receiving in a course of eleven hundred and eighty-eight miles fifteen principal rivers, all navigable, besides many smaller streams. The Susquehannah, through Pennsylvania, New York and Maryland; and lastly, the Savannah, through South Carolina and Georgia.

There is, consequently, no country either so united, or capable of being united, by means of na-

\* The 5th and last edition is printed at Boston, 1395.

tural and artificial navigation. The collections of water are so immense, and so advantageously situated, that we may expect with the progressive resources of the country, to see the most stupendous canals cut, uniting long rivers flowing in opposite directions, and taking their courses to distant and different seas.

The sea coast of all North America, offers equal advantages for foreign commerce, by the numerous and extensive bays indenting it, and which are equal in size to any on the globe. In the north there are the bays of St. Lawrence, Chedabucto, Chedabucto, and Fundy, in Nova Scotia. Continuing the enumeration southwardly, we have the bays of Passamaquoddy, Penobscot, and Casco, lying along the state of Maine: Massachusetts bay, Naraganset, Long Island sound, communicating at both ends with the ocean; Delaware bay, sixty miles long, and eighteen wide from cape to cape; the Chesapeak, one hundred and fifty miles long, and from seven to eighteen miles broad, and nine fathoms deep; and the bay of St. Simon's in Georgia.

## CHAP. III.

### SOIL OF THE UNITED STATES.

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IN a country embracing fifteen degrees of latitude, and about ninety five of longitude, and extending 1500 miles in one direction, and 1400 in another, a great variety of soils, climates, and productions is naturally to be expected. Such in fact is the case.... While the plants and animals of Lapland are found on the mossy hills of the north, the native plants of burning Africa, flourish in the sandy soil of the south. As however it may be useful to particularise the soils peculiar to the states composing the union, the task shall now be attempted; acknowledging at the same time that much of the materials is furnished by the work of Dr. Morse, to whom this country is under great obligations for the unremitting industry he has bestowed upon its geography.

#### *The Soil of New England.*

The soil of New England is diversified by every variety, from a lean and barren sand, to the richest clays and loams. The first great division of soil is a brown loam every where mixed with gravel. With

this the hills, which constitute a great proportion of the whole surface, are universally covered. This soil is always favorable to the production of grass, and in the western parts of the country, when not too moist, of wheat and all other kinds of grain, and of every kind of fruit suited to the climate. Maize, or Indian corn grows well, even on the wet ground, where this soil exists.

Clayey soils are more rarely found, and are also very productive, especially when manured. A rich loam, varying towards clay, begins at Guilford and Branford in Connecticut, and spreads through the whole breadth of that state, terminating in West Springfield. The same soil prevails also in Salisbury and Sharon, and covers about one quarter of the western half of Connecticut. This soil, wherever it exists, is favorable to every kind of cultivation, and is surpassed in goodness by no land in this country.

The yellow pine plains are commonly a mixture of sand and gravel; are light and warm, and friendly to every production which does not demand a richer soil. The white pine plains are usually covered with loam, as are some of the yellow pine plains, and are not unfrequently fertile. The vallies, almost without exception, are a rich mould, and friendly to every growth of the climate.

The intervals, which border the various streams, are usually lands formed by earth deposited by the floods, or, as they are called freshes, in the spring, and are of the richest quality. Marshes, except of trifling extent, are rare: the most considerable are around New Haven, and along the eastern coast of Massachusetts and New Hampshire.

On the west side of the Green mountain, and in many places on Connecticut river, wheat is raised in great quantities, of an excellent quality, particularly on the marly lands bordering on lake Champlaine. On the mountainous part, to the east, winter wheat does not in general succeed, until the lands have been some time cultivated. But summer wheat thrives well, as do very generally, barley, oats, pease, flax, and all kinds of eatable roots, which are cultivated in the neighbouring states. The warmer soils, and the lands along the rivers, produce good Indian corn. The state affords the best pasturage, particularly the higher lands, and which support considerable droves of very fine cattle.

#### *Soil of Massachusetts.*

That part of Massachusetts which is distinguished by the name of the *Old or Plymouth colony*,, including the counties of Barnstable, Duke's, Nantucket, Bristol, and Plymouth, in point of soil, is the poorest part of the state, being generally sandy and light, interspersed, however, with many excellent tracts of land. The northern, middle, and western parts of the state have, generally, speaking, a strong, good soil, adapted to grazing and grain; very similar to the soil of New Hampshire and Vermont on one side, and to that of Rhode Island and Connecticut on the other.

#### *Soil of Rhode Island.*

Rhode island is for the most part lean and barren, but it nevertheless produces the grain common to the New England states. The barley of this state is par-



ticularly good. The slip of land in Hancock county, lying between North and South Kingston on the east, and Connecticut on the west, is excellent grazing land, and very large cattle are raised there. Extensive dairies are also kept there, and on the islands on the coast. The cheese made here is excellent, and has often been mistaken for that of England by good judges.

#### *Soil of Connecticut.*

Connecticut is generally broken land, made up of mountains, hills, and vallies; and is exceedingly well watered. Some small parts of it are thin and barren. It lies in the fifth and sixth northern climates, and has a strong fertile soil, which is very well calculated for pasture and mowing, and enables the farmer to feed large numbers of cattle and horses. Actual calculation has evinced, that any given quantity of the best mowing land in Connecticut, produces about twice as much clear profit as the same quantity of the best wheat land in the state of New York.

#### *Soil of New York.*

Beyond the Alleghany mountains in New York, the country is a dead level, of a fine rich soil, covered with maple, beach, birch, cherry, black walnut, locust, hickory, and mulberry trees. The country west of Whitestown is waving, and possesses a very rich soil. The lands between the Seneca and Cayuga lakes are represented as very excellent. East of the Alleghany the country is broken into hills with rich intervening vallies. The best lands in the state, which lie along the Mohawk river, and north of it,

and west of the Alleghany mountains, are yet nearly in a state of nature, but are most rapidly settling.\*

The face of the Genessee country appears to be a succession of gentle swellings of land, running most frequently from north to south, and the intermediate spaces afford considerable bottom or meadow land, and generally a small stream of water. The upland is well timbered. The openings or large tracts of land found frequently in this country free of timber, and shewing great signs of having once been in a state of cultivation, are singularly curious.

On the Genessee river ten thousand acres may be found in one body, not even encumbered with a bush, but covered with grass of such height, that the largest bullocks, at thirty feet from the path, will be completely hidden from the view.†

#### *Soil of New Jersey.*

As much as five-eighths of most of the southern counties of New Jersey, or one-fourth of the whole state, is almost a sandy barren, unfit, in many parts, for cultivation. The land on the sea-coast in this, like that in the more southern states, has every appearance of *made ground*. The soil is generally a light sand; but this state has all the varieties of soil, from the worst to the best kind. It has a great proportion of barrens. The good land in the southern counties lies principally on the banks of rivers and creeks.

\* Morse.

† Description of Genessee, New York, 1799. These flats resemble the *Pampus plains*, which commence a few miles from Buenos Ayres, and extend to a great distance in the interior. See the account of South America, in *Wonders of Nature and Art*, vol. xi.

The soil on these banks is generally a stiff clay ; and while in a state of nature, produces various species of oak, hickory, poplar, chesnut, ash, gum, &c. The barrens produce little else but shrub oaks and yellow pines. These sandy lands yield an immense quantity of bog-iron ore, which is worked up to great advantage in the iron works. There are large bodies of salt meadow along the lower part of the Delaware river and bay, which afford a plentiful pasture for cattle in Summer, and hay in Winter ; but the flies and muskitoes frequent these meadows in large swarms, in the months of June, July, and August, and prove very troublesome, both to man and beast. In Gloucester and Cumberland counties are several large tracts of banked meadow. Their vicinity to Philadelphia renders them highly valuable. Their swamps afford lumber, which is easily conveyed to a good market. The sugar maple tree is common in Sussex county, upon the Delaware. In the hilly and mountainous parts of the state, which are not too rocky for cultivation, the soil is of a stronger kind, and covered, in its natural state, with stately oaks, hickories, chesnuts, &c. and when cultivated, produces wheat, rye, Indian corn, buckwheat, oats, barley, flax, and fruits of all kinds, common to the climate. The land in this hilly country is good for grazing, and farmers feed great numbers of cattle for New York and Philadelphia markets ; and many of them keep large dairies, as there are large tracts of fine meadows between the hills.\*

\* Morse.

*Soil of Pennsylvania.*

The soil of the state of Pennsylvania is greatly diversified. The Alleghany mountains run through the state from north-east to south-west, and have many spurs or offsets, and parallel ridges, between which, the soil is very fertile, and produce every species of grain suitable to the climate, and of weight equal to any in the world. In some of the newly cleared land of the western counties, the strength of soil is so great as to cause wheat to lodge before it ripens, to prevent which it is necessary to take repeated crops of hemp, tobacco, and corn (maize) in order to reduce its strength, and cause the head to shoot. Years of cultivation pass on without any manure being put upon the land. The county of Lancaster is composed of a durable clay, not liable to be much injured by the wet in Winter, or the sun in Summer, and being in high cultivation, the land sells at as great a price as within one mile of Philadelphia. Limestone almost every where abounds in this county, and enable the farmer to keep up the strength of his land upon moderate terms, by the use of that powerful and most excellent manure. Hence it is not uncommon to find land as good after having been worked half a century, as the best land of newly cleared tracts. These facts which are so well known to the inhabitants of the counties to which a reference is particularly had, will not be credited in Europe, where the *truth upon an subject* connected with the native or artificial riches of this country is seldom if ever told.

The native grasses of our woods, in the western counties, feed immense droves of cattle, which are annually brought down to the thickly settled parts, and sold to the farmers, who graze them for the Philadelphia market, whence they are also annually sent in droves to the cities of New York and Baltimore.

Great care is paid to the formation of meadows, the soil of which, being alluvial or composed of the deposition from the waters is very deep, yield abundant crops of grass, without any other manure than that which drops from the cattle grazing on them. The meadows, especially on the rivers Delaware and Schuylkill, south and south-west of Philadelphia, are not surpassed by any in the world, for a luxuriance of the most nourishing grass, a native of the United States, the seeds of which are never sown.

The valley of Shenandoah extends from Winchester in Virginia, to Carlisle and Shippensburg in Pennsylvania. A stratum of slate runs through all this valley in Pennsylvania, and is found also on one side of the Opeckan creek in Virginia, and Conegocheague creek in Maryland and Pennsylvania, and the Conodogwinnett creek in the last mentioned state, but the soil is much inferior to the limestone soil.

About Sunbury and Northumberland, the soil is a sandy loam, several feet deep, near the river.

*Soil of Delaware.*

The state of Delaware, the upper parts of the county of New Castle excepted, is, to speak generally, extremely low and level. Large quantities of stagnant water, at particular seasons of the year, overspreading a great proportion of the land, render it equally unfit for the purposes of agriculture, and injurious to the health of the inhabitants. The spine, or highest ridge of the peninsula, runs through the state of Delaware, inclined to the eastern or Delaware side. It is designated in Sussex, Kent, and part of New Castle county, by a remarkable chain of swamps, from which the waters descend on each side, passing, on the east, to the Delaware, and on the west, to the Chesapeake. Many of the shrubs and plants, growing in these swamps, are similar to those found on the highest mountains.

Delaware is chiefly an agricultural state. It includes a very fertile tract of country; and scarcely any part of the union can be selected more adapted to the different purposes of agriculture, or in which a great variety of the most useful productions, can be so conveniently and plentifully reared. The soil along the Delaware river, and from eight to ten miles into the interior country, is generally a rich clay, producing large timber, and well adapted to the various purposes of agriculture. Thence to the swamps above-mentioned, the soil is light, sandy, and of an inferior quality.

The general aspect of the country is very favourable for cultivation. Excepting some of the upper parts of the county of New Castle, the surface of the

state is very little broken or irregular. The heights of Christiana are lofty and commanding; some of the hills of Brandywine are rough and stony; but descending from these, and a few others, the lower country is so little diversified as almost to form one extended plain. In the county of New Castle, the soil consists of a strong clay: in Kent, there is a considerable mixture of sand: and in Sussex, the quantity of sand altogether predominates. Wheat is the staple of this state: it grows here in such perfection as not only to be particularly sought by the manufacturers of flour throughout the union, but also to be distinguished and preferred, for its superior qualities, in foreign markets.

#### *Soil of Maryland.*

East of the blue ridge of mountains, which stretches across the western part of the state of Maryland, the land, like that in all the southern states, is generally level and free of stones; and appears to have been made much in the same way; of course the soil must be similar, and the natural growth not remarkably different.\*

The eastern shore is level, and consists of a variety of soils; on the bay and on the rivers, the timber, which is large, consists of poplar, hickory, oak of different kinds, and chesnut; wherever the latter abounds the soil is good, but light, and where the forests are found it is generally a stiff clay. The banks on the bay and rivers are high, but the inland is level, the soil generally clay, intermixed with loam; in some, particularly in Queen Anne's and Talbot

\* Morse.

counties, there are large tracts of a white clay, bearing oak and pine, and so flat that they require to be drained ; and on those lands some of the whitest and finest wheat is raised. In many places on the waters there are immense banks of oyster-shells, which are an inexhaustible fund of manure. In Kent, Queen Anne's, Talbot, and Caroline counties, *retired from the waters*, the grounds are flat, and mixed with small ponds of stagnated waters, the soil sandy, and very indifferent ; the wood consists of small oak and hickory. The soil of the county of Cecil, particularly of the manor of Bohemia, was originally luxuriant, but, by long cultivation without manure, it is now much reduced. Between Susquehannah and Elk rivers, the land is hilly and broken, and the soil generally thin and cold. The soil of the county of Frederick is very rich.

*Soil of Virginia.*

The whole country of Virginia, between the head of the tide-waters, about 100 miles from the sea, is level, and exhibits every appearance of having, in former times, been covered with the sea.

The soil is very various : above the mountains it is extremely rich, and yields not only great crops of grain, but also of grass, in excellent meadows. Between the blue ridge and tide-water, is the tobacco country. In the peninsula, the soil is sandy and extremely barren, but has greatly ameliorated within a few years, in consequence of the cultivation of the cassia *chamæcrista* or magothy bay bean.\*

The northern neck of Virginia, situated between the Potowmac and Rappahanoc rivers, with the exception of some few spots only, is flat and sandy, and

\* See the chapter on the vegetables of the United States.



abounds with pine and cedar trees. Some parts of it are well cultivated, and afford good crops; but these are so intermixed with extensive tracts of waste land, worn out by the culture of tobacco, and which are almost destitute of verdure, that on the whole, the country has the appearance of barrenness.

In Urbanna, upon the Rappahannoc, in the county of Middlesex, the soil is white, loose and sandy. At Richmond, and the neighbourhood, it is sandy, but on the banks of James river, rich. Near the southwest mountain, the soil is a red clay, very good for wheat. The country pleasant and healthful. In Frederick and Berkley counties, the best part of the country lies between the waters of the Opeckan creek, and the Shenandoah. It is the richest limestone land on the eastern waters of this state. It is of a dark grey, and supposed to be much about the same quality as the third rate land in Kentucky.

#### *Soil of Kentucky.*

Kentucky generally lies upon a bed of lime-stone, which is commonly about eight feet below the surface, except in the vallies, where the soil is much thinner. A tract of about 20 miles wide, along the banks of the Ohio, is hilly, broken land, interspersed with many fertile spots. The rest of the country is agreeably uneven, gently ascending and descending, at no great distance. The angles of ascent are from eight to twenty-four degrees, and sometimes more. The vallies in common are very narrow, and the soil in them is very thin, and of an inferior quality; and that along the ascending ground is frequently not much better; for where you see a tree blown up,

you find the roots clinging to the upper parts of the rock. The soil on these agreeable ascents (for they cannot be called hills) is sufficiently deep, as is evident from the size of the trees. The soil is either black, or tinged with a lighter or deeper vermilion, or is of the colour of dark ashes. In many places there are appearances of potters' clay, and coal in abundance. The country promises to be well supplied with wholesome well-tasted water. In Nelson county, north-west of Rolling fork, a branch of Salt river, is a tract of about 40 miles square, mostly barren, interspersed with plains and strips of good land, which are advantageous situations for raising cattle, as the neighbouring barrens, as they are improperly styled, are covered with grass, and afford good pasturage. The lands east of Nolin creek, a branch of Green river, are in general of an inferior quality, but the banks of Green river afford many desirable situations.

The accounts of the fertility of the soil in this state have in some instances exceeded belief, and probably have been exaggerated. That some parts of Kentucky, particularly the high grounds, are remarkably good, all accounts agree. The lands of the first rate are too rich for wheat, and will produce 50 and 60, and in some instances it is affirmed, 100 bushels of good corn an acre. In common, the lands will produce 30 bushels of wheat or rye an acre. Barley, oats, flax, hemp, and vegetables of all kinds common in this climate, yield abundantly. Cotton is seldom, and with difficulty, brought to perfection. Irish potatoes produce well, but succeed better farther north; sweet potatoes are raised with difficulty.

*Soil of North Carolina.*

North Carolina, in its whole width, for 60 miles from the sea, is a dead level. A great proportion of this tract lies in forest, and is barren. On the banks of some of the rivers, particularly the Roanoke, the land is fertile and good. Interspersed through the other parts, are glades of rich swamp, and ridges of oak land, of a black rich soil. In all this champagne country, marine productions are found by digging 18 or 20 feet below the surface of the ground. The sea-coast, the sounds, inlets, and the lower parts of the rivers, have uniformly a muddy, soft bottom. Sixty or eighty miles from the sea, the country rises into hills and mountains, as described under this head in South Carolina and Georgia.

*Soil of South Carolina.*

The shore of South Carolina rises gradually from the Atlantic ocean. The sea-coast is continually intersected by inlets, creeks, and marshes; causing a number of islands. Some of them present a sandy front to the sea; undulated with conical sand hills, sixteen or twenty feet high; while the sides next the main land, are level and low, and are connected with extensive marshes, intersected by creeks and inlets. Their soil is of a very sandy nature, producing small pines and bay trees, live oak, cedar, palmetto cabbage, palmetto royal, silk grass, myrtle, cassena, wild olive, tooth-ach-tree, prickly pear, sea-side oats, and scattering coarse saline grasses. Others whose bounds are deep and extensive, possess a soil of a sandy nature, extremely fertile; and are wood-

ed with pine, white oak, red oak, live oak, gum, hickory, dogwood, sassafras, elm, laurel and bay ; while their undergrowth is covered with a profusion of shrubbery ; and jassmines (*bignonia semper-virens*) are abundantly strewed along the ground, or clasp the trees above them, in beautiful festoons.

From these islands, the main land presents a level country, with a surface of light black earth, on a stratum of sand ; and that sometimes resting at a few feet below, on a stratum of marle or clay. In some places the sand deepens, and at the distance of fifteen or twenty feet below the surface, it rests upon a bed of small and broken sea-shells, and other marine productions. At first sight they present the appearance of a light porous rock, like Bermudian stone ; but, on examination, they prove to be nothing more than a variety of broken shells, attached to each other by particles of marsh clay and sand. These lands generally produce extensive pine forests ; known by the name of *pine* barrens, because of their unproductive nature. They are without any stones on their surface, for eighty miles or more, from the sea ; rising by an almost imperceptible ascent to that distance, where the elevation is said to be near two hundred feet above the level of the ocean. Through this tract of country, the pine barrens have little or no underwood, some species of shrub-oak excepted ; the ground being generally covered with coarse wild grasses. This is probably not its natural appearance, but is caused by the custom of burning the dry grass in the spring, in order to hasten early pasturage, at the same time destroying the young shrubs, which would otherwise, shoot up a growth of under-

wood. Fertile veins of land, upon a clayey or marley foundation, occasionally intersect these barrens.

A multiplicity of swamps and bays,\* are found throughout the country, which branch out and unite, by an infinity of meanderings; sooner or later, emptying their waters into some river, or inlet from the sea. Natural meadows, called savannas, are often seen in this part of the state, some of which cover an area of fifty acres. They are destitute of trees or bushes; producing little more than a few species of coarse grass, and wild herbaceous flowers.

The rivers which course along these lands are bordered with the most fertile soils, and upon them some of the best rice plantations are situated. These lands, as far as the influence of the salt water, are composed of a stratum of dark blue clay, clothed with a plenteous growth of rushes, and salt water sedge, whose roots are completely interwoven with each other. When the salts begin to subside, the growth of vegetables immediately declare it. Here, different kinds of fresh water flags; high and strong species of grass, of the wild oat kind; and quantities of wampe (a species of arum); with small tupelo, cypress, myrtle, and elder, indicate a more freshened soil. And from hence upwards, as far as the tides flow, the rice lands extend deep on each side of the rivers, until they join the high pine lands.

\* They are called *bays*, from the multiplicity of *bay-trees* which grow therein, and which are so tall, and closely connected with each other, as to throw a continual shade over the land below. Hence their soil is naturally sour and spongy; producing china briars, andromedas, and ferns; soon exhausted with culture, and of course but little attended to.

The swamps are covered with the heaviest growth of timber, shooting up canes (*arundo gigantea*) in great quantities; and so thick in many places, that a bird cannot fly between them. Over these, a thick growth is produced of tupelo, cypress, ash, maple, water oak, bay, gum, elm, and white oak, in proportion to the greater or less strength of the land, and the higher or lower the situation may be, on which they grow. In these swamps knolls or small rising grounds present themselves; on which grow the laurel (*magnolia grandiflora*), the beech, the plane tree, the cotton tree, birch, prickly leaved holly, and the deciduous holly, the wild orange, (*prunus lusitanica*), persimmon, wild swamp whorde-berry, and dwarf palmetto. A soil so productive sufficiently denotes its riches. The inundations, and flowing of tides, bear to it, and precipitate thereon, the finest and most subtile particles of manure; and form a soil of a dark brown loam, with a strong tenaceous light blue clay underneath, for a depth of fifteen or twenty feet, or more; perfectly inexhaustible, and of so level a nature that where the tides flow, a few inches of water can cover the lands for agricultural purposes. This soil will dissolve in the mouth, without leaving a particle of sand upon the tongue; and in every respect is entitled to high consideration, as being the best kind of land in the state. From the point, to where the tides flow, freshes occasionally pour violently down the river; but the swamps continue deep, and excellent, rising in height above the level of the rivers, as one advances towards their falls; and in the same proportion, their soils are of coarser texture, but still abundantly promoting all purposes of vegetation.

With the sand hills the middle country may be said to commence, stretching in a belt of from twenty to forty miles from Savannah river, to the upper part of Pedee river, and thence into North Carolina. In general, this land is barren. At these places sand hills rise one hundred and fifty, or two hundred feet above the adjacent lands; from whence a prospect of many miles is presented over the surrounding country. And little else is to be seen growing on them, than pine trees of very stunted growth, small shrub oaks, and one or two species of lupine. Their soil is of so sterile a nature, that in many places it produces no grass to cover it; and the tracks of any animal passing over it, are discernible as if they had been upon snow. The low grounds among these hills are either extensive swamps and bays, or narrow vallies, into which the mould from the adjacent high lands has been deposited by the rains which run down their sides. Hence they become suitable for agriculture and pasturage, and are principally those places, near which settlements are effected. In this belt or middle country, the hills of Santee arise two hundred feet high; the soil is a mixture of sand, clay and gravel, well calculated for grain, indigo and cotton, affording at the same time, the most healthy settlements within the state. Beyond this belt, and from the first falls of the rivers, loose stones appear along the declivity of hills; and in meadows, flowering shrubs, of a singular appearance present themselves; the long moss is no longer seen, the soil changes to a dark and fertile mould, the country rises, currents become rapid, and are often opposed by scattering rocks. At length the mountains spring,

which are the sources of rivers running easterly into the Atlantic, and westward into the Mississippi.\*

### *Soil of Georgia.*

The soil of Georgia resembles that of the state last mentioned, in many particulars. On the coast are several islands, the soil of which is sandy, but yields cotton of a fine quality, and remarkably long staple, and sells at a higher price at the British markets, than the same article from any other quarter of the globe.

Between the islands and the main land, are extensive salt marshes and rice swamps, the soil of which is very rich; and above these, in the eastern part of the state, which includes all the country between the mountains and the Atlantic, and upwards of one hundred miles by forty, in extent, there is scarcely a hill or stone to be seen. The soil of a great part of the land in the lower and middle divisions of the state is sand, and covered with pines; the substratum is clay, and commonly lies from 12 to 20 inches below the surface. A due admixture of these soils, would tend greatly to improve the land, and to preserve its strength, which is continually exhausting by cultivation, and exposure to a blazing sun. The soil of the back country is a strong clay, and yields great crops of cotton, wheat, corn, and the common grain of the more northern states.

### *Soil of Ohio.*

The state of Ohio, according to Mr. Ellicott, is exceedingly fertile near the rivers, but in many

\* Drayton's View of South Carolina.



places these rich flats are of small extent, being limited by hills on one side, and the river on the other. A large proportion of the hills and mountains are unfit for agricultural purposes, being either too steep, or faced with rocks. On the various streams falling into the Ohio, there are large level bottoms or natural meadows, from twenty to fifty miles in circuit, affording a rich soil, and may be reduced to proper cultivation with very little labour. Very little waste land is to be found in any part of this tract of country. There are no swamps, but such as may be easily drained, and converted into arable and meadow land; and though the hills are frequent, they swell gently and admit of tillage. They are of a deep rich soil, covered with timber, and well adapted to the production of grain.

#### *Soil of Tennessee.*

The farmers on Cumberland river (Tennessee,) for the sake of describing their lands, distinguish them by first, second, and third qualities. Land of the first quality will bear Indian corn, or hemp; but it will not bear wheat without great reduction..... Land of the second quality does not bear wheat to advantage until it has been reduced by two or three crops of corn, hemp, tobacco, or cotton... Land of the third quality bears every kind of grain that is usually sown on dry grounds in the Atlantic states. It is agreed by all who have visited Cumberland settlement, that 100 bushels of Indian corn are frequently gathered from an acre of their best land. Sixty or seventy bushels from an acre is very common; but the farmer who expects to gather such a crop must

be careful while the corn is soft, to guard it against bears and raccoons. This, however, is a trouble that must cease when the country is well settled. Wheat, barley, oats, rye, buckwheat, Indian corn, pease, beans, potatoes of both kinds, flax, hemp, tobacco, indigo, rice and cotton, have already been planted in that settlement, and they all thrive in great perfection. The usual crop of cotton is 800 pounds to the acre, the staple is long and fine. It is alleged, however, that the lands on the Mississippi have a decided preference to those on the Cumberland river, for the production of cotton and indigo. No experiments have been made on land near the Mississippi, within the ceded territory; but there is a small settlement further down the river, within the limits of the United States, on a similar soil, where the growth and quality of cotton is so remarkable, that its culture is more profitable than any other crop.... The soil on those rivers is deep and light, having a small mixture of sand with a black earth; hence, as the planters allege, it proves favourable to the culture of all kinds of roots, as well as indigo and cotton.\*

\* Account of the state of Tennessee, Philadelphia, 1796.

## VEGETABLES.

Having prepared the way for this subject by a consideration of the internal structure of the country, the climate, and the different kinds of soils, an account shall now be given of the principal vegetable productions of the United States.

Of those grasses which are essential to the existence of man and beast, a great variety is found, both natural and artificial, and of as useful qualities as any of the same kind in the world. Of the native grasses the number is great; and their nourishing qualities are evinced by the size and number of the cattle which are annually brought from the thickly timbered forests of the new land. In the northern and middle states, the *Poa viridis* or green sward grass, deserves to be particularly noticed; as it shews itself in the most abundant manner in all places, which have been enriched by manure, or the alluvial soil of our creeks and rivers. In the inexhaustible mellow soil of the peninsula between the Delaware and Schuylkill, and on the banks of those rivers, three crops of this grass may be cut every year, and from two to three tons obtained from an acre at a cutting; and has this peculiar quality, that frost does not affect it, so that after the artificial grasses are killed for the season, this excellent grass continues to flourish, and even to acquire a new relish by the operation of the cold. Cattle therefore continue to fatten upon it, while those who depend upon clover and other artificial grasses, are either obliged to kill their stock, or to resort to the expensive measure of feeding on hay

to prevent their falling off. For a long time it was supposed that it was peculiar to low moist soils, but we now know from the successful and extensive experiments of a distinguished native of Pennsylvania,\* that upland, when properly prepared and enriched, is equally congenial to it as the created soil of our rivers: a discovery which has served, among other causes, greatly to enrich the state.

Dr. Muhlenberg assures the author that this plant is not described by Linnæus, though nearly allied to his *poa angustifolia*. It may be easily known by the following description. "Culm (or haulm) erect and round, (columnar) panicle diffuse, spicules five-flowered, and hairy at their base." Such is the tendency of this grass to take possession of rich ground, that if the meadows on the Delaware be ploughed and sown with grain and clover seeds, the green grass will smother the clover after the first year.

*Blue grass, poa compressa* L. *rehwasen* of the Germans, a native grass of the United States, having a compressed oblique culm, (or haulm) panicle squeezed, spicules round, (columnar) and eight-flowered. This is eaten tolerably well by cattle when young, and remains green until frost. It binds the soil in the course of three or four years, so as to require ploughing up. This is often mistaken for the green grass, and both are called occasionally *spear grass*, and *wire grass*. In wet seasons or in moist places it affords good pasture, but is not to be compared to the former grass.

\* William West, whose merit as a farmer, is as great as that of his brother Benjamin, in historical painting.

*Herd grass.* White top, foul meadow grass of East Jersey. Dr. Muhlenberg informs the author, he thinks this grass is the *agrostis stricta* of Willdenow. It is particularly adapted to wet low grounds. It mats and consolidates the surface, continues many years, excluding every other grass, and all weeds. Many worthless swampy spots in the low parts of the state of New Jersey have been rendered valuable grazing grounds by this grass, loaded waggons having passed over places, which a few years before sowing it, would scarcely admit an animal to walk over them without sinking. It makes excellent hay, and cattle are said to prefer it to that made of either clover or timothy. It is more succulent than timothy, though not so coarse. The same bulk of herd grass hay will weigh one-third more than the same bulk of timothy hay. Four tons is a common crop from one acre. It yields no second crop, but affords excellent late and early pasture. It was first brought to New Jersey from New England by the late William Foster, who resided near Mount Holly; and introduced into Pennsylvania about ten or twelve years since.

The *red top* and *white top* of New England are only varieties of the above species of grass. The latter is the larger of the two. The red top is particularly valuable, as it will grow and sod the first year on banks, when no other grass will thrive.

The *juncus bulbosus*, or black grass of New England and Long Island, is another valuable grass, meriting particular notice; this plant was first noticed about sixty years since, and is gradually progressing

westward. Large quantities of hay are made from this grass on farms, where ten or fifteen years ago it was unknown. It grows alike on upland or low marsh, but thrives best on land that is overflowed once a year at least, with salt water. It appears early, and yields two tons of hay to the acre. No ploughing or harrowing, or other preparation of the land is necessary, as the seeds only require to be sprinkled over the soil in the Autumn, or early in March. For the following botanical description of this grass we are indebted to Dr. Cutler of Massachusetts.

*Juncus bulbosus*, black grass. *Roots* enlarged at the base of the culm; creeping. *Culms* thread-shaped; somewhat compressed; longer than the leaves; from three to twelve inches high. *Leaves* linear and channelled; striated, smooth. Points of the leaves generally dead at the time of flowering. *Capsules* obtuse, ovate, brownish and glossy; three cells; many seeds.\*

The *fowl meadow grass* of New England, is also in great estimation. The story respecting its introduction, according to Mr. Meigs, is, that it first appeared on the river Agawan, which unites with the east branch of Connecticut, near Springfield, on the spot where an uncommon bird had perished; but this account has not been authenticated, and until we know the botanical characters of the plant, the truth respecting it cannot be ascertained. It is probable, however, that it is the herd grass or *agrostis stricta*. "It abounds on Neponsit river, between Dedham

\* Med. Repos. Hexade 2. vol. 2.

and Stoughton, where it has covered a large tract of land without the assistance of man.”\*

*White clover* is undoubtedly a native plant of the United States. In every part of America the ground is spontaneously covered with this grass, “growing frequently with a luxuriance that art can rarely equal in Europe.”† Even in the Indian country, far westward, fields are seen covered with this grass, the nourishing quality of which is not exceeded by any other within our knowledge. The flesh of sheep fattened on this grass is peculiarly high flavoured. There are other grasses, natives of the United States, which form part of our pastures, but they are less valuable than those already mentioned, and do not grow with equal luxuriance.

The southern states are not less favoured by Providence, with excellent native grasses, and other plants, for cattle. There, a vertical sun will not permit the artificial grasses of the more northern states to grow, but they find excellent substitutes in the following plants.

1. Crab grass, or crop grass. (*Syntherisma, præcox, serotina, et villosa.*) This grass bears one or two cuttings during the season; and grows to the height of two or three feet. It makes its appearance in the latter end of April and beginning of May, with the crops which are then advancing, and does not mature itself until the latter end of Summer, about the time the crops are made. It was hence called *crop grass*: and, by adulteration, is now call-

\* Dr. Fisher, quoted by Morse.

† Mr. Strickland's Report to the British Board of Agriculture.

ed *crab grass*. In good high land, or where it has been manured, this grass comes up thickly without being sown: and from the little trouble attending its growth, and the excellence of its fodder, it is the grass which is most attended to in Carolina.\*

This grass is a real blessing to the southern planter. It uniformly appears in all well cultivated grounds, which have been manured, or are rich by nature. It covers the ground after the crop of Indian corn has been taken off, furnishing an excellent pasture for cattle.

The quantity of this grass which good ground will produce, is really astonishing. During the last Winter, the author was informed by several persons of the most undoubted credit in Savannah, that Mr. Stephen Pearce, living between that town and Augusta cut so much of this grass off one acre, that, with all the advantages of a warm sun, the hay could not be made on the ground which produced it.

2. *Avena Caroliniana*, oat grass, grows in rich tide lands. When cut green, it makes an excellent fodder for horses.

3. Cane. (*Arundo gigantea et tecta*). Grows in low grounds and river swamps, and, when young, furnishes the most acceptable and nourishing food to cattle. Their leaves continue throughout the Winter.

4. Water oats. (*Zizania aquatica*). Grows on the borders of fresh water rivers, where tides flow, and makes an excellent fodder when cut green.

\* Drayton's View of S. Carolina.



In South Carolina and Georgia, the appearance of this plant is always indicative of good land.

The Indians of Canada carefully collect the seeds of this plant, in the Autumn, to make bread, as we are informed by Mr. Mackenzie, and other travellers. Wild fowl grow fat upon the seeds.

Its introduction into England, has been seriously proposed by an eminent character.\* This plant has an extensive range in North America.

### *Artificial Grasses.*

The artificial grasses in common cultivation in the United States, are :

1. Red clover. This important grass was introduced into Pennsylvania about sixty years ago, but excited little attention until twenty years afterwards, when its vegetative power was discovered to be increased to a most incredible degree, by the apparent magical effects of gypsum. Since that time it has become an essential article in the rotation of crops of the state, and has diffused more substantial wealth than would have resulted from the discovery of a gold mine.†

The cultivation of this grass is now beginning to progress southward, and in passing through Maryland and Virginia, spots of clover may be occasionally seen; but, *it is to be regretted, that the planters of these states do not see their interest in cultivating this excellent exotic in an extensive manner; instead of continuing the exhausting and pre-*

\* Lambert, in Trans. Lin. Soc.

† For an account of the introduction of gypsum into Pennsylvania, its use as a manure, and a theory of its action, see the Dom. Encyc. art. *Gypsum*.

*carious tobacco plant, or in taking repeated crops of wheat or Indian corn.*

In poor land, in Pennsylvania, clover is generally ploughed in when in full bloom, the second Summer, as preparatory to a crop of wheat or Winter barley, by which a very large portion of vegetable manure is added to the soil, and its strength kept up; but when the land has been enriched by a repetition of this process, and it is wished to lay down the field to grass, the clover is permitted to remain, and annually top-dressed by compost; gypsum is sown the second year of the clover, and occasionally afterwards in the proportion of one, or one and a half bushels to the acre.

Some late experiments induce a belief, that, the use of gypsum in October has a better effect on the grass, causing it to grow more rapidly, and to sprout more early, in the following year, than when sown in the Spring, according to the common practice.

Two varieties of clover are cultivated in the U. States, one of which grows to a much greater height than the other, and is more early by three weeks: thus affording a succession of green food either for soiling or pasture.

2. *Avena elatior*, or tall meadow oats, was imported many years ago by Dr. Muhlenburg, and is now spreading fast through the state of Pennsylvania. It is the *Wiesenhaffer franzosich*, ray grass of the Germans.....The English rye grass or ray grass is the *lolium perenne*, a very different plant. A very good figure and description is given of the

avæna in Sherber's Treatise on Grasses, vol. i, tab. 1.

Agreeably to the experience of Dr. M. this grass is of all the earliest, latest, and best grass for green fodder and hay. It blossoms about the middle of May, with red clover, and the seed ripens a month after. It grows best in a clover soil, and rises to a height of from five to seven feet. It ought to be cut in blossom about the end of May. The seed may be sown in the Fall or Spring, with or without grain, and must be brushed in, or lightly harrowed. If mixed with clover, it will make good upland meadow. Horned cattle prefer this grass to all others: but some horses do not relish it green.\*

In addition to the above, Dr. M. informs the author, that the ray grass must be pastured or cut at least three times in a season; if suffered to grow old, it will become strawlike. When intended for hay it must be salted.

3. Timothy grass, (or *phleum pratense*), is more extensively cultivated than any other grass in the United States; for where the fertilizing red clover has never yet been introduced, we find timothy growing abundantly.

This plant, according to Mr. Strickland, is the *cat's tail grass of England*. It is not esteemed by the British farmers, if we may credit the reports of their agricultural writers; but no doubt can remain as to the excellence of this grass when cultivated in America.

\* Trans. Agr. Soc. of N. York.

4. Orchard grass, (*dactylis glomerata*, rough rock's foot grass of England), is also largely cultivated in the United States.

This grass is also spoken of in slight terms by the British writers: but our own experience is much in its favour. It ripens before timothy, flourishes well in the shade of orchards, and is greedily eaten by horses if cut before the stalk grows old.

5. *Lucerne* is but partially cultivated, notwithstanding our light soils are so particularly adapted to the extension of its top roots, and that it is so well calculated to resist the parching effects of our increasing dry Summers. From the experiments which have been made with it in New Jersey, it appears, that in the second year, four cuttings are obtained, and that good pasture is afterwards afforded. And Chancellor Livingston, of New York, has shewn, that the profit of an acre of this grass, will exceed, on the two first years, £7. per acre. The duration of this plant is another argument in favour of its cultivation.

6. *Sain foin*, *esparcet*, and *Pimpernel*, are scarcely known, though highly valuable.\*

The inhabitants of the most southern states are in an especial manner interested in increasing the number of their materials for both green and dry food for cattle. The mildness of their Winters, does indeed save them the trouble, to which the more northern farmer is obliged to submit, of preparing a large

\* See Trans. Agr. Soc. of N. York, and Dem. Enc. vol. iii. for a full account of these grasses.

portion of hay for Winter provender, but a variety of considerations should, nevertheless, induce the cultivation of such artificial grasses as are found to be particularly adapted to warm climates: such as the lucerne, and *avæna elatior* or tall meadow oats, already mentioned, together with the aquatic Scott's grass, and Guinea grass, which add so greatly to the comforts of the people of the West Indies.\*

But probably as important a grass as any for the southern States is the Bermuda grass, which grows with great luxuriance, and propagates with astonishing rapidity, by means of its numerous joints, every one of which takes root, and thus also performs the important office of binding the sandy soil in which it grows.

#### *Varieties of Grain.*

Of the varieties of grain with which Providence has blessed mankind, and capable of being converted into bread; the United States were originally intirely indebted to other quarters of the world;† but if they cannot boast of originating those necessary vegetables, the United States may, with justice, claim the merit of improving the qualities of those kinds which have been introduced, and of producing from them some inestimable varieties, superior, in point of quality, to any in the known world. This assertion is not hastily made, or without sufficient authority.... The superiority of the American flour

\* See *Wond. of Nat. and Art*, vol. x.

† *Zizania aquatica* excepted. See p. 222.

has been acknowledged by the London bakers, when examined by a committee of the house of commons, during the last scarcity; and by the justly celebrated Parmentier of Paris, in his Account of the Analysis of various kinds of Wheat.

The rice of the southern states will bear a comparison with any in the world.

There are many different kinds of wheat in the U. States; arising from the effect of cultivation, soil, and climate; and from another circumstance, discovered by an enlightened patriot and farmer, viz. the strong disposition of wheat to produce varieties. The facts on the subject are curious and interesting, and will, probably, be brought before the public on another occasion.

The following varieties are cultivated in Pennsylvania, and the middle states.

1. Yellow lammas wheat, of England, changed into red wheat by cultivation on a stiff soil.

2. Red chaff wheat. This kind originated on the eastern shore of Maryland, about fifty years ago, and generally cultivated. Immense quantities of it were shipped to England before the revolutionary war. The straw is stout, the grain mellow, and yields white flour of a superior quality. It is some weeks later than others, and hence, in moist places, subject to fogs in the Autumn, it is apt to mildew. This kind of wheat is now much cultivated in England.\*

\* The straw is used in packing Liverpool ware, which is imported into the United States..

3. The yellow bearded wheat, originated on Long Island, state of New York, and was supposed to be proof against the attack of the tipula insect, absurdly called the Hessian fly; but it is now found to be nearly as accessible to that insect as any other kind. The grain is flinty, yields well, and stands the vicissitudes of the Winter; but the flour is not so white as that of some other varieties, and in New York the plant is liable to smut.

4. Red chaff bearded wheat, is of modern origin in Virginia: it is very productive, the flour very white, the straw stout, and grows taller than the common kinds; it also bears the Winter well, and is now in the greatest estimation with the millers.

5. Early Virginia wheat. This variety originated on the farm of Mr. Isbel, of Caroline county, Virginia, about fifteen years since, and ripens nearly two weeks sooner than any other: a quality which renders it very valuable to those who live in damp situations, where the common kinds of wheat, from their ripening late, are very apt to be hurt by mildew.

6. Jones's wheat, originated in Pennsylvania; it yields excellent white flour, stands the Winter well, and resists the tipula fly, but produces less than any other kind.

The standard weight of the bushel of wheat, in Pennsylvania, is sixty pounds. But, although that grain often weighs less, it frequently weighs more. The produce per acre is very various.....In the old settled parts twenty-five bushels may be deemed the average crop per acre, though forty or fifty bush-

els are often produced from the same quantity of land.

The warmth of the climate of the middle states is not favourable to oats, and, in lands long cultivated, it is a light grain: but, in the new lands of the western counties, its weight is equal to any produced in Europe.

Barley thrives well, as does rye.

The *triticum spelta*, or *spelt*, is cultivated by the Germans in Pennsylvania. It makes a brown bread, but of a very wholesome quality.

In all the States the numerous varieties of maize, or Indian corn, are extensively cultivated. This *inestimable blessing*, this *magnum Dei donum*, enters largely into the food of a great portion of the people of the United States, and for wholesome qualities is exceeded by no grain on earth.

Rice (*oryza*) is exclusively cultivated in North and South Carolina and Georgia, and has become one of the most valuable staples, particularly of the last two states.

As the history of the introduction of this valuable grain into this country, and its mode of culture, may be interesting, it shall now be given.

Rice was first planted in South Carolina, about the year 1688: when by chance a little of it, of a small unprofitable kind, was introduced into the state. In the year 1696, a bag of a larger and whiter kind was presented, by a captain of a brigantine from Madagascar, to the governor; who divided it between several gentlemen. And some time afterwards, Mr. Du Bois, treasurer to the British East India Company, sent another parcel of rice; which



probably made the distinction which now prevails, between white and gold rice. Rice may be said to be solely the produce of the lower country. The plantations which produce this grain, are of two kinds, *river swamp* and *inland swamp*. The first are immediately connected with fresh water rivers; the latter are situated on low inland swamp, unconnected with tides or navigation. About the twentieth of March, the land is drilled either with ploughs or hoes, into about one hundred trenches to the acre, and the rice sown therein in the proportion of one or two bushels to the acre. The land is then flowed for three or four days. After the rice is some inches high, and has attained a little strength, it requires a hoeing. Three or more of these hoeings are commonly given to rice, during its growth; and at the second hoeing the toil becomes more serious; for then the grass is hand picked from the rice. After this operation is over, a flowing in tide lands, is commonly given, and continued from ten to twenty days, to prepare it for branching: after which the water is run off gradually, and the rice remains dry for some time. This is a critical period of the crop; the harvest proving good or bad, in proportion to the branching of the rice: every branch produces one ear, containing from one hundred to two hundred and fifty, or three hundred grains.

Three months after sowing the rice, it joints, blossoms, and forms the ear; water is then let on the fields, and retained, being occasionally changed, until a few days before harvest, *viz.* towards the

end of August. In general, the produce of rice is from 1200 to 1500 *lbs.* to the acre.

The rough rice is carried by a set of elevating buckets, from the lower, into the upper story, of the machine house, from whence it falls into a rolling screen; which separates the sand and gravel from it; and pours it clean into the hopper. From the hopper it passes to the mill stones, where the chaff is separated from the grain, and is afterwards blown away by a wind fan. The milled rice is then discharged into a bin, placed above the mortars, having funnels communicating therefrom to the mortars. The rice is then introduced into the mortars by the funnels, and is there beaten by pestles weighing about 230 *lbs.* which strike the rice from 32 to 44 times in a minute. When the rice is sufficiently beaten, it is taken out and thrown into a hopper, from whence by a set of elevating buckets, it is carried up to another rolling screen, where the small rice and flour are separated from it. The whole rice then passes through a funnel, under the friction of a brush, which takes off any flour which may still adhere to the grain; it thence falls into a wind fan, which winnows it clean, and discharges it into a bin, from whence, by funnels, it is received into barrels; and in some mills is even packed in them by mechanical operation. The dispatch and neatness of the work done by these mills, is extremely pleasing; particularly when we consider the small attendance necessary for working them.

The cotton of the United States may be ranged in three classes, *viz.* *nankeen*, *green seed*, and *black*

*seed* cotton. Nankeen cotton is principally grown in the middle and upper country for family use. It is so called from the wool, resembling the colour of *nankeen*, or *Nunkin* cloth; which it retains as long as it is worn. It is not in much demand, the white cotton having engrossed the public attention. Were it encouraged, however, cloths might be manufactured from it, perhaps not inferior to those imported from China, it being probable the cotton is of the same kind; as from experiments which have been made, nankeens have been manufactured in South Carolina state, of good colour and of very strong texture.

*Green seed cotton* produces a good white wool, adhering much to the seed; and, of course with difficulty ginned. Its produce is greater, and its maturity is sooner than the black seed; for which reason it is principally cultivated in the upper and middle country; as the seasons of those districts are shorter, by several weeks, than those of the lower country; and the frosts are more severe.

*Black seed cotton* is that which is grown in the lower country, and on the sea islands; producing a fine white cotton, of silky appearance; very strong, and of good staple. The mode of culture is the same with all these species; and rich high land is the soil on which they are generally planted. In the middle country, however, the high swamp lands produce the *green seed*, in great abundance; and some tide lands and salt water marshes (after being reclaimed) in the lower country, have also made excellent crops of this valuable article.\*

\* Drayton's View of South Carolina.

It is a singular fact with respect to this plant, that the influence of the sea air is essential to the preservation of the black colour of the seed, and to the length and fine quality of the staple. Repeated experiments having shewn, that the seed turns green, and the quality of the wool diminished when planted in the upper country....The cotton of the sea-coast, and particularly of the sea-islands of South Carolina and Georgia, is equal to any in the world: it has even brought a greater price at the British market than that of Brazil, which always before was deemed of the first quality.

The quantity of black seed cotton produced on an acre of land, in a Georgia sea island, is about 200 *lbs.* in Carolina from 130 to 150 *lbs.* an acre of upland will produce 300 *lbs.* of green seed cotton.

The cultivation of this important article has added greatly to the riches of the southern states. The extension of its cultivation to the present extent, only took place within the last twelve years, and opportunely succeeded the unprofitable and unhealthy culture and preparation of indigo; for the planters found that after their land had ceased to produce a crop of that plant, sufficient to make an attention to it an object, the same land would yield an abundant crop of cotton; thus affording them an useful lesson with respect to the importance of a rotation of crops, while their income was considerably increased.

Cotton has come to perfection in Newcastle county, Delaware state, near the southern boundary of the state of Pennsylvania; and during the revolutionary war was much cultivated: there is every reason to believe that near the sea coast where frost is less

severe than at a distance in the country, cotton might become an object with the people of both New Jersey and Delaware. The quantity of cotton exported from the United States in 1804, was 32,000,000 *lbs.*

The forest trees, shrubs and plants of the United States, whether for the purposes of the ship or house carpenter, dyer, or medicine, may well hold a comparison with the vegetable productions of any quarter of the globe. We owe to Mr. Jefferson the first attempt to disprove the absurd and degrading idea, that nature had acted with a contracted hand in the formation of the vegetables and animals of America, and as this subject cannot but be interesting to every American, a few remarks shall be offered upon it, on the present occasion. These ought to have the more weight, because they are the result of observations made by an enlightened foreigner, whose prejudices would naturally incline him to the adoption of the opinion of his countryman Buffon; but his own judgment was convinced upon an investigation of the subject, that the opinion was not only ill-founded, but that as far as respects France, the superiority was on the side of the United States. A conviction of this truth has so forcibly impressed the minds of the French œconomists, that a representation was made on the subject to the present government, and the younger Michaux was appointed for the express purpose of sending over those kinds of our trees, which would be deemed an acquisition to the country; and he has been engaged in this patriotic business for the four last years.

According to a memoir by M. Thouin, inserted in the transactions of the Royal Agricultural Society of

Paris, 1786, there does not exist in France more than thirty-seven species of trees higher than thirty feet; while in North America there are ninety above forty feet high. Of the thirty-seven species which France possesses, there are, according to the above memoir, only eighteen which form the mass of the forests of the country; while there are ninety in America, so that the difference amounts to seventy-two. Of the eighteen species which form the forests of France, sixteen grow in all parts of that country, and two in the middle of it: in the United States there are seventy-six, which are equally found in the north and the south, and which will bear a degree of cold equal to the north of Germany.

Of the eighteen species of trees, we can fairly confine the number of those which are suitable for the carpenter, and to civil and naval purposes, to nine species; the woods of North America proper for the same purposes are fifty-one.

In a memoir expressly written on the subject of the naturalization of the forest trees of the United States in France, Mr. Michaux has inserted a table of all the trees, the importation of which would be useful to France; with their common heights, diameters, places of abode, quality of the wood, and nature of the soil in which they grow, and concludes by saying, "The whole number is ninety, composed chiefly of twenty species of oaks, sixteen of walnut, seven of resinous trees, five of poplars, three of birch, four of maple, three of ash, two of cypress, two of elms, two of nyssa or tupelo, two of honey locust, three magnolias, two of celtis or nettle tree,\* The rest belong to

\* Or hackberry tree.

particular genera. Of these ninety trees, thirty rise to a height of from sixty to an hundred feet, fifty-seven from forty to sixty feet: three species may be added on account of the excellence of their wood, of which the height is from twenty-five to forty feet.

For the following excellent account of the American oaks, we are indebted to the late celebrated botanist Michaux, whose truly superb work\* ought to be in the hands of every gentleman in the United States.

The oak family comprehends a great number of species which are not known; and the greater part of those which grow in America, appear under such diversified forms when they are young, that we cannot be certain what they are, until they have arrived at maturer age, or have attained their full growth. It seems that nature has intended to multiply this tree, and render it of general utility, by causing to grow in the same latitudes, various species which could accommodate themselves to the diversity of temperature and soil. For the oak does not always grow in the forests, nor elevate its top to a very great height. There are places which produce nothing but dwarf oaks, such as the *kermes* oak (*quercus coccifera*), and some others, which are naturally small, while there are others which grow among the rocks, on the shores of the Mediterranean sea, whose moderate height is owing merely to the dryness of the soil where they have taken root. There are also some varieties produced by causes purely accidental; in North America there is a

\* On the oaks of America, Paris, 4to. 1801.

dwarf scion bearing oak (*chenes nains stoloniferes*), whose multiplied suckers cover vast tracts of country. The meadows (savannas) situated in the middle of the forests of this continent, are burned annually by the savages and by the new settlers, for the purpose of renewing the grass, attracting deer, and pasturing cattle. The fire spreading thence into the woods and destroying the great trees, the horizontal roots of several species of oak detached from the trunk reproduce themselves, and separately, shoots which produce fruit afterwards when not more than two or three feet high. Every bundle or assemblage of these shoots, from the same root (*souche*) may be considered as a dwarf tree; or without stem (*tige*); for the fire, in consuming these trees down to the root, produces the same effect that the cutting off the stem and trimming does in cultivated pear trees, which otherwise would have become tall trees, but which, by these repeated operations, are made to remain dwarfs, and to put forth fruit-bearing branches near their very roots.

Several travellers not having had time to observe these oaks with sufficient care, have taken them to be particular species; but those whose acorns have been planted, have sent forth, like all others, a descending root, without producing suckers; whence it seems probable there are no stoloniferous oaks.

Oaks present numerous varieties, and the determination of the species to which they belong is attended with great difficulties. Frequently an intermediate variety appears so to approximate two species, that it is difficult to determine, from an examination of the leaves, to which of the two species the



variety ought to belong. Some species, apt to vary during their tender age, appear then so different, that the characters of the foliage are insufficient to determine and recognise the same species in young and old individuals. Several others, on the contrary, are so exactly uniform that the specific distinctions can only be established on the fructification, which is itself subject to exceptions and variations. It is only by comparative observations on individuals, considered both when grown and growing, that we can arrive at the distinction of the species that resemble each other so nearly, and at the distribution of the varieties to their proper species when found.

The description of the oaks of North America has hitherto been obscure for several reasons: 1st. the botanists who have visited that country have only given detached observations upon those trees, and have not attended sufficiently to the characters of the fructification: 2d. the authors who have treated on those subjects after them, have often united several species under the same denomination: and 3d. the figures they have given of American oaks, cultivated in Europe, are not always correct, because their growth there, is retarded by a temperature which is less favourable to them than their native land, and because they there preserve longer the varieties of foliage, which characterise their growing state.

To clear up my doubts I have planted and cultivated, during my residence in America, all the species which I have had opportunity to observe and collect; and after two years, I had the satisfaction to recognise all the varieties which had perplexed me so much when I had traversed the woods.

In following with attention and assiduity, the variations experienced by certain species, until they arrive at maturity, I have found in the young individuals, the stamp and type of their species. It is thus that I became acquainted with the connexions existing between them. To find out their *analogy* I availed myself of the means which nature herself seems to have furnished me with: but on the one hand, if an observer who follows the order of nature, succeeds by the analogy of the species, to class them, on the other hand he will find himself embarrassed when it is wished to determine each species, and to give to it proper and differential characters.

I have tried to dispose the different species of American oaks in a natural series. To succeed, I thought at first, that the parts of fructification would furnish me with proper marks to establish this series, but none furnished the means, and I perceived very trifling distinctions, such as the situation of female flowers sometimes almost sessile, sometimes pedunculated; the size of the fruits, their different time of maturity, &c. Neither has it been possible for me to establish a sufficient distinction from the form of the *cup*. I have then fixed my observations on the leaves; they have offered more striking distinctions, of which I made use to establish two divisions in the genus. The first includes the species with *mutique* leaves, that is to say, deprived of setaceous points; I have classed in the second, those with leaves of which the summits or the notches are terminated by a bristle.

The interval of time between the appearance of the flower, and maturity of the fruit, is not alike in

all the species of oaks. This term of fructification which I represented at first as insufficient to establish the two principal divisions, is nevertheless of sufficient importance to be admitted as a secondary character.

It is well known, that all the species of oaks, are monoecious, and that in the red oak, (*quercus robur*, Linn.) and in several other species, the male flowers are situated on the young branches, which appear in the spring, and that the female flowers are fixed on these same branches above the male flowers: it is known also that both are *axillary*, that immediately after fecundation, the male flowers wither and fall, while the female flowers continue to grow, and in the course of the same year complete their fructification. Such is the ordinary course of nature, but it is not the same with several species of this genus, with which the female flowers which are seen to appear in the spring, stay a whole year without growing. It is to be presumed that they are not fecundated in the first year, since it is but after the second spring that they encrease in size, and attain maturity. There is then an interval of eighteen months between the appearance of the flower and maturity of the fruit. These considerations have enabled me to establish two secondary divisions.... One comprehends the species, as I call them, of *annual fructifications*, that is to say, of which the ordinary interval of six months is sufficient for the fruit to attain maturity. The other comprehends the species whose fructification is *biennial*, that is to say, the fruit of which ripens only every eighteen

months.\* It must be remarked, that when fructification is annual, it always remains *axillary*, while in the species where it is biennial, it is so during the first year only; but during the second, and when the leaves fall, it is necessarily isolated. Clusius has made the remark concerning the *quercus cerris*, Linn. whose fructification is biennial; we must except those, the fructification of which, although biennial, always remain axillary, because the leaves do not fall, such as the *quercus coccifera*, Linn. and the *q. virens*, or live oak. I will also observe that in the old continent, there are to be found oaks of biennial fructification, such are the *quercus cerris*, *q. æglops*, *q. coccifera*, Linn. *q. pseudosuber*, Desf. &c.

The species and varieties which Mr. Michaux describes are twenty-nine, and the arrangement of them he has made out in the following manner, to wit:

### *Methodical disposition of American oaks.*

#### *Section I.*

Oak, full grown plants without bristles at the summits of the leaves, acorns pedunculated, annual fructification. (The 6th species biennial.)

\* To the above remarks it may be added, that the timber of the different species of oak, which complete their fructification in one year, is of a much better quality than those which require eighteen months to ripen their acorns. A remarkable exception, however, is to be made in the case of the durable live oak of the southern states.  
Note by Michaux, jun.

*Division I.*

## Lobated leaves.

- Sp. 1. q. obtusiloba, upland white oak, iron oak.  
 2. q. macrocarpa, over cup, white oak.  
 3. q. lyrata, water white oak.  
 4. q. alba, var. pinnatifida, } white oak.  
       ..... repanda, }

*Division II.*

## Dentated leaves.

- Sp. 5. q. prinus, var. palustris, swamp chesnut oak.  
       monticola, mountain chesnut oak,  
       rock oak.  
       acuminata, narrow leaf chesnut  
       oak.  
       pumila, chinquapin, oak.  
       tomentosa, Illinois oak, Downy  
       oak.

*Division III.*

## Intire leaves.

- Sp. 6. q. virens, live oak.

*Section II.*

Oak, full grown, plants of which the leaves are armed by a bristle, acorns almost sessile, fructification annual.

*Division I.*

## Intire leaves.

- Sp. 7. q. phellos, var. sylvatica, willow oak.  
       maritima, sea willow oak.  
       pumila, dwarf willow oak.

- 8. q. cinerea, upland willow oak.
- 9. q. imbricaria, shingle willow oak.
- 10. q. laurifolia, swamp willow oak.  
var. obtusifolia.

*Division II.*

Leaves short lobed.

- Sp. 11. q. aquatica, water oak.
- 12. q. nigra, black oak.
- 13. q. tinctoria, var. 1. angulosa, great black oak, or Champlain black oak.  
2. sinuosa, quercitron oak.
- 14. q. triloba, downy black oak.

*Division III.*

Leaves deeply sinuated.

- Sp. 15. q. banisteri, running downy oak.
- 16. q. falcata, downy red oak.
- 17. q. catesbœi, sandy red oak.
- 18. q. coccinea, scarlet oak.
- 19. q. palustris, swamp red oak.
- 20. q. rubra, red oak.

1st. *Quercus Obtusiloba*. Upland white oak, iron oak.

2d. *Alba*, or common American white oak of Marshall.\*

Height about 17 metres (54 feet), straight trunk, whitish bark, regular ramification. Leaves woolly underneath, grey or earthy colour underneath, com-

\* See his *Arbustrum Americanum*, Philadelphia, Cruksbank, 1784, 8vo.

monly with five lobes, and truncated and deeply sinuated, base sharp, the petiole short.

This tree rarely grows in low and damp places, the acorns are abundant, wild beasts are very fond of them; its wood is much esteemed for economical purposes, especially for posts and rails, and staves, houses, and vessels.

2d. *Quercus macrocarpa*, over cup white oak.

Height about 65 to 85 feet, bark smooth, a little cracked or broken, even when fully grown. Leaves woolly underneath, lyre shaped, deeply sinuated, lobes obtuse and crenated, much larger than those of the preceding species, of a green less deep, and less rough; petiole much longer; cup deep and fibrous towards its border, acorns very large, oval and confined in the cup, before maturity; peduncle moderately long; abounds west of the Alleghany.\* The wood is excellent when growing on high clayey and calcareous soils, but in marshy grounds, it dwindles and is covered with moss: the young branches are covered with a fungous substance like that on the elm and sweet gum (liquidamber), which disappears when they come to their growth: small woolly galls, like lentiles, are found under its leaves.

3d. *Quercus lyrata*, water white oak.

Height 55 to 65 feet, smooth bark; trunk when young and branches flexible; leaves of a fine green colour, quite smooth, lyre shaped; lobes approaching to a square, and the angles sharp, their terminations three pointed; sinus very blunt: petiole short:

\* Also in the upper parts of Pennsylvania and New York.—Michaux, junr.

the cup of a moderate size, almost spherical, studded with pointed tubercles; nearly enveloping the acorn, the peduncle sometimes very short. Grows in South Carolina and Georgia, on low grounds, frequently overflowed by rivers.

4th. *Quercus alba*, white oak. *q. alba palustris*, or swamp white oak of Marshall.

Height 65 feet, bark whitish, rising by longitudinal bands, in proportion as it comes to its growth. Leaves almost uniformly pinnatifid, obfusely indented, lobes often entire, smooth and whitish underneath. Cup half globed, tuberculous, acorn oval, of a moderate size, peduncle sometimes very short. Grows generally throughout North America. This oak furnishes the best timber for houses, and ship building, and liquor casks, in preference to those made of red oak, and many other species, which will only hold dry articles. Brooms and baskets are made of it. Parkinson\* says, that the Indians boil the acorns to extract the oil, which they mix with their food. They are very sweet.

5th. *Quercus prinus*, 1st variety, swamp chesnut oak.

Height from 70 to 90 feet; whitish bark detaching longitudinal bands when fully grown; leaves moderately long in the spring; during the summer sometimes very woolly in old trees. Acorn large; capsule shallow, very scaly; peduncle sometimes very short: grows in North and South Carolina, Georgia and Florida, in low lands and thick woods.

This tree is one of the largest that grows in the

\* The botanist, not the farmer.



southern states; noted for the beauty of its form, and size of its acorns, which are sweet and abundant; they are much sought after by wild beasts, also by hogs: the wood is excellent, and much used by wheel-wrights, being easily split: and it is also used to make brooms and baskets.

2d Variety. *Quercus prinus* (monticola), *Q. prinus* of Marshall, mountain chesnut oak.

Height from 40 to 50 feet, leaves whitish underneath; rhomboidal; obtusely dentated, petioles short; acorn oblong and middle-sized; grows throughout the United States on high mountains: acorns of this variety are abundant; and the wood as much esteemed as the white oak; its bark is much valued by tanners.

3d variety, *Quercus prinus* (acuminata) narrow leaf chesnut oak.

Height between 70 and 80 feet; leaves sometimes whitish, long petioles, with an obtuse base and sharply dentated: acorn middle sized, cup thin, not quite hemispherical: grows in all rich grounds west of the Alleghany; all the varieties of the chesnut oak have many good qualities; the acorns are sweet, and bark much used for tanning.

4th. *Quercus prinus* (pumilus), *pinus pumilus* of Marshall, chinquapin oak.

Height three feet; leaves spear-pointed, petiole short, acorn like the preceding; grows in the western part of Virginia and Carolina.

5th. *Quercus prinus* (tomentosa), downy chesnut oak.

Grows abundantly in the Illinois, in a vast marshy plain; its leaves are downy, nearly oval, obtusely

dentated: the petiole very short; acorns very sweet. A chesnut oak like this grows in lower Virginia.

6. *Quercus virens*. *Phellos sempervivens* of Marshall.

Live oak of South Carolina and Georgia.

Height 30 to 45 feet, bark dark brown, somewhat cracked, leaves firm and tough, entire, oval or oblong, and a little obtuse, dentated while young, silky in the spring; afterwards of a dark green, with a light down underneath, petiole short and reddish, as also the nerves, cup turbinated, tolerably smooth, with short scales, acorns oblong; grows from lower Virginia, to Florida and the Mississippi, on the sea coast.

This tree only grows on the islands and coasts exposed to the sea winds; in a sandy soil, with a clayey substratum. It affords a fine shade; the acorns are abundant, and less bitter\* than those of other kinds of oak. It is said that the Florida Indians extract an oil from them, which they use in cooking. Hogs and wild animals are very fond of them; the timber is excellent, and more esteemed than that of any other species in North America: it is much used for ship timber.

7. *Q. Phellos*, willow oak. *Q. p. angustifolia* of Marshall.

Height 50 to 55 feet, bark smooth, leaves narrow and lanceolated, pointed at both ends, trifid, short petiole, cup thin, small acorns, grows (slowly) all through the United States in moist places, and is a pretty tree: wood much used.

\* Mr. M. might have added, very savoury. They can scarcely be distinguished from chinquapins late in the winter.

8. *Q. cinerea*, upland willow oak.

Height from 18 to 20 feet, leaves petiolated, lanceolated, somewhat oblong, pointed, entire, of a dark green colour, on upper side of an ash colour, woolly beneath; cup saucer shaped, scales visible on the inner margin, acorn spherical: grows in the low lands of North and South Carolina and Georgia, in dry places; it is of an ugly shape, wood only fit for fuel. Catesby's figure of this tree is very inaccurate.

9. *Q. imbricaria*, shingle willow oak.

Height about 45 feet, grey bark, somewhat chapped, branches straight; leaves almost sessile, large, oval-oblong, pointed, entire, dark green on the upper surface, a little downy underneath; acorns like the preceding, but the scales of the cup a little larger; grows on the Alleghany, and countries to the west of them, particularly on the Wabash and at the mouth of Cumberland; used for shingles in the Illinois.

10. *Q. Laurifolia*, swamp willow oak.

Height 65 feet, bark plain, branches straight, leaves almost sessile, ovo-lanceolated, extending beneath to an acute angle, entire, smooth and shining, cup turbinated, acorn almost globular, a little larger than the willow oak.... Grows in thick forests on sea coast of South Carolina and Georgia, wood of good quality, but inferior to live oak; of this there is a variety, viz.

*Q. Laurifolia*, hybrida.

Obtusely leaved, swamp willow oak. It grows in the banks of creeks running through sandy soils; and

differs from the foregoing by its leaves being broad and obtuse at their extremities.

11. *Q. Aquatica* of Catesby.

Height from 60 to 65 feet, leaves smooth, wedge shaped, pointed at the base, the summit a little sinuous, or otherwise three lobed, petiole short; the cup a little concave, acorns almost round. Grows from Maryland to Florida, in marshy grounds. It also grows in dry and sandy places near the sea coast. It is improperly called aquatic, the willow oak being likewise aquatic. This tree is often confounded with the black oak. A variety of this oak is the *q. dentata*, or narrow leaved winter green oak mentioned by Bartram.\*

12. *Quercus nigra*, black oak. *q. n. integrifolia* of Marshall.

Height about 50 feet; trunk crooked, bark rough and dark, leaves tough, russet hue, and powdery underneath, wedge form, base obtuse, and somewhat jagged, the top very broad, cup turbinated, scales membranous and obtuse at the summit; acorn egg shaped. Grows from Maryland to Florida and Tennessee. There is a variety with lobes more sharp, and peaked points. It appears to resemble the three lobed oak; nevertheless it has more affinity to the black or water oak.

13. *Quercus tinctoria* of Bartram. *Var. q. tinct. angulosa*, or *sinuosa*....*q. nigra*, or black oak of Marshall.

Height from 70 to 85 feet; blackish bark, leaves petiolated, broadly oval, obtuse at base, lobes not

\* See Travels, p. 13.

very deep and angular, of a dark green on the upper surface, lightly downy underneath, cup almost shallow, very scaly, scales not adhesive, acorn roundish, a little depressed. Grows in almost all parts of the union. This tree is called black oak, but the true black oak is that of Catesby, growing in sandy soils, whereas the *q. tinctoria* grows only in rich soils, always removed from the sea. Bartram measured some in Carolina from six to eight feet in diameter.... Those which Michaux saw on lake Champlain were from three to four feet, but between the high mountains of North Carolina, they are double that diameter.

[Mr. Michaux, jun. assures the author, that the *sinuosa* and *angulosa*, which are marked as varieties in his father's work, are the same. It is this variety which Dr. Bancroft calls quercitron, and which is so useful as a yellow dye and tonic remedy. The black oak is much used for shingles and rails.]

14. *Quercus triloba*, downy black oak.

Height from 55 to 65 feet, grows rapidly, bark plain, leaves oblongly wedge formed, three lobed at their tops, napped and ash-coloured underneath, petiole much longer than that of the black oak. Acorn globe-shaped and small. Grows throughout the United States.

The vegetation of this tree is very rapid, even in bad soils. After the annual firing of the woods in America, suckers come out during the first year, the leaves of which do not resemble those of the full grown tree. The lateral and intermediate divisions are much more deep, and the divisions are more numerous.

This is a very rare species, which has been previously noticed by Kalm.

15. *Quercus banisteri*. *Q. nigra pumila*, or black dwarf oak of Marshall.

Running downy oak.

Height six to nine feet; leaves long, petiolated, divided into five lobes, forming as many sharp angles, and always entire; whitish, or ash-coloured underneath; acorns very small, and nearly round, two upon each peduncle, cup somewhat turbinate. Grows in Massachusetts, New York, and New Jersey,\* in clayey and cold grounds. It is always small, and seems adapted to live fences, as well as the *q. triloba*.

16. *Quercus falcata*. *Q. rubra montana*, or upland oak of Marshall.

Height from 55 to 64 feet, petioles long, obtuse at the base, palmated, the lobes a little divided at their summit, and often curved outwardly, cup shallow, the scales slightly adhesive, acorn small and round. Grows from Virginia to Florida. Before this tree arrives at maturity, it produces leaves, the lateral and intermediate divisions of which are subdivided, and in this state of variation, the lobes are strait. This character shews its affinity with the *q. triloba*, in consequence of which it is difficult to distinguish these trees from one another, but when fully grown, they take on their individual proper character.

[In Pennsylvania this species is called Spanish oak; Marshall says it has some varieties differing in the size of their fruit and leaves, and that the

\* And in Pennsylvania. Michaux, jun.

timber is generally worn eaten, or rotten at heart." But it is presumed that this observation refers only to old trees.]

17. *Q. Catesbei*, sandy red oak.

Height from 35 to 45 feet, bark black and rough, leaves smooth and shining, tough, contracted by a sharp angle at their bases, has five or six lobes, which are sometimes curved outwardly, petioles very short, acorn almost globular. Grows in Maryland, Virginia, and the Carolinas, in dry soils; often found with the black oak, wood of a bad quality, and only used for fuel.

18. *Quercus coccinea*, scarlet oak.

Height from 80 to 90 feet, leaves smooth, five or seven lobed, of which the teeth and the summit are drawn to a point, the sinuses circular, petiole very long, cup turbinate, very scaly, acorn egg-shaped. Grows in Virginia, and the higher parts of both North and South Carolina; rarely found in the more northern parts. The branches of the red oak are more flexible than the scarlet, the leaves of which are larger, and are supported by very long petioles. They fall at the approach of winter, the red colour is moderately dark: the form of the acorn, and particularly of the cup, constitute characters so different, and so uniform in the scarlet oak, that they ought to be considered as two species.

The wood of this tree is preferred to that of the red oak, but its bark is more esteemed for tanning.

19. *Quercus palustris*. *Q. rubra ramosissima*, or water red oak of Marshall. Swamp red oak.

Height from 35 to 45 feet, very branchy, the lower

branches inclining towards the earth; the petioles very long, deeply pinked by broad sinuses, the lobes are seven, oblong, and have teeth, or sharp subdivisions, like those of the scarlet oak, but much less. The cup is saucer shaped, acorn small. Grows throughout the United States, and west of the Alleghany. Abounds in the Illinois, and is there used for spokes of wheels. Of all the species of American oaks, this varies the least.

[The butts are often used for rimming of carriage wheels. Marsh.]

20. *Quercus rubra*. *Q. rub. maxima*, largest red oak of Marshall. Red oak.

Height from 100 to 110 feet, rapid in growth, leaves less deeply sinuated than those of the two preceding species; seven or nine lobed, teeth or angles very sharp, sinus sharp, sometimes obtuse, petiole very long, acorns moderately large, cup saucer shaped, acorns egg shaped and short. Grows in all the states and in the counties west of the Alleghany mountains. The wood, though inferior to the red oak, is nevertheless employed by carpenters and wheelwrights. Its bark is preferable to all the other species for tanning. The European tanners settled in the United States have observed, that it possesses a more active principle than the European oak. It grows rapidly in sandy, ferruginous, and cold soils.

[Marshall says, the timber is used for staves, shingles, and rails. The tree retains its thickness to a considerable height, and without lateral branches, spreading at top; often is six feet in diameter.]



*Liriodendron, tulipifera*, or tulip bearing poplar, tulip tree, American poplar, white wood. A native and well known tree in the United States. It attains to a very large size, rising as high as any forest tree; and makes a beautiful appearance when in flower, about the middle of May. There are two varieties, the yellow and the white; both of which afford excellent timber. The bark of the root has long been employed by medical men, and others in the United States as a *tonic*; and when joined with various proportions of black alder, (*prinos verticillata*) and dogwood, (*cornus florida*) has afforded a remedy of equal efficacy with the Peruvian bark. It is a strong bitter, and considerably aromatic; a decoction of it is said to be a common remedy in Virginia for bots in horses; the powder, combined with steel dust, is an excellent remedy in cases of general debility, or relaxation of the stomach. The timber is much used for various mechanical purposes, especially joists for upper floors, for which it answers well, being light, and of tolerable strength.

*Celtis occidentalis*. American yellow-fruited nettle tree.

This grows naturally in many parts of North America. It delights in a rich, moist soil, in which it becomes a large tree, rising with a straight stem, the bark of which, in young trees, is sometimes smooth, and of a dark colour, but as they advance becomes rougher, and of a lighter colour. The branches are set thick on every side, and garnished with oblique oval leaves, ending in points and sawed on their edges. The flowers come out opposite to the leaves, upon pretty long footstalks; they are

small and make but little appearance, and are succeeded by round, hard berries, about the size of a small pea, of a yellow colour and sweet taste when ripe. The juice of the fruit is said to give ease in violent dysenteries.

*Acacia.* Robinia, pseudo acacia, or false acacia, is a native of the middle states. It is commonly termed locust tree.

It grows best in warm sandy land, and becomes fit for timber in about twenty five years. The greatest use made of the trees, is for ship tunnels, ship timbers, fence posts, mill cogs, and fire wood; or if worked into posts to be set into the ground for garden fences and other inclosures, they are superior in point of durability to almost any known wood. The acacia is ornamental as a flowering tree. The blossoms unfold in June, and perfume the air to a considerable distance with their sweet and fragrant odour. It is so easily cultivated, that on Long Island we often see large pieces of land entirely overgrown with artificial woods of these trees. As our commerce and manufactures improve, the demand for this valuable timber will increase; farmers on whose lands the acacia will grow, ought to begin immediately the cultivation of the trees.

The multiplication of this tree has seldom been attempted by seeds, but almost constantly by young trees sprouting up from the wounded roots of the old one. The readiness of the roots of the parent tree, to vegetate, soon after the incumbent sward is broken up by the plough, surpasses that of any other tree; for in soils favourable to their growth, the farmers are obliged to grub with great labour to prevent them

from overrunning the land, and whenever suffered to indulge their native luxuriance, they will soon convert a piece of cleared land into a forest.

Citizen François de Neufchateau, member of the Conservative Senate, and of the National Institute, has lately published a treatise at Paris, in the form of a letter, on this tree. He observes, that it was brought from America by Jean Robin, curator of the king's garden, about the year 1620. It was quickly perceived that, in the course of ten or twelve years, it would, in very barren land, reach the size of an oak of thirty or forty years standing; but it appears that the advantage which it presented of putting forth flowers of an agreeable scent, has hitherto condemned it to be only a tree for show. This has been always the language of the different societies of agriculture, of the ministerial instructions, French and foreign treatises of gardening, &c. &c. In the space of ten years, however, says citizen de Neufchateau, a number of robiniers, planted in the quincunx form, at the distance of two meters from one another, and valued at not more than six francs, had a cutting or selling worth about 36,000 francs the hectare (a space little more than two acres); and, in the course of the last ten years, has had three prunings or topplings of very considerable value. The same trees, planted in the form of hedges, and cropped every third year, form an impenetrable inclosure, with a very valuable produce. § Notwithstanding this, it requires only a slight and meagre soil.

In the United States, particularly near Philadelphia various attempts have been made to plant hedges with the robinia, but it has been found that

ground mice destroy the roots of the young plants, and that a worm attacks the limbs of the old trees, which causes them to break off when high winds blow. Another objection to them is their disposition to sucker, and to extend their roots a great distance; but these evils might be prevented by a ditch.

*Gleditsia spinosa*, or *triacanthos*. Triple thorned acacia or honey locust.

This tree grows naturally in a rich soil, rising to the height of thirty or forty feet, dividing into many branches, which, together with the trunk, are armed with long pithy spines of five or six inches in length, sending off lateral ones, some of which are nearly the same length, and generally triple-thorned. The branches are garnished with winged leaves, composed of ten or more pair of small lobes, sitting close to the midrib, of a lucid green colour. The flowers come out from the sides of the young branches, in form of katkins, of an herbaceous colour, and are succeeded by crooked, compressed pods, from nine or ten to sixteen or eighteen inches in length, and about an inch and a half or two inches in breadth, of which near one half is filled with a sweet pulp, the other containing many seeds in separate cells. The pods, from the sweetness of their pulp, are used to brew in beer.

The genus *pinus*, is of the greatest importance in the arts. The noble and majestic *p. strobus*, or white pine, furnishes the masts and yards of ships, boards for inside house work, and shingles. The *p. taeda*, *palustris*, *pinca*, and *larix*, afford those useful articles, tar and turpentine, and the knots a superior charcoal. The *p. abies balsamia*, or spruce,

with its three varieties, afford a material for the most useful Summer beer, which is also a most powerful antiscorbutic. The *p. abies Americana*, or hemlock, though labouring under a bad character, by reason of its being used when cut at improper seasons, and exposed to the weather, is nevertheless a valuable wood for inside work, and for the upper rafters of houses: it also is useful for tanning; but requires to be mixed with the well known oaks; the Indians dye the splints of their baskets with it, of a red colour. The tree yields a balsam which has been useful as a medicine.

The genus *acer*, or maple, is not less useful for various purposes. The *a. negundo*, or white or ash leaved maple, is much used in cabinet work, being firm and smooth, takes a fine polish, and stain. The *a. rubrum*, or scarlet maple, when sawed into boards, exhibits the most beautiful waving appearance, and makes articles of furniture equal to satin wood. A species of maple abounds in Nova Scotia, and, no doubt, farther south, called bird-eye maple, which also is very beautiful. But the *a. saccharinum*, or sugar maple, ranks in the first importance among our forest trees. This valuable native is peculiarly dear to the citizens of this country, as it furnishes an article of the first necessity, by the labour of free men, and of equal quality, to that produced by the sugar cane; and the timber is highly useful for various mechanical purposes, particularly for saddle trees. From the maple may also be made a pleasant molasses, an agreeable beer, a strong sound wine, and an excellent vinegar.

The following facts upon the flowing of maple-juice, are curious, and deserve investigation.

The flowing of maple-juice is as completely *locked up* by continued warmth as by frost, and only flows by the alternate operation of these agents. Yet the same degrees of heat, even after frost, have not always the same effect. Thus, a warm south wind stops the flowing more than a cool north-west wind. To judge from sensations, generally a bracing wind facilitates the discharge, and a relaxing wind acts to the contrary. Whether, or how far, electricity may operate in this case, must be left for future inquirers to determine. The juice flows for about twenty-four hours after a frost; but, when a tapped tree has ceased, tap a new tree, and it will flow considerably, as if a certain quantity was discharged by the frost. The juice flows from all sides of the incision.

Cut a sugar maple early in the morning, if the night has been cold, and it will appear comparatively dry and devoid of juice, in every part of the tree. Cut it a few hours after, if the day is moderately warm, and the juice will issue almost in streams.\*

The *guilandia bonduc*, or nickar tree. A forest tree abounding in the western states of America. It bears nuts about the size of a pig-nut, of a deep chocolate colour, and shining appearance. The shells are so thick and hard, that they require to be filed to forward the vegetation: the nuts when parched and ground, are substituted for coffee by the inhabitants of the western country.

*Platanus occidentalis*, American plane tree, or large button wood.

\* Med. & Phys. Journal.

It is of quick growth, and often becomes a large tree of sixty or seventy feet in height, and above three feet in diameter, sending off but a few long, diverging branches, which, together with the upper part of the trunk, are generally covered with a smoothish bark, annually, or often renewed, and falling off in plates or scales. It may be propagated by cuttings, and is particularly valuable for the sea-coast of America, as it is not injured by the salt spray or boisterous winds.

Of this genus, *æsculus*, we have,

1. *Æ. pavia*, scarlet flowering horse-chesnut, fish-poison, or buck-eye. This species abounds in different parts of the United States, especially to the southward. The roots of it washed and bruised, are used in preference to soap, for washing woollens and coloured cottons; as they do not injure the colours so much as soap. Sattins also, it is said, washed with this root, and carefully ironed, look almost as well as new. The fresh kernels macerated in water, mixed with wheat flour, and formed into a stiff paste, will, if crumbled and thrown into any water where there are small fish, make those which eat of it so drunk, that they may be easily caught; but they soon recover when put into fresh water.

The fruit of our *æ. pavia* is much larger than that of the foreign *æ. hippocastanum*, and is of a white colour: that of the *hippocastanum* is yellow.

A single nut dried, weighed half an ounce and twenty grains, and yielded forty-four grains of fine starch. Dr. Woodhouse prepared half a pound of this starch from the nuts of *æ. pavia*, and kept it two years, without impairing the white colour. It is su-

perior to the finest Poland starch, and has been used to starch various articles of dress without imparting any yellow colour to them.

The method of preparing the starch, is, to take off the shells from the nuts with a knife; grate them in a vessel of water, which will hold the fine particles of starch suspended, when they are to be decanted into another vessel, which must remain at rest until the starch subsides to the bottom. The water is then poured off, and fresh water added, and the starch well stirred about in it, when it must again be permitted to subside. The water is then to be thrown away, and the starch dried in the sun. The water of the first washing holds a poisonous matter in solution, which when evaporated to the consistence of an extract, and mixed with dough, as above-mentioned, will intoxicate and swell the bellies of small fish.

2. *Æ. flava*, yellow flowered horse-chesnut, or tall buck eye, *æ. octandra* of Marshall. This often grows to a pretty large size. It is a native of the western parts of Pennsylvania and Virginia.

3. *Æ. alba*, grows in the north-west parts of Georgia, and West Florida.

4. *Æ. spicata*, with white spiked flowers; it is a dwarf, and was first found by W. Bartram, in the Creek country, and afterwards brought by Mr. Michaux to Mr. B. from Flint river, Georgia.

5. Dwarf variegated flowered horse-chesnut, found in the Cherokee country by Mr. W. Bartram.

The bark of the *æsculus hippocastanum* has been recommended by many writers as a substitute for the



Peruvian bark : our medical gentlemen in the country should try the bark of our native species.

1. *Ulmus Americana* of Marshal, American rough-leaved elm tree. Red elm.

This tree rises to the height of about thirty feet, with a pretty strong trunk; dividing into many branches, covered with a lightish coloured rough bark. The leaves are oblong, oval and sharp pointed, somewhat unequally sawed on their edges, unequal at the base, very rough on their upper surface, and hairy underneath. The flowers are produced thick upon the branches, upon short collected footstalks; and are succeeded by oval, compressed, membranaceous seed vessels, with entire margins, containing each one oval compressed seed.\*

The virtues of this tree were first publicly noticed by Dr. Samuel L. Mitchell, in the year 1789. He observes, that the inner bark, by infusion, or gentle boiling in water, affords a great quantity of insipid mucous substance, that may be employed with safety as food; I have eaten it repeatedly, and found it to agree with me perfectly well, and when mixed with sugar or lemon juice, it became very palatable. The knowledge of this fact may be very serviceable to such travellers, in the unsettled parts of our country, as lose their way, or fall short of provisions. It has been beneficially administered in catarrhs, pleurisies, quinsies, and applied as a poultice to tumours, and as a liniment to chaps and festers.†

\* *Arbustrum Americanum*, Philadelphia, 1785. Cruikshank.

† Carey's Amer. Mus. vol. vii, 1790.

The following additional facts upon this tree which were communicated by Dr. Joseph Strong of Philadelphia, have already been inserted by the author in the Domestic Encyclopædia (Art. Elm), but may be with great propriety introduced in this place, on account of the important information they furnish.

Dr. Strong states, that during the time he served as surgeon in the army on our western frontiers, he experienced the most happy effects from the application of poultices of the red elm bark to gun-shot wounds, which were soon brought to a good suppuration, and to a disposition to heal. It was applied as the first remedy. When a tendency to mortification appeared, the bark bruised and boiled in water, produced the most surprising good effects. After repeated comparative experiments with the other common emollient applications, as poultices of milk and bread, and linseed, its superiority was firmly established. He particularly stated to me the cases of the wounded in the action, in which the late general Wayne defeated the Indians, in August, 1794, as proving, in the most evident manner, the beneficial effects of this poultice. In old, ill-conditioned ulcers, and in fresh burns, equal benefit was derived from it. In diarrhœas and dysenteries, an infusion of the bark was used with advantage as a diet drink. A soldier who lost his way in the woods, supported himself for ten days, upon the mucilage of the elm, and on sassafras twigs. From the above facts, the red elm tree may be considered as a highly valuable addition to our stock of medicines, exclusively American, and ought to be carefully searched for by all medical gentlemen

in the country, and its virtues proclaimed, in order that the farmers upon whose plantations it may be found, may preserve it from the indiscriminating axe.

*Laurus borbonia.* Red stalked Carolinian bay tree.

This grows naturally in Carolina, and rises with a straight trunk to a considerable height, especially near the sea coast. The leaves are sharp pointed, and much longer than those of the European bay; a little woolly underneath, veined transversely, and somewhat reflexed on their edges. The male trees produce their flowers in long bunches from the wings of the leaves; the female in loose bunches, standing upon long red footstalks, and are succeeded by blue berries sitting in red cups.

The wood is of a very fine grain, proper for cabinet making, and other ornamental furniture. It also dyes a beautiful black colour.

*Nyssa aquatica.* Water tupelo tree. This grows naturally in wet swamps, or near large rivers, in Carolina and Florida; rising with a strong upright trunk to the height of eighty or an hundred feet, dividing into many branches towards the top. The leaves are pretty large, of an oval, spear-shaped form, generally entire, but sometimes somewhat toothed, and covered with a whitish down; they are joined to long slender footstalks, and affixed to the branches in somewhat of a verticillate order, presenting a beautiful varied foliage. The berries are near the size and shape of small olives, and preserved in like manner by the French inhabitants upon the Mississippi, where it greatly abounds, and is called the olive tree. The timber is white and soft when un-

seasoned, but light and compact when dry, which renders it very proper for making trays, bowls, &c. The root is very soft and light, and makes good bottle stoppers.

*Nyssa ogeche.* The ogeche lime tree. This is a tree of great singularity and beauty; growing naturally in water, in the southern states, and rising to the height of about thirty feet. The leaves are oblong, of a deep shining green on their upper sides, and lightly hoary underneath. The flowers are male and female upon different trees, and are produced upon divided or many-flowered footstalks. The fruit is nearly oval, of a deep red colour, of the size of a Damascene plumb, and of an agreeable acid taste; from which it is called the lime tree. Perhaps this is the *multiflora* of Weston.

*Nyssa sylvatica.* Upland tupelo tree, or sour gum. This grows naturally in Pennsylvania, and perhaps elsewhere, with a strong upright trunk to the height of thirty or forty feet, and sometimes near two feet in diameter; sending off many horizontal, and often depending branches; garnished with oval, or rather inverse egg-shaped leaves, a little pointed, entire, of a dark green and shining upper surface, but lighter and a little hairy underneath: those of male trees are often narrower and sometimes lance-shaped. The flowers are produced upon pretty long common footstalks, arising from the base of the young shoots, and dividing irregularly into several parts, generally from six to ten; each supporting a small flower, having an empalement of six or seven linear, unequal leaves, and from six to eight awl-shaped, spreading stamina, supporting short four-lobed an-

theræ. The female trees have fewer flowers produced upon much longer, simple, cylindrical footstalks, thickened at the extremity, and supporting generally three flowers, sitting close and having a small involucre. They are composed of five small oval leaves, and in the center an awl-shaped, incurved style, arising from the oblong germen, which is beneath, and becomes an oval oblong berry, of a dark purplish colour when ripe. The timber of this tree is close grained and curled, so as not to be split or parted; and therefore much used for hubs of wheels for waggons, carriages, &c.

Persimmon tree. *Diospyros Virginiana*, or American prune, data, or plum, a well known and valuable native tree, growing in all the states of the union, south of New York inclusive.

The unripe plums are green and very astringent; towards winter they become of a light brick dust colour, and when acted on by the frost, are softened, and have a sweet agreeable taste.

A fine transparent gum, of a light brown colour, insipid to the taste, readily soluble in water, exudes from the body of the tree.

According to Dr. Woodhouse's experiments on this tree, detailed in his *Inaugural Dissertation*, it appears, that the juice of the unripe fruit, inspissated in the sun, yields a large quantity of a brown, semi-transparent, astringent, gummy substance, of which common spirit dissolves a larger quantity than spirit of wine, or the vegetable oils. The unripe fruit divided, *well dried* in the sun, and reduced to powder, may be used as a valuable astringent re-

medy, in either the forms of powder, pills, or spirituous tincture, in all cases requiring astringents.

*Use of the persimmon in the arts.* Dr. Woodhouse says, "the unripe juice of the plum is preferable to oak bark for tanning. Allowing every tree to produce four bushels of fruit, and suppose three hundred trees cultivated, the quantity of gum resin which would be produced, would be 1800 pounds, computing six pounds to a tree. The quantity of juice would be several hundred gallons, which might be kept in barrels till wanted for use. Country tanners should attend to this useful fact.

*As a black dye.* Dr. Woodhouse dyed silk with an ink made of this substance, which was as black, and bore washing as well as that dyed with galls or logwood.

From an excellent memoir upon this tree by the late Isaac Bartram of Philadelphia, inserted in the 1st vol. of the *Amer. Phil. Trans.* it appears, that from half a bushel of perfectly ripe fruit, mashed, and mixed with two gallons of water, and fermented with a small quantity of yeast, he produced half a gallon of proof spirit, of an agreeable flavour. Beer is also made from the fruit in Maryland, by boiling it in water, straining and fermenting it, and adding hops to prevent the fermentation from going too far.

Bread is also made from the fruit, by mixing them as potatoes are with flour, in the case of potatoe bread. The wood of the tree, which grows rapidly, burns nearly as well as our favorite hickory, and its ashes yield a large proportion of salts. The great

value of this tree ought to induce farmers to cultivate it.

*Carica papaya.* This admirable tree, is certainly the most beautiful of any vegetable production I know of; the towering laurel magnolia, and exalted palm, indeed exceed it in grandeur and magnificence, but not in elegance, delicacy, and gracefulness; it rises erect, with a perfectly straight tapering stem, to the height of fifteen or twenty feet, which is smooth and polished, of a bright ash colour, resembling leaf-silver, curiously inscribed with the foot-steps of the fallen leaves, and these vestiges are placed in a very regular, uniform, imbricated order, which has a fine effect, as if the little columns were elegantly carved all over. Its perfectly spherical top is formed of a very large lobe-sinuate leaves, supported on very long footstalks; the lower leaves are the largest, as well as their petioles the longest, and make a graceful sweep or flourish, like the branches of a sconce candlestick. The ripe and green fruit are placed round about the stem or trunk, from the lowermost leaves, where the ripe fruit are, and upwards almost to the top; the heart or inmost pithy part of the trunk is in a manner hollow, or at best consists of very thin porous medullæ or membranes; the tree very seldom branches or divides into limbs. It is always green, ornamented at the same time with flowers and fruit, which, like figs, come out singly from the trunk or stem....Bartram.

*Juglans nigra*, round black Virginia walnut. This tree often rises to the height of fifty or sixty feet, and to three feet or more in diameter, covered with a dark furrowed bark, and dividing into many

branches, furnished with winged leaves, composed of ten or twelve pair of lobes, and an odd one; these are smooth, oblong, sharp pointed, and sawed on their edges; and upon being bruised emit a strong aromatic flavour, as doth also the external covering of the fruit. The fruit is round, their covering pretty smooth, and a little soft when fully ripe. The nuts themselves are hard, netted and furrowed, containing a sweet oily kernel.

2. *J. nigra oblonga*, black oblong fruited walnut. This tree resembles the former so as scarcely to be distinguished from it, except by its fruit, which is oblong or oval; the shells or coverings are rougher, harder, and of a deeper green colour. The timber of both sorts is much used by joiners, &c. in making tables, drawers, book and clock cases, &c. Coffins are also generally made of it. The bark and outer coverings of the nuts are used in dyeing wool, cloth, &c.

There are, perhaps, some other varieties of these.

It abounds on our western waters, especially on the Ohio, where it is employed in constructing the frames of the sea vessels built, being light and extremely durable, and nearly of the same strength as of the white oak.

3. *J. oblonga alba*, butter nut or white walnut, (*cathartica* of Cutler). This often grows to the height of twenty or thirty feet, and to eighteen inches or more in diameter, with a smooth light coloured bark. The branches are garnished with leaves, composed generally of eight or nine pair of lobes and an odd one, which are villose, oblong, egg-



shaped, sharp pointed, slightly serrated, and larger than those of the other kinds. The fruit, when ripe, is villous, and covered with a viscid clammy substance, by which it almost sticks to the fingers when handled. It is long, and somewhat pointed at the ends, and freed of its hull or covering, is very rough, and deeply furrowed, containing a soft, oily, sweet kernel.

An extract of the bark of this tree affords a mild and safe cathartic. The bark and shells of the nuts dye a good brown colour, scarcely ever fading. The mordant in common use is the sulphat of iron, (copperas): grey and black are also died with it. The young fruit make an excellent pickle, little inferior to the Madeira nut, (absurdly called English walnut.) The kernel of the nut contains a large quantity of rich sweet oil.

4. *J. alba acuminata*, long, sharp fruited hickory tree. The leaves are composed of three or four pair of lobes and an odd one. Nuts, with shells on, are two inches in length, and one in diameter. The nuts are thick shelled, the kernel small and not very sweet.

5. *J. alba minima*, pig hickory. Bark smooth when young, but becomes rough when old. Leaves are five-lobed and an odd one. The fruit is small and round; shell thin; kernel very bitter; timber not esteemed.

The late Dr. Pennington, of Philadelphia, strongly recommends this nut as an astringent.\*

\* See his valuable *Economical Essays*.

6. *J. alba odorata*, balsam hickory. This resembles the former: nuts small and round; thin shelled; kernel sweet; the branches very flexible and slender. There is a variety with a rough and furrowed bark, and broader leaves, larger nuts, and thicker covers. Timber of both hard and tough, used for axle-trees of carriages, mill cogs and rounds, handles, and most implements of husbandry.

7. *J. alba ovata*, shell-barked hickory. Height from seventy to eighty feet; grows in rich moist soils; bark rough and scaly; leaves two pair of lobes and an odd one, narrow towards the base, oval, and pointed at the extremity, sawed on the edges; fruit flattened, and indented at the ends; cover very thick; shell thin; kernel very sweet. Varieties numerous, some with nuts as large as walnuts.

8. *J. pican*, pican or Illinois nut. Abounds in Louisiana and the Illinois. The nuts are small and thin-shelled.

There are many other species of *juglans* in the United States, which offer a fine field for the researches of the American botanist.

Deciduous cypress tree, or *cypressus disticha*, stands, according to Mr. Wm. Bartram, in the first order of American trees. It abounds in the southern states, where it measures from eight to twelve feet in diameter, and from forty to fifty feet straight shaft.

It affords materials for shingles, &c. is also applied to all purposes where strength and durability are required.

The *tilia*, or black lime, or linden tree, is extremely useful, by reason of the softness of its wood, to

turners, carvers, and architects, in framing models for buildings.

Cedar. There are two celebrated trees under this name, of different genera.

The first is the *juniperus Virginiana*, or red cedar, which is famous in America for affording the most durable fence-posts. In Virginia and Carolina the berries of this tree are distilled into brandy. The wood is said to preserve furs or woollens enclosed in boxes of it, from being touched by moths.

The white cedar, or *cupressus thyoides*, affords one of the most useful woods in the United States, particularly for covering houses and other buildings; most of the houses of Philadelphia are roofed with shingles made of this wood. It is also used for fence-rails, boarding frame buildings, and all sorts of inside work of houses, particularly where paint, varnishing, or paper-hangings are intended. It is preferred to all other wood, for coopers' ware, such as wooden cisterns, tubs, pails, churns, &c.

This celebrated tree possesses an extensive range on the Atlantic coasts, from New Jersey, southward, as far as East and West Florida. Its natural situation and soil is the flat country, near the sea-shore, and fifty or sixty miles back, where swamps, or a wet marshy soil abounds, but will grow very well if planted in higher land, provided the soil be sandy and moist.

The Bermudian red cedar is of a different species from the one before-mentioned.

Cabbage tree, *corypha umbraculifera*. A tall and beautiful species of palm tree, which grows on the sea-coast of Carolina, Georgia, and Florida. Its

stem or trunk is erect, and rises to eighty or ninety feet, embellished at top by a globe of plumed leaves, each somewhat like a large fan, and plicated in the same manner, each frond with its stipes or stem, thirty feet in length; the frond or expanded part of the leaf is fifteen feet over. There are six species of the palm in Carolina and Florida, all of which have flabelli-formed leaves or fronds.

It is the central part of this vast plant at top which stands erect, like a sharp cone or sugar-loaf, surrounded by the expanding leaves, that is eaten, roasted or boiled, like cabbage; and consists of the young frond, rudiments of fronds, with all the succeeding appendages of the future growth, involved together, white and tender as a curd, as rich, and of the like pleasant flavour.

A well grown palm stands perfectly erect, on a shaft or column of sixty or eighty feet high, its base three feet diameter, having three or four rings and circular mouldings, three or four feet upwards; from thence upwards to the top, it diminishes almost imperceptibly, forming a model of a pillar for the greatest architect, perhaps inimitable.

A tree produces but one cabbage, and, as soon as that is cut off, this glorious production of nature perishes. But, though the tree dies, yet it ceases not to be useful; the exterior ligneous parts, of 3-4 of an inch in thickness, is as hard as bone when dry, and the interior spongy consistence being rotted out, or devoured by worms, it makes excellent trunks or conduits for draining off water, being almost incorruptible under ground. These shafts also, split in two, and set upright in the ground, make strong and

durable palisades; and they answered a very good purpose in South Carolina, at the time of our revolutionary war, particularly at Sullivan's Island..... The ramparts of the fortifications being lined with the trunks of the cabbage tree, split in two, and set upright against the wall; their smooth, firm, and elastic surface, together with their spongy interior, united to repel the shot of their assailants.

The stems are also used in Charleston, for the facing of wharves, as the salt water worm never touches them. This quality has induced its use as a sheathing for the bottoms of boats, with excellent effect; and renders the tree next in value to its neighbour the live oak. Pieces of the spongy part of the stem afford a very good substitute for scrubbing-brushes, and are even preferred for whitening floors.

The *palmetto royal*, or bayonet bush, (*yucca aloefolia*), is a very singular production. It rises with a stiff, ligneous, reticulated stem, to the height of several feet, and crowned with a chaplet of sword or dagger-like leaves of a green colour, each terminating with a stiff sharp spur, and their edges finely crenated. This thorny crown is crested with a pyramid of white flowers, of the tulip form, which are succeeded by a large fruit like a cucumber, of a deep purple colour when ripe, and a smooth shining skin. Its pulp is soft, very juicy, and of an agreeable aromatic flavour, but of rather a bitter taste, which are sometimes eaten, and frequently prove laxative.

An important use was formerly made of this plant by the people of Augustine; *viz.* planting them upon their banks round the town to keep off cattle. Very excellent fences might be made of them.

An island at one of the mouths of the river Alata-maha is covered with this plant, the thorny crown of which is chosen by a great variety of cranes and herons as a secure place to build their nests.

*Eupatorium*, a genus of plants of which several are natives of the United States. The species most used are *E. perfoliatum*, commonly called thorough-wort. This plant is annual, and rises from two to three feet high, is hairy, and the leaves at each joint rough, from three to four inches long, and about one inch broad at their base, gradually lessening to a very acute point, of a dark green, and covered with short hairs. This plant certainly possesses active properties, and deserves the attention of American physicians. A strong infusion in water will vomit and purge. A weaker dose will sweat powerfully. A still weaker infusion drank for some weeks, has done good in cases of deranged circulation, producing scabby and other eruptions, which are commonly said to proceed from "bad blood."

*Baccharis halimifolia*, cotton groundsel tree, sea purslane. This is a sea-side shrub of great beauty in the autumn, when mantled in silky down white as snow. The bark of the last year's growth of twigs, early in the spring, when the sap begins to flow, expands suddenly, and opens longitudinally, from which springs a limpid juice of the consistence of pure honey, and as sweet and pleasant to the taste. At this season the bees visit these shrubs, and sip the honey entirely before the sun rise.

*Anagallis arvensis*, L. or common pimpernel, has two strong varieties, *a. flore caruleo*, *b. flore phar-niceo*: these have been distinguished by late botanists

as distinct species, leaving the name *arvensis* for *a*, or calling it *cærulea*; *b*, is their *phœnicea*. The *phœnicea* is common, perhaps a native.

This plant affords another instance among many others, with which the records of medicine abound, of remedies obtaining a high character without the smallest pretension thereto. Crowned heads and republics have passed laws to preserve it from destruction, and learned doctors have celebrated in classical Latin its imaginary virtue in preventing the effects of the bite of mad dogs. In this country it has long been celebrated among the Germans, two of whom kept the same remedy a great secret. One of these persons, a Mr. Kettering, of Dauphin county, communicated the knowledge of the plant to the legislature of Pennsylvania three years since.

*Chironia angularis*, common American centaury. This plant is a native of the United States and has the appearance of lesser centaury, (*gentiana centaurium*). In Pennsylvania it is constantly called centaury; and is deservedly esteemed a highly medicinal, and very agreeable simple bitter. It is used with great success, in relaxation of the stomach, loss of appetite, and general debility. In sickly situations, an infusion of this plant, joined with *calamus aromaticus*, is an excellent medicine, taken early in the morning.

*Ceanothus Americanus*, New Jersey tea tree. This shrub seldom rises more than two or three feet high, sending out branches on every side from the ground upward. The branches are very slender, and are garnished with oval-pointed leaves, having three

longitudinal veins running from the footstalk to the point, and diverging in the broad part of the leaves from each other; the leaves are placed opposite, are deciduous, and of a light green colour. At the extremity of each shoot the flowers are produced in close thick spikes, and are composed of five small petals of a clear white. These appear in June. During the American revolutionary war, the leaves of this shrub were dried and used as a substitute for common tea. The plant is said to dye wool a fine strong nanking cinnamon colour.

*Convolvulus.* There are several species of this genus, natives of the United States; at present the *C. panduratus* only will be noticed. It is called wild potatoe in Carolina. This root is perennial, thick and long like that of a carrot. Capsule two-celled and two-seeded. This species grows very plentifully about Bethlehem; the roots are purgative, and are collected and sold, according to Shoepf, for mechoacanna. They are said to be escharotic, and useful to take down proud or fungous flesh in sores.

*Euphorbia, ipecacuanha*, Linn. This plant is peculiar to light, dry, sandy soils, and grows abundantly in New Jersey, and the maritime districts of the southern states. It is a pretty plant, the stems rather procumbent and diffusive in their manner of growth, leaves remarkably variable in their figure, but generally oblong or broad lanceolate, whilst others are long and narrow, some almost linear like grass; but all are of a full, dark, crimson colour, except such as grow in shade, which are of a livid green, elegantly reticulated with crimson veins. In medicine it is a



sure and powerful emetic, but perhaps too drastic, and ought to be administered with caution, and by such as have investigated its properties. It is an Indian medicine, yet commonly used by country people.

We have several other species of this genus, two of which are very handsome plants, viz. *E. corollata*, *E. pieta*.

*Chelidonium*, celandine, or horned poppy. There are two species of this genus indigenous to the United States. 1, *C. majus*, greater or common celandine. The juice of this plant is extremely acrid. It is a common remedy for warts, and it is said will cure the itch, tetter, and ring worms.

2, *C. glaucum*, sea celandine, yellow horned poppy. This plant is very ornamental to sandy shores, but poisonous.

*Collinsonia, Canadensis*, nettle-leaved collinsonia, horse weed, knott root, knott wood.

This plant has a perennial root, and usually rises four feet; the stalks decay in the Autumn; they are square, leaves heart-shaped, opposite and serrate. The flowers are produced at the extremity of the stalks in loose spikes, are of a purplish yellow, and appear early in July. The root is composed of woody knots, which are extremely hard; and when broken and infused in cyder, have cured several alarming cases of dropsy, an account of which has been communicated to the author. The remedy ought to be tried infused in warm water.

*Xanthorisa*. This shrub is so called from the Greek words signifying "yellow" and "root." It is denominated *simplicissima* by Marshall, from the supposed simplicity of its stem. L'Heretier has given

it the name of *apiifolia*, as he thought the leaves resembled those of parsley or celery; and it was formerly called *Marboisia tinctoria* by Mr. William Bartram, in honour of M. de Marbois, an encourager of the science of botany, and from its qualities as a dyeing drug. As the stalks of this plant sometimes bear five branches, the specific name of *simplicissima* cannot be very proper, and its leaves do not sufficiently resemble those of parsley or celery to be called *apiifolia*.

The *xanthorisa tinctoria* is a native of North Carolina, and was first brought from that state into Pennsylvania, about 40 years since, by Mr. John Bartram. The stem and root of the *xanthorisa* are of a bright yellow colour, and possess a strong bitter taste.

According to Dr. Woodhouse's experiments on this plant, it contains a gum and resin, both of which are intensely bitter, the resin being more abundant than the gum.

The watery extract of the grated roots, mixed with alum, and added to Prussian blue, gives a green colour which is far more lively and elegant than that made with gamboge and Prussian blue, and stands well in the shade, but soon contracts a dull colour when exposed to a bright light, and to a high temperature.

As the *xanthorisa tinctoria* is a strong and pleasant bitter, and very nearly allied to the celebrated India plant, columbo root, it promises to become a valuable addition to the American *Materia Medica*. It is preferable to all our native bitters. The bark

of the root of the *aristolochia siphon*, or Dutchman's pipe, which is often made use of by the inhabitants near Pittsburg, is a weak aromatic bitter. The root of the *actea racemosa*, black snake-root or rich weed, is a nauseous bitter. The bark of the root of the *liriodendron tulipifera*, tulip or poplar tree, is more pungent and aromatic than bitter. *Chironia angularis*, or centaury; *gentiana saponaria*, or blue gentian; *veratrum luteum*, or devil's bit; the red berries of *cornus florida*, or dog wood; and the bark of several species of *salix*, or willow, are weaker bitters than the yellow root.

Dr. Woodhouse has often used the powdered stem and root of the *xanthoxis* with success, in the dose of two scruples to an adult, in many of those diseases in which bitters are recommended, but generally combined with other remedies. It is a medicine which sits easy upon the stomach, and produces no disagreeable effects.\*

The root of the *podophyllum peltatum* or May apple, is a most valuable purgative, in doses of from 18 to 20 grains. The industrious Mr. Michaux has discovered the true jalap in Georgia.

*Prinos verticillata*, Virginian winter berry.  
Black alder.

This grows naturally in moist places, by streams of water; generally sending up several slender stalks to the height of eight or ten feet, dividing into a few branches towards the top. The leaves are lance shaped, sharp pointed, and acutely sawed on their

\* Trans. Agric. Soc. New York.

edges; having short slender foot stalks, and placed alternately. The flowers come out at the bosom of the leaves in small corymbi or clusters; of an herbaceous colour. They are succeeded by roundish berries of a red colour when ripe, and remaining long on the branches.

The virtues of this excellent shrub when joined with the *cornus florida*, or dog-wood, in the intermittent, are well known. But it is also a powerful remedy in mortifications. A decoction of the bark mixed with spirits and flour is to be applied to the parts, and the decoction taken freely.

The poisonous *datura stramonium*, or Jamestown weed, is not without its virtues. An ointment prepared by boiling the leaves with hog's lard is a superior remedy in burns and scalds; and an extract from the leaves has been used with great advantage in that awful disease, the epilepsy.

The *asclepias decumbens*, butterfly weed, or pleurisy root, is a powerful diuretic, and will doubtless become one of our standard remedies.

*Kalmia latifolia*, or broad-leaved laurel, winter green, calico tree.

This is the largest of all the species of this genus, growing to the height of seven or eight feet, and sometimes higher. The wood is hard, compact, and is employed by turners and joiners in making work requiring such wood. It also furnishes handles for scythes. The leaves are highly poisonous to horses, but deer, and the pheasant eat them with impunity. They however, when eaten late in the winter by pheasants, once communicated a quality to the flesh of these birds, which occasioned alarm-

ing symptoms, in many persons, and the death of others who eat of them, during the latter end of the winter of 1790-91....An account of the fact as recorded by the author, may be found in the *New York Med. Repository*, vol. i.

2. *K. angustifolia*, narrow leaved, or dwarf laurel.

It grows on sandy heaths, and dry poor soils. Bees collect a deleterious honey from the flowers of both species of this plant, which produces very disagreeable symptoms in those who eat of it.

An ingenious Experimental Inaugural Dissertation was published in Philadelphia, in 1802, by Dr. Thomas, upon the above species of kalmia; from which it appears, that the leaves of both abound with resin, but that the last is the most active of the two. From the same dissertation we find, that a decoction of the *k. latifolia*, prepared by putting one ounce of the leaves in eight ounces of water, and boiling it down to four ounces, cured a diarrhœa of eight weeks continuance. The dose at first was thirty drops six times a day, but producing vertigo, it was diminished to four times a day. The itch was speedily cured by washing the parts with the decoction.

The scald head, *tinea capitis*, was also cured by anointing the head with an ointment made of the leaves and hogs fat. Dr. Barton bears testimony of the efficacy of this ointment in the tinea. See 'Collections for a Materia Medica.'

*Chionanthus*, snow-drop, or fringe-tree.

A genus of plants comprising four species, of which only one is a native of the United States. This

plant, the *c. virginica*, is common in several of the states, and rises to the height of fifteen or twenty feet, spreading into many branches, covered with a light coloured bark. The leaves are large, oblong, and entire; placed nearly opposite. The flowers are produced in May, towards the extremity of the shoots of the former year, hang in long bunches, and are of a pure white, whence the name *snow-drop*, and from the flowers being cut into narrow segments, it has obtained the name of *fringe-tree*. When the flowers are fully grown, the tree makes a handsome appearance. After the flowers have fallen, oval berries appear, of a livid blackish colour, when ripe, each containing one hard, oblong, pointed seed. The bark of the root of this shrub, Mr. Marshall says, bruised and applied to fresh wounds, is esteemed by the natives a specific in healing them without suppuration. The *chionanthus v.* has several varieties.

*Ginseng....Panax quinquefolium....*The dried root of this plant has a mucilaginous, sweetish taste, similar to that of liquorice, but accompanied with some degree of bitterness, and a slight aromatic warmth, with very little odour. The Chinese ascribe extraordinary virtues to this plant, and consider it as a sovereign remedy in almost every disease to which they are subject. In particular, they suppose it possesses the property of preventing the effects of old age, and in preserving their virility to a late period.

The physicians of Europe and North America never prescribe ginseng: but no experiments have

ever been made by them with the fresh root, to ascertain its effects on the human body. The jesuit Jartoux, who resided a long time in China, and whose authority is respectable, speaks decidedly in favour of its virtues; and Mr. Pennant says, "he never can believe that a root so unanimously esteemed in that empire for ages, can be destitute of virtues."

This plant is the only native production of the United States, which answers to export to China in order to procure the luxuries of that country. It is not much esteemed in China, unless clarified, except in times of great scarcity of the plant. When, however, well clarified, it has brought the extravagant price of 100 dolls. per lb. and great wealth was acquired by some early adventurers from Philadelphia. The process of clarifying, though hitherto kept a profound secret, consists in the careful application of steam of water to the fresh roots after they are scraped and cleaned. It is observed that not more than one root in twelve will clarify. This plant grows abundantly near Philadelphia.

*Geranium, maculatum*, or crane's bill.

This plant is also known by the English name of crowfoot. The same name has long since been appropriated to the different species of the genus *ranunculus*; the name of crowfoot is also bestowed, in some parts of Pennsylvania, upon a species of *geum*, or *bennet*, the *geum rivale*, or red water avens. This confusion shews the importance of calling plants by their botanical, instead of their trivial names.

The *geranium maculatum*, is a common plant near Philadelphia, and flowers in the spring; it

is a powerful astringent, and will stop very violent bleeding.

The *chenopodium anthelminticum*, or wormseed plant, is a powerful remedy against worms; the seeds and expressed oil are used. The efficacy of *spigelia*, or pinkroot, in the same complaint, is familiar to us all. But a more powerful remedy is the *melia azedarach*, or pride of India, which although not a native tree, is now naturalized amongst us, especially in the southern States. Its use, however, requires caution, as it is certainly possessed of active powers. In Persia, according to the celebrated botanist Michaux, the pulp investing the stone, is pounded with tallow, and used in cases of *tinea capitis*, or scald head of children.

The *lobelia* has long been before the public, as a remedy for *siphylis*, in the milder forms of which it has certainly done good.

*Pyrola*, winter berry. A genus of plants comprehending six species, all of which are natives of the United States. The *P. maculata* is exclusively a native of our country.

The *P. umbellata* or *hipsisseva*, has been specially treated of by Dr. J. J. Mitchell, in his Inaugural Dissertation, Philadelphia, 1803, by whom a variety of experiments were made to ascertain its virtues. It is astringent, and nearly allied to the *arbutus uva ursae* or bear berry. It was used with success during our revolutionary war in typhus. The application of a decoction of the plant, joined with vinegar speedily removed the blackness arising from a bruise. The

\* See Phil. Med. Museum, vol. ii, for an account of the medicinal virtues of some American trees, shrubs, and plants, by the author.



bruised leaves moistened with brandy and applied to the skin, produced blisters. The Indians use the *P. rotundifolia* for the same purpose.

*Asclepias Syriaca*, or swallow wort. The stalks of this valuable plant attain the height of seven feet; the pale purplish flowers appear in June or July, and are succeeded by large, thick, and rough capsules, the seeds of which are furnished with long glossy silk. This plant abounds in the neighbourhood of Philadelphia, and other parts of the United States, and deserves to be cultivated for the many valuable purposes to which it may be applied. In Germany the plant is cultivated extensively, and stuffs have been made from it which rival in lustre the true animal silk. The stems of the plant are said to dye a good olive; and also to answer for candlewicks. The valves of the flowers are said to possess the same irritability as the *dionea mucipula*, or fly-trap, and close upon the common house fly which light on them.\*

Snake root (Virginia), or *aristolochia serpentaria*; a well known medicinal plant, and a native of the United States exclusively. It has a bitter taste joined with an aromatic acrimony; highly stimulant, and increases the force of the pulse very perceptibly. It is a powerful sudorific, but is improper whenever bleeding is requisite. It is a common remedy in low fevers. Dr. Barton (Collection for a Mat. Med. 2d edit.) says it was used with great benefit in a malignant fever attended with carbuncles, which prevailed in Bristol on the Delaware in this state, in 1749 and

\* See the Amer. Phil. Trans. vol. vi, for Dr. Barton's paper on this subject.

1753. It may be given in infusion, or in powder from a few grains to 20 or 30. It frequently assists the powers of the Peruvian bark in the cure of agues, and of general weakness. It is usually combined with *calamus aromaticus*, infused in spirits or water, and forms the common morning dram in agueish situations. As water fully extracts the virtues of these plants, it should be preferred to spirits to make these daily medicines.

Another species of *aristolochia* (*A. siphon*), or pipe vine is a curious species of birthwort, and abounds near the town of Pittsburg, in Pennsylvania. It is a climbing plant, and will rise to the height of 50 feet, attaching itself to trees. The flowers are large, and resemble in figure a German tobacco pipe. The root has a pungent, aromatic taste, and for certain purposes, is thought preferable to the first-mentioned species.

*Sanguinaria Canadensis*, called commonly *fuc-coon*, bloodwort, red root, Indian paint, turmeric.

The root is from one-fourth to half an inch in diameter, from three to four inches long, sending forth numerous stringy fibres, two or three inches long; a coloured liquor is thrown out when the root is broken.

This plant abounds in our woods. The powdered root, in doses of 20 to 25 grains, is powerfully emetic, and is but little inferior to ipecacuanha. It contains a large proportion of gum, some resin, and extractive matter. The first and last are the most active parts.

The leaves and seeds of this plant are powerful and diffusible stimuli; promote sweat, and are given in Maryland with that view to horses, to cause the

shedding of their coats. A tincture of the root is used to prevent the intermittent fever; and a decoction of the roots to cure the dysentery.

The powdered root in doses of ten or fifteen grains, is invaluable as a remedy for jaundice.

The *Heuchera Americana*, or sanicle, or alum-root, is a powerful astringent. The *uva ursi*, or bear-berry, a common plant in the sandy soil of New Jersey, is also well known as an astringent; and in particular, as a powerful remedy in that distressing complaint the gravel in the urinary bladder or kidneys.

The seneca snake root (*polygala seneca* of Linnaeus) is, without doubt, a plant of great powers, and may be worthy of our attention as a remedy against the bite of venomous serpents. Among the Indians this plant has sustained a high reputation in this respect. The following case was communicated to Dr. Barton by Mr. Samuel Preston, of Pennsylvania. In the year 1798, a man, whilst he was mowing, was bitten by a rattle snake in the little toe of his foot. Almost instantly he was seized with a pain in his breast and eyes. The leg became greatly swollen, and violent symptoms of a genuine tetanus ensued. The seneca, which was at hand, was boiled in milk, and the patient drank large quantities of the decoction, at the same time that the root, in the shape of a poultice, was applied to the part immediately wounded. The medicine threw him into a profuse perspiration; in a short time all his spasms subsided, and at the end of two days he was able to return to his occupation of mowing again.

As a powerful expectorant and diaphoretic, it has long been known; and lately, has been found very useful in that fatal disease the croup, or hives of children.

Of the *magnolia* there are several species, natives of the United States.

*M. acuminata*, or cucumber tree, long leaved magnolia.

The cones or seed vessels are about three inches long, and resemble somewhat the cucumber in shape, but are in part of a bright red colour. They are a common ingredient in bitters, which they render very warm and pungent; and are used to cure the rheumatism, when infused in spirits.

*M. glauca*, swamp sassafras, sweet bay, beaver tree.

It grows naturally in low moist ground, but becomes more regular, and thrives better in a high and dry situation: the operation of the *M. glauca* is similar to that of the fine bitters, gentian, and columbo roots. The bark of the root is very astringent, and in all diseases where invigorating remedies are required, deserves the trials of physicians. Marshall (*arbustrum Americanum*) says, the bark and berries have been used with success in rheumatism. The root in decoction, has been equally useful in the same complaint.

*M. grandiflora*, evergreen laurel.

Grows to the height of 80 feet in Carolina and Georgia, and is one of the most beautiful evergreens. Mr. Bartram thinks it exceeds every other known vegetable when in flower. It is to be regretted, that it will not bear the cold of Pennsylvania.

The bark of the root was used as a substitute for the Peruvian bark in intermittent fevers in South Carolina, by Dr. Lining.

The *M. tripetala*, umbrella tree. *M. auriculata*, supposed to be a variety of *m. frazeri*. *M. pyramidalis*, and *m. excelsior*. They all flourish in the open ground in Pennsylvania, and deserve to be cultivated for their beauty, and the fragrance of their flowers.

*Rhus glabrum*, smooth Pennsylvania sumach, common or upland sumach, grows abundantly in the United States, rising to the height of eight or ten feet. The leaves are feathered, sawed, lanced, and naked on both sides, and change to a beautiful red in autumn. From Dr. Horsefield's accurate experiments, it appears that the leaves are more valuable as a black dye, than the berries (though the latter are commonly used), and a valuable substitute for *nut galls*, either in dying, or in making ink.

The preparers of Morocco in Philadelphia prefer this species to the imported sumach, and remark, that its strength increases by cutting.

*Rhus toxicodendron*, or poison oak, has a low shrubby stalk. The berries are yellow when ripe. Horses eat the leaves with impunity.

Dr. Alderson of Hull, and Du Fresnoy, highly recommend from one to four grains of this species, three or four times a day, in paralytic affections.

*R. vernix*, varnish tree, poison oak, swamp sumach, or white sumach, is the largest of our native species of *rhus*; grows in swamps, and makes a fine appearance. Dr. Horsefield is convinced, with Thunberg and others, that this is the true varnish

tree of the Japanese; he found that the greatest quantity of juice was obtained from incisions made in the tree about the middle of May.

*R. radicans*, poison vine, poison creeper, has a slender ascending stem, and frequently climbs up to the top of our tallest trees. The flowers are produced along the whole course of the smaller branches; they are small, are of a light yellow colour, and have a delightful odour.

The two last, viz. *r. vernix*, and *r. radicans*, are highly poisonous, and are particularly active in warm weather; after a meal; and when the part touching the leaves is moist with sweat.

The *r. vernix* is more violent than the other species, and affects, 1. by its effluvium; 2. by its smoke when burning; 3. by contact; 4. by steam of a decoction of the plant. The poison induces an inflammatory eruption in the skin, attended by pain, swelling, itching, and fever. The eruption sometimes ends in suppuration, and ulceration. The above symptoms are apt to return periodically, for the course of even ten years.

So deleterious is the effluvium of this plant, that a swarm of bees was killed by attaching themselves to a branch of it, and by being covered with a box for a few hours, the bees were swelled one-third beyond their ordinary size, and were turned black.\*

The remedies are blood-letting, when the symptoms are violent, smart purging, especially by *sea-water*. Cold water, or ice, or a solution of *corro-*

\* James Somerville, Esq. of New York, Med. Repos. Hexad. 2d. vol. iii.

*sive sublimate* in water applied to the parts; or a wash of spirits of *sal ammoniac* diluted with water, or of lead water.

*Cassine*, or *youpon*. A very useful shrub of the United States. It is highly diuretic, and possessed of emetic and purgative qualities. It is highly esteemed by the southern Indians, who annually visit the sea-side to drink the watery infusion of it. According to the editors of the Medical Repository, almost all the southern coasters who frequent the port of New York, are in the constant use of youpon tea made from this vegetable. They employ it as a gentle astringent, giving strength to the stomach, and guarding the constitution against the intermittent and other fevers which reign among the swamps, ponds, and marshes of that low and foggy region. It is also used for the purpose of correcting the bad quality of the water. Near the bays and sounds which indent this curiously diversified coast, the well-water is so disagreeable, as to be scarcely fit to drink, without something to disguise its flavour, or to correct its noxious qualities, and the good sense and experience of the people have convinced them that youpon is a better ingredient for this purpose than rum, whiskey, or any kind of ardent spirits. It is used also in diet, like the teas of China; and many of those who consume it, prefer it to souchong, and even to coffee. A Carolinian, therefore, who drinks the infusion of the *iiex cassine*, accomplishes three good objects at once; for while he corrects thereby the faults of the water, he renders that very water a remedy to the diseases induced by the cli-

mate, or turns it to an agreeable and tonic article of aliment.

The common method of preserving the ilex for use, is said to be this: At a convenient time in Autumn, the extremities of the branches, consisting of the twigs and leaves, are plucked off; they are then cut with a hatchet to pieces, small enough to put into a tea-pot. From this manner of treating it, the youpon consists of leaves and sticks mingled together; then a quantity of it is thrown into a barrel or hogshead, and sweated and browned by putting hot stones into the midst of it. After undergoing this operation, it is spread and dried for use in the shade.

The taste of the drink made from it is not very different from that of bohea tea. There is nothing unpleasant and nauseous in it, and, by a little use, persons grow extravagantly fond of it. The dry material is commonly sold by measure, and the price in Carolina is about a dollar the bushel. There can be no doubt, if the leaves of this wholesome plant were picked at the most proper time, separated from the sticks, and cured without being burned or smoked, that their flavour would be greatly improved, and that they might be brought more extensively into use, at least among the citizens of the United States if not among foreigners.

The barks of the *cornus sericea*, and of the *red willow*, called also *rose willow*, have been found but little inferior to the common Peruvian bark, in intermittent fevers. These species grow in wet places, on the sides of rivers and creeks, &c. and flowers in August and September.



The large tuberous roots of the *smilax china* afford our southern Indians a nourishing food. The fresh nuts are well macerated in wooden mortars. The mass is then put into vessels nearly filled with clear water, where it is well mixed with paddles. It is decanted off into other vessels, where it is left to settle, and after the subsidence is completed, the water is cast off, leaving the farinaceous substance at the bottom. When this is taken out and dried, it is an impalpable powder of a reddish colour. Mixed with boiling water, it becomes a beautiful jelly, which, when sweetened with honey or sugar, affords a most nourishing and pleasant food for children and aged people. The Indians sometimes use it mixed with fine corn flour, and fried in fresh bear's oil.\*

*Aralia.* Four species grow in the United States.

1. *Aralia spinosa*, *angelica tree*, *prickly ash*, *tooth-ach tree*.

A decoction of its bark and root has often succeeded when taken inwardly, in removing rheumatic complaints. It excites a gentle perspiration, and powerfully affects the salivary glands. The berries are used to put into a hollow tooth when aching. A tincture of them in spirits is also used for the same purpose.

2. *A. racemosa*, *spikenard*, *wild liquorice*, *berry bearing a*.

Parkinson says, the berries are eaten in Canada, and that both leaves and roots are used as sallads and pot-herbs, by the natives.

\* Barton's collection for a Mat. Med.

3. *A. nedicaulis, sarsaparilla.*

The roots are substituted for sarsaparilla. A decoction is used in the country, for that eruptive complaint called the shingles. It is also esteemed as a remedy to restore the tone of the stomach.

4. *A. hispida.*

The root of this is highly emetic.

*Myrica cerifera*, or candle-berry myrtle, grows upon low boggy lands in the southern states, rising with many strong shrubby stalks to the height of six or eight feet.

The wax is obtained, in South Carolina and Georgia, by boiling the berries of the *m. cerifera* in water, and skimming it. Mixed with tallow it forms excellent candles. A soap may be also made from it.\*

*Cassia chamaecrista*, is cultivated in Maryland, and on the eastern shore of Virginia, for the purpose of recovering worn-out lands, and of enriching such as are naturally poor. Sandy lands in particular, are ameliorated by it.

It bears the absurd and confusing trivial names of eastern-shore bean, golden cassia, peacock flower, accomack or magothay-bay bean.

Mr. Bordley asserts, that this plant which is *not* the *partridge* pea, is so difficult to eradicate, that it becomes an injurious weed in other soils and courses of crops than those in Accomack: the courses there being maize and oats lay, on a sandy loose soil.

This plant is particularly described, and an account of its culture detailed by Dr. Greenaway. Amer. Phil. Trans. vol. iii.

\* See Domestic Encyclop. vol. iv, for the process.

*Calicanthus Floridus*, sweet-scented shrub, Carolina allspice. This favourite shrub is a native of the southern states, and occupies a considerable range of hilly country, beneath our chains of mountains from Pennsylvania to West Florida.

This shrub is of a middle size, with many stems ascending from the same source, eight feet high, covered with a brown aromatic bark, with two entire leaves placed opposite on every joint, on short foot-stalks. The flowers grow single, on short peduncles, at the extremity of the branches: they have two series of narrow thick petals, which spread open and turn inward at the top. These are of a dusky purple colour, of a scent composed of the pine-apple and strawberry fragrance: the pericarps are also highly aromatic. There are two varieties; one with long leaves; another with round leaves. The flowers appear late in May.

This charming shrub bears the climate of Pennsylvania very well; and may be easily propagated by laying down the young branches, which will take root in one year, and may be taken from the mother plant, and set where they are designed to remain; for they do not bear transplanting well after they are grown to a tolerable size.

One of the numerous species of the genus *liatris*, (*l. odoratissima*), is called in Georgia, where it abounds, *vanilla*, from the circumstance of the leaves possessing the powerful perfume of that grateful exotic.

Eddoes, a variety of the *arum esculentum*, L., another variety is the *tanniers*.

These plants resemble each other, except that eddoes are smaller, more acrid, and require longer boiling than tanners.

They are planted in South Carolina, in the latter end of March, in small beds, or hills, three or four feet apart; the leaves are very large, from eighteen inches to two feet long, and from twelve to fifteen inches wide. For seed-plants, the small fruit of the last year, or the larger fruit, cut in two, is planted. During the growth the earth is drawn up once or twice round the root, and the grass hoed from them; they are dug in before the heavy frosts commence, and put away in cellars, covered with earth and straw, or pine leaves.

They are excellent when boiled and eaten with butter like yams.

A rich mellow soil, inclining to moist, such as is generally found along declivities of land, just before it becomes wet and boggy, answers best for eddoes and tanners.

The long moss, so called, (*tillandsea usneascites*) is a singular and surprising vegetable production: it grows from the limbs and twigs of all trees in the southern regions, from north lat. 35 deg. down as far as 28 deg. and I believe every where within the tropics. Wherever it fixes itself, on a limb or branch, it spreads into short and intricate divarications; these in time collect sand and dust, wafted by the wind, and which, probably by the moisture it absorbs, softens the bark and sappy part of the tree, about the roots of the plant, and renders it more fit for it to establish itself; and from this small beginning it en-

creases, by sending downwards and obliquely, on all sides, long pendant branches, which divide and subdivide themselves, *ad infinitum*. It is common to find the spaces betwixt the limbs of large trees, almost occupied by this plant; it also hangs waving in the wind like streamers, from the lower limbs to the length of fifteen or twenty feet, and of a bulk and weight more than several men together could carry; and in some places cart-loads of it are lying on the ground, torn off by the violence of the wind. Any part of the living plant torn off and caught in the limbs of a tree, will presently take root, grow, and increase in the same degree of perfection, as if it had sprung up from the seed.

When fresh, cattle and deer will eat it in the Winter season.

It seems particularly adapted to the purpose of stuffing mattresses, chairs, saddles, collars, &c. and for these purposes, nothing yet known equals it. The Spaniards in South America and the West Indies, work it into cables, that are said to be very strong and durable; but, in order to render it useful, it ought to be thrown into shallow ponds of water, and exposed to the sun, where it soon rots, and the outside furry substance is dissolved. It is then taken out of the water and spread to dry; when, after a little beating and shaking, it is sufficiently clean, nothing remaining but the interior, hard, black, elastic filament, entangled together, and greatly resembling horse-hair.\*

\* Bartram's Travels.

The dyeing plants of the United States are numerous and very important. We abound in yellow dyes of the first quality, of these we have first, the quercitron oak, already described under the article oak; the colour produced by it is of unrivalled beauty: the exportation of the powdered bark is regular and considerable. Its qualities as a dye have been largely treated of by Dr. Bancroft, in his "Philosophy of Permanent Colours."

To prepare it for the dyer, the epidermis is shaved off, and then it is ground in a mill. It separates partly into stringy filaments, and partly into a fine light powder. Both of these contain colouring matter, and therefore are to be employed; but as they contain unequal quantities, they should be used in their natural proportions. The stringy parts yield only half as much colour as the powder.\*

2. *Isatis* or woad, abounds in the western counties of Pennsylvania; where, according to the report of an experienced native of Britain, five crops are annually produced, instead of two crops which that plant yields in England; the farina is also stated to be much richer here than in England.

3. The root of the *hydrastis Canadensis* affords a fine yellow dye, and is constantly employed by the Indians for that purpose.

4. The *hypericum perforatum*, a species of St. John's wort, is found in Pennsylvania, and requires little trouble in the propagation.

5. The *coreopsis lanceolata* of the southern states

\* The manufactory of this powder is extensively carried on by Mr. Benger, of Philadelphia.

also dyes a beautiful yellow : the trivial name of this plant is unknown.

The slender rooted *gallium tinctorium*, which grows abundantly in the woods, swamps, and banks of rivers in the middle and back parts of Pennsylvania, and Canada, and on the western waters, also dyes an admirable red. The Indians fix the colour on their porcupine quills, used in ornamenting their wampum belts and shot pouches, with the acid juice of the crab apple, (*pyrus coronaria*). The root of *sanguinaria Canadensis*, or puccoon, already noticed as a valuable medicine, dyes a fine orange colour ; and is much used by the Indians. The *murio sulphate* of tin, as a mordant produces a handsome colour, sufficiently permanent on cotton and linen. Allant is also a tolerable good mordant for silk and flannel.

The various species of juglans by means of the most simple mordants, enable our farmers to dye the most useful brown and other colours.

The *acer rubrum*, or red maple, with the sulphate of iron (copperas) as a mordant, dyes a good purple.

Madder, though not native, grows well in all the states, and was formerly extensively cultivated in South Carolina, the climate and soil of which state is highly congenial to it. It is an accommodating plant, being a native of Persia, and yet flourishing in the moist cold province of Zealand, which is almost entirely covered with this plant ; whence it is exported to every part of Europe and America, yielding almost incalculable profit.

Indigo thrives in the southern states, and before

the introduction of cotton was one of the staple articles of the country.

In reviewing the foregoing account of the native vegetables of the United States, we find many of them useful for all the mechanical purposes of life, others for medicine, others for dyeing, while some are applicable to all these purposes.

It is not to be understood that the list comprehends the whole of the useful vegetable productions of the United States. Many more might have been enumerated, did not the plan of the present work, and the limits necessarily prescribed to it, require brevity on the various subjects treated of. For further information on this head, the reader is referred to another publication.\*

Of the useful exotics now naturalized in the United States, may be mentioned the grateful orange of Georgia and Carolina, the tallow tree, (*croton setiferum*) of China, which was introduced into South Carolina by the late H. Lawrens; the *melia azedarach*, or pride of India, already noticed; the *maranta arundinacea*, or medicinal arrow root, which grows luxuriantly in the islands Jekyl and Cumberland on the coast of Georgia; the *digitalis purpurea*, or purple fox glove; the *artemesiâ dracunculus*, or tarragon, so celebrated for perfuming vinegar in France; the *palma christi*, or castor oil nut, which might become an important article of commerce from the southern states.... The qualities of the above plants are well known, but another which yet remains, deserves to be particularly noticed, viz.

\* Domestic Encyclopædia, Philadelphia edition.



the African plant *sesamum orientale*, the bene of South Carolina and Georgia, or vangioe of the West Indies. The excellent sallad oil which the seeds of this plant yield, was long since made public by Mr. Morel of Savannah;\* and in 1803, a decoction of the leaves was used with the most marked good effect in an epidemic dysentery in South Carolina.

Of the really useful fruits, in the United States, the variety is great: in the genus *pyrus* or apple, in particular, this country is not exceeded by any other in the world, whether size, flavour, or good qualities are considered. The Newtown and golden pippin are justly esteemed the best of our apples; they abound in every state of the union, with the exception of the maritime districts of the Carolinas and Georgia, which are sandy and level, and where the air is replete with humidity. The greater part of these are imported; but some few are unquestionably native, having been found in the early part of the settlement of this country upon the sites of Indian villages; in this class may be included the incomparable cyder apple of New Jersey, called Cooper's russeting; the Hughe's crab apple of Virginia, (not the *pyrus coronaria*,) so justly esteemed for making cyder is likewise a native. The fine cyder apples of Newark, New Jersey, are also the produce of own country.\*

Many of our apples will keep from six to twelve months. The humble *pyrus coronaria* or native crab apple of North America, is not to be passed un-

\* Amer. Phil. Trans. vol. 1.

\* For a particular account of the varieties of apples of the United States, see the Domestic Encyclopedia, Philad. edit. under the articles *apples* and *fruits*.

noticed ; for although it is too acid and astringent to be eaten in a raw state, yet when preserved in sugar, it is justly esteemed a great delicacy. The grateful and medicinal *rubus Amer.* and *r. procumbens*, blackberry and dewberry, are common throughout the United States. The ornamental mountain raspberry, (*rubus montan. odorat.*) grows on the sides of hills in the western country, particularly in Ohio ; the fruit is large and delicious.

Grapes are found in every part of this country. Some species yield a sprightly juice, and make an excellent wine, even in the hands of our unpractised farmers ; but aided by the knowledge of a skilful European vigneron, some of them would vie with the costly Madeira. The few experiments which have been made with our native grapes, by persons of more than common knowledge, warrant this assertion. The little blue bunch grape, which ripens in Pennsylvania in October, the bland grape of Virginia, the bull grape of South Carolina and Georgia, and the grape of the islands of the Ohio, may be recommended from experience as the best for the purpose. By cultivation all these would greatly improve.

To those who are anxious to become acquainted with the whole process of wine making, the excellent treatise by Chaptal, which is translated into English, may be safely recommended.

## CHAP. IV.

### ANIMALS OF THE UNITED STATES.

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THE magnitude which any animal will attain, seems to depend much upon its original constitution, the climate, and proper nourishment. Nature has also fitted each quadruped for the climate in which it was originally placed; and in that climate only, will it attain its proper perfection. The lion would lose its fierceness, and perish, if it was removed to Lapland; and the rein deer would diminish and die, if it was carried to the sandy deserts of Africa. In those climates only, to which nature has adapted each animal, will it attain its greatest magnitude, and most perfect form. The animal, to which nature has thus assigned its proper constitution and climate, must be preserved and supported by proper food or nourishment. A deficiency here will bring on leanness, impotency, a diminution of size, and a gradual waste and consumption of the whole species. But when the climate and the food are both suited to the natural constitution of the animal, their joint influence will produce the greatest size or magnitude, that species will admit.\*

\* For some interesting observations on Buffon's assertions respecting the small size of the American animals, see Mr. Jefferson's Notes on Virginia; and Clavigero's History of Mexico.

By comparing the magnitude of such quadrupeds in Europe, and in America, as are common to both, and derive their support from the hand of nature, we shall of consequence have another comparative view of the vigour and force to which animated nature arrives, in each country. Several of those quadrupeds, whose weight has been ascertained in Vermont, M. Buffon has given us the weight of in Europe. They are these.

	Wt. in Eur. <i>lbs. oz.</i>	Wt. in Ver. <i>lbs. oz.</i>
The Bear . . . . .	153 7	456
Wolf . . . . .	69 8	92
Deer . . . . .	288 8	308
Fox, red . . . . .	13 5	20
Porcupine . . . . .	2 2	16
Martin . . . . .	1 9	5 4
Polecat . . . . .	3 3	7 8
Hare . . . . .	7 6	8
Rabbit . . . . .	3 4	7
Weasel . . . . .	2 2.2	12
Ermine . . . . .	8.2	14
Flying squirrel . . . . .	2.2	10
Beaver . . . . .	18 5	63 8
Otter . . . . .	8 9	29 8

From this comparison it appears that every one of these animals, is larger in America than it is in Europe. The inference is clear and decisive : It is in America, and not in Europe, that these quadrupeds of a cold climate, attain their greatest magnitude, and highest perfection.

If the comparison should be made between the quadrupeds of the torrid zone, the reverse will be found to be the case. The elephant and the rhinoceros of Asia are much larger than the quadrupeds of Peru and Brasil. The truth is, America is the most favourable to the productions and growth of the quadrupeds of cold climates. Asia is the most favourable to the productions, and growth of the quadrupeds of a hot climate. But the greatest of all animals, the mammoth, was not an animal of the torrid, but of the temperate zone; and was the production of both countries, of Asia, and of America.\*

The *bison* of North America has a very extensive range, being found six hundred miles west of Hudson's bay, and also in the province of Mexico. They inhabit Canada to the west of the lakes, and in greater abundance in the rich savannas which border on the river Mississippi, and the great rivers falling into it from the west, in Upper Louisiana: they are seen feeding in herds innumerable, promiscuously with multitudes of stags and deer.

This animal is confounded with the buffalo, an animal which has already been described in the account of Italy.....The bison has short black rounded horns, with a great space between their bases; their shoulders are much elevated, so that the depth from the withers through to the brisket is greater in proportion than perhaps in any other creature. The hinder parts taper away, and are comparatively of a diminutive size; the tail is about a foot long, naked to the end, which is tufted; the legs are short and thick.

\* Williams's Hist. Vermont,

The head and shoulders of the bull are covered with very long flocks of reddish woolly hair, falling over the eyes and horns, leaving only the points of the latter to be seen: on the chin, and along the dewlaps, is a great length of shaggy hairs: the rest of the body during Summer is naked, in Winter it is cloathed equally in all parts. The cow is lesser, and wants the shaggy coat, which gives the bull so tremendous an aspect.

It grows to a great size, even to the weight of sixteen hundred, or two thousand four hundred, pounds. The strongest man cannot lift the hide of one of these animals from the ground.

The bison and auroch of Europe are certainly of the same species; the only difference between them consists in the former being less shaggy, and the hair neither so soft nor woolly, nor the hind parts so weak. Both European and American kinds scent of musk.

In ancient times they were found in different parts of the old world, but went under different names. In later days a white species was a native of the Scottish mountains; it is now extinct in its savage state, but the offspring, sufficiently wild, is still to be seen in the parks of Drumlanrig, in the south of Scotland, and of Chillingham Castle in Northumberland.

They are exceedingly shy, and very fearful of man, unless they are wounded, when they pursue their enemy, and become very dangerous.

The chase of these animals is a favourite diversion of the Indians: it is effected in two ways....





*A. Bison Pound.*



First, by shooting; when the marksman must take great care to go against the wind, for their smell is so exquisite that the moment they get scent of him they instantly retire with the utmost precipitation. He aims at their shoulders, that they may drop at once, and not be irritated by an ineffectual wound. Provided the wind does not favour the beasts. they may be approached very near, being blinded by the hair which covers their eyes. The other method is performed by a great number of men, who divide and form a vast square: each band sets fire to the dry grass of the savanna where the herds are feeding; these animals have a great dread of fire, which they see approach on all sides; they retire from it to the centre of the square; the bands close, and kill them (pressed together in heaps) without the least hazard. It is pretended, that on every expedition of this nature, they kill fifteen hundred or two thousand beeves.

But the greatest number of these animals are taken in pounds, which are either of a square or circular form, according to the fancy of the tribes by whom they are constructed. The square ones are composed of trees, laid one upon another to the height of about five feet, each square side being fifty feet long. On the side where the animals are to enter, a bank of earth is raised with an easy descent, so as to be on a level with the top of the enclosure, or the other side of the square. Several branches of trees are then placed, in a straight line, from the raised bank to the distance of a hundred and ten feet, the lines spreading continually from each other, so as to be two hundred feet apart

at the distance of one hundred feet from the pound. These lines of trees are lengthened out by a number of poles about fifteen feet long, with a piece of buffalodung on the top of each, whilst a certain number of men lie concealed in buffalo-skins, to drive the animals in a straight direction to the pound.

Every preparation being made, three or four men set off on foot to find a herd of female buffaloes, and having discovered them, they drive them along to the neighbourhood of the pound; when the other Indians assemble on horseback, but keep at a proper distance so as not to frighten the animals. Thus they are conducted within the poles, and when any of them attempt to run out, the men who are placed at the bottom of each pole shake their skins, and frighten them back, till at length they are driven up the bank into the pound; whence falling headlong, some break their necks, some their backs, and others their legs, and the confusion within becomes so general, that none of them can make an escape.

The uses of these animals are various. Powder-flasks are made of their horns. The skins are very valuable; in old times the Indians made of them the best targets. When dressed they form an excellent buff; the Indians dress them with the hair on, and clothe themselves with them; the Europeans of Louisiana use them for blankets, and find them light, warm, and soft. The flesh is a considerable article of food, and the bunch on the back is esteemed a very great delicacy. The bulls become excessively fat, and yield great quantity of tallow, a hundred and fifty pounds weight has been got from a single beast, which forms a considerable matter of commerce.

These over-fed animals usually become the prey of wolves; for, by reason of their great unwieldiness, they cannot keep up with the herd.

The hair or wool is spun into cloth, gloves, stockings, and garters, which are very strong, and look as well as those made of the best sheeps' wool; governor Pownall assures us, that the most luxurious fabric might be made of it. The fleece of one of these animals has been found to weigh eight pounds.

Their sagacity in defending themselves against the attacks of wolves is admirable: when they scent the approach of a drove of those ravenous creatures, the herd casts itself into the form of a circle: the weakest keep in the middle; the strongest are ranged on the outside, presenting to the enemy an impenetrable front of horns: when taken by surprise, numbers are sure to perish. Successful attempts have been made in the western country, to domesticate the bison, by catching the calves and bringing them up with the common kind, in hopes of improving the breed.

*Elk.* The head resembles that of the common deer, and of the horse, much more than that of the moose, and is pointed and handsome. The neck is rather long and handsome.

The elk has an oblique slit or opening under the inner angle of each eye externally, of near an inch in length; which is said to communicate with the nostril. Something of the same kind obtains in the fallow deer, supposed to be analagous to the *puncta lachrymalia* in the human head. A like opening is noticed by Sparrman, and is supposed by him to answer the purpose of facilitating free respiration, in the cervine antelope.

**Horns.** The female has no horns. The appearance of the horns of the fawn exactly resembles those on the head of the principal figure (opposite page 18) given by Mr. Pennant. The males drop their horns annually, in May, then leaving a pith about four inches in length, which is soon covered and protected by velvet. In eight weeks the horns begin to grow again. The animals free their horns from it when wild, by rubbing them against trees. Now they derived the same aid from the posts, &c. of their stable; and the proprietor occasionally assisted them.

The horns of the elk, instead of being palmated as are those of the moose, consist of three principal divisions:

1. The brow antlers, which the hunters call the *altars*.

2. The two middle prongs, called *fighting-horns*. And,

3. The *horns*, properly so called.

The two first retain their simplicity; the last increases in complexity every year. They do not, as those of the moose are said to do, acquire a new branch every year, though something analagous actually occurs. When the animal enters his third year, a single prong or point comes out on the inside of the *left* horn; the next year a similar point on the inside of the *right* horn; and so alternately. Four short points, called *pikes*, were now apparent, one on each brow antler, and one on each fighting-horn; they seldom exceed an inch in length.

The following measurements were made of the horns of one of the male elks. They were some-

what longer than those of the other; notwithstanding an inch or two had accidentally broken off from the end of one of them.

	Ft.	Inc.
Distance between the roots or origin of the horns . . . . .		4
Brow antlers . . . . .	1	6
Fighting-horns not measured but about the same		
Longest horn . . . . .		3
From the tip of one horn to that of the other . . . . .	2	6

Size. As the animals now described had by no means attained their full growth, it is impossible to give any precise information concerning it. The measurements made of them in their present state are as follows:

	Ft.	Inc.
Length of the male, from the top of the nose to the tail, along the line of his back, (the males were nearly of a size), . . . . .	7	3
Of the female, a year older than the males, . . . . .	7	9
Height . . . . .	4	7
Round the girth or belly . . . . .	5	6
the withers . . . . .	4	10
Length of the head . . . . .	1	11
tail . . . . .		3
From the extremity of one ear to that of the other . . . . .	2	2
Length of the ear . . . . .		9

The brisket of the elk very much resembles that of the ox.

Place and food. The elks which were exhibited in New York were brought from Upper Canada. They are said to be found in almost all the back country of the United States, as low down as Virginia. In respect to food, as these had been domesticated from infancy, nothing particular could be learnt from them concerning what they most affected in the wild state. What appeared remarkable to us was, that they all *ate tobacco*, as variously prepared by the tobacconists, with greediness. This the proprietor asserted was a natural appetite; and that the wild elks ate the wild plant. We are informed by Hasselquist, that the *cervi capra* of Barbary "loves the smook of tobacco; and, when caught alive, will approach the pipe of the huntsman, though otherwise more timid than any animal."\*

Yeung. The rutting time is from about the 20th of September to the 1st of October. The female goes about nine months; generally brings forth twins; and it seldom happens but that one is male and the other female.

The hoofs of the elk are very much cloven; and like the moose and rein-deer, he makes a great clattering with them in travelling. He is very fleet.

The flesh is said to be excellent; and the skin employed for various useful purposes.

On the outside of each hind leg the elk has a small vesicle or bag, which contains a thin unctuous sub-

\* The rock goat of Switzerland also eats tobacco.

stance, that the hunters call *oil*, and the bag the *oil-spring*. The male is said to open this, by means of his horns, as they begin to grow ; when the oil spreads over the young horn, and is supposed to nourish and protect it. This he does regularly, the keeper informed Dr. Smith, at 10 P. M. and at 4 A. M. \*

*Moose.* The descriptions, by European writers, of the elk and moose of America, are confused.... they having confounded these animals: the elk has been ably described by the late lamented Dr. E. Smith, in the second volume of the Medical Repository ; an abridgement of his minute paper is contained in the foregoing article. The account of the moose shall now be given from Mr. Pennant, whose accurate account cannot be improved. The reader is referred to the Arctic Zoology of that able zoologist, for a very accurate plate of the animal.

The horns have short beams, spreading into a broad palm, furnished on the outward side with sharp snags ; the inner side plain : no brow antlers ; small eyes ; long slouching asinine ears ; nostrils large ; upper lip square, great, and hanging far over the lower, has a deep furrow in the middle, so as to appear almost bifid ; under the throat a small excrescence, with a long tuft of coarse black hair pendant from it ; neck shorter than the head, along the top an upright, short, thick mane ; withers elevated ; tail short ; legs long, the hind legs the shortest ; hoofs much cloven.

\* Med. Repos. vol. ii.

Colour of the mane a light brown; of the body in general a hoary brown; tail dusky above, white beneath.

The vast size of the head, the shortness of the neck, and the length of the ears, give the beast a deformed and stupid look.

The greatest height of this animal is seventeen hands; the greatest weight 1229 pounds.

The largest horns in the house of the Hudson's Bay Company, weigh fifty-six pounds: their length is thirty-two inches; breadth of one of the palms thirteen inches and a half; space between point and point thirty-four.

The female is lesser than the male, and wants horns.

They have a singular gait; their pace is a shambling trot, but they go with great swiftness. In their common walk they lift their feet very high, and will, without any difficulty, step over a gate five feet high.

They feed principally in the night. If they graze, it is always against an ascent, on account of their short necks. They ruminate like the ox.

They go to rut in Autumn; are at that time very furious, seeking the female by swimming from isle to isle. They bring two young at a birth, in the month of April, which follow the dam a whole year. During the Summer they keep in families. In deep snows they collect in numbers in the forests of pines, for protection from the inclemency of the weather, under the shelter of those ever-greens.

They are very inoffensive, except in the rutting-season; or except they are wounded, when they will



turn on the assailant, and attack him with their horns, or trample him to death beneath their great hoofs.

Their flesh is extremely sweet and nourishing. The tongues are excellent, but the nose is perfect marrow, and esteemed the greatest delicacy in all Canada.

The skin makes excellent buff; is strong, soft, and light.

The hair on the neck, withers, and hams, of a full grown moose is of much use in making mattresses and saddles; being, by its great length, well adapted for those purposes.

The palmated parts of the horns are farther excavated by the savages, and converted into ladles which will hold a pint.

*Bear.* Of this animal two sorts are found in the northern States; both are black, but different in their forms and habits. One has short legs, a thick clumsy body, is generally fat, and is very fond of sweet vegetable food, such as sweet apples, Indian corn in the milk, berries, grapes, honey, &c. Probably he is not carnivorous. As soon as the first snow falls he betakes himself to his den, which is a hole in a cleft of rocks, a hollow tree, or some such place; here he gradually becomes torpid, and dozes away the Winter, sucking his paws, and expending the stock of fat he had previously acquired.

The other sort is distinguished by the name of the ranging bear, and seems to be a grade between the preceding and the wolf. His legs are longer, and his body more lean and gaunt. He is carnivorous, frequently destroying calves, sheep, and pigs, and

sometimes children. In Winter he migrates from the north to the southward.

The former appears to be the common black bear of Europe, but larger, some weighing upwards of 400 pounds.\* The latter corresponds to the brown bear of the Alps.

Mr. Hearne and other travellers in North America, remark, that no female bear had ever been killed with young; and hence the peculiar manner in which she matured her fœtus, has long remained a secret: and an absurd and old account has been adopted and reported by some hunters, that the animal was dropped at an early period, and nourished by the continual licking of the mother, until the limbs and organs were evolved, and the surface covered with hair. But the question is now decided....The day before Christmas, 1799, a she bear was killed in her den, in Salisbury, Connecticut, and dissected by Mr. Bingham, of that place, who found in her three young ones, which were in perfect shape, and of the size of kittens of two months old. They were of different sexes, and as complete bears as they could have been at their full growth.

Whether the opinion of the premature exclusion of the young bear is true, and will bear the scrutiny of modern observation, our rural inquirers must decide. The story, however, is an old one; for we find the opinion held by the ancients longer ago than the beginning of the Christian æra. The poet Ovid,

\* Morse. Dr. Williams says, one weighed 456 pounds.

in the fifteenth book of his *Metamorphoses*, mentions it thus:

Nec catulus partu, quem reddidit ursa recenti  
Sed malè viva caro est. Lambendo, mater in artus  
Fingit; et in formam, quam capit ipsa, reducit.

The gravid bear brings forth, devoid of help,  
An ill shap'd living lump, and not a whelp:  
From this the dam, by licking, forms her young,  
And shapes its plastic members with her tongue.\*

The *cougar*, of Buffon, or *filis concolor*, is also called *panther* in some of the states; but this name is improper, as the North American animal is of a sallow or yellowish colour, and the proper panther is spotted, and not found in North America.

A cougar killed in South Carolina measured eight feet six inches in length.

Dr. Morse speaks of a grey cougar which was lately shown in Massachusetts, which was strong, fierce and untamable. He played with a cat, as a cat does with a mouse, and afterwards killed and ate it.

The *foxes* of the United States are numerous and of different colours.

The *wolverene*, is called in Canada the *carcajou*, and by hunters the *beaver eater*. His length is two and a half feet and upwards; his circumference is nearly two feet; his head and ears resembles woodchucks; his legs short; feet and paws large and strong; tail about seven inches long, black and very

\* *Med. Repos.* Hex. 2d. vol. i, p. 419.

bushy, or shaggy ; hair about two inches long, and very coarse ; his head sallow grey ; back almost black ; breast spotted with white ; belly dark brown ; sides and rump, light reddish brown. This animal lives in holes, cannot run fast, and has a clumsy appearance. He is very mischievous to hunters, following them when setting their traps, and destroying their game, particularly the beaver. Found in the northern states. Dr. Williams says, that they are very fierce.

*Wolf.* Of this animal, which is of the dog kind, or rather the dog himself in his savage state, we have great numbers, and a considerable variety in size and colour.

The dimensions of a skin, measured while writing this account, were as follows :

	Ft.	Inc.
Length of the body . . . . .	5	
The fore legs . . . . .		18
The hind legs . . . . .		15
The tail . . . . .		18
The circumference of the body was from two and a half to three feet.		

In Vermont one was killed that weighed ninety-two pounds. †

The colour of these animals in the northern states is generally a light dirty sallow, with a list of black along their back. Mr. Williams says, that in Vermont the colour is a dirty grey, with tinges of yellow about his ears and legs. In some the black is ex-

\* Morse, 1805.

† Williams's Vermont, p. 84.

tended down their sides, and sometimes forms waving streaks; others are said to be spotted; some of them, particularly in the southern states, are entirely black, and considerably smaller.

The Indians are said to have so far tamed some of these animals before their acquaintance with the Europeans, as to have used them in hunting. They next made use of European dogs, and afterwards of mongrels, the offspring of the wolf and dog, as being more docile than the former, and more eager in the chase than the latter. The appearance of many of the dogs, in the newly settled parts of the country, indicate their relation to the wolf. Found in all the states.

The *Skunk* (*viverra putorius*), is one of the most extraordinary animals of which we have any account. It seems to be of the same species with the pole-cat, but is of a less size, and differs from it in several respects. Its hair is long and shining, of a clouded or dirty white, intermixed with spots of black. Its tail is long and bushy, like that of the fox. It lives chiefly in the woods and hedges, but often burrows under barns and out-houses.

When undisturbed, this animal is without any ill scent or disagreeable effluvium. Their natural evacuations are not more nauseous than those of other animals. Whole nests of them will lie under the floor of a barn, and so long as they are undisturbed, no disagreeable odour will be perceived during the whole Winter. Their flesh, when it is properly dressed, is sweet and nourishing. When pursued or attacked, the skunk discovers its extraordinary powers, by a singular and most effectual method of

defence. It emits a fluid of the most nauseous and intolerable scent that has ever been known. So odious, subtle, and penetrating, is this ill-scented matter, that there is no animal which can long endure it, or will venture to approach the skunk, when he is throwing it out. It infects the air to the distance of half a mile all around: and no method has been found to extract the scent out of any object, on which the odious fluid has been thrown. Time and air, after a long period, affords the only complete remedy.

By an accurate dissection, which was made by Dr. Mitchell, it has been found, that this ill-scented fluid is entirely distinct from the urine. It is contained in two bags, situated in the posterior parts of the body; and surrounded by the circular muscles in such a manner, that, by their constriction, the fluid is forced out with great velocity and violence. The urinary organs are totally distinct from these bags.

The female produces a litter every year; and they generally amount to five or six in number.

One of these animals weighed seven pounds and a half.\*

*Catamount.* This animal, the most dreaded by hunters of any of the inhabitants of the forest, is rarely seen, which is probably the reason why no accurate account of it has ever been published, to our knowledge, except what is contained in a letter of Mr. Collinson's to M. de Buffon.

The dimensions of one killed a few years ago, in

\* Williams's Vermont. p. 20.

New Hampshire, as nearly as could be ascertained by the skin, were as follow :

	Ft.
The length of his body (including the head)	6
Circumference of his body . . . . .	2 ½
Length of his tail . . . . .	3
legs about . . . . .	1

The colour along his back is nearly black ; on his sides a dark reddish brown ; his feet black. He seems not calculated for running, but leaps with surprising agility. His favourite food is blood, which, like other animals of the cat kind, he takes from the jugular vessels of cattle, deer, &c. leaving the carcass. Smaller prey he takes to his den; and he has been known to carry off a child. He seems to be allured by fire, which terrifies all other carnivorous animals, and betrays no fear of either man or beast. He is found in the northern and middle states.\*

The *deer, cervus*, is one of our most common and valuable animals. In the Spring he sheds his hair, and appears of a light red ; this colour gradually grows darker until Autumn, when it becomes a pale or cinereous brown ; and remains thus through the Winter.

His horns are slender, round, projecting forwards, and bent into a curve ; with branches or shoots on the interior side. These branches do not commence until the deer is three years old ; from which period a new one arises every year ; and by this circumstance the hunters compute their age. These horns are cast every Spring ; the new ones, in the course

\* Morse.

of a year, will grow two feet in length, and weigh from two to four pounds.

The amorous season with these animals is in the month of September. From September to March the bucks and does herd together; early in the Spring they separate, and the does secrete themselves in order to bring forth their young; which generally happens in the month of April. The female generally bears two, and sometimes three, at a birth. The fawns are red, most beautifully spotted with white. They are easily tamed, and become as gentle and domestic as a calf.

The deer is an animal of great mildness and activity. They are always in motion; and leap over our highest fences with the greatest ease. The largest deer of which I have a particular account, weighed three hundred and eight pounds.

The deer are numerous in Vermont; and on account of their flesh and skin are of much value.

The *rein deer* is not to be found in this part of the continent. But there seems to be another species of the American deer, distinguished chiefly by its horns, and often by its colour. The horns of this deer are never extensive, broad and branched like those of the common deer: but they are round, thick, but little curved, and not more than ten or twelve inches in length. This species is generally larger than the other: several of them have large white spots, and some have been killed which were wholly white.\*

*Wild sheep.* Notwithstanding the assertion of Buffon, that two animals of the same species were not placed by nature in the Old and New World,

\* Williams's Vermont.



the fact nevertheless is, that sheep are found native in North America. The Spanish missionaries had long since seen them wild, and mentioned them in their journal. In Venega's History of California, they are also noticed; but they have lately been seen by Mr. M'Gillivray, of Canada, whose account here follows:

The dimensions of the male, taken on the spot where he was killed, (namely, longitude 115 deg. 30 min. west. and latitude 50 deg. north.) are as follow:

	Ft.	Inc.
Length, from the nose to the root of the tail . . . . .	5	
Length of the tail . . . . .		4
Circumference round the body . . . . .	4	
The stand . . . . .	3	3-4
Length of the horn . . . . .	3	1-2
And girth at the head . . . . .	1	1-4

The horn is of the circular kind, proceeding in a triangle from the head, like that of the ram. In short, this animal appears to be a compound of the deer and the sheep, having the body and hair of the first, with the head and horns of the last.

It is to be met with in the rocky mountains, and generally frequents the highest regions which produce any vegetation; though sometimes it descends to feed at the bottoms of the valleys, from whence, on the least alarm, he retires to the most inaccessible precipices, where the hunter can seldom follow him,

His appearance, though rather clumsy, is expressive of active strength, and the nimbleness of his motion is surprising. He bounds from one rock to another, with as much facility as the goat, and makes his way through places quite impracticable to any other animal in that country without wings. No animal encourages pursuit so much as this. In his flight he frequently turns back, and stares at the hunter with a kind of stupid curiosity, which is often fatal to him. This ought, perhaps, to be ascribed to his ignorance of man; these mountains being so horribly desolate that they are but little frequented, except it be by some straggling war parties of the natives.

The mountain ram, or sheep, though not very often seen, is to be met with in considerable numbers, in some parts of the mountains. I have (says Mr. M'Gillivray) on several occasions, seen herds of twenty or thirty, but generally not more than two or three of them together. Frequently I have been entertained with a view of one of them looking over the brink of a precipice several hundred yards above my head, scarcely appearing bigger than a crow, and bidding defiance to all approach. These frightful situations are quite natural to them. They run up declivities of hard snow, or rough ice, with facility. Pursuing them in these situations, I have been obliged to cut steps with my knife where they passed without difficulty. Sometimes you think their progress is stopped by a chasm or projecting rock, but if you attempt too near an approach, at one bound they are out of your reach.

The female does not differ materially from the male, except that her size is much less, and she has only a small black straight horn, like the goat. The colour and texture of the hair is the same in both, and they are all distinguished by the white rump and dark tail. In other respects the female greatly resembles the sheep in her general figure, and particularly in the timid, good natured cast of the countenance. In winter they frequent the southern declivity of the mountains, to enjoy the sun-shine; the lower regions and the valleys, at that season, being covered with a great depth of snow.

The flesh of the female and of the young male is a great dainty; for my own part, I think much more delicate than any other kind of venison; and the Indians, who live entirely on animal food, and must be epicures in the choice of flesh, agree, that the flesh of the *my-attic* is the sweetest feast in the forest.\*

“The existence of a native species of sheep, in North America, is thus,” says Dr. Barton, “sufficiently established. But it still remains to be ascertained, whether it be a species *peculiar* to this continent, or one *common* to it and the Old World. If the mountain ram shall prove to be the argali, we shall thus have increased the list of quadrupeds that are common to the Old and New World; we shall have rendered it more probable (and at present it is highly probable), that the continents of Asia and North America were formerly joined; and that many of the quadrupeds, as well as the human species passed from the former into the latter portion of the world.”

\* Med. Repos, vol. vi.

*Opossum....Didelphis opossum....*The opossum of the United States is the most curious animal in the world. It is about the size of a cat; it appears, however, from the upright growth of its fur to be much thicker. Its general colour is a dingy white; its head is long and sharpened; its mouth wide, ears thin, naked, round, and blackish, but edged with a white border. The tail is about a foot long, prehensile, hairy at its origin, but afterwards covered with a scaly skin, which gives it very much the appearance of a snake. The legs are short, blackish, and all the toes, except the two interior ones, which are flat and rounded, with nails like those of the monkey-tribe, are armed with sharp claws.

When it is on the ground the opossum appears to be a very helpless animal: the formation of its hands prevents it from either running or walking very fast, but in recompense for this apparent defect, it is able to ascend trees with the utmost facility and expedition; and, by the help of its prehensile tail, it is more active in this situation than most quadrupeds. It hunts eagerly after birds and their nests, and is very destructive to poultry, of which it sucks the blood without eating the flesh. It also eats roots and wild fruits.

When it is pursued and overtaken it will feign itself dead, till the danger is over. They never move till their disturber is either gone to a distance, or has hidden himself, on which they endeavour to scramble, with as much expedition as possible, into some hole or bush.

They are very tenacious of life, and cannot, without great difficulty, be killed. In North Carolina it is a well-known adage, "if a cat has nine lives, the opossum has nineteen."

When the female is about to litter, she selects a place in the thick bushes, at the foot of some tree. Assisted by the male, she then collects together a quantity of fine dry grass; this is loaded upon her belly, and the male drags her and her burthen by the tail to the nest. She produces from four to twelve at a time. As soon as they come into the world, they retreat into a pouch or false belly which she has, blind, naked, and exactly resembling little fœtuses. They fasten closely to the teats as if they grew to them. Here they remain, adhering as though inanimate, till they arrive at some degree of perfection in shape, and obtain their sight, strength, and hair, after which they undergo a sort of second birth. From that time, they use the pouch as an asylum from danger. The female carries them about with the utmost affection, and they may frequently be seen sporting in and out of this false belly. Whenever they are surprised, and have not time to retreat into the pouch, it is said, that they will adhere to the tail of the parent, and thus still endeavour to escape with her.

The American Indians spin the hair of the opossum, and dye it red, then weave it into girdles, and other parts of their dress. The flesh is white, well-tasted, and preferred by the Indians to pork; that of the young eats very much like sucking-pig.

The opossum is not only remarkable for its peculiar organization, but for an unnatural disposition,

viz. to eat their young. This was the fate of several young ones, which with the female, I was bringing from Georgia last May. In case of a deficiency of food, such an act might be expected, but my opossum was well supplied with vegetable food.

The *kangaroo* of New Holland also possesses the peculiarity of the double paunch.

At the close of Chastelleux's travels in the United States, vol. ii, there are some interesting observations upon the American opossum, by M. d'Abboville. According to that author, the opossum is more timid than untractable, and very readily becomes tame. His observations upon two of them which he kept in his room in Virginia, would lead to the opinion, that the period of gestation is about fifteen days, for at the end of that time he felt one of the young opossums at the bottom of the pouch; two days after he felt two, one beside the other, and adherent to the body of the mother. Their volume did not exceed that of a pea. It is probable, therefore, that at their birth they are still smaller. Ten days afterward, the young were felt moving under the finger. The 42d day, they could be plainly perceived on opening the pouch. At the end of two months, the female lying down, the young ones were partly out of the pouch and might be easily seen adhering to the mother by a canal which enters the maw of the young one, and which cannot be withdrawn, at an early period, without destroying it, for the young one is then unable to take hold again of the teat. But when six weeks old, it can resume it by strong suction, the aperture at the end of the muzzle being barely large enough to receive the pap.

The *beaver* is a native of most of the northern parts of Europe and Asia, but is most plentiful in North America.

The general length of the beaver is about three feet. The tail is oval, nearly a foot long, compressed horizontally, but rising into a convexity on its upper surface. It is perfectly destitute of hair, except at the base, and marked out into scaly divisions, like the skin of a fish. The hair is very fine, smooth, glossy, and of a chesnut colour, varying sometimes to black; and instances have occurred, in which it has been found, white, cream-coloured, or spotted. The ears are short, and almost hidden in the fur.

No other quadrupeds seem to possess so great a degree of natural sagacity as the beavers, yet when we consider that their history, as hitherto given to mankind, has been principally taken from the reports of the beaver-hunters, whose object is, not to study the nature or manners of the animals, but merely to seize them as articles of commerce, and whose accounts are often perfectly contradictory, it is necessary that we should not give implicit faith to every thing that has been written even by the most respectable authors concerning them, who have not themselves witnessed their operations.

Captain George Cartwright, who resided above fourteen years on the coast of Labrador, in order to collect the different furs of that dreary climate, saw more of the manners of the beaver, than nearly all the other writers put together. To his volumes, therefore, we have principally had recourse, in our endeavours to give the reader as faithful an account as possible of this wonderful animal.

The front teeth, says capt. Cartwright, are very strong, and well adapted to the purpose of gnawing wood. They feed on leaves and the bark of trees; and when they eat, they sit upright, and carry the food to their mouth, in the same manner as the squirrel tribe. It has long been observed, that of all the trees growing in Newfoundland or Labrador, they like the aspen best, and next to that the birch.

The beavers live in general in associated communities, of two or three hundred; inhabiting dwellings, which they raise to the height of six or eight feet above the water. They select, if possible, a large pond, and raise their houses on piles, forming them either of a circular or oval shape, with arched tops, which give them on the outside, the appearance of a dome, whilst within they somewhat resemble an oven. The number of houses is, in general, from ten to thirty. If they cannot find a pond to their liking, they fix on some flat piece of ground, with a stream running through it. In making this a suitable place for their habitations, a degree of sagacity and intelligence, of intention and memory, is exhibited, nearly equal to that of some part of the human race.

If the pond be deep close to the bank, and that free from rocks, they begin under water, at the foot of the bank, and scoop out a hole, rising gradually to the surface; carrying all the earth which they dig out there to the top, and mix abundance of sticks, and even stones among it. The sticks which they make use of on this occasion, are of all sizes, from the thickness of a man's ankle to his little finger, but very seldom of larger dimensions. They



pile up these materials in the form of a dome, sometimes to the height of six or seven feet above the level of the ground, but commonly not more than four. The base is generally of an oval form; the height ten or twelve feet, and eight or nine in width. As they raise this pile above, they hollow it out below, taking care that their bed, or lodging place shall be above the reach of floods, and sufficiently roomy to contain the whole family. From the fore part of the house, they build a projection into the pond, sloping downwards all the way, and under this they enter into their house. This entrance is called by the furriers, *the angle*; nor do they always content themselves with one, but more commonly will have two, and sometimes three. They have but one apartment, which is termed the lodging, and is always shaped in the inside like an oven, the bottom of which is covered with the shreds of sticks, resembling fine narrow shavings. At a little distance from the angle, is their magazine of provisions, which consists of the roots of water-lilly, and the branches of trees; the butt-ends of the latter they stick into the mud, where there is any. The whole is termed *writh*, and I have seen as much as a cart would hold, great part appearing above water. They are very industrious creatures, for even amidst a superabundance of provisions, they will continue to add to the store; and though their house be completely built, they will still carry on fresh works, until the pond is frozen firm over; they will even keep a hole open to work on the house for some nights after, provided the frost is not very severe: and as they will enter every old

house and do a little work upon it, young furriers are frequently deceived thereby, supposing those houses to be inhabited. Although they will sometimes continue in the same pond for three or four years or more, yet they will frequently build themselves a new house every year; at other times they will repair an old one, and live in that; and they often build a new house upon, or close adjoining to an old one, making the two tops into one, and cut a communication between the lodgings: hence arose the idea of their having several apartments. When the pond is not deep enough for them, they will throw a dam across the mouth of the brook, by which it discharges its water, to raise it to a sufficient height; making use of sticks, stones, mud, and sand, for this purpose. Some of these Mr. Cartwright has seen of great length and strength, insomuch that he has walked over them with the greatest safety. But if, notwithstanding the stint, they cannot raise the water to a proper depth, near the bank, they build their house in the pond, at a few yards distance from the shore, beginning at the bottom and hollowing it out as they go on, for they must have about three feet depth over the end of the angle, or the water would freeze in it, and they could go neither in nor out. If there be an island in the pond, they generally make their house on that, being the safest place; and on the south shore, for the advantage of the sun. They have no opening from their house on the land side, and for these reasons; because the frosty air would enter at that hole and freeze up the water in the angle, whereby they would be cut off from their magazine: the wolves likewise and other

enemies might enter thereat and kill them; and the cold would be greater than they could bear. For, although they are provided with a thick skin, covered with plenty of long, warm fur, they cannot endure severe frost, and die if exposed to it for a short time. They are, however, not endued with unerring sagacity, for they have been known to build their house in a pond, where there was such a scarcity of food, that they have all died for want.

They are always killed by staking their houses, by guns, or by traps; and not by hunting them with dogs, by men on horseback with spears, as ridiculously described in prints. Nor do they ever castrate themselves to escape their pursuers. If their flesh were not such excellent eating, very few beaver skins would ever come to market. Beavers generally bring forth two young ones at a time, which are most commonly male and female; yet they will often have but one, especially the first time of breeding; and sometimes three or four. The young ones continue to live with their parents until they are full three years old; then pair off, build a house for themselves, and begin to breed. Yet sometimes, and not uncommonly, if they are undisturbed and have plenty of provisions, they will continue longer with the old ones, and breed in the same house.

Whether they do, or do not make use of their tails as trowels to plaster their houses with, Mr. Cartwright cannot say, though he is inclined to believe they do not; because their tail is so heavy, and the tendons of it weak, though numerous. When they dive, they give a smack on the water with their tails as they go down: but that appears to

proceed from the tail falling over by its own weight. They move very slowly on land, and being also a very cowardly creature, are easily killed there by any man or beast that chances to meet with them: yet, being defended by long fur, and a thick skin, and armed with long, strong teeth, firmly set in very strong jaws, they are capable of making a stout resistance. An old one cut the leg of a dog nearly off at one stroke.

Small trees they cut on one side only, but large ones they go round and always fell them towards the water, to save themselves carriage. A stick, the thickness of a stout walking cane, they will cut off at one stroke, and as clean as if done by a gardener's pruning-knife.

If they are caught young, they are soon made tame, and then are very fond of boiled pease. Buffon and others say, that they make use of their tails as sleds to draw stones and earth upon; but this is improbable, for the skin of the under part of the tail would be rubbed off by the friction on the ground; which never yet has been observed, and is a strong proof that they never do make use of them for that purpose.

*Hamster of Georgia.* This creature is of the order of glires. He is a mus, and belongs to the division of the criceti, or hamsters; and is thus described by John Milledge, esq. representative in congress from the state of Georgia.

Its body is of the length and thickness of a common rat and of the same colour: the size of the head between that of a rat and mole, with small whiskers and short snout; the tail without hair, but shorter than that of a rat: the fore feet like those of a mole, with nails

near an inch long: the hind feet like those of a rat, but the nails not of the same length, each foot having five claws: very sparkling small eyes: also short ears: teeth like a squirrel, and full as long. On both sides of the jaw, externally, are sacks or wallets, where it deposits its food, and each will contain as much as can be put in a large table spoon. Little or no fur, and the hair of the length of a wood rat. The whole face of the pine country is covered with little mounds made by this animal, of the circumference of a peck, and from six to eight inches high. It is by no means active, but remarkably fierce. No common wooden place of confinement can hold it long, as it gnaws its way out. It lives entirely on roots, and is very fond of the sweet potatoe, and often proves injurious to the planter by getting under his stacks. It appears to move nearer the surface in the spring and fall, than at any other season. It is surprising, that though the work of this creature is seen throughout the country, in the region of the long-leaf pine, and that region only, yet such is its skill in burrowing, and acuteness of hearing, that there is no animal in all our state so seldom caught or seen.

This account, which does not wholly correspond with the character of the *mus cricetus germanicus*, leads to the belief of its being a new species. But in order to be quite satisfied of this, it is necessary to be more particularly acquainted with its manners and way of life.

A cut of the hamster may be seen in the additions to Mr. Anderson's edition of Bewick's history of quadrupeds, New York, 1804.

*The wood rat* is a very curious animal; they are not half the size of the domestic rat; of a dark brown or black colour; their tail slender and shorter in proportion, and covered thinly with short hair; they are singular with respect to their ingenuity and great labour in the construction of their habitations, which are conical pyramids about three or four feet high, constructed with dry branches, which they collect with great labour and perseverance, and pile up without any apparent order, yet they are so interwoven with one another, that it would take a bear or wild cat some time to pull one of these castles to pieces, and allow the animals sufficient time to secure a retreat with their young.\*

*The otter* is a voracious animal of great activity and fierceness. When it is fully grown, it is five or six feet long; with sharp and strong teeth; short legs, and membranes in all his feet: and fitted either for running or swimming.

The otter explores the rivers and ponds in search of fish, frogs, water rats, and other small animals; and when these are not to be had, he lives on the boughs and bark of young or aquatic trees. He has been generally ranked among the amphibious animals, which can live either in the air or water; but he is not properly an amphibious animal, for he cannot live without respiration, any more than the land animals. The female is in heat in the winter, and bears her young in the month of March; the litter generally consists of three or four. The fierceness and strength of the old otter is such, that the dog can

\* Bartram's Travels.

seldom overcome them; and when they cannot escape, they will attack the hunter with great rage. The colour of this animal is black, and its fur is much esteemed. The otter formerly abounded very much in our creeks, and rivers; and especially in those, which emptied themselves into Lake Champlain: on this account one of them still bears the name of *Otter creek*; but the animal has now become scarce. The largest otter of which I have a particular account, weighed twenty-nine pounds and an half.

*The ermine* is the most beautiful quadruped which is seen in our woods. In its form, dimensions, activity and fecundity, it resembles the weasel, but is rather larger; one of them weighed fourteen ounces. Its colour is a beautiful white: the tail is tipped with a beautiful black. Some of these animals have a stripe of a dark brown or mouse colour, extending along the back, from the head to the tail; the other parts being perfectly white. This little, brisk, light and beautiful animal, has the most fine and delicate fur that can be imagined; and the animal itself is one of the greatest beauties of nature.\*

*Dipus jerboa*. This curious little quadruped was first discovered by Dr. Barton in 1795, near Philadelphia. It belongs to the order of glires. It is about the size of a common house mouse, and weighed 9 *dwt.* and 22 *gr.* soon after the death of the animal and before the bowels were taken out. Like all the other species of *dipus*, this is furnished with two *dentes primores* or cutting teeth, in each jaw.

\* Williams's Vermont.

These teeth are sharp at the points, and of a chesnut brown colour. The upper jaw projects considerably beyond the lower one. The nostrils are open. The whiskers are long. The ears are small, somewhat oval and covered. The fore-feet, or rather arms, are short, and are furnished with four toes or fingers, the nails of which are long and very sharp.

The head, the back, and the whole upper part of the body, are of a reddish brown colour, somewhat inclining to yellow. The back is marked by a darker brown than the other parts. The whole under side of the body is of a cream colour; as are likewise the insides of the fore legs or arms, and the insides of the hind legs.

A yellow streak or band, beginning near the lower part of the nostrils, on each side, runs along the whole length of the head and neck, the upper and under side of the fore legs, from thence all along the body, terminating with the thighs, at the joint.

The tail is considerably longer than the body, gradually tapers from its origin, and is finely ciliated, or lightly covered with hair its whole length. It ends in a fine pencil of hairs. The upper side is of a slate brown colour, the under side is of a yellowish cream colour. It is composed of a great number of joints.

From the description which I have given of this animal, it will appear that it is very closely allied to the *dipus Hudsonius* of professor Zimmermann; or the Labrador rat of Mr. Pennant.

He frequents our corn fields, meadows, and forests, and eats wheat, corn, clover, and acorns; it often gets in granaries, and proves very destructive. Notwithstanding the great disproportion in the



length of its legs, it runs up trees, in the hollows of which it is often found. It moves by leaping; and often jumps one yard and a half at a time. It has been seen leaping with four young ones attached to its teats.\*

The *mus bursarius* belongs to a particular division in the genus, containing such species as are furnished with cheek pouches for the temporary reception of their food. It seems not to have been yet described, or at least not so distinctly as to be easily ascertained. It approaches however to one or two species mentioned by Dr. Pallas, Mr. Pennant, and others; but differs in size, being much larger, as well as in the appearance of the fore feet, which have claws differently formed from any of the pouched species hitherto described.

In order to secure its knowledge among naturalists, it may be proper to form for it a specific character, viz.

Ash coloured rat, with short, round, nearly naked tail, pouched cheeks, and the claws of the fore feet very large, formed for burrowing in the ground.

The cheek pouches are far larger, in proportion to the animal, than any other of this tribe, and therefore have given occasion to the specific name.

Among the other quadrupeds of the United States, may be enumerated the *mountain cat*, *pardalis*, Linn. Lynx, or wild cat, of which there are three species; one of them *catus cervarius*, L. is highly ravenous; the kincajou: the weasel, and mink, destructive little animals among our poultry; the

\* See Amer. Phil. Trans. vol. 5. for a more full account, with a plate, by Dr. Barton.

fisher or pekan of Canada, the Maryland marmot, wood-chuck or ground hog, *arctomyx monax* L. : the urchin, hedge hog, or porcupine. The hare, rabbit, raccoon, various species of squirrels, among which the flying squirrel deserves particular notice. Ground mouse, the solitary American rat, muskrat, and the little shrew mouse, the smallest of quadrupeds. For a particular account of these animals, the reader is referred to the geography of Dr. Morse, who has taken much pains to collect observations upon their peculiarities from the best authorities.

## BIRDS.

THE United States are rich in birds, and, although some of them have already been described, yet many more remain, and wait the attention of the American ornithologist.\*

Our countrymen are not aware of the numerous facts that remain to be noticed upon this subject, and of the original observations which it is in their power to make.

We are indebted to Dr. Barton for the greatest body of collected information, respecting the American ornithology, which has as yet been presented to the world, and may soon expect much more from the same pen. His "Fragments of the Natural History of Pennsylvania,"† may be considered as a valuable addition to our stock of natural history. Of the *Spring* and *Summer migratory birds* of Pennsylvania, he enumerates one hundred; all of which, with few exceptions, come from the south, and build and breed in Pennsylvania. At the close of the Summer and in the Autumn, they retire again to the south, and visit us in the Spring. Of the *Autumnal* and *Winter birds of passage*, he enumerates thirty-two; these are divided into two classes, viz. the Spring

\* The snake bird of the southern states, among others, is wanting to add to the list of our natives; a description of that bird, its peculiarities, and habits, would be an important addition to this interesting branch of natural history.

† Philadelphia, 1799.

and Summer birds, which are now on their return to the south; the second comprehends the real Autumnal and Winter birds of passage: these, compared with the Spring and Summer birds, are very few in number. They all come from the north, and either Winter with us, or in the southern States. In the Spring they return to the north, where they breed and rear their young.

The resident birds of Pennsylvania amount to thirty-nine: but Dr. B. justly remarks, that many of these birds migrate to the south in very cold Winters.

For a particular list of the birds of Pennsylvania, the reader is referred to Dr. Barton's work, before-mentioned; for those of the other parts of the Union, the histories of the different States may be consulted.\* A list of most of the birds may be seen in Dr. Morse's American Geography.†

“Birds, in migrating, are fond of following the course of rivers, and other large streams of water. This circumstance, in my opinion, partly explains the reason, why some of the birds of the southern parts of the United States, and also some of the South American birds, which have never, or very rarely, been discovered in the Atlantic countries of North America, are not uncommon in the countries west of the Alleghany mountains. These southern birds following the courses of the Mississippi and its branches, (the Ohio, the Illinois, &c.) are spread or

\* *Viz.* Drayton's View of South Carolina. Belknap's Hist. of New Hampshire. Williams's Hist. of Vermont. Jefferson's Notes on Virginia.

† Boston, 1805

dispersed through the rich and extensive territories that are washed by these waters. Whether or not this explanation be admitted, the fact is certainly as I have stated; and to the naturalist it cannot but appear interesting. *Psittacus pertinax* is one of the birds of Brasil; and the *musicapa tyrannus*, which is held in so much esteem by the Naudowessies, and other western Indian tribes, is a native of Surinam, and of the country bordering on the river Plata.

“As a devourer of pernicious insects, one of the most useful birds is the house wren, or *certhia familiaris*.

“This little bird seems peculiarly fond of the society of man, and it must be confessed, that it is often protected by his interested care. From observing the usefulness of this bird in destroying insects, it has long been a custom, in many parts of our country, to fix a small box at the end of a long pole in gardens, about houses, &c. as a place for it to build in. In these boxes they build, and hatch their young. When the young are hatched, the parent birds feed them with a variety of different insects, particularly such as are injurious in gardens. The number of times that a pair of these birds come from their box, and return with insects for their young, is about from forty to sixty times in an hour: and in one particular hour, the birds have carried food to their young seventy-one times. In this business they are engaged the greater part of the day; say twelve hours.... Taking the medium, therefore, of fifty times an hour, it appeared, that a single pair of these birds took, from the cabbage, sallad, beans, peas, and other vegetables in the garden, at least six hundred insects

in the course of one day. This calculation proceeds upon the supposition, that the two birds took each only a single insect each time. But it is highly probable they often took several at a time.\*”

*Blue bird (motacilla sialis).* The head, neck, back, wings and tail, are of a sky-blue colour; breast of a red or brick colour; the bill short, the upper mandible bending downwards a little at the point.

The blue bird is of a friendly social nature. The attachment of the male to the female, is remarkable and pleasing. He seldom permits her to be out of his sight, and eagerly darts upon a favourite morsel, and carries it to her. They pair in March, and the female lays two or three eggs in a season. The male takes care of the former broods as soon as fledged, whilst the female sits on the eggs of the succeeding ones.

The notes of the blue bird are invariably the tidings of fine weather, for although he is not strictly a bird of passage, yet in severely cold weather, he disappears for a short time, returning to the sea-coast, where the air is milder, or a few days' journey south, but is sure to return with a southerly wind or milder air, when he approaches his accustomed place of residence.

Their food consists of all kinds of insects, beetles, and grasshoppers; they seldom feed on fruit or vegetable substances.

This innocent bird is highly worthy of our protection.

\* Barton's Fragments.

The *turkey buzzard* (*vultur aura*) abounds in the states of South Carolina and Georgia, and performs the duty of public scavengers, (at least as far as concerns the removal of dead animal matter), with great fidelity. They are continually hovering in the air over the towns, searching for the sole object of their food, when not employed in devouring it; and appears, as if by common consent,\* to be welcome visitors, for there is scarcely an instance of their being killed: they are in consequence very tame. Indeed, they seem to be regarded with as much veneration by the people of those states, as the *ibis* formerly was by the Egyptians.

They are uncommonly fat, but the nature of their food renders their flesh so rank, that even a new negro, to whom a musky alligator is a delicious morsel, refuses to eat it. Their quills are large and strong, and answers very well for writing pens.

The *columba migratoria*, or common wild pigeon of the United States, winters in the woods of the southern states and Florida, and pass over to the Bahama Islands. After their return in the Autumn to their Winter quarters, they sometimes in mild Winters, remain in the middle and northern states. During the present season (1806-7), which, upon the whole, has not been severe, they were occasionally seen in our markets.

The rev. Mr. Hall gives us the following curious account of the pigeon roosts in the Mississippi territory.

\* In Virginia they are protected by law.

“Another curiosity, which occurred to my view, was the pigeon roost on a branch of Big Black, about sixty miles below the Chickasaw nation. An account of the phenomenon there exhibited, carries with it such an air of the marvellous, that, had I been the only spectator, it would have been passed over in silence. The pigeons had taken their station in and about a place known by the name of the Hurricane Swamp. The greater part of the large timber had been blown down, and they had perched on the branches of the small timber that remained; and which, being broken by them, now hung down like the inverted bush of a broom. Under each tree and sappling, lay an astonishing quantity of their dung, of which, from the specimens we saw, there must have been not only hundreds, but thousands, of waggon loads. Round each resting place was an hillock raised a considerable height above the surface, although the substance had been there eighteen months when we made our observations on the place. At that time the heaps were, no doubt, greatly sunk. What bounds they occupied we could not ascertain as the swamp was so full of brambles and fallen timber that we could not leave the road. It is near a mile in diameter; and, as far as I can recollect, their traces were the chief part of the way, and about an hundred paces on the north side of the swamp.”

To give an idea of the number and weight of the pigeons, Mr. H. then relates, that a hickory tree, of more than a foot in diameter, was alighted on by so many of these birds, that its top was bent down to the ground, and its roots started a little on the op-



posite side, so as to raise a bank. Trees of a brittle structure were often broken off by them.

We leave our readers to ponder these things without any comment of ours.

The rev. Mr. Harris, of Massachusetts, in his "Tour to the State of Ohio," gives an account equally curious, of the pigeon roosts in that state.

The following account of the manners of the woodcock (*scolopax rusticola*, L.) when pairing in the Spring, by the late Robert Milligan, Esq. of Wilmington, Delaware, cannot fail to prove highly interesting.

"About forty minutes after sun-set, we arrived at the spot where we expected to hear the woodcocks.

Presently we heard several, in different directions, calling in a note that sounded like the word *quake*, pronounced long. We attended particularly to one, that seemed, from his note, to be about one hundred yards from us, in an open field. The grass was long, and the light beginning to fade, we could not distinguish him very well.

After calling five or six times, pausing eight or ten seconds between each call, he ascended into the air in an oblique course, till he rose two or three hundred yards above the field; there he continued several minutes flying in a circle, and singing in a beautiful manner. As he descended, he narrowed his circle, and varied his note, till he came within one hundred yards of the ground, when he threw himself perpendicularly down to the spot whence he had risen. He repeated these flights several times, calling eight or ten times between each flight;

at length the female came, and after a few notes of congratulation, they ascended together, almost perpendicularly, one hundred yards, and then, taking a horizontal course, they disappeared.

The woodcock ascends with a uniform note, like the ringing of a very small bell; at his greatest height he has a variety of notes, some of which exceedingly resemble those of the English sky lark.”\*

*Grouse, partridge, quail.* As there is much confusion prevalent in the United States, respecting these birds, owing to the adoption of absurd trivial names, an accurate statement of their true names shall be given.

1. The *pinnated grouse (tetrao cupido)* is larger than the European partridge. The bill is brown; irides hazel; the whole plumage reddish-brown, marked transversely with black and white waved lines; the feathers of the head form a short crest, on each side of the neck a most singular tuft (five feathers in each) gradually lengthening to the fifth, which is about three inches long; the upper feathers ferruginous and white, the lower black; the greater quills brown, spotted with rufous on the outer edge; tail also brown, tipped with a fine line at the end; on each side of the neck a naked skin of a bright orange colour; feet covered with dingy white short feathers, quite to the toes. This last is the characteristic mark of difference between the *pheasant* and *grouse*.

This bird is found in Carolina, New Jersey, and other parts of North America. They are numerous

\* Med. and Phys. Journal, vol. ii.

on the bushy plains on Long Island, in the state of New York. They breed in July: their chief food is *whortle-berries*, and acorns of the *dwarf oak*. They resort to the pines in the Winter season. The male crows for half an hour about day break, and at that time sets the wing-like feathers quite erect, which in general are depending on each side of the neck.

It is observed that more *males* are brought to market than *females*, no doubt occasioned by their being betrayed to the sportsman by their noise.

The female is smaller than the male, less bright in colour, and wants the wing-feathers on the neck.

Dr. Mitchell\* says, this bird is called partridge in New York, and pheasant in Pennsylvania; but with respect to the last name he is mistaken: the bird called pheasant in Pennsylvania is the one next described.

2. *Tetrao tympanistes*, or *t. umbellus*, L. *ruffed heath cock* or *grouse*, *ruffed grouse* of Latham.

It has a ruff on each side of the neck, which it raises or depresses at pleasure. The head is crested; the general plumage is brown, inclined to the ferruginous on the back, prettily varied with black; the black on the ruff disposed in broad black bars; the under part of the bird light with large bars of brown. Tail large, expansible like a fan; in some of a cinereous colour, in others orange, most elegantly barred with narrow undulated lines of black; near the end a broad band of ash colour, another of

\* Med. Repos.

black, and tipped with white. Feet feathered, with short dingy white feathers, to the toes. Toes pectinated.

The female wants both crest and ruff, the plumage generally like the male.

They are not quite so large as our common fowls. They inhabit North America from Carolina to Hudson's Bay. A letter of Mr. Bartram's to Mr. Edwards describes their manners very accurately :

“It is (says Mr. B.) a fine bird when his gaiety is displayed, that is, when he spreads his tail like that of a turkey cock, and erects a circle of feathers round his neck like a ruff, walking very stately with an even pace, and making a noise something like a turkey; at which time the hunters must fire immediately at him, or he flies away directly two or three hundred yards before he lights on the ground.

“There is something very remarkable in what we call thumping, which they do with their wings, by clapping them against their sides: the cock bird stands on a fallen tree, and gradually swells his breast, like a pouting pigeon, then begins to clap his wings, the strokes being about two seconds of time distant from each other, and repeats them quicker and quicker, until they run into one another, for about two minutes; then he ceases for about six or eight minutes before he begins again. The sound is heard near half a mile, by which means they are discovered by the hunters. They commonly exercise in thumping Spring and Fall, at about nine or ten in the morning, and four or five in the afternoon.”

Their food is chiefly berries and seeds of the country; their flesh is white and choice food.

They lay their eggs on the ground, and breed but once a-year, in the Spring, and hatch twelve or fourteen at a brood; which keep in company till the Spring following. Many have attempted to raise the young ones, and to tame them, but to no purpose; even when hatched under a hen, they escape into the woods soon after they come out.

The flesh of these birds is sometimes unquestionably poisonous, from their eating the buds of laurel early in the Spring, as already mentioned under the article *kalmia*.

This bird is called improperly pheasant in Pennsylvania, for no pheasant is found native in America. It is conceived, that it is the same bird which is called partridge in New York, and further north.

They lay from 12 to 18 eggs, and make their nests in the leaves, by the side of a tree. The young leave their nests as soon as hatched; and when a few days old they feed on various berries, particularly ivy-berries, fruits and grain.

3. *Tetrao Marylandus*, L. Is the partridge of Pennsylvania, and the quail of New York.

The male is white under the throat, and has many black feathers on the head. The under part of the female is yellow, and there are fewer black feathers on the head than on the male.

The distinction between the partridge and quail is very trifling: therefore Linnæus has not separated them. Buffon has attempted to shew some distinctions which do not all agree in the same bird: he

notes however one good mark, viz. the want of the naked skin round the eyes, which is found in the partridge and not in the quail. The Pennsylvania bird, called partridge, wanting this mark, is therefore a quail, and properly so called in New York and the more northern states.\*

Dr. Mitchell proposes to call this bird the New England or Virginian quail, to distinguish it from the partridge and quail of Old England, which are very different creatures from the American bird.

The *tetrao Marylandus* is not found in Nova Scotia.

The quail of Europe is the *tetrao coturnix* of Linnæus, and is not found in the United States.

It lays spotted eggs, to the number of six or seven : they are much given to fighting ; and are remarkable for the hotness of their bodies.

The *lanius excubitor*, or *great shrike bird*, of the United States, adopts an odd stratagem, in order to decoy prey within its power.

Mr. Heckewelder † accidentally observing, that several grasshoppers were stuck upon the sharp thorny branches of some trees, enquired of a person, who lived close by, into the cause of this phenomenon, and was informed, that they were stuck there by this bird, which is called by the English in America *nine killer*. On further enquiry he was led to suppose, that this was an instinctive stratagem adopt-

\* Mr. Peale's MS. Lectures on Nat. Hist.

† Trans. Amer. Phil. Soc. vol. iv.

ed by this bird, in order to decoy smaller birds which feed on insects, into a situation from whence he could dart on and seize them.

He is called nine killer from the supposition that he sticks up nine grasshoppers in succession.

That the insects are placed there as food to tempt other birds, is said to appear from their being frequently left for a considerable length of time.

The *roseate spoon bill*. *Platalea ajaja*.

The bill is six inches in length; flattish, long and thin; the tip dilated, orbiculated and plain; it is marked all round with a furrow parallel to the edge, and is of a greyish white, somewhat transparent, so as to shew the ramification of the blood vessels belonging to it. The forehead, between the bill and eyes, and throat, are bare and whitish; the plumage is a fine rose colour, deepest on the wings; the legs are grey; and the claws blackish; the toes furnished with membranes as in the white species. These beautiful birds are seen in great plenty upon the coast of Georgia, particularly in the islands at the north mouth of the Alatamaha.

*Canvass back duck*. This species of duck is more extolled for the delicious flavour of its flesh than any other of the whole order of water fowl.

There is a fine specimen of it in Mr. Peale's museum. It is a migratory fowl, and breeds in the regions north or north-west of the United States. The old ones return southward with their young, so as to arrive on the coast of the Atlantic towards the end of autumn or the beginning of winter, where they remain until the approach of warm weather, and

then fly away to their more northerly summer residence.

Although these ducks migrate in this manner, there are very few places in which they are found. It is not known that they frequent the waters north of Chesapeake bay ; though it has been affirmed that a straggler has been now and then killed. Indeed, their range to the southward is so circumscribed, that they are rarely or never seen at present any where but on the waters of the Susquehannah, and the Potowmack ;\* and in vain do the sportsmen seek them in the rivers of the southern states. Sometimes they have been seen on the tables of the luxurious in the city of New York ; but in these cases they have always been sent from the Chesapeake. Formerly they were frequent in James river, in Virginia, but latterly they have deserted it altogether. This abandonment of a place formerly resorted to by them, is supposed to be owing to a failure of the particular food which formerly invited them there.

This food is of the vegetable kind ; for it would scarcely be expected that a bird of such a delicate taste at the table, should subsist on animal aliment. They feed upon the roots of a coarse long grass which grows in the two before-mentioned rivers, higher toward their sources than the salt water extends. And these roots which are large, succulent, and resemble in some respects those of celeri, are procured by diving ; for the canvass back is a diver.

Within the remembrance of people now alive, canvass backs were so numerous on those parts of

\* They certainly have been seen in Georgia.



the Potowmack where their food abounded, as to cover acres of its surface, and to be seen in flocks for a mile or more in extent. They might then be bought from three pence to six pence a piece. At present they are become so scarce, that few are killed, and a single one costs seventy-five cents or a dollar. Whenever ice covers the fresh water of the Susquehannah and the Potowmack, and forces the canvass backs to leave their feeding places, and go down to the salt water of the Chesapeake and live as other ducks do, they very soon become lean, and their flesh loses all the excellence of relish for which it is so highly prized.

The increase of navigation on the rivers disturbs them considerably; but in addition to that, they are so incessantly alarmed and destroyed by the gunners, that their numbers are diminishing very rapidly.\*

This delicious bird is not peculiar to the United States; an ingenious Italian naturalist† assures us that it is the *anas ferna* of Linn. and *milvouin* of Buffon, and very common in Italy and France, where he has seen it, but it is not so highly esteemed as in this country. The same gentleman says, that the plant upon which it feeds in the Chesapeake is the *valisneria Americana*, or channel weed, a different species from the *v. spiralis* of Europe. The roots shoot in the autumn, fleshy, and stand the winter.

*Wild goose.* Attempts have frequently been made on Long Island, to render the wild goose,

\* Med. Repos. Hexade 1, vol. 1.

† Mr. Rafinesque.

which winters in the bays adjoining the Atlantic ocean, a tame and domesticated bird. Individuals of this species have accordingly been caught alive, after having been wing-broken by a shot, and carried home free from any other injury. When thus disabled from flying, they become gentle, and will mate with common geese. They even breed together; but the offspring is a mule incapable of further procreation. Mr. Daniel Coles, of Oyster bay, has gone a step beyond others in this business. He has a wild goose and gander in a domesticated state, which he keeps from flying away by taking off the extreme bones of the wings at the joint. The goose has laid eggs, and hatched a brood of goslings. For fear of losing the young ones, their wings have been treated in the same manner; and the whole family now composes (September, 1800) a beautiful stock of wild geese, in a domesticated state. They are as gentle as common geese, and live upon the food obtained about a house and on a farm quite as well. Mr. Coles even found that the goslings, on the day of being hatched, ate Indian meal as readily as chickens. They are more active and handsome than the tame goose; and their long necks are arched more like those of swans. If this experiment should be continued for several generations, it is highly probable the temper and habits of the breed may be changed, so that the descendants of these wild geese may lose their inclination to fly from country to country, and attach themselves, like turkeys, ducks, and other birds, whose progenitors were once wild, to the society and protection of man. Should Mr.

Coles meet with no disasters, it is not improbable that the wild goose will be eventually added to our stock of poultry.\*



## FISHES.

*Sturgeons* abound in all our rivers, and in the state of Virginia, when young, they are pickled for exportation; they are also eaten in a variety of ways, and justly esteemed. It is to be regretted that the intestines and roes are thrown away by the fishermen; as both are capable of being made into very valuable articles of commerce, viz. *ichthyocolla* or fish glue from the first, and *caviar* from the last. The exportation of those articles, add considerably to the revenue of Russia.

The *blue bream* of the three southern states is a large, beautiful and delicious fish; when full grown they are nine inches in length, and five to six inches in breadth; the whole body is of a dull blue or indigo colour, marked with transverse lists or zones of a darker colour, scatteringly powdered with sky blue, gold and red specks; fins and tail of a dark purple or livid flesh colour; the ultimate angle of the branchiostega forming a spatula, the extreme end of which is broad and circular, terminating like the feather of a peacock's train, and having a brilliant spot or eye like it, being delicately painted with a fringed border of a fine colour.†

\* Med. Repos.

† Bartram's Travels.

*Herrings* regularly appear on our coast the latter end of March, and by the middle of April are caught in immense quantities. The annual passage of this useful and important fish is a curious subject in natural history, but this is not the place for its investigation or to detail it.\* The Dutch have long been in the practice of pickling and exporting many thousands of barrels every year to every part of the globe, and there is no reason why the same commerce might not become equally extensive from the United States. The peculiar method of preparation has long since been detailed by that patriotic nobleman lord Dundonald, and I had great pleasure in diffusing the same knowledge among our own countrymen, in a work already referred to in these pages†. The quality of our herring is excellent, but that it is more owing to the mode of curing, than to the quality of the fish that the Dutch have acquired so much credit in the article, appears from this fact, that the English, though the herrings are caught on their own coast, have not been able to equal the Dutch in curing them: probably owing to the neglect of the process pursued with so much care by the latter industrious nation.

*Shad* of a superior quality, pay a regular annual visit to our coast, a short time after the herrings. It is said, that the further north they are caught, the higher flavoured they are....Perch, rock, trout, old wives, cat fish of an excellent flavour, with forked tails, and many others are caught in our rivers. Trout abound in our creeks having rocky or gravelly bottoms.

\* The reader is referred to the Amer. Phil. Trans. vol. 2d, for some observations on the subject.

† Domestic Encyclopædia. *Herrings*.

The *lamprey* abounds in the rivers of New England. After the spawning season has passed, the old fish attach themselves to the roots and limbs of trees, which have fallen or have run into the water, and there perish by a mortification, which begins at the tail, and proceeds upwards.\*

*Green turtle* are found in our western waters many hundred miles from the sea, cat fish from 30 to 100 *lbs.* in weight; and perch from 8 to 12 *lbs.*

The late Mr. James Boyd of Lancaster, has left on record, that he saw the head of a cat fish, which had been caught in the Ohio, weigh 40 *lbs.*: the whole fish was said to have weighed 115 *lbs.* It was eleven inches between the eyes; the mouth was fifteen inches wide.

*Pike* too, of a great size, abound in the western waters. The ravenous nature of this fish is well known, but the following fact, related by Mr. Ellicott, shews that he is not only endowed with a good appetite, but very strong digestive powers.

“In the month of September, 1794, a pike of about twenty pounds in weight, was taken in the Small Lake near Le Bœuf. It was brought into the fort and opened; and, to our surprise, the stomach contained all the bones of a squirrel’s head, retaining their positions with respect to each other, but reduced to the state of a very soft cartilage. Even the teeth, so remarkable for hardness in this animal, were in the same state. They had lost their brown colour, and were perfectly white.”†

\* Belknap’s Hist. New Hampshire, vol. 3d.

† Med. and Phys. Journal.

*Cod* abound upon our coast. The history of the progress of this valuable fish upon the coast of North America is curious. At the first discovery of the northern continent of America, few or no cod-fish were found to the southward of the banks of Newfoundland and Sable Island. About 35 or 40 years ago, they were first discovered off Sandy hook, in the vicinity of New York. It has been observed, that ever since that time, they have gradually become more and more abundant, on the fishing ground of the Neversink in 6, 7, and 8 fathoms water, and perhaps equally so many miles farther eastward. A few years since they appeared about the capes of Delaware bay, though in comparatively small quantities; and it is said, that they have been caught on Chincoteague shoals in lat 38 deg. on the coast of Maryland. From these facts it seems probable, that the cod-fish is gradually progressing southward, and in time may, perhaps, be caught along the whole extent of coast belonging to the United States. Hence we may conclude, that they originally inhabited the Banks of Newfoundland; whence on account of their prodigious increase, they annually push out colonies in every direction where sustenance can be procured.

*Clupea tyrannus*, and *oniscus fuscus*. The following account of these animals is an abridgement of a very interesting paper by Mr. Latrobe.\*

Among the fish that at this early season of the year (March) resort to the waters of York river, the alewife or oldwife, called the *bay alewife* (*clupea*

\* Trans. Phil. Soc. Philad. vol. 5.

*nondescripta*) arrives in very considerable shoals, and in some seasons their number is almost incredible. They are of the size of a large herring, and are principally distinguished from the herring, by a *bay* or red spot above the gill fins. They are, when caught from March to May, full roed and fat, and are at least as good a fish for the table as the herring.

In this season each of these alewives carries in her mouth an insect, about two inches long, hanging with its back downwards, and firmly holding itself by its 14 legs to the palate. The fishermen call this insect the *louse*. It is with difficulty that it can be separated, and perhaps never without injury to the jaws of the fish. The fishermen therefore consider the insect as essential to the life of the fish; for when it is taken out, and the fish is again thrown into the water, he is incapable of swimming, and soon dies. I endeavoured in a number of instances to preserve both the insect and the fish from injury, but was obliged either to destroy the one or injure the other. I have sometimes succeeded in taking out the insect in a brisk and lively state, and as soon as he was set free from my grasp, he immediately scrambled nimbly back into the mouth of the fish, and resumed his position. In every instance he was disgustingly corpulent, and unpleasant to handle; and it seemed that whether he have obtained his post by force, or by favour, whether he be a mere traveller, or a constant resident, or what else may be his business where he is found; he certainly has a *fat* place of it, and fares sumptuously every day.

There are many circumstances, to ascertain which is essential to the natural history of this in-

sect. The fish whose mouth he inhabits comes, about the same time with the shad, into the rivers of Virginia from the ocean, and continues to travel upwards from the beginning of March to the middle of May; as long as they are caught upon their passage up the river, they are found fat and full of roe. Every fish which I saw had the oniscus in his mouth; and I was assured, not only by the more ignorant fishermen, but by a very intelligent man who came down now and then to divert himself with fishing, that in forty years observation, he had never seen a bay alewife without the louse. The shad begin to return from the fresh water lean and *shotten*, about the end of May and beginning of June, and continue descending during the remaining summer months. No one attempts then to catch them, for they are unfit for the table. Whether the bay alewife returns with the shad I could not learn, but it is certain, that after June it is not thought worth the trouble to catch them. No one could tell me *positively* whether the *oniscus* still continues with them, but it was the opinion of my informant that, like every other parasite, he deserts his protector in his reduced state, for he could not *recollect* that he had ever seen him in the mouth of those accidentally caught in the seine in July or August.

The oniscus resembles the minion of a tyrant in other respects, for he is not without those who suck him. Many of them have two or three leeches on their bodies, adhering so closely, that their removal costs them their heads.

*Squid, ink fish, or cuttle fish. (Sepia.)*

A beautiful species of the cuttle fish is sometimes



found on the sea coast of New York. It is about eight inches long. The tentacula or feelers of this animal, are furnished with many mouths without throats, which are armed with a circular row of teeth to seize their prey. These convey the food to the real or principal mouth, which is armed with a beak, resembling the rostrum of a parrot. The creature is furnished with a bag of black liquor for its defence against its enemies. When pursued by them, it ejects this fluid into the water through a particular orifice in the anterior part of its body. The water is darkened and rendered of an inky colour thereby, so that its adversary is enveloped in a cloud, while the sepia suddenly darting backward with a spring to the distance of several feet, makes its escape. It is very amusing to view them thus employing the means of self defence. Some of the larger species of the sepia, are said to be the chief food of the spermaceti whale (*physeter macrocephalus*), and the likenesses or impressions of their beaks are frequently seen in ambergris, which is said, by the more intelligent of our Nantucket whalers, to be but indurated excrement of that animal in a constipated state of the *intestinum rectum*.\*

The *thresher*, or *long-tailed shark*.

This fish was found on the south side of Long Island in the autumn of 1803, by James Fairlie, Esq. He made a drawing and description of the animal and communicated them to Dr. Mitchell shortly after. It is evidently a different species from that figured by Pennant in his *British Zoology*.† This

\* *Med. Repos.* vol. 4, p. 199.

† This opinion of Dr. Mitchell is confirmed by the account given in

fish is rare in this part of America. The whole length of the body and tail was thirteen feet and one inch. The skin, though thick as that of the common shark, was not at all rough, except a very little on the back. The colour was dusky or brown, and the shades darker on the upper side than on the belly. The tail was stout and elastic. Its superior edge was about three or four inches broad, and tapered away to nothing below. In this respect it had some resemblance to the fin of the sea tortoise. The teeth were very sharp, of about three fourths of an inch long, and formed but one row. The body was very cylindrically formed, and possessed the great general features of the shark family. A cut of this fish is given in the Medical Repository, Hexade 2d. vol. 2.

Dr Mitchell, to whom we are much indebted for his investigations on many subjects connected with the natural history of the United States, has also given us an interesting account of the structure and functions of the fœtus of a species of shark found on the coast of New York during the summer months. About nine years since, while he was engaged in a fishing party in one of the bays on the south side of Long Island, a shark between four and five feet in length was taken in the seine, and upon examination,

the Monthly Magazine of London, for August last, by Mr. Bingley, of a thresher shark, *squalus vulpes*, Linn. caught on the British coast, in which the largest of the teeth was a quarter of an inch long, they were also triangular, and ranged in three rows in front of the upper, and four rows in front of the lower jaw. The upper parts of the body are cinereous, and blue under, with ash coloured spots....Many more marks of difference might be mentioned.

eleven young ones were found in the uterus; they were about three inches long.

Besides these young ones that had advanced thus far in their growth, there were contained a large number of ova within the body of the fish, in different degrees of evolution and size; some of them resembling the full grown eggs of the tortoise, and others similar to the smaller rudiments of eggs found in the ovaria of laying hens. On opening the uterus, the young fishes were found each connected with an egg, dependent from that part of the belly which may be considered as the umbilicus, and appearing in the form of a very large hernia, this hernia on examination proved to be a true ovum filled with a yolky substance, evidently intended for its nourishment; and what was very remarkable, the young animal, though grown to a considerable size, and connected in this manner with its egg, had no connection whatever, by means of an umbilical cord, a placenta, or by vessels of any kind, to the uterus of its dam; but it was so completely organised, as to derive no sustenance to its body, nor to receive any renovation of its blood, from its parent.

The singularity of all these appearances was considerably heightened by the capability of the little sharks, when out of the uterus, to live for a considerable time in the open air. The larger part of the brood had been left on the grass of the shore where the dam had been dissected; but the three which were reserved for examination lived, and exhibited, during the greater part of the time, brisk motions for almost three hours, although exposed to the temperature of a common atmosphere. During

this time, while they lay before Dr. M. on a plate, nothing of the kind appeared more beautiful or distinct, than the branches of blood vessels shooting through, and running over the transparent membrane of the egg; the blood evidently appearing to acquire a brighter scarlet colour, whilst the fish was thus exposed to the air, than it had possessed during the immersion of the young animal in the fluid of the uterus. It seems to have acquired more rapidly, and to a greater quantity than before exclusion from its maternal membrane, the oxygen of the air to which it was exposed; the union of which with the blood seemed to have brightened its colour, and imparted to it, at the same time, so much of a stimulant quality, as to have shortened the duration of its life by excessive excitement. Thus the shark forms the connecting link between the oviparous and viviparous animals.

*Testudo polyphemus*....The great land tortoise called gopher abounds in the state of Georgia, on the high dry sand hills. When arrived to their greatest magnitude, the upper shell is near eighteen inches in length, and ten or twelve inches in breadth; the back is very high, and the shell of a very hard bony substance, consisting of many regular compartments united by sutures, in the manner of the other species of tortoises, and covered with thin horny plates. The nether, or belly shell is large, and regularly divided transversely, into five parts: these compartments are not knit together like the sutures of the skull, or the back shell of the tortoise, but adhere, or are connected together by a very ridgy horny cartilage, which serves as hinges for him to

shut up his body within his shell at pleasure. The fore part of the belly shell towards its extremity, is formed somewhat like a spade, extends forward near three inches, and is about an inch and a half in breadth; its extremity is a little bifid, the posterior division of the belly shell is likewise protended backwards considerably, and is deeply bifurcated.

The legs and feet are covered with flat, horny squamea; he seems to have no clefts in them or toes, but long flattish nails or talons, somewhat in resemblance to the nails of the human figures, five on the fore feet; the hind legs or feet, armed all round with sharp, flattish, strong nails, the number undetermined or irregular; the head is of a moderate size, the upper mandible a little hooked, the edges hard and sharp, the eyes are large, the nose peaked, the nostrils near together and very minute, the general colour of the animal is a light ash or clay, and at a distance, unless he is in motion, any one would disregard or overlook it as a stone or an old stump. It is astonishing what a weight one of these creatures will bear; it will easily carry any man standing on its back, on level ground. They form great and deep dens in the sand hills casting out incredible quantities of earth. They are esteemed excellent food; the eggs are larger than a musket ball, round, and the shell hard.

The soft shelled tortoise of the southern states is very large when full grown, from 20 to 30 lbs. weight, extremely fat and delicious, but if eaten to excess, is apt to purge those who are not accustomed to eat its meat.

It is flat and very thin; two feet and a half in length, and eighteen inches in breadth across the back; in form, appearance and texture, very much resembling the sea turtle; the whole back shell, except the vertebræ, or ridge, which is not at all prominent, and ribs on each side, is soft or cartilaginous, and easily reduced to a jelly when boiled: the anterior and posterior extremities of the back shell, appear to be embossed with round, horny warts, or tubercles, the belly, or nether shell, is but small and semicartilaginous, except a narrow cross-bar connecting it at each end with the back shell, which is hard and osseous; the head is large and clubbed, of nearly an oval form, the upper mandible, however, is protended forward, and truncated, somewhat resembling a swine's snout, at the extreme end of which the nostrils are placed, on each side of the root or base of this proboscis are the eyes, which are large; the upper beak is hooked and sharp, like a hawk's bill; the lips and corners of the mouth large, tumid, wrinkled, and barred with long, pointed warts, which he can project and contract at pleasure, which gives the creature a frightful and disagreeable countenance. He buries himself in the slushy bottoms of rivers and ponds, under the roots of flags and other aquatic herbage, leaving a hole or aperture just sufficient for his head to play through; in such places he withdraws himself when hungry, and there seizes his prey by surprise, darting out his head as quick as lightning, upon the unwary animal that unfortunately strolls within his reach; he can extend his neck to a surprising length, which enables him to seize young fowl swimming on the surface of the

water above him, which he instantly drags down. He is seen to raise his head above the surface of the water, in the depths of lakes and rivers, and blow, causing a faint puffing noise, somewhat like a porpoise; probably this is for pastime, or to charge themselves with a proper supply of fresh air. They are carnivorous, feeding on any animal they can seize, particularly young ducks, frogs, and fish.\*

This turtle is also found in the waters of the state of Ohio.

\* *Bartram's Travels.*

## INSECTS.

The first insect of the United States that deserves notice is the *locust* or *cicada septendecim*, both on account of the singularity of its habits, and the great destruction which they cause when they make their appearance.

They are known to have appeared in immense numbers, in the following years in Pennsylvania; but it is probable that they also were seen in equal quantities in other years....*viz.* 1715, (which was a very healthy year) between 1742 and 1750, in 1749, between 1752 and 1758, in 1765, 1775, 1782, 1792, 1800.

They are also seen annually; but not in such numbers as to do mischief, or excite attention.

This remarkable insect, though but trivial attention has been given to its history, appears as an extraordinary phenomenon in the works of creation. Its periodical visits....its long absence....the numbers which rise from the earth, where they have, perhaps, undergone various transformations whilst they have remained entombed, for the space of 15, 16, or even 17 years, (for they are not always regular in their visits) certainly deserve some enquiry.

Towards the middle or latter end of May, under such trees as had been planted previously to their former visit, the ground is perforated; so as, in some degree, to resemble a honey-comb; and from these perforations issue an army of these insects; which,



if they were endued with the voraciousness of the locusts of the east, would spread devastation and terror throughout the country they fix upon for a visit.... But happily the cicada or locust, in this state, is not more injurious than the sportive summer grasshopper.

The appearance of the locust, when first escaping from its earthy mansion, is a large amber-coloured grub-worm, about one inch and a half in length, and about an inch in circumference; the feet are more strongly formed than those of the grasshopper, and considerably shorter; the insect seldom leaping; in the outer covering, or *grub case*, if the term may be admitted, near the back of the neck, begins an opening, which continues down the body, nearly half the length of the insect: through this opening the locust protrudes itself, and appears, at first, a white-coloured moth, nearly resembling a silk worm, in its moth state, though much larger. The wings, in this tender state of the insect, are wonderfelly folded, in close rolls, near their basis, so exquisitely compact, that it requires several careful observations to comprehend the possibility of the wings being formed with the insect, as they appear an almost instantaneous creation, when they are expanded, which is performed by the locust shaking itself with a considerable force. The time when they issue from the ground, is about an hour or two after sun-set; soon after which they begin their exertions to free themselves from the grub case, which the stronger ones effect in an hour or two. They remain on the branches of the trees, which they have attained (before this last metamorphosis) until morning, when

they are of a high amber colour, have acquired their strength, and are able to contend with some of their enemies. The weaker ones, and those who do not leave the earth till morning, do not so easily effect their transformation, and often prove a prey to the larger and even the smaller birds.

While in the grub worm state, there is a fissure in the back of the skin, sufficiently large to admit the locust to pass therefrom, which, notwithstanding, is not made without great exertions, as has been before noticed. When this escape is effected, the insect leaves the place where its covering is, and rests at a very short distance from it, where it remains until the moisture is evaporated from its body. It is in this situation that our admiration is in a very lively manner excited by the sudden manner of unfolding its wings; which, as has already been remarked, are folded up in so narrow a compass, that the insect appears to have none; although after our surprise from the first object of our observation has subsided, we plainly discover a large protuberance at the insertion of the wings, yet these folds are arranged in the most nice and delicate manner; so that an inattentive observer would imagine the insect was entirely destitute of them. Yet a second and a third subject repays us, even in this instance, for our close inquiry. The wings, as well as the insects, when first protruded from the grub case, are very moist and tender; though by degrees they dry, and become firm and rigid. But should any accident prevent the cicada from a free expansion of its wings, for a considerable time after the grub case is forsaken, the poor

[ insect is doomed to remain either in a state of total or partial debility; for should it be so weak as to be unable to expand its wings thoroughly, while the moisture and pliancy remain, as soon as they become dry and rigid, they are fixed in that partial or total want of expansion; and, in this helpless state, the cicada is a certain prey to birds or hogs.

The locust grub, rising from the ground, is nearly the colour of the locust when it has attained its full perfection, though not altogether as dark; its strength is very great, nearly equalling that of the scarabæus carnifex, or the beetle which forms the balls from ordure. But as it is about to leave the case, it becomes weaker.

At the time of their last appearance, an apple tree was approved of for the theatre of observation; and though it must have been very small at the time of their former visit, yet, having carefully collected the grubs which came up under its branches, the first evening numbered 500, which were removed; the second evening 600 more made their appearance, and the third evening upwards of 400. Several stragglers remained, who were neglected, as the numbers were already sufficiently great to claim the whole attention, and to inspire a reverential admiration of the power of creation, and its supreme director.

Two or three days after their assuming the moth state, the air resounded with their notes, which were re-echoed either on the wing, or on the branches of the trees indiscriminately. These notes, expressive as those of the feathered songsters, prove a call to

courtship. The power of song, which somewhat resembles the noise of a stocking loom, is confined to the male; which it is easy to discover is produced by inflating air into his body, and expressing it through two small apertures, placed a little below the base of his wings; these holes lead from a musical table, on each side of which are five or six thin bars, connected by exquisitely fine membranes; which, during the time of song, maintains a continual vibration. Like the grasshopper, the locust very seldom sports its social call without a response from almost all the males within hearing; and frequently when the courtship has obtained his mate's approbation, an intruder, allured by the concert, which is easily distinguished, challenges the hero to combat, and the fight is often long and desperate, as the victory always confers an interesting reward.

“In coupling, the male enters two hooks, which he has at the end of his tail, between the rings that surround the body of the female. These spreading internally, confine them together, which may be requisite, as there is a great number of eggs to impregnate, some say six or seven hundred.”<sup>2</sup>

When gestation is fully accomplished, which is generally two or three days after they have assumed the flying state, the female prepares to deposit her burden, and although her body does not appear greatly distended, yet she generally lays about 140 eggs. The egg is of a white colour, and about a line in length, and one-third of a line in diameter. Nature has wonderfully provided her with an instru-

<sup>2</sup> Peter Collinson. Phil. Trans. 1764.

ment in her tail,\* somewhat resembling a two-edged sword, which, like the grasshopper, she can sheath and unsheath at pleasure. With this she perforates to the pith of the tender twigs of such trees as will afford a convenient nidus for the eggs, and deposits them by 14 or 15, under the bark in the form of the letter V; and sometimes she pierces through a twig one-fourth of an inch thick.

It is thus that the parent provides for a succession of the species, in which employment she is generally busied until about the tenth day of her moth state, seldom if ever feeding on any thing but the early dew: for, as they fly in such numbers (and always carelessly, without a leader, as is usual with the eastern locust) were they to feed on plants, the damage must certainly be observable: and as they live in the moth state twelve or thirteen days, it is probable they have a portion of dew for their sustenance. Then they dry up as the silk worm moth, the male becoming superannuated two or three days before the female.

Having pursued the locust through its several moth stages, the numerous offspring it has deposited in the slender twigs of trees, have still some claim to investigation. The eggs are, of a cylindrical form, rounded at the ends, and are of such a consistence, that they require a hard pressure between the fingers to crush them. The substance within, as in most other small eggs, is a white, transparent, and viscous fluid. In about the space of fourteen days, from the time of their first being left by the parent, the egg

\* Others say, that the dart is fixed between her breast and belly, and extends to the end of her tail.

produces a whitish insect, somewhat larger than the silk worm, when fresh hatched, which leaves the branch where the nest was, and dropping on the ground, either enters into the hole through which the old locust issued, or turns the earth aside afresh, and entombs itself there, to undergo the metamorphosis of its ancestors.

In digging wells, cellars, &c. in America, insects of very different appearances have been discovered, some twenty feet deep, which have been supposed to be of this species; others have been discovered nearer the surface, of which no doubt remains but that they are the grub of the locust; and early in the spring, previous to their assuming the moth state, the plough-share often furnishes the blackbird, which follows the ploughman, with a rich repast of them; for which, by his clamour and flutterings, he endeavours to express his obligations.\*

There are two distinct species of cicada in North America; the one here described being much larger than the other. The smaller species has a black body with golden eyes, and remarkably yellow veined wings.

#### The *Hessian fly*.

It seems to be now understood, that this destructive little animal is a *tipula*. In the entomological system of Linnè, this genus belonged to the *diptera*, or two-winged order of the class of insects. But in the arrangement more recently adopted by the distinguished professor Fabricius of Keil, it is placed in his eleventh order, or the *antiliata*. Of this genus,

\* *Columbian Magazine*, December, 1786.

his disciple Frederic Weber, enumerates ninety-four species in his *Nomenclator Entomologicus*, published at Keil in 1795.

We are not positively informed whether this is an undescribed creature. Though Dr. Mitchell has often seen and examined it, he still hesitates to decide on so nice a point, as pronouncing whether, in so numerous a family, this is a new individual.

The history of a wheat insect has also been given, by the Rev. Mr. Kirby, in a memoir printed in the 5th vol. of the Transactions of the London Linnæan Society. He has treated of it as a non-descript. But whether Mr. Kirby's insect is new or not, it is not the animal which has been so greatly injurious to the American farmers, for this latter infests the stalk and vaginal leaves, while the former nestles in the fructification and ear.

Common opinion has ascribed the introduction of the Hessian fly into America, to the troops from Hesse Cassel, which came over with the British troops, during the revolutionary war in the United States. But there is great reason to believe this opinion erroneous. Sir Joseph Banks informs Dr. Mitchell, that it does not exist in England, and he has no reason to believe its existence in any part of Germany. Count Ginani of Ravenna, has not mentioned the fly in his splendid work\* upon the diseases to which wheat is subject in its growing state, though fifty different insects are described.†

Agreeably to the interesting observations of the

\* Delle malattie del grano in Erba in Pesaro 1759, 4to.

† Med. Repos. Hexad'e 2d, vol. i.

late Hon. I. Havens of Long Island, inserted in the 1st vol. of the *Transactions of the Agricultural Society of New York*, the maggot of the fly generally proves more destructive to wheat in the autumn of the year than in the spring; and before cold weather it is transformed into a chrysalis, in which state it is prepared to remain during the winter, and in the spring will again be transformed into a fly, which completes two generations of the insect in one year.

An instructive memoir by Dr. Barton, upon various destructive insects, obtained the Magellanic premium last year from the Phil. Soc. of Philadelphia, and will probably be published. The following are the names of the principal insects of which he has given an account in the memoir alluded to.

1. A species of *Cimex*, which proves very destructive to the wheat, the Indian corn, and other important vegetables, in Virginia, and other parts of the United States.

2. A species of *Phalena*, which destroys the Indian corn in various stages of its growth. This is called the "Budworm," &c.

3. A species of *Phalena*, which is called *Phalena migratoria*. The larva of this, known by the name of the "grass caterpillar," &c. proves very destructive to different species of *gramina*, or grasses, while in their growing state, not neglecting the Indian corn.\*

[\* This species did immense mischief in Maryland, Virginia, and Salem county, New Jersey, during the summer of 1796.]



4. Another species of the same family of insects, which has also destroyed the grasses, and the leaves of the sugar maple, &c.

5. Two species of *Bruchus*, viz. the common pea bug (*Bruchus Pisi*), which commits such dreadful havoc upon the common garden pea (*pisum sativum*), and another species, principally confined to the southern parts of the United States.

6. The common striped "*Potatoe fly*," (*Lytta vittata* of Fabricius), destructive to the potatoe (*solanum tuberosum*), and other vegetables, and so beneficially employed as a substitute for the cantharides of the shops.

7. Different species of *Phalena*, the larvæ of which destroy the leaves, &c. of the common apple tree, the crab apple (*pyrus coronaria*), the wild cherry tree (*prunus virginiana*), &c.

8. Different species of *Curculio*, or weavel, particularly those which destroy the young fruit of the peach, the plumb, the apricot, the nectarine, &c.\*

9. The *Zygaena Persicæ*, and other insects which prove destructive to the roots and branches of the peach tree.

10. The *periodical locust* (*cicada septendecim*), of which some account is given in the first part of Dr. Barton's Philadelphia Medical and Physical Journal. In the *memoir*, however, the author has confined himself principally to an account of the injuries inflicted by this insect, and the means of preventing these injuries.

\* For a full account of the fruit Curculio, see the Domestic Encyclopædia, article "*fruit*."

11. The *crioceris cucumeris*, or *cucumber fly*, which commits such depredations upon the vines of the cucumber, the melon, squash, and other plants of the natural order *Cucurbitaceæ*, as well as upon other plants, not of this family.

12. A species of *Cimex*, or *bug* (perhaps the *Cimex hæmorrhous* of Linnæus), which also ravages the cucurbitaceous vines, particularly the large ones, such as the squash and pumpkin.

13. A species of *Coccinella*, or *May bug*, still more destructive, than either of the two preceding insects to the *cucurbitaceæ*, not contenting itself with the vines and leaves, but also destroying the fruits, in different stages of their growth.

14. *Melolontha multivorum*, commonly called "*rose bug*," on account of its ravages upon the petals, &c. of the garden rose. But this insect proves extremely destructive to many other vegetables, some of which are of much more consequence to us than the rose; such as the apple, the peach, the cherry, different kinds of mulberry, and many others; for, perhaps, no insect is more strictly entitled to the appellation of *multivora*, or *multi-vorous*.

15. Various species of insects which inhabit and devour the leaves of the common tobacco, and other plants of the natural order called *Luridæ*, or *Solanaceæ*. In this section the author's principal attention is turned to the common "*tobacco worm*," as it is generally called.

16. Different species of *Gryllus*, or *Grasshopper*, which, in the southern states, devour the young

indigo (*indigofera tinctoria*), and in Pennsylvania, New Jersey, &c. devour the leaves and stems of the potatoe, to the great injury of the crops.\*

Four species of meloe that blister are found in the United States. The first was brought into notice by Dr. Isaac Chapman of Bucks county, Pennsylvania. The species described by Dr. Chapman feeds chiefly upon the potatoe; another upon the *clematis crispa*, a third (*meloe Penns. Linn.*) upon *prunella vulgaris* or self heal, and *ambrosia trifida* or stickweed. The *meloe majalis* has not yet been used to blister, though the attention of physicians was some years since directed to it by Dr. Shoepf. From frequent trials I am convinced, that the powers of Dr. Chapman's blistering fly are equal, if not superior, to those of Europe. In several cases three blisters were raised in succession; whereas it seldom happens that more than one follows the application of the European cantharides. These insects swept away whole fields of potatoe tops in the years 1798, and 99, but since that time they have been seen but seldom. †

*Blue wasp*, a species of *sphex*, of the order hymenoptera of Linnæus. Two species will only now be noticed, on account of their singularly cruel mode of providing for their young.

1. The *sphex cerulea* or blue wasp, is most common. His antennæ are pointed, and stand up when he is at work. His nose is furnished with a strong beak, with which he works sideways, leaving ridges on his cell; his thorax is thick, abdomen petiolated. The wings play between a beautiful green, brown

\* Med. and Phys. Journal, vol. 2d.

† This insect is the *Lytta Vitata*, before-mentioned.

and blue. The joints of the feet are yellow, head, body and legs are blue; has a broad head, nose blunt, thorax longer in proportion, abdomen conical, and elegantly formed. General colour dark blue. This first species make their cells of clay, and in the form of a tube, three or four inches long, in the open air on a rock or tree, or the inside of houses. The other builds separate horizontal apartments close to each other, and are smooth on the inside, but rough on the outside. Both of these species feed their young on *spiders* of every kind, which they first disable by stinging them, and then carry them to their cells, where they are packed close, waiting to be devoured by the young worm for whose support they are destined. They exercise a nice judgment in the quantity of provisions they lay up. For additional observations and a plate of the insect and their cells, the reader is referred to Mr. Latrobe's paper, from which the above account is taken, in the *Trans. Amer. Phil. Soc.* vol. 6, and to Mr. Bartram's paper in the *Phil. Trans. Royal Soc. Lond.* vol. 43.

The cotton plant in South Carolina and Georgia, is frequently destroyed by a caterpillar, for which no remedy in those states, has as yet been found. These destructive insects seldom appear, unless the preceding spring and summer have been very moist. In that case, they are almost sure to begin their ravages about the beginning of August, by first devouring the leaves, and then entering and eating the tender pod.

So rapid is their progress, and so extensive their depredations, that they will destroy many acres in

one night. It is said that the caterpillar which attacks the upland cotton, is different from that which ravages the black seed, or long staple cotton of the sea islands. The natural history of these insects would be a valuable addition to entomology, and, it is to be hoped that we shall yet obtain it from some of the many well-informed planters of the Southern States.

In the Bahama islands, it is said, that after many trials, the planters have, at last, succeeded in preventing the progress of these destructive insects, by firing cannon in the fields; by which the eggs are destroyed; and by carrying many hundred small pots or pans of tar and brimstone in a state of inflammation, to windward of the field in which the insects appear, so as to cause the smoke to be diffused through it.

The cotton plant has still another enemy; viz. a red bug which enters the pod when fully blown, and stains the wool.

About four years since, it was observed that the pine trees in the northern and eastern parts of the state of South Carolina, died in great numbers, and upon a careful investigation into the cause, it was found to be a small black winged bug resembling the weevil, but somewhat larger. A great number of these bugs have been observed, in the spring of the year, and early in the summer, flying near the root of each tree: they pierce the bark a little distance above the ground, and lay their eggs between the bark and the wood; in a few weeks after, these eggs hatch, and a worm appears, which at its full growth, is

about an inch long; they immediately begin to feed on the sappy part of the tree, and do not leave off eating until the whole of it is destroyed.

It is believed that no attempt has as yet been made to remedy the evil, which if it continue, threatens to destroy the whole of the pine trees in the country. In one place in a tract of two thousand acres of pine land on the Sampic river, near Georgetown, at least ninety trees in every hundred have been destroyed by this pernicious insect, and the adjoining lands, and many tracts near Lenud's ferry on the Santee, and on Black river, are in the same situation.

## REPTILES.

Snakes are very numerous in thinly settled parts of the United States. Of the genus *coluber* twenty species are enumerated; of the genus *anguis* there are five; and one *amphisbena*, or two-headed snake.

Among all the serpents of North America, none has excited so much notice as the *crotalus horridus*, or rattle-snake.

The absurd accounts published in Europe, by early travellers in America, respecting this snake deserve no attention. What is here given may be considered as the result of observation or experiment. Besides the well-known *crotalus horridus*, there is another, viz. the *crotalus miliaris*, called ground rattle-snake, because it keeps itself frequently under ground. There is a third species, a non-descript, and known by the name of *water rattle-snake*; it is longer than the former, and confines itself to low ground. They may be easily distinguished from one another. On the back of the *crotalus horridus*, there are brown transversal lines terminated on each side by a spot almost round, of the same colour. The back of the *c. miliaris* is covered with lozenge-shaped spots of a browner colour than the rest of the body, and terminated by a yellow border.

Dr. Brickell of Savannah, has lately announced the discovery by him of four new species of *crotalus*. One is nearly black, with a chain of white lined rhombi on the back; this he has named *crotalus*

*rhombiferus*; it measured six feet two inches in length, and above eleven inches three quarters round. Another has a yellow skin, with zigzag brown belts, six feet long; this he has named *crotalus zetazona*. The third and fourth are twelve to fifteen inches long, venomous as the others; one is black, with paler bands down its sides; the other is yellowish, with a chain of rhomboid dark lines on the back, and a brown line round the head above the eyes.

A species of *boa* was also discovered on Long Island in 1801, of which the following account is published by Dr. Mitchell.

Its length was seven feet and four inches, and its thickness proportional, being around the swell about the size of a man's wrist: belly and sides of a yellowish, or straw colour; on the back were thirty-six black spots, reaching in a row from the head to the tail, and on each side of this row, approaching the belly, were many other blackish or dark brown spots.

It had no fangs, or biting teeth, to pierce the bodies of its enemies, and insert poison, and therefore, was not venomous. In the lower part of the mouth, there was a considerable fleshy portion like a tongue, which terminated in a long bicuspidated projection. The jaws were furnished with hooks, or hamated teeth, in the manner common to snakes. It had scuta both on the belly and tail; and these amounted to about 300. From these characters it appears to belong to the genus of *boa*. The number of the scuta so exactly corresponds with the species termed constrictor, that the *boa constrictor* may be enumerated among the American serpents.



This is the creature which is said to grow in India to the length of thirty feet and more, and to crush animals to death by twining around them; though in the United States it is not yet known to grow to so large a size.

The rattle-snake, it is known, never attacks a man unless he has been touched or affrighted. We may pass very near him without disturbing him, or his shewing the least disposition to bite. The rattles make no noise, as commonly supposed, when the snake creeps: but when they are affrighted, they coil upon themselves, remain motionless, and ready to dart forward. Then only, they move with an inconceivable velocity the rattles which advise us of their vicinity, and which they do not agitate unless in a state of anger and contraction incompatible with the act of creeping. In time of danger, the young snakes take refuge in the maw of the old one. Mr. Beauvois saw five enter a snake in the Indian country, and come out again in a quarter of an hour; on a second alarm from him they again entered, and the old one fled into the grass.

These animals abound near Morriss river in New Jersey; Mr. Beauvois found seventy-five of them entwined with each other, in a hole from three to four feet deep, and of about the same diameter. They always chuse a winter residence near a stream of water which never freezes, and on the side of hills. In summer, they keep on dry ground.

The mode pursued by the *crotalus horridus*, and black-snake in fighting, is curious. They entwine their tails round a shrub, and both rising, they dart

\* Trans. Amer. Phil. Soc. vol iv.

at each other, endeavouring to throw their heads round the neck of their antagonist; the one that succeeds pulls with great violence, and endeavours to drag the other down to the ground. In this struggle they frequently loose their holds, which they again resume, and proceed as before. A friend who was an eye-witness to such a combat between Savannah and Augusta in Georgia, saw the black snake completely conquer the rattle-snake and drag him into the water.

Dr. Barton informs us he has made a considerable number of experiments to ascertain the effects of the venom of this reptile upon different animals, and has found that it often kills in a very few minutes. The effects of the poison are very various, not only in different species of animals, but even in different individuals of the same species. It sometimes induces most violent pains, which, if we may judge from the cries of the bitten animal, continue nearly to the close of its life. At other times, the poison induces death without creating any, or but very little pain. Hitherto, his principal experiments have been made with warm blooded animals, such as dogs, cats, and rabbits. He is inclined to think, that the venom exerts very inconsiderable effects upon cold blooded animals. Warm blooded animals that have been most violently affected by the poison, sometimes struggle through the danger, and perfectly recover, although no remedy has been applied. This may serve to shew how many inert vegetables have acquired the reputation of curing the bite of the rattle-snake. He has ventured to apply a portion of the undiluted venom of a rattle-snake, recently thrown

from its fang, to his tongue. "But I do not think," says he, "I shall venture to repeat the experiment. I did not find the venom insipid, as the abbé Fontana and his servant did that of the viper. It had, on the contrary, a peculiarly pungent taste, and left, for a considerable time, a pretty strong sense of heat upon my tongue and fauces. I have found that its powers of digestion are very strong. Even the bony fabric of the animals which it devours is completely digested, or reduced to the state of fluid mortar.

Great, however, as is the faculty of digestion in this reptile, it is capable of living a long time without any food, unless, perhaps a small quantity of water. One lived without having ate one grain of any solid food, from the 28th of April to about the 9th of March following. It then died; but upon examining it, I found it very fat.\*"

This fact shews that this horrid reptile is exceedingly tenacious of life. Mr. Peale of Philadelphia, has also repeatedly verified this observation in the snakes which he has kept in his extensive Museum. It is commonly supposed that the number of its rattles is proportioned to the age of the animal, and that it acquires one rattle for every year: this however is a mistake; the same gentleman found that they acquire two or three bells in one year. Dr. Barton also says, that upon dissecting a female rattlesnake, several young ones were found, and that in more than sixty instances, three bells could be plainly discerned upon the foetal snake.

The venom of the rattle-snake is of a clear and transparent yellow colour. It is contained in a blad-

\* Letter to Lacepede.

der beneath each fang and towards the middle of the lower jaw, communicating with the root of the teeth, which are pierced at their bases, and this opening communicates with the bladder containing the poison. The old teeth of the rattle-snake drop every year, and are replaced by new teeth.

The following experiments on the venom of the rattle-snake, by Dr. Brickell of Savannah, are very interesting.

On putting a slip of litmus paper into the mouth of a rattle-snake five feet long, and disabled by blows of a stick applied to the back, and then pressing the head, by placing the foot on it, the poison squirted out to the distance of some feet. Some of the poison struck above the eye of the gentleman who performed the operation for him; he wiped it off with his pocket handkerchief, and no harm ensued; some struck on his white cotton waistcoat, and tinged it of a yellowish colour, inclining to brown.

The part of the litmus paper, which he made of a sky blue, had its blue entirely discharged, and became white. A light band of red was to be seen between the part of the paper touched, and untouched by the poison. Dipping it, when dry, in a solution of fixed alkali (ley) restored the former blue colour.

The above experiments would seem to explain the great utility of alkaline remedies in the disease produced by the bite of venomous serpents. Dr. Brickell therefore recommends their use, and cites a case in which he gave frequently five or six grains of salt of tartar (pearl ash is nearly the same) dissolved in a cup of water. The part bitten being

scarified, was washed and kept constantly moist with a similar, but stronger solution. This treatment was continued for several hours, and relieved all the distressing symptoms. The snake was of the kind termed mockasin.

The same writer observes, that he has seen litmus paper turned red by water, in which the teeth of a rattle-snake had been steeped. He also recommends as a substitute for the salt of tartar, the ley of wood ashes, which may be extemporaneously made by mixing ashes with water, passing it through a cloth, and permitting the sediment to subside.

Volatile alkali in the various forms of hartshorn, solid volatile sal ammoniac, eau de luce, and spirits of sal ammoniac, have been also found efficacious in preventing the progress of, and curing the symptoms resulting from the bites of venomous snakes in the East Indies; the dose is 20, 30, or 40 drops in water, every five, eight, or ten minutes, till the sufferer is relieved. The reader may be assured that there is such a body of the most respectable testimony in favour of the efficacy of this remedy, that to neglect its use would be to trifle with life. Where ligatures are admissible, they should not be neglected, but these cannot be retained beyond a certain period, and that is so short, that all the aid we can expect from their application is to admit of time sufficient for administering the alkaline remedies. Every plantation, especially in the southern states, should be supplied with a bottle of this cheap medicine.

The subject of the rattle-snake must not be passed over without noticing the extraordinary power gene-

rally attributed to it, viz. of *fascination*. For a long time the opinion was so commonly entertained, as not to admit of a doubt, but at length, Dr. J. E. Smith expressed his apprehensions respecting the accuracy of the report, and since that time, the subject has been extensively treated by professor Blumenbach of Goettingen, and Dr. Barton, the former in support of the opinion, and the latter in opposition to it. A short review shall be given of the arguments on both sides. The opinion of the fascinating power of the rattle-snake, and other serpents of America is certainly very ancient; but if the antiquity of the belief was the only ground upon which it could rest, it would deserve very little attention, for the world, at various times, has been deluded with opinions, which subsequent experience, investigation, or reasoning have clearly disproved.

Various theories of the mode in which fascination is effected, have been given. La Cepede supposes, that it is either by the pestilential breath of the serpent, or noxious effluvia exhaling from his body, which by agitating the animals which it means to devour, may prevent their escape. But this cannot be the cause, for it is known from the testimony of Mr. Beauvois who expressly directed his attention to this point, that no fœtid smell was perceived from eight living rattle-snakes confined in a box about 18 inches square, and not opened for three weeks.\* Another theory of the same author, is that in cases of supposed fascination, the animals thought to be fascinated, have been previously bitten by the ser-

\* Trans, Amer. Phil. Soc. vol. iv. p. 376.

pent, and that their cries, and apparent agonies, are the effects of the poison: but Dr. Barton rejects this explanation, because, among other reasons, the animal has often survived, after having been subjected to fascination, when the serpent had been seasonably frightened away; and because other snakes, said to possess the power of fascinating, are not venomous, as the black snake. He also shows, that Professor Blumenbach's opinion is erroneous, viz. that the fascinating power is owing to the steadfast looks, and to the hissing noise of the rattles of the snake, by which he entices the birds, &c. to follow him; for that serpents without rattles, are equally successful as the rattle-snake. The most probable explanation of the mystery, according to Dr. Barton, is this: the young birds before they have acquired their full strength, fall to the ground in attempting to fly, and are thus exposed to the attacks of the serpent. The old bird will dart upon the serpent, but fear will compel her to retire. She returns again, and often prevents the destruction of her young, attacking the snake with her wings, her beak, or her claws. Should the reptile succeed in capturing the young, the mother is exposed to less danger. But the appetite and capacity of the stomach of the serpent are great, and when the young are devoured, the snake seizes upon her, and this is the catastrophe which crowns the tale of fascination.

A new theory has been brought forward by the learned Dr. Williamson of New York, to account for the power of fascination;\* viz. extreme terror

\* The Memoir on this subject will shortly appear in Dr. Coxe's Philadelphia Museum.

at the sight of the brilliant eyes of the snake, producing dementation. This position he supports in a very ingenious manner, and offers the following case to shew the actual possession of this extraordinary power in snakes.

“Some years ago, Joseph Sandford, who lives near Newark in New Jersey, about the last of August, near the side of a large meadow, heard some cat birds complain exceedingly.

He asked of Reuben Carter, who was near him, ‘What can be the matter with the birds?’ Carter replied, ‘A snake is charming them.’ It seems that a large black snake, of the family that are called racers, frequented that place, and Carter had often seen him catch birds. He ran for a gun, and Sandford approached the tree round which the birds were flying. It was a plum tree that stood upon clear ground. He discovered a snake upon a large limb of the tree, that extended nearly parallel to the horizon. The birds, four in number, were flying near to one another, at a moderate distance from the tree, complaining exceedingly, but every time they surrounded the tree, they came nearer the snake; their eyes were fixed on him; he presently seized one of the birds and swallowed it, without changing his position; the other three birds continued to fly round him, and to complain: he seized a second bird, and a third, and devoured them in the same manner; the fourth bird was at his mouth when Sandford, having obtained the gun, cut the snake in pieces with small shot. In this case, there was not a bird’s nest on the tree; there was not an old bird protecting her young, for the birds were



all strong in wing, and they might have escaped; but to speak of them as we do of rational creatures, they had lost their senses; they were demented by fear. They were disposed, they were constrained to move; but as they durst not turn their eyes from the object of terror, they moved to their destruction. I have detailed this case, because no man who knows Mr. Sandford will dispute his veracity, and because he noted the case with inquisitive eyes, for until that hour, he had questioned the received opinion concerning the fascination of serpents. I shall rest the question here, because I should despair of finding proofs of what is called fascination, unless this should be admitted as a clear and direct proof."

Those who are anxious to see this subject treated at great length, are referred to Dr. Barton's paper already quoted; to professor Blumenbach's piece in Tilloch's Philos. Mag. and to the paper by Dr. Williamson.

## CHAP. V.

### MINERALS, FOSSILS, OF THE UNITED STATES

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THE mineralogy of the United States, and of North America, has been very little attended to. We are scarcely acquainted with the mineral productions which are found on the surface; and as to the internal structure and composition of the soil, we know nothing, except in some districts where the external appearance of valuable minerals has tempted the industrious to explore the bowels of the earth. The success which has generally attended their experiments, and the daily discoveries which are made by the few persons in the United States, who have a taste for the study of mineralogy, warrants the belief, that a rich harvest awaits the amateur who will patiently and carefully examine our country.

The ignorance of the people of Europe with respect to the number of minerals we possess, is evinced by the expression of Mr. Pinkerton,\* who must be supposed to be well acquainted with the state of the

\* See his Geography.

general information upon this subject. "The mineralogy of the United States," says he, "will not supply an extensive theme, as few substances are found, except those which are, indeed, the most precious to industry, iron and coal."

It is apprehended that, deficient as our knowledge is, with regard to the subject, it will be seen how incorrect is his opinion.

*Quartz*....Several varieties of quartz are found in most of the states. In New York it composes in part the granites, and is of three colours; white, half clear, and reddish. It is found either in a separate form, or variously compacted and combined with feldspar, glimmer, schoerl, and granite.\* Pennsylvania, near West Chester, affords a variety of a dark blue colour, which has considerable lustre, and as far as we know, is not common in Europe.

*Elegant Rock Chrystals* are found in different parts of Pennsylvania, especially near Bethlehem; in Maryland, Virginia, Kentucky, South Carolina,† and New Hampshire‡, many of which are transparent, and beautifully truncated at the terminations.

*Amethystine quartz*, is found in Pennsylvania and Virginia.

Large masses of *Amorphous smoky topaz*, are found in Pennsylvania.

*Agate* has been found in Greenbriar county, Virginia.

*Common Flint* is found on the banks of the rivers Neshaminy and Susquehannah, and in Virginia.

\* Dr. Mitchell.

† Drayton's View of South Carolina.

‡ Belknap, vol. 3d.

*Zeolites*.... Beautiful zeolites have lately been discovered at Hoboken, New Jersey, filling up the veins in the rocks of Stellstein and Jade which abound thereabout\* Zeolite imbedded in regularly crystallized basalt, of which there is a great abundance in the vicinity, was found by Dr. Barton, near Reading, Pennsylvania.†

*Common Brown Garnetts*, of various sizes, from the smallest grain to 4 oz. are found near Philadelphia, imbedded in micaceous schistus.

*Emeralds* have been found in Virginia, according to Mr. Jefferson: and at Chesnut Hill, above Germantown, near Philadelphia, in a granite, and also in the neighbourhood of Chester, in Pennsylvania, by Dr. Seybert. This last specimen resembles the beryl of Siberia.... Emeralds are also found in Maryland and South Carolina.

*Black Schoerl*, is frequently found as a component part of the granite of the United States.

Several varieties of *Hornblende* occur in Pennsylvania and New York. In the former state, large masses of granite are intersected by it.

*Mica*. This stone which forms an essential part of many mountains in the United States, has long been known under the names of *Muscovy glass*. It consists of a great number of thin laminæ adhering to each other, sometimes of a very large size. It is found in various parts of New Hampshire, adhering to rocks of white or yellow *quartz*, and lying in *laminæ*, like sheets of paper. The most of it is white, some is yellow, and some has a purple hue. The largest leaves of this curious substance are found in

\* Dr. Mitchell.

† Med. and Phys. Journal.

a mountain, in the township of Grafton, about twenty miles eastward of Dartmouth college.

The scarcity of glass during the American war, brought this mica into repute. Many persons employed their time in blowing the rocks, and separating the laminæ, cutting them into squares, and vending them about the country. This substance is particularly valuable for the windows of ships, as it is not brittle but elastic, and will stand the explosion of cannon. It is also used to cover miniature paintings, and to preserve minute objects for the microscope. The disadvantage of it for windows is, that it contracts dust, and is not easily cleaned; but for lanterns, it is preferable to glass.\*

For magazine lanterns it is particularly valuable, as it will not crack by the falling of a candle against the sides, an accident which has often occasioned great mischief on board ships of war.

Near Philadelphia the rocks of granite are interspersed with mica, and large strata of it are frequently met with, of no determinate figure or size. In New York red feldspar forms huge masses of red granite.

*Clays....*The United States abound with a variety of excellent clays, proper for even fine wares. In North Carolina, a large body is said to have been found before the revolutionary war, some of which was taken to England, and highly approved of by Mr. Wedgwood.† Marle abounds near Mount Holly.

\* Belknap.

† A specimen of this clay, with an account of the soil near which it is found, would be highly acceptable to the author, who regrets that his information with respect to the place where it is to be found is so deficient. It is said to be found near Halifax, North Carolina.

In that part of the South Mountain, where the Cotoctin Mountain separates from it, in Washington county, Maryland, in Conegocheague settlement, an argillaceous earth has been found, which bears all the characters of the *Argilla Porcelana* of Linnæus. It lies in immense bodies along the strata of iron ore, and is called *mine clay* by the miners.

Before the late revolutionary war, a china manufactory was established at Philadelphia, and some excellent specimens made at it, are still to be found. The clay was brought from White Clay creek, Delaware, as we have been informed.

A very fine clay is also found in a rivulet, in Howard's park, near Baltimore. Fine pipe clay abounds on the banks of the Delaware, below Bordentown, New Jersey. This clay resists the action of fire, and is extensively employed for fire bricks, and glass-house pots.

In New Jersey, ochres of various colours are found in great plenty in different parts, as in Salem county; near Woodbury in Gloucester county: a manufacture of Spanish brown is carried on from the production of one of the veins. Green clay is found near Long Coming in New Jersey....Near Allentown, many of the houses are painted with a red clay found in the vicinity.

Red and yellow ochres, of excellent quality, are found in the ore bed, near Hill and Haynes's iron works, in York district, South Carolina. Some of which has been successfully used in painting houses in Yorkville.\*

\* Drayton's View of South Carolina.

*Ferruginous nodules* are found at the Lower Three Runs, and at other places in South Carolina; which on being broken present an hollow, like that of a peach stone, but much larger; containing therein either a red or yellow ochre, in a proportion of one fifth to the sand and grit mixed with it. Some of this ochre has been ground and mixed up with oil; and when used, has been found so well adapted to painting, as to encourage further trials.\*

The western country abounds with *alluminous schistus*, which probably hereafter may turn to great advantage in manufactures: and near the eastern foot of the North mountain in Virginia, according to Mr. Jefferson, there are immense bodies of schistus, containing impressions of shells in various forms. In New York the schistus tract begins where the granitic region ends, *viz.* at Pollepell's island. The interval space is of the breadth of forty yards; and to the north of this the slate rocks rise and form the margin of the river. These schistic rocks prevail through a large tract of country, and appear to underlay all the limestone and calcareous earth. In many places they constitute a large proportion of the banks of the Hudson. Schistic rocks form the basis of the beautiful cascade on Cornelius kill, near Claverack river; the Blue mountains stand upon a basis of slate. Dr. Mitchell, from whose excellent mineralogical survey of New York these facts are taken, observes, that the obvious inference, from the dis-

\* Drayton's View of South Carolina. These sand stones are also common in Pennsylvania.

position of schist in New York, is, that priority must be allowed schistus rocks, notwithstanding the very great antiquity generally ascribed to granite.\*

*Slate (schistus tegularis)* proper for houses, is found in the township of Rhinebeck, in Dutchess county, state of New York; and is now extensively worked. In the county of Wayne, state of Pennsylvania, a slate quarry has lately been discovered, and promises to be of the greatest benefit to Philadelphia, and the United States generally. It is on the banks of the Delaware, within three hundred yards of the river, and about seventy-five miles from Philadelphia. The rock appears on the surface of the ground, and quarries so easily, that plates several feet square have scaled off. This slate is much thinner than that of New York, and equal to any which has been imported. Extensive use is now made of it in Philadelphia for covering houses, as the expense is only a trifle more than that of a shingle roof. A company is incorporated for working this quarry.

Slate of a good quality is also found, according to Mr. Drayton, near the head waters of Lynch's creek, in South Carolina.

*Earthy Chlorite* is found in Delaware and Chester counties, Pennsylvania; and there is a stratum of chlorite schistus, with dodecahedral iron stones imbedded in it, traversing Montgomery county, Pennsylvania, near the soapstone quarries.

*Steatites, or Soapstone.* This very useful stone is found in inexhaustible quantities on the banks of

\* The schistic tract is minutely described by Dr. Mitchell.



the river Schuylkill, fifteen miles above Philadelphia, and in the state of South Carolina, particularly near the extensive iron works of Hill and Haynes; and also in New Hampshire. Several varieties of serpentine, are found in Montgomery, Chester, and Delaware counties, Pennsylvania.

“Specimens of a stone of the magnesian order have been brought from a quarry very near the town of Newport, in Rhode Island. It smooths and polishes well, and possesses a fine grain. Its predominating colour is a dark green, which is relieved by spots of a paler green, verging in some parts towards a yellow or whitish. It is considerably heavy. From these qualities it may be pronounced an handsome serpentine, and apparently well worthy of being worked. Hopes are entertained that the quarry will be further opened, and fair and larger trials made upon the fine and valuable material which it contains.”\*

*Asbestos.* This mineral was well known to the ancients, who made a kind of cloth of it, which was famous for its incombustibility. There are many varieties of it in the United States. One is found in Chester county, Pennsylvania; another in New York; and another at the head waters of Lynch’s creek, South Carolina.

A single specimen, not well defined, of *Cyanite* or *Disthene*, has been found by Dr. Seybert, in micaceous schistus, on the borders of the Wissahiccon creek, near Philadelphia.

Specimens of *Glassy Actilonite*, are in the pos-

\* Med. Repos.

session of the same gentleman : they were found near Concord, in Delaware county, Pennsylvania.

*Limestone....*The calcareous region in general has been already amply noticed in the mineralogical survey of the United States. It may be here permitted to mention some particular tracts of limestone and marble.

Only one vein of limestone is known below the Blue Ridge in Virginia. Its first appearance is in Prince William county, two miles below the Pignut ridge of mountains, and is never more than one hundred yards in width. From the Blue Ridge, westwardly, the whole country seems to be founded on a rock of limestone, besides infinite quantities on the surface, both loose and fixed.\* In New York it is found in great quantities, and is every where superficial, and bedded both on granite and schistus. Near Claverack there is a mass of it about 800 acres in extent, which is remarkable for its petrifications. The whole tract in New York is minutely described by Dr. Mitchell.

Pennsylvania owes much of her agricultural riches, to the abundance of this excellent stone in the state.

In Maryland it is also found in great plenty, and North Carolina is crossed by a long ridge of limestone, in a south-westerly direction.

*Marble....*Quarries of Marble have been opened in Stockbridge, Massachusetts. Its quality is so good as to make it an object of demand. The corporation of the city of New York have ordered large quantities of it for the construction of their new hall:

\* Jefferson's Notes.

which, with perhaps the exception of the capitol, at Washington, will be the most magnificent building in the nation. This stone is of a somewhat coarse crystallized grain of a white colour, rather inclining to blueish; and is intended for outside work, which will not need polishing, but only rough shaping from the chissel. There is a stratum of marble and limestone extending from Stockbridge through the western range of towns in Massachusetts, quite to Bennington, in Vermont; a distance of more than forty miles. From this extensive body, various qualities of this valuable stone could doubtless be procured, differently veined, shaded and coloured, and of different degrees of fineness and hardness.\*

Marble of different colours, as white, blue, variegated, and black, is found in Montgomery county Pennsylvania on the Schuylkill, and also at Harper's ferry on the river Potowmack, in Virginia.

In Center county, Pennsylvania, near Aaronsburg, very fine black marble is found, of a hard quality, with pure white specks in it, resembling the Kilkenny marble.

In almost every state in the union are found *Stalactites*, and *crystallized calcareous spar*; but in Virginia, in a cave recently discovered, near Madison's cave, the quantity is immense. The crystallized masses take on the most fantastic forms: they are variously coloured.

*Gypsum*....It is much to be regretted that this article, which is so important to the agriculture of our country, should be so sparingly diffused throughout

\* Med. Repos. Hexade 2d, vol. 2d.

the United States; of the immense quantities imported into this country, the greater part comes from the Bay of Fundy. Very little is brought from France. Dr. Barton has been informed that very considerable quantities of gypsum have lately been discovered in the state of Virginia, upon one of the head waters of the Staunton, and at the distance of about twenty-five miles from Fincastle: also on the Nine Mile creek, or outlet of the Owasko lake; at the falls of the Genessee river; at the falls of Niagara on the Canada side;\* at St. Mary's between the Patuxent and Potowmack in Maryland; and in the town of Marcellus in New York, according to Dr. Mitchell.

Specimens of a very fine gypsum, have also been brought from about 150 leagues up the Missouri; where it is said to abound.

*Fibrous Gypsum* is found in great quantities near Lexington, Kentucky.

*Sky blue sulphate of Strontian, or Celestine*, was found some years since by Mr. Schütz, in the neighbourhood of Francstown, Pennsylvania, between laminae of a brownish red slate.†

*Sulphate of Barytes* has been found in Sussex county, New Jersey. It is of a very white colour, and of a laminated structure. There is also a vein of it on the west side of Paulin's hill, about six miles from Sussex county, in the state just mentioned. A large quantity of barytes also is found in the Sugar loaf mountain, not far from the junction of the Monocacy with the Potowmack, in Maryland.‡

\* Med. and Phys. Journal, vol. 1.

† Dr. Seybert,

‡ Med. Repos;

Sulphate of Barytes is also found as a gangue to the lead ore on Perkiomen creek, in Montgomery county Pennsylvania.

*Lapis Hepaticus*, or *Bituminous Sulphate of Barytes*, is found in Albemarle county, Virginia.

*Saltpetre* exists ready formed in caves of Virginia, and in Kentucky; the quantity is said to be equal to any probable demand of the United States; and is constantly used by the people of those states for the manufacture of their gunpowder.

*Native sulphates of magnesia and soda*, having a slight admixture of the muriate of soda or common salt, have been found in a newly discovered chamber of one of the very large saltpetre caverns in Greenbriar county, Virginia, near the court house.\*

“On the road to Reading, five miles from the town, is a stratum of *breccia*, chiefly calcareous, with quartzose pebbles imbedded in it, of various colours.†

*Sulphate of Alumine (Alum)* abounds near Pittsburg, Pennsylvania, and also in the townships of Barrington, Oxford and Jeffery, New Hampshire.

*Nitrate of Potash*, and *nitrate of lime* are found in great abundance near Lexington, Kentucky, and in the Cherokee mountain, South Carolina.

*Brimstone* has been discovered in Ontario county, New York. It is deposited from the waters of a spring which arises in the Genessee tract, about twelve miles north-west of Geneva. The stream is

\* Med. Repos. Hexade 2d, vol. 3d.

† It is probable that this is the stone which Mr. Guillemar mistook for fluor; which as yet has not been discovered in the United States. Dr. Seybert.

large enough to turn an overshot mill, and emits sulphureous steams which can be smelled to the distance of two miles. The water issues from the ground in different branches, and, adjoining the main fountain, are two bogs of sulphur, into which a stick may be thrust more than six feet deep.\*

A *bituminous oil* is found on the waters of the Seneka lake, in New York, and also in a creek, called oil creek, which empties into the river Alleghany, about one hundred miles from its mouth, which is singularly beneficial in chronic rheumatisms, bruises, old ulcers, and rigid limbs. Springs affording a similar oil, are found in Kentucky.

*Coal....*The United States abound with various kinds of excellent coal (*lithanthrax*). There are inexhaustible mines of it on both banks of the river, at Pittsburg, and for many miles down the Ohio; also in Bedford county, on the Laurel Mountain, and the mountains west of it; and so near the surface, that it is discoverable in the gullies of the road; and among the roots of trees that have been overthrown by the wind.

It is also found in every part of the state of Ohio, and in the township of Marlborough, west of Poughkeepsie, on the banks of the Hudson. Inexhaustible quantities of it are also found upon James river, in Virginia. The exportation of this coal to the other parts of the union, forms a considerable branch of commerce. Of this last kind, however, it is understood, that all the quarries are not equally good. Coal has also been discovered upon the river Ra-

riton in New Jersey. But the most valuable coal which has yet been discovered, is that from the county of Northampton, state of Pennsylvania, near the Lehigh river. Of this coal, a particular account is given by Dr. Woodhouse, in the Philadelphia Medical Museum.

“This coal is found in immense quantities in Pennsylvania, in the county of Northampton, near the river Lehigh. It is of a shining black colour, and stains the hands very little. Its fragments are tabular, as may be seen particularly after it has been submitted to heat. Its specific gravity is 16,181. It burns with very little flame, and no smoke; is with some difficulty kindled, and requires a considerable draught of air to keep up its combustion.

When perfectly consumed, it leaves behind a small portion of white siliceous earth, containing no potash, and sometimes coloured brown, by means of iron. It does not contain any sulphur.

“A fire was kindled at half past eleven o’clock, by placing a quantity of the Lehigh coal, upon a stratum of common charcoal in a powerful air furnace, which was then filled with equal portions of the two substances.

“As fast as the charcoal consumed, the Northampton coal was added, and at half past one, the furnace was completely filled with it, and two-thirds of it red hot. At four o’clock the coal was half consumed, and it continued burning until eleven o’clock at night.

“James river coal submitted to an experiment of the same kind, burned out in four hours.

“A fire was made with the Lehigh coal, in a smith’s forge, and two thick bars of iron were placed in it, and welded with great care, by the proprietor of the furnace.

“The smith, his journeyman, and by-standers were convinced, that the heat was much greater than that of James river coal.

“As the Virginia coal burns with flame and much smoke, a vast portion of this combustible substance, and the heat generated by it, is lost by passing up the chimney.

“The Lehigh coal promises to be particularly useful, where a long continued heat is necessary, as in distilling, or in evaporating large quantities of water from various substances; in the melting of metals, or in subliming of salts; in generating steam to work steam engines; and in common life, for washing, cooking, &c. *provided the fire places are constructed in such a manner as to keep up a strong draught of air.*”

A company is formed to clear the river Lehigh, in order to permit this coal to be brought to Philadelphia.

In Virginia, the richest mines of coal are found to be covered by beds of gravel and large pebbles. In England and France (according to St. Fond), the best coal is found under freestone. It may be useful to mention, that the lateral stragglings of coal must not be attended to when digging for it, but the perpendicular direction pursued: eighty or one hundred feet are sometimes to be penetrated, before the main body of coal will be found.



The burning of coal has been supposed to contribute to the healthiness of the cities of England and Scotland, where pestilential diseases prevailed much more formerly, before the forests were carefully preserved, than since the general introduction of coal. The city of Richmond, in Virginia, has been referred to, as an example of the febrifuge operation of the smoke of coal; the febrile ailments of its inhabitants having greatly lessened, since their fires were generally made of that material.

Dr. Mitchell supposes that coal acts in thus keeping away diseases, by the volatile alkali it affords in combustion, destroying the acidity, which, he imagines, exists in the atmosphere of cities, arising from the putrefactive processes continually going on.

Plumbago, or black lead, is found in the township of Sutton, New Hampshire. The specimens produced in Philadelphia are of a superior quality, quite free from impurities, and give a fine silvery stroke on paper.

*Gold....*In Cabarras county, North Carolina, gold was discovered, in 1803, in the bottom of a small stream, called Meadow Creek, which falls into Rocky River, a principal branch of the Pedee. The first piece of this precious metal was found by a boy who was exercising himself by shooting small fishes with a bow and arrow. The masses are of different sizes, from very small grains, to that of a mass weighing a quarter of avoirdupois hundred. This transcends, by far, a piece of native gold sent from Mexico to Spain, for the royal cabinet, on account of its extraordinary size. This Carolinian

specimen of 28 lbs. on being melted and refined, lost only 15 per cent. of its weight.

The face of the country in the neighbourhood of this Pactolean water is, for the most part, very uneven. The soil is barren and rocky. The strata of the rock are nearly vertical, and their direction is from north-east to south-west, like the other great strata throughout the United States. In the interstices and chinks between these strata of rock, over which Meadow Creek runs, the pieces of gold are found intermixed with sand. Flint (quartz), and a blue coloured rock (granite), are the prevailing kinds of rock hereabout. Another sort of earthy matter is irregularly scattered around, which is perfectly black, and covered with a substance resembling soot; as is also another kind of substance which looks like a mixture of tar and sand. Gold has also been discovered in the neighbourhood, in creeks.

A journey and survey of the auriferous region was taken during the summer of 1805, by William Thornton, M. D. of Washington. This gentleman has purchased 30,000 acres of the land in the neighbourhood of Reed's farm, in Cabarras county, where the first parcels of this precious metal were found. Under a persuasion that the tract contains a great quantity of gold, he has published proposals for forming an association, under the name of the "North Carolina Gold Mine Company."\* This is to consist of eleven hundred shares, of 100 dolls. each; which sum when paid to the agent, will be followed by a deed of conveyance to certain persons in trust for the company. They are then to get themselves

\* This Company has been formed.

incorporated, to search for gold, and manage their common concerns.\*

Specimens of this gold, are in the extensive cabinet of minerals belonging to the Philosophical Society of Philadelphia.

The amount of gold bullion received at the mint of the United States, at Philadelphia, from North Carolina, since the discovery of that metal is as follows :

	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>		<i>dolls.</i>	<i>cts.</i>	<i>mills.</i>
Gross	778	0	12.				
Stand.	804	18	23.				
				Value	14,310	18	5

Quality from 22 carats 0 3-4 grs.

To 22 carats 3 1-2 grs. fine.

The standard of the

United States is 22 carats fine.

This statement was politely furnished by Mr. Cloud, the melter and refiner of the mint U. S.

Gold has also been found in small quantity on the upper part of James river, and a single lump of four pounds weight, found near the falls of Rappahannoc river, yielded, according to Mr. Jefferson, 17 dwts.

In the county of Buckingham, between James river and Appomattox river, have been found, according to the same respectable authority, small lumps of pure gold, from the size of a pin's head to the size

\* Med. Repos,

of a hazle nut, to the value of several hundred dollars.

Very brilliant auriferous pyrites, which yielded one per cent of gold, 70 of iron, and 29 of sulphur, was found in Virginia, according to the analysis of Dr. Seybert of Philadelphia.

The following species of copper ore have been found in the United States.

1. Native copper in Lancaster and York counties.

“ Pieces of a very pure native copper have been also lately procured near Woodbridge, New Jersey. The matrix of the metal is a dark coloured or blackish kind of rock. This, however, is very brittle, and may be easily broken by an hammer, or even crumbled to pieces by the fingers. The metal, in its proper form, is dispersed through this earthy mass. In some places the copper is dispersed through every part in the form of specks resembling filings, which shine when the ore is broken; but a more common appearance is that of leaves, or plates of native copper, which are interspersed between the lamina into which the stone breaks, and present bright and beautiful surfaces. Some of these natural films, or sheets, are almost as thin and delicate as gold leaf, while others are so thick and extensive, as to resemble rolled copper or old sheathing. Now and then the workmen find more solid and ponderous masses. Efforts are making to discover more of this remarkable deposition of copper.”\*

2. Azure copper ore in Berks county Pennsylvania, and near the river Rariton in New Jersey. †

3. Malachite, in Berks county, Pennsylvania, and at Schuyler's mine in New Jersey,

† Med. Repos.

The Schuyler Copper Mine, situated between the rivers Passaic, and Hackinsack, near their confluence, in the state of New Jersey, was discovered about the year 1719, by Arant Schuyler. The ore was found where it appeared on the side of the hill, was easily raised, and as the policy of England, at that time, prohibited the establishment of smelting works or manufactories in her colonies, it was packed in casks, each containing about 400 weight, and exported, in its state of ore, to England. It appears by his books, that before the year 1731, Arant Schuyler had shipped 6933 casks, making about 1386 tons of raw ore, to the Bristol copper and brass company.

The ore of the Schuyler's mine yields, in each hundred pound of copper, from four to seven ounces of silver, and like most copper ores, a small portion of gold. At the time when pure copper was sold in England at 75 pounds sterling per ton, the ore of Schuyler's mine was shipped for England at New York, at 70 pounds sterling per ton. This proves the uncommon richness of the ore, and the small expense of converting it into metal. An offer has lately been made by Messrs. Bolton and Watt to purchase all the ore which can be raised, and to enter into contract for that purpose.\* These facts shew, that a proper knowledge and capital are only requisite to work the mines to great advantage.

Malachite is also found in Wescott's copper mine near Baltimore, in Maryland. At this place, grey

\* Report to Congress respecting the New Jersey copper, by Mr. Latrobe: and J. Hornblower's Letter, 1800.

copper is also abundant, and yields from 60 to 75 per cent. of copper.

*Iron...* This mineral is found in the most abundant manner in every State of the Union, of different qualities. Excellent steel, by the process of cementation, is made in Pennsylvania. In New Jersey, there is the greatest variety of iron ore. The bog ore in the lower parts of that country, near the sea-coast, is observed to grow. The cold sheer iron in that state is almost uniformly of a grey grain. The ore in the hilly and northern parts of the state is allowed to be equal to any in the United States. Mr. Jefferson remarks of the iron of some parts of Virginia, that its toughness is so great, that pots and other utensils cast thinner than usual, maybe safely thrown into, or out of, the waggons in which they are transported. Salt pans made of the same, and no longer wanted for that purpose, cannot be broken up in order to be melted again, unless previously drilled in many parts."

It is believed that this property is general in the iron of the United States. A considerable manufacturer of iron in Philadelphia informed the author, that he could not make an elbow to a stove pipe of the English sheet iron, as in lapping, it constantly broke. This defect was not observed in the sheet iron of this country, which of course was exclusively used for the purpose mentioned.

Magnetic iron ore is found in Berks county and Chester county Pennsylvania, at Scooley's mountain, New Jersey,\* and in the upper parts of Nieu-

\* For an account of the present state of the iron business in Pennsylvania, See *Domestic Encyclopedia*, vol. iii.

berg district near the Enorce river, South Carolina.\*

“ On the banks of the Ohio are found some very fine *marcasites*. They are black, less ponderous than the coal, and yet capable of giving fire when struck against steel. Their structure is irregularly foliaceous. In the fire, they yield a blue sulphureous flame, and calcine into a purple powder. The natives make use of them in blacking leather.” † Sulphurets of iron, are common in Pennsylvania.

*Lead....*The lead mines in Virginia (belonging to the American Lead Mine Company), for many years conducted by Stephen and Moses Austin, proprietors, are situated in latitude 36 degrees, north-west from Philadelphia 6 deg. 40 min. 100 miles south-west from James River; 45 miles west of the Alleghany Mountain; and on the banks of the great Kanhawa River, opposite the mouth of Apple Creek, in an elbow of which it is washed on the north and west about two miles in a semicircle. The whole of what is called the Lead Mine Tract, contains about 1400 acres. About one-quarter of a mile from the river, and along its banks, is a fertile plain, on which is laid out a town, known by the name of Austin Ville, on which place the Company's works are built. The lead ore is dug from the mines, smelted into pigs, and manufactured into shot and sheet lead on the same spot, a circumstance which is not to be met with in any other part of the world. The ore hills adjoining the works are about three miles in cir-

\* Drayton's View of South Carolina.

† Harris's Tour to the State of Ohio.

cumference, in all parts of which abundance of lead ore is to be found.

The present mode of digging the ore is to sink a shaft, beginning about two-thirds of the way up the mountain descending perpendicularly into the ground about 100 feet, at which depth the miners generally meet with water, which prevents them descending further, although they are yet above the level of the river more than 100 feet. The ore is often found at the top of the ground, but generally at about 50 feet from the surface, and continues to increase in quality and quantity as they descend.

The washed ore contains from 60 to 75 per cent. in lead, and thirty-four ounces of silver to one ton of lead. The Company have employed a number of the most experienced English workmen, all of whom agree, that these mines appear to have an inexhaustible quantity of ore; for having as yet only dug about 100 feet from the surface of the earth, they find the ore, as they go deeper, increases both in quantity and purity. This induces a belief, that if they could go from 200 to 300 feet, the ore would be found in much greater abundance, and superior in quality.

To facilitate the obtaining of ore, a level has been commenced on the south-west side of the ore mountain at the foot, and extending so as to pass through the centre of the ore beds about 250 feet below the top of the works, which when completed will open a subterraneous passage, sufficient for a waggon, about half a mile through the main body of the ore mountain, and will answer the double purpose of supplying ore, and draining the water from all the



works. These mines are capable of supplying all the United States with lead and shot, which readily sells from 35 to 40 pounds sterl. per ton. Congress have patronised them, by laying a duty of 5 pounds sterling per ton on all shot imported into these states. For the accommodation of the works and workmen, the Company have built a number of houses, stores, tradesmen's shops, furnaces, corn mills, and saw mills, &c.

The great road to Knoxville, Kentucky, and Tennessee, passes through this place, where there is a public tavern, ferry, and post-office, &c.

A very valuable lead mine was discovered a few years since on the Perkiomen Creek, near its junction with the Schuylkill, the ore of which yields 75 per cent.

Lead of the finest quality, as has been long known, abounds in the Illinois country; it is also found in the Cherokee mountains near the boundary line of South Carolina, according to governor Drayton. But the most extensive lead country within the bounds of the whole Union, is in Upper Louisiana. No less than ten mines are worked near St. Genevieve, on Grand river. The mineral is found within two feet of the surface, mixed with gravel, or imbedded in sand rock, or red clay under the rock. The masses of ore vary in size from one to five hundred lbs.\*

*Columbium*....In arranging some minerals in Sir Hans Sloane's Museum, now called the British Museum, Mr. Hatchett found a dark-coloured heavy

\* See a full account of these mines in the President's message to Congress of November 8, 1804.

substance which, though a small specimen, attracted his attention, on account of its having some resemblance to the Siberian chromate of iron, on which he was then making some experiments. On turning to Sir Hans Sloane's catalogue, he found the specimen described only as "very heavy black stone, with golden streaks." These streaks were only yellow mica. It had been sent from Massachusetts, by Mr. Winthrop, to Sir Hans, with a parcel of iron ores. It has been ascertained, that the specimen of this metal, upon which Mr. Hatchett's experiments were made, was taken from a spring of water in the town of New London, in the state of Connecticut.

The fountain is near the house where governor Winthrop used to live, and is about three miles distant from the margin of salt water, at the head of the harbour. This is the spot heretofore called Nautneague, which is in Connecticut, and not in Massachusetts. By the politeness of Francis Ben. Winthrop, Esq. of New York, the manuscript papers of his ancestor, relative to this place, and to the minerals he carried to Sir Hans Sloane, have been sent to the Historical Society of Massachusetts. By their care we hope every interesting particular concerning this substance, and the place where it was originally found, will be made known to the public. It will then be easy for gentlemen to visit the spot, and to collect other specimens of this singular ore.

Mr. Hatchett's experiments appear to him to shew, that this kind of ore "consists of iron combined with an unknown substance, and that the latter constitutes

three-fourths of the whole. This substance has proved to be of a metallic nature, by the coloured precipitates which it forms with prussiate of potash, and with tincture of galls; by the effects which zinc produces when immersed in the acid solutions; and by the colour which it communicates to phosphate of ammonia, or rather to concrete phosphoric acid, when melted with it." The new metal retains oxygen with great obstinacy, and is therefore very difficult of reduction. It is acidifiable; for the oxyd reddens litmus paper, expels carbonic acid, and forms combinations with the fixed alkalies. Still it differs, in many particulars, from the other acidifiable metals of arsenic, tungstein, molybdæna and chrome. And it is yet further removed from the newly discovered metals of uranium, titanium, and tellurium.

No complete disoxydation of it has as yet been effected. The pure metal, therefore, has not been seen, even by Mr. Hatchett himself. And if this discerning experimenter had succeeded in freeing the metal from its oxygen, the quantity he worked upon was so very small, that it would have been impossible to have gratified many of the curious by presents. At this time it is not known what quantity may exist in nature, nor to what economical uses it may be applied.\*

The *sulphuret of zinc*, or *blende*, has been found in the Perkiomen lead mine: a small specimen of it is in the collection of Dr. Seybert of Philadelphia.

\* Medical Repository, vol. vi.

*Antimony* has been found in New Jersey, and *Cobalt* on the west branch of the Susquehannah.

A large mine of *Manganese* has been discovered in the county of Shenandoah, in the great calcareous valley between the Blue Ridge, or South mountain, and the North mountain. Mines of this useful mineral have been discovered in other parts of Virginia, &c. It also abounds in Nova Scotia.

*Molybdæna*\* has been frequently found in the granitical rocks, which abound in the southern parts of the state of New York.

A large mass of *sulphuret of arsenic*, or *red orpiment realgar* was found some years since by some labourers in digging a cellar near Philadelphia. A specimen of it is deposited in Mr. Pealc's museum.

\* Med. Repos.... Is not this a very soft plumbaginous iron ore?

## MINERAL SPRINGS.

The various kinds of mineral and other springs in the United States, are 1. Springs which ebb and flow fresh water.

2. Springs producing common salt, in the interior parts of the country.

3. Medicinal Springs.

Of the *Ebbing Springs*, there is one upon the western side of the north fork of Holston river in the state of Tennessee, just below the Waggon ford at Ross's iron works, which may be considered as a specimen corresponding with all the rest of this kind, and resembling one at Griggleswick in Yorkshire, so far as its being situated beneath a high bank of limestone country, and in the nature of its fluctuations.

In the township of Hanover in this county, on a ridge of hills, are a number of wells, which regularly ebb and flow about six feet, twice in every twenty-four hours. These wells are nearly forty miles from the sea in a straight line.

Mr. Ferguson, in his lectures, under the head of intermitting, or reciprocating springs, has accounted for this phenomenon.

2d. The *Salines*, or *Salt Springs*, from which salt is made for common household purposes, are mostly found in places termed *salt-licks*, and the

water from which the salt is made by boiling, is chiefly procured by digging wells in such places. Nature may be said to have been peculiarly bounteous in this respect, to the interior countries of this favoured continent, in every part which is remote from the sea. They abound in many places near the lakes of Canada; in many places upon the waters of the Ohio river; throughout the country upon the extensive sources of the Great Sandy river; many rivers of Kentucky, and the Illinois, North-western Territory, and state of Tennessee, and in the Holstein settlements; besides various waters at a great distance, which form a confluence with remote parts of the Mississippi.

The working of these salt springs has hitherto been of very happy tendency, by accommodating the western settlements at about one-tenth of the price which has often been paid for this ponderous article, while it was brought several hundred miles from the seaports to the frontier counties.

The salt springs in the vicinity of the Onondago lake,\* state of New York, deserve particular notice. They do not stream in a horizontal direction from under its banks, but spring up, generally in marshes, at some distance from the hard land, and the vein of water, when searched for, is found to be directly downwards. By accurate experiments, the strongest springs were found to contain from 1-2 to 1-4 nearly of a pound of salt to the gallon of water. The manufactory of the salt is extensively carried on, and

\* See Dewitt's full account of this lake.

is even carried to the settlements on the Ohio.\* It is shipped on board flat bottom boats, and brought up the lakes Ontario and Erie, then overland ten miles to the town of Erie; thence to Waterford by a portage of fifteen miles to the navigation of French creek, which opens a cheap and safe conveyance to the towns on the Ohio.

3d. The *Sulphureous* and *Bituminous Springs* are perhaps somewhat indistinctly represented by the hunters, who frequent them most, and our accounts of the burning springs are perhaps in some degree confounded with both kinds. One of this description exists at or near the mouth of Elk river, in Kanhawa county, and one upon Coal river, in the same county.

4th. Of *Alum Springs*, there is one said to be very remarkable in the neighbourhood of Falmouth, on the Rappahannock, which is said to emit lumps of pure alum; a further description cannot now be given, and it is only thought proper now to mention it as an index for men of science, who may have leisure and inclination to examine the curiosity.

In the counties of Saffield and Tolland, Connecticut, there are some mineral springs which have acquired very considerable celebrity. But all the watering places of the northern states are eclipsed by the fashionable springs of Saratoga county, New York; which have been analysed by Dr. Mitchell and Dr. Scamen. The experiments of the last

\* In the spring of 1806, salt to the amount of 80,000 dollars, was brought to the countries bordering on the Alleghany and Ohio rivers, and consumed there.

author, being more complete, shall be used on the present occasion.

1. " These waters, in general, appear nearly transparent and colourless, and emit a great quantity of air. The vessel used to dip the water out of the rock, and also the bathing tub, soon gather an *ochry crust* upon their inner surfaces. Wherever these waters stagnate, around the springs, besides depositing the stony matter before-mentioned, they also soon become covered with a pellicle of a metallic splendour, reflecting variegated colours.

2. They diffuse a *subtle penetrating odour*, which is most particularly experienced by breathing in the orifice of the rock.

3. When drank, their first impression on the palate is agreeably *acescent*, succeeded by a nauseous saline taste; they afterwards give up acescent eructations, like fermented liquors, and which are no ways unpleasant.

4. The hydrometer stands at the same height in these, as in snow water.

5. Notwithstanding the discharge of air from these waters makes them appear to be in a continued state of ebullition, yet they are cold; the temperature, however, is not the same in all the springs; but seems to diminish in proportion to their briskness.

6. By the application of a gentle heat, these waters discharge a greater quantity of *air* in bubbles; it is upon this property that their use in raising bread depends, and for which purpose they are carried away in considerable quantities, daily, even sometimes to eight or ten miles distance; all that is ne-



cessary being merely to make the dough with flour and this water alone, and it is immediately ready to put in the oven.

A *lighted candle* let down in the crater of the rock was immediately *extinguished*, both blaze and wick, before it came within a foot of the surface of the water; the air obtained by agitating the water of this, as well as the other springs, was equally incapable of supporting combustion, as well as that collected from the bubbles, that were continually discharging from the different springs.

A *chicken* being immersed in this air, expired in three minutes. A kitten confined in it for one and a half minutes, appeared very flaccid and almost dead: yet, on being brought out, into free atmospheric air, its fleeting life was soon recalled through the medium of convulsions; being again put into the noxious gas, in fourteen minutes it was irrecoverably dead.

The air being made to pass through lime water, immediately rendered it very turbid.

It rendered a diluted tincture of turnsol of a red tinge by passing through it.

From the physical qualities mentioned, and from the above experiments, we may safely conclude that this air is the true *spiritus mineralis* of Hoffman, the *carbonic acid gas* of the French chemists, the *aerial acid* of Bergman, the *fixed air* of Priestley and Black, the *cretaceous acid* of Fourcroy, and what is generally known with the miners, by the name of *choak damp*; it is similar to the noxious gas, which rises up to the height of several inches in the famous

*grotto del cani*\* in Italy. It is this air which is so plentifully given out, during the spirituous fermentation, and is what gives that briskness to porter, and other malt liquors. Being united with the vegetable alkali, it forms our common potash, hence the reason why housewives are enabled, any time, at half an hour's warning, to furnish a well-raised cake, merely by mixing up the flour with a solution of potash and sour milk; here the acid of the milk, from a greater attraction, joins itself to the alkali, while the æriform acid being set at liberty, and assisted by the expansive power of heat, penetrates and puffs up every particle of dough.

From Dr. Seaman's experiments, it appears that one gallon of the waters contain, of

	cubic in.
Carbonic acid . . . . .	40
Ærated iron . . . . .	1.7
Lime, supersaturated with carbonic acid	38
A muriatic neutral salt . . . . .	34.6
A mineral alkali . . . . .	5.2
Sulphureous impregnation . . . . .	.

*Virtues....* They open the bowels, induce gentle perspiration, and increase the appetite. They may be taken in large quantities without producing any uneasiness or weight, excepting sometimes in delicate stomachs, they cause a sense of coldness, and prove emetic. They cure cutaneous disorders, dropsy, and intermittent fevers, and relieve paralytic affections. According to Dr. Waterhouse, they

\* See the 2d vol. of the Wonders of Nature and Art.

are deemed specific in difficulty of digestion, and relieve the stone and gravel, and hypochondriacal affections; he adds, that when first used they sometimes disagree with persons, creating uneasiness in the glands of the throat, until they begin to pass off freely by the kidneys; then they become agreeable. It is remarked that those who drink the water, lose much of their relish for wine and spirits.

*Bristol Springs*. ...In the town of Bristol, 20 miles north of Philadelphia, are chalybeate springs of a very powerful nature; and were formerly resorted to by the people of the middle states. They are particularly serviceable in complaints of the urinary passage, loss of appetite, and general debility of constitution, or in any disease unaccompanied by an inflammatory constitution. But the particular cases in which they have rendered as marked benefit, as in any other, are old affections of the liver. Some very remarkable cures have been effected in such complaints. It is much to be regretted that they cannot be brought again into general use.

In Virginia, there are several justly celebrated springs.

1. The *warm* and *hot springs* in the county of Bath (formerly part of Augusta county), near the first sources of James river, where it is called Jackson's river. They rise near the foot of the ridge of mountains, generally called the Warm Spring mountains, but in the maps, Jackson's mountain. The warm spring issues with a very bold stream, sufficient to turn a grist mill, and to keep the waters of its bason, which is 30 feet in diameter, at the

vital warmth, viz. 96 of Fahrenheit's thermometer.\* At present the spring, which is the bath, is surrounded by a stone wall, and covered, of an octagon shape, of which each side is 18 feet. The bath is filled in about 15 minutes to a height of seven feet. The situation of this bath is one of the most agreeable in these mountains. The air is excellent. The taste of the water is acidulous, but sulphureous, or more properly hepatic; the elastic fluid escaping through the water in bubbles, being no other air but hepatic: it makes some impression upon the nose, eyes, and breath; occasioning a small head-ach, which soon goes off. This air is very volatile, and evaporates when exposed in an open vessel, before it can be brought to the house. Hence invalids drink the water at the spring.

Dr. Rouelle says, that silver is not altered by being immersed in it; a proof that it contains no sulphur, and that upon evaporating 13 quarts, he obtained only two gr. of calcareous earth, half a gr. of selenite, and one grain of calcareous marine salt: the quantity of air he could not determine. He remarks, that the waters of Aix la Chapelle are equally devoid of sediment.

This water is commonly recommended as preparatory to the use of the others. It is rather relaxing to the stomach, when drank warm; but this effect may be avoided by filling a bottle with the water, corking it well, and permitting it to cool before using it. A neglect of this precaution has done great injury to persons of weak stomach and bowels, by producing dangerous diarrhœas.

\* Jefferson's Notes.

The use of these waters, externally and internally, has relieved many persons of cutaneous diseases, old ulcers, swelled glands, and bilious habits, rheumatism, and even gout. In the two last diseases, their salutary effects are almost incredible.

The following excellent directions with respect to the use of this water are given by the Rev. Dr. Green\* of Philadelphia, who visited this spring for his health in 1800, and was fully capable of the task of observing their effects, and of detailing the proper mode of using the waters.

“These waters should not be drunken in large quantities at first. A few glasses may be taken warm in the course of a day, especially by those of a bilious habit, or those who are subject to costiveness; but, in general, it is of much consequence to cool the water, before it is taken into the stomach.

“In using the water as a bath, a person should not at first, remain in the water more than a few minutes, and perhaps never beyond a quarter of an hour. By degrees, the time of remaining in, may be continued to 40 minutes, and may be used twice a day by those who have a firmness of the muscular system, or who are affected with obstinate rheumatism or gout.

“There is more danger of taking cold after using this bath, than after a warm bath of common water. To avoid cold, it is necessary to go from the bath immediately to a close room, and continue walking for a considerable time, or else to go to bed. When

\* See Med. and Phys. Journal.

the bath is used in the evening, perhaps, it is always best to go directly to bed. But as a most profuse perspiration, and of considerable duration, is the certain consequence of this, it ought not to be done more than a few times by any except those who have a fixed rheumatism, or gout. They, indeed, should do it daily; but as it weakens the system very much, it is certainly to be avoided where circumstances do not render it indispensable. On the whole, one bathing in the morning, without going to bed after it, is sufficient in most cases. And in all cases, to avoid a check of perspiration is to be the subject of constant attention. After coming from a warm room, exercise in the open air should be used for some time."

*Hot spring...* About six miles from the preceding spring, on following the road between the two high ridges, we come to the end of a valley, where the water, or brook, has cut its way through the *petrosilex*, down to Jackson's river. This bottom is covered by various materials of the destroyed mountains on each side, and offers all kinds of stones, as, freestone of different colours, the red kind especially, which is sonorous. There is plenty of the blue marble crossed by a white vein of *calcareous nephites*: all the surrounding substances are bottoms of old cavities filled up by fragments of all kinds of materials. The uppermost of the mountains is cut in different cones all round, which are mostly sterile, or at least vegetation is very poor all round about them, and in general there is little of water in proportion to the mountains.

The springs are upon a *hillock*, and come out

among mud and grasses of different kinds, some holes have been cut in the calcareous sediment upon the declivity, to make a kind of bath. The water springs through these sediments and is of a middle temperature, between half boiling and warm water, so as to support that heat very well on bathing in it. Whatever may be the heat of this water, it does not prove unfavourable to vegetation: there are plants growing in this water, and all the kinds of plants natural to springs in general, live as well in this as in a cool water. This may be attributed to the aerial acid, which probably keeps them from being overheated, because these waters contain more of this acid than they can retain in combination.\*

The temperature of these springs has frequently been ascertained. The hottest is 106 1-2 to 108 of Fahrenheit; the second is 102....Near to these is a chalybeate acidulous spring of the heat of 92. A limestone spring of 68, is within 100 yards of the hottest bath. There is a cold bath freestone spring of only 53 degrees.

“The *hot springs*,” according to Dr. Green, “are used in the same cases as the warm, especially where gout and rheumatism require a powerful sudorific. It is not easy to remain more than 15 minutes at a time in the hottest spring, and even with this, a degree of faintness is often felt. The patient, on coming out, is immediately wrapt in a blanket, and lies down in the bath house, and sweats most profusely. After this, he frequently goes in again, and the same process is used. The other springs are used as circumstances or inclination dictate.

\* Rouelle on Mineral Waters of Virginia.

“A cure is said to have been made by these waters, in some cases in which the warm springs have failed. Yet there is, certainly, a body and richness in the warm spring waters, that is not perceived in these, which are more like common water warmed or heated; though the bubbles of air, or gas, ascend in them in considerable numbers.”

*Sweet springs...* They rise on the north side, and at the bottom of a large mountain, in Monro county, formerly a part of Botetourt. According to Dr. Green, “they are 400 miles distant from Philadelphia, in nearly a south-west direction. The road to them is by the warm and hot springs, and from Staunton, is almost impassable for a carriage.

“These springs are usually considered as more medicinal than any other in Virginia, especially for drinking. They are very copious, so that a saw-mill is turned by them, at the distance of 200 yards from their source. The water rises perpendicularly out of the earth, forming an immense number of bubbles in its ascent.

“These waters when taken into the stomach, are sometimes emetic, especially when first used. Generally, however, they are not emetic. Their common operation is to prove gently purgative, and powerfully diuretic. They have an acidulous taste, (and hence are absurdly called sweet,) somewhat resembling the taste of weak cream of tartar punch. The temperature is 72 degrees of Fahrenheit’s thermometer.

“The water is seldom agreeable when first used, and almost as seldom fails to become highly so, when used for some time. The water is considered as



salutary in all cases of debility, in rheumatism of the chronic kind, in bilious and febrile habits, in an incipient consumption, where ulcers are not formed in the lungs (for they are highly tonic and stimulant), in all complaints of the urinary organs, and in ulcers."

The Rev. Dr. Madison says, "they have little or no smell, do not form an incrustation, nor do they leave a deposit upon standing many hours. Upon bathing in the morning, the skin has a soapy kind of feel, an effect not observed in the evening."

Dr. Rouelle says, "all the different substances composing the soil, are an indication to the naturalist, that he is in a country formerly altered by great revolutions." The nature and composition of the earth and stones, fossils, &c. prove that this part of the mountain, is older than any of the adjacent ones. Dr. Rouelle's analysis afforded epsom salt, or sulphate of magnesia, and some marine salt, and a very small quantity of iron.

*Red Spring*.....This rises in Botetourt county, within a mile of the sweet springs.

Dr. Rouelle informs us, "that this spring comes out of a kind of argillose calcareous rock; spreading from the mountain down the valley, which produces acidulous waters in many places.

"The water going through all these interstices, containing aerial acid, carries along parcels of the iron, which precipitates as soon as it comes in contact with the atmosphere, when another part of it remains in the water in solid combination with the acid. The superfluous iron settles upon any surrounding bodies, gives out its native colour, of a fine red crocus.

The water when drank has a light, acidulous, chalybeate taste, a little hepatic, common to all springs containing iron.

Dr. Rouelle found by analysis, that the active ingredients are aerial acid, magnesia, vitriol of magnesia, and iron.

It would be more acidulous than the other springs if the superfluity of acid was not taken up by the iron. If this did not happen, the water would be more acidulous than that of *Pymont*; and from the circumstance of its containing but one kind of air, it is rendered in Dr. Rouelle's opinion, well adapted to our constitution.

It is, moreover, not liable to be disturbed by the accidents of the valley, as putrefaction. It may be transported to any part of the United States in its purity, as Dr. Rouelle proved, by being well corked, and the cork covered with resin.

All the waters which come out of the meadow are of the same nature.

*Sulphur Springs....*“ These are distant from the hot springs about 32 miles; and are situated in Green-briar county, on the west of the Alleghany.

“ These waters have a strong impregnation of sulphur, so that flakes of it are easily gathered up from the sides of the rills that run from the spring. The water is extremely cold, being 63 degrees of Fahrenheit's thermometer.

“ The spring from which the sulphur water proceeds, issues from the ground into a marsh, and is not very abundant. It requires a number of hours to fill the bath.

“ These waters are more purgative than any in

Virginia. They are extremely useful in all bilious habits, and in a variety of cutaneous eruptions. They are taken into the stomach in very large quantities, and produce a very strong appetite. They so effectually penetrate the system, that a person who uses them freely, in drinking and bathing, smells strongly of sulphur, and communicates it even to his clothes, so as to be perceptible for a considerable time after leaving the springs; and turns silver watches black, when carried in the pocket." \*

Dr. Rouelle informs us, that this hepatic water comes out through spots, exhibiting strong marks of volcanic remains, and that the air has an action upon the eyes, nose and breath, and occasion a head-ach but which soon goes off. His analysis of a quart of the water yielded chiefly, of

	<i>grains.</i>
Calcareous earth . . .	12
Vitriol of magnesia . . .	5

He observes, that the hepatic air gives a strong impression of sulphur without yielding much of it; and advises a quart to be taken in the morning, and one at night, eating no supper.

*Red Sulphur Spring...* "This is in Monro county, about 40 miles from the sweet spring. It receives its name from the circumstance of the appearance of the sediment which the water deposits, and which is nearly of the colour of poke berries.

"The taste of the water indicates sulphur, but not in so great a quantity as the sulphur spring before-mentioned. This spring, which has not long been

\* Dr. Green.

discovered, is growing into great repute, both in pulmonary complaints, and in eruptions of various kinds. It is difficult to say what produces the red sediment in the water of this spring." According to Dr. Green, "it has no taste but that of sulphur."

*Berkley Springs.*..Are in the town of Bath and county of Berkley, on the river Patowmac, in a fertile country; and have, within a few years, been much frequented by invalids. The water is a little warmer than common water, and very soft. The waters prove diuretic, if the person walks about after drinking them. But if he remain quiet, they will purge very gently, and copiously. They have no particular taste: they have rendered much benefit to persons labouring under jaundice, or affections of the liver.

*New Mineral Spring in Virginia.*...Near Harrisonburgh a spring of water has lately been brought into notice by David Holmes, Esq. It rises on the land of Mr. Taylor, and is warmer than other springs in the same neighbourhood; for while springs of common water are at 54 deg. he affirms this to raise the mercury to 62 deg. Small bubbles of air are constantly issuing through the water, It is perfectly fair and transparent; and possesses no smell, and scarcely any taste. Dr. Harrison has made some experiments to prove this gas to be carbonic acid; but they seem more plainly to prove the presence of azotic, or rather, perhaps, atmospheric air. From the pleasant temperature of the waters, and the constant transmission of air bubbles through it, there seems to be a great similitude between it and the celebrated waters of Lebanon springs in New York. And if so, the invalids who frequent it, may expect

to have a bath both pure and invigorating, as the quantity of water is so considerable, as with an adequate fall, to drive an overshot mill wheel.\*

*Medicinal Springs in South Carolina....* Are situated on the western side of Pacolet river, in the upper country, and are said to be of much virtue in rheumatic, cutaneous, and some other complaints. Their waters are clear, and are supposed to be impregnated with sulphur and iron; but from processes taken to analyze them, the issue has not been such as to establish this supposition. By some they are said to taste and smell like the washings of a gun barrel; and by others they are denied having any extraordinary smell or taste. Another spring of the same kind is in the Catabaw lands, near the road leading from Landsford to Hill and Haynes' iron works: as is also one on a branch of the Waxaw creek, which is said to possess the same virtues as the Catabaw springs in North Carolina, and is therefore supposed to be impregnated with iron and sulphur.

A spring impregnated with iron and sulphur, proceeds from the eastern side of Paris's mountain. The water is perfectly clear, but smells strongly, like the washings of a gun barrel: this spring is very powerful in curing ringworms, and other cutaneous disorders; and for that purpose has been resorted to by the inhabitants. In the forks of Lynch's creek, a beautiful spring bursts and boils up from the earth, in a large stream, whose waters are of so salubrious a nature, that many persons resort to them in the

\* Med. Repos, Hexade 2d, vol. ii.

autumn for health. A similar one breaks out from a whitish clay, or chalky hill, in Richland district, near Rice creek, which is efficacious in curing ring-worms, cutaneous disorders, and rheumatisms. This last spring has been but lately known; it was, however, resorted to in the year 1801, by upwards of one hundred persons, who drank of, and bathed in its waters with success.

Another spring of some notoriety has been found within a few years past, boiling up from the base of the ridge of high land in the Orangeburgh district, which overlooks a branch of the little Saltcatcher Swamp. Many of these medicinal springs extend some hundred yards along the edge of the swamp, and their virtues were not known until about the year 1796, when they were first discovered by an huntsman, who was in pursuit of game. Fatigued with exercise, he arrived at the large spring; and was naturally induced to taste its waters. In doing so, he washed his hands, which were affected with ring-worms, and in a few days found they were much better. He renewed the visit, and in a short time was perfectly cured. Hence a reputation arose, inducing the neighbourhood to bathe in these waters for sores, lameness, and pains in the body; which sometimes proving successful, their virtues were magnified, and in the course of that year, they were visited by two hundred persons.

The residents of Springtown, formed a settlement near it, and find it so little different, either in taste or effect, from drinking water, that they constantly use it as such, without the smallest inconvenience.\*

\* Drayton's View of South Carolina.

In the county of Cape May, New Jersey, is a spring of fresh water which boils up from the bottom of a salt water creek, which runs nearly dry at low tide ; but at flood tide, is covered with water directly from the ocean, to the depth of three or four feet ; yet in this situation, by letting down a bottle well corked, through the salt water into the spring, and immediately drawing the cork with a string prepared for that purpose, it may be drawn up full of fine, untainted, fresh water. There are springs of this kind in other parts of the states.\*

\* Morse.

## CHAP. VI.

### NATURAL CURIOSITIES OF THE UNITED STATES.

IN the township of Chester, New Hampshire, on the main road from Newburyport to Dartmouth college, is a circular eminence, half a mile in diameter, and 400 feet high, called *Rattle Snake Hill*. On the south side, ten yards from its base is the entrance of a cave called the *Devil's Den*, in which is a room 15 or 20 feet square, and four feet high, floored and circled by a regular rock, from the upper part of which are dependent many excrescences, nearly in the form and size of a pear, and when approached by a torch, throw out a sparkling lustre of almost every hue.\* Many frightful stories have been told of this cave, by those who delight in the marvellous. It is a cold, dreary, gloomy place.

In the town of Durham, in the same state, is a rock, computed to weigh 60 or 70 tons. It lies so exactly poised on another rock, as to be easily moved with one finger. It is on the top of a hill, and appears to be natural.

In the towship of Atkinson, in a large meadow

\* No doubt they are stalactites, already mentioned in this work.



there is a small island of six or seven acres, which was formerly loaded with valuable pine timber and other forest wood. When the meadow is overflowed, by means of an artificial dam, this island rises with the water, to a height sometimes of 6 feet. Near the middle of this island is a small pond, which has been gradually lessening ever since it was known, and is now almost covered with verdure. In this place a pole 50 feet long has disappeared, without finding bottom. In the water of that pond there have been fish in plenty, which, when the meadow has been overflowed, have appeared there, and when the water has been drawn off, have been left on the meadow, at which time the island settles to its usual place.

In the north part of the township of Adams, in Berkshire county Massachusetts, not half a mile from Stamford in Vermont, is a natural curiosity which merits a description. A pretty mill stream, called Hudson's brook, which rises in Vermont, and falls into the north branch of Hoosuck river, has for 30 or 40 rods, formed a very deep channel through a quarry of white marble. The hill gradually descending towards the south, terminates in a steep precipice, down which, probably, the water once tumbled. But finding in some places natural chasms in the rocks, and in others wearing them away; as is evident from their appearance, it has formed a channel, which in some places is more than 60 feet deep. Over this channel, where deepest, some of the rocks remain, and form a natural bridge. From the top of this bridge to the water it is 62 feet; its length is about 12 or 15, and its breadth about 10

feet. Partly under this bridge, and about 10 or 12 feet below it, is another, which is wider, but not so long; for at the east end they form one body of rock, 12 or 14 feet thick, and under this the water flows. It is evident, from the appearance of the rocks, that the water, in some places, formerly flowed 40 or 50 feet above its present bed. Many cavities, of different figures and dimensions, but generally circular, are worn out in the rocks. One of these in the solid rock, is about four feet in diameter, and four or five feet deep; the rock is on one side worn through at the bottom. A little above the bridge, on the west side of the chasm, is a cave or little room, which has a convenient entrance on the north, and a passage out at the east. From the west side of this cave, a chasm extends into the hill; but soon becomes too narrow to pass. The rocks here, which are mostly white, though in some places clouded or streaked with other colours, appear to be of that species of coarse white marble which is common at Lanesborough, and in other towns of Berkshire county.

In the county of Montgomery, N. York, is a small, rapid stream, emptying into Scroon Lake, west of Lake George; it runs under a hill, the base of which is 60 or 70 yards diameter, forming a most curious and beautiful arch in the rock, as white as snow. The fury of the waters and roughness of the bottom, added to the terrific noise within, has hitherto prevented any person from passing through the chasm.

In the township of Willsborough in Clinton county, is a curious split rock. A point of a mountain, which projected about 50 yards into Lake Champlain, ap-

pears to have been broken by some violent shock of nature. It is removed from the main rock or mountain about 20 feet, and the opposite sides so exactly suit each other, that one need no other proof of their having once been united. The point broken off contain about half an acre, and is covered with wood. The height of the rock on each side the fissure, is about 12 feet. Round this point is a spacious bay, sheltered from the south-west and north-west winds by the surrounding hills and wood. On the west side are four or five finely cultivated farms, which altogether at certain seasons and in certain situations, forms one of the most beautiful landscapes imaginable. "Sailing under this coast for several miles before you come to the split rock, the mountains rude and barren, seem to hang over the passengers and threaten destruction. A water, boundless to the sight, lies before him; man feels his own littleness, and infidelity itself pays an unwilling homage to the creator. Instantly, and unexpectedly, the scene changes, and peeping with greedy eyes through the fissure, nature presents to the view a silver bason....a verdant lawn...an humble cottage...a golden harvest....a majestic forest....a lofty mountain....an azure sky....rising one above another "in just gradation to the amazing whole."\*

In the south-east part of Lake Erie, 20 rods from the shore, where the water is four feet and a half deep; is a curious spring which boils up from the bottom, and is inflammable when a brand is thrust into it, and proves a powerful emetic when drank. It has been named Ether spring.

\* Mr. Woolsey....Morse.

In the county of Rowan, near Salisbury, North Carolina, 200 miles from the sea, and 70 from the mountains, are two basaltic walls; one is 20 inches thick, 300 feet long, and 12 or 14 feet high; the top is about one foot below the surface, and flat: another is 40 feet long, four or five high, and seven inches thick.

“The *Tennessee*, called by the French *Cherokee*, and absurdly by others, the *Hogohce* river, is the largest branch of the Ohio; it is 600 yards wide at its mouth.

“The *Whirl*, as it is called, of the Tennessee, is in about latitude 35 deg. It is reckoned a greater curiosity than the bursting of the Patowmac, through the Blue Ridge. The river, which a few miles above is half a mile wide, is here compressed to the width of about 70 yards. Just as it enters the mountain, a large rock projects from the north shore, in an oblique direction, which renders the bed of the river still narrower, and causes a sudden bend; the water of the river is of course thrown with great rapidity against the south shore, whence it rebounds around the point of the rock, and produces the whirl, which is about 80 yards in circumference. Boats pass the whirl without danger or difficulty. Such is the situation of the shore, that boats ascending the river may be towed up. In less than a mile below the whirl, the river spreads into its common width, and except the muscle shoals, flows beautiful and placid, till it mingles with the Ohio.”\*

*Narrows of Connecticut River*.... There are five falls, and except at the first, which is about sixty

\* Morse.

miles from its mouth, the river is navigable throughout. In the northern parts, are three great bendings, called *cohosses*, about 100 miles asunder. Two hundred miles from the sound, is a narrow, of five yards only, formed by two shelving mountains of solid rock; whose tops intercept the clouds. Through this chasm are compelled to pass all the waters, which in the time of the floods, bury the northern country. At the upper *cohos*, the river then spreads 24 miles wide; and for five or six weeks, ships of war might sail over lands, that afterwards produce the greatest crops of hay and grain in all America. People who can bear the sight, the groans, the tremblings and surly motion of water trees and ice, through this awful passage, view with astonishment one of the greatest phenomena in nature. Here water is consolidated, without frost; by pressure, by swiftness, between the pinching, sturdy rocks, to such a degree of induration, that no iron crow can be forced into it: here iron, lead, and cork, have one common weight; here, steady as time, and harder than marble, the stream passes irresistible, if not swift as lightning: the electric fire rends trees in pieces with no greater ease, than does this mighty water. The passage is about 400 yards in length, and of a zig-zag form, with obtuse angles.

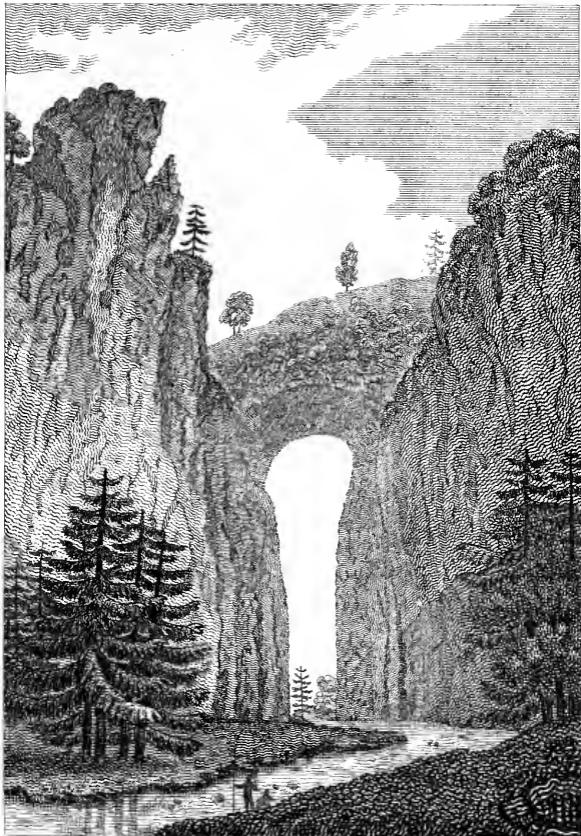
At high water are carried through this strait, masts and other timber, with incredible swiftness, and sometimes with safety; but when the water is too low, the masts, timber, and trees, strike on one side or the other, and though of the largest size, are rent, in one moment, into shivers and splintered like a broom, to the amazement of the spectators. The

meadows, for many miles below, are covered with immense quantities of wood thus torn in pieces.

No living creature was ever known to pass through this narrow, except an Indian woman, who was in a canoe, attempting to cross the river, above it, but carelessly suffered herself to fall within the power of the current. Perceiving her danger, she took a bottle of rum she had with her, and drank the whole of it; then lay down in her canoe, to meet her destiny. She marvellously went through safely, and was taken out of the canoe some miles below quite intoxicated.\*

The natural bridge over Cedar creek, Virginia, which gives name to the county of Rockbridge, extends across a cleft in a mountain, which seems to have been cloven through its length. The chasm or cleft is about two miles long, and in some places upwards of three hundred feet deep, but the depth varies. The breadth of the chasm also varies; but in every part it is uniformly wider at top than towards the bottom. The height of the bridge, from the water, is about 210 or 213 feet. The span of the arch, as measured by the Baron De Turpin of the French army, is ninety feet: the distance between the abutments at bottom is from fifty to seventy feet. The immense mass of rock which loads this arch is from forty to fifty feet thick. It is a limestone, and of course could not be the effect of a volcano: but, that the two sides of the chasm were once united, appears evident, not only from projecting rocks on the one side, corresponding with suitable cavities on the other, but also from the different strata of earth,

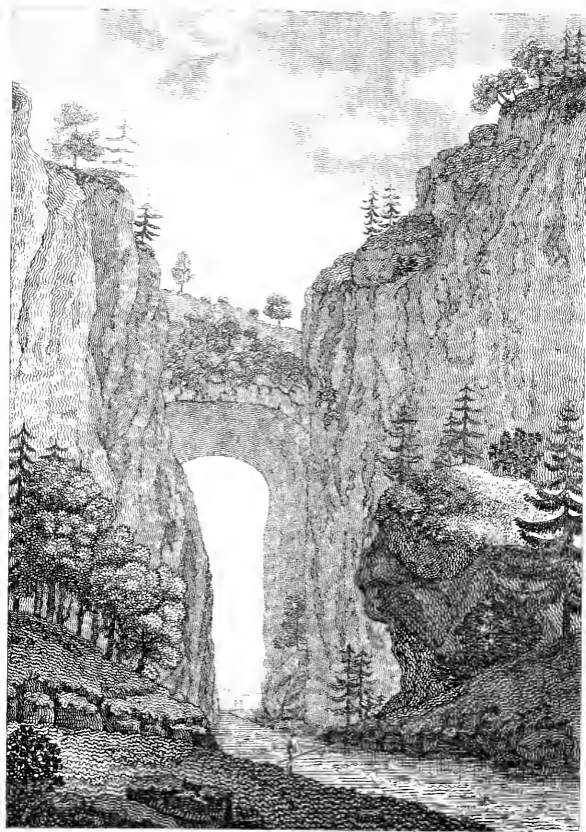
\* Carey's American Museum, vol. ix.



*Natural Bridge.*







*Natural Bridge.*



sand, clay, &c. being exactly similar from top to bottom on both sides. Several large trees grow upon the arch. The road leading to the bridge runs through a thick wood, and up a hill; which, being ascended nearly to the top, the visitor pauses for a moment, at finding a sudden discontinuance of trees at one side, but the amazement which fills the mind is great indeed, when, on going a few paces towards the part which appears thus open, he finds himself on the brink of a tremendous precipice. He involuntarily draws back, and stares around; "then falling (says Mr. Jefferson) on his hands and knees, creeps to the parapet, and peeps over it." The very edge of the bridge may be approached with safety, being protected by a parapet of fixed rocks. At the distance of a few yards from the bridge, a narrow path winds along the sides of the fissure, amidst immense rocks and trees, down to the bottom of the bridge. From this spot the prospect is truly grand: besides this view from below, the bridge is seen to very great advantage, from a pinnacle of rocks, about fifty feet below the top of the fissure; for here not only the arch is seen in all its beauty, but the spectator is impressed in the most forcible manner with ideas of its grandeur, from being enabled at the same time to look down into the profound gulf over which it passes.

The Ararat, or Pilot mountain, about sixteen miles north-west of Salem, in North Carolina, draws the attention of every curious traveller in this part of the state. It is discernible at the distance of sixty or seventy miles, overlooking the country below. It was anciently called the Pilot, by the Indians, as it serv-

ed them for a beacon, to conduct their routes in the northern and southern wars. On approaching it, a grand display of nature's workmanship, in a rude dress, is exhibited. From its broad base the mountain rises in easy ascent, like a pyramid, near a mile high, to where it is not more than the area of an acre broad; when, on a sudden, a vast stupendous rock, having the appearance of a large castle with its battlements, erects its perpendicular height to upwards of three hundred feet, and terminates in a flat, which is generally as level as a floor. To ascend this precipice there is only one way, which, through cavities and fissures of the rock, is with some difficulty and danger effected. When on the summit, the eye is entertained with a vast delightful prospect of the Apalachian mountains, on the north, and a wide extended level country below, on the south; while the streams of the Yadkin and Dan, on the right and left hand, are discovered at several distant places winding through the fertile low grounds, their way towards the ocean.\*

\* Morse. A rock of granite similar to the above is at the Cape of Good Hope: it is 400 feet high, and half a mile in circumference: it is called the Pearl Diamond. See Parkinson's Organic Remains.

## CATARACTS, CASCADES, CAVERNS.

Under this article we mention the falls of *Powwow* river, which rises in New Hampshire, and falls into the Merrimack between Salisbury and Amesbury in the county of Essex. At these falls, the descent of the water, in the distance of 50 rods is 100 feet, and its passage carries one bloomery, five saw mills, seven grist mills, two linseed oil mills, one fulling mill, and one snuff mill, besides several wheels, auxiliary to different labours. The rapid fall of the water....the dams at very short distances crossing the river....the various wheels and mills, arising almost immediately over one another...and the very irregular and grotesque situation of the houses and other buildings on the adjoining grounds, give this place a romantic appearance, and afford, on the whole, one of the most singular views to be found in this country.\*

*Passage of the Hudson, down Glenn's Falls....* About fifty miles north of Albany, near Kingsbury, is a very picturesque and magnificent scene. The whole waters of the Hudson fall down a prodigious steep. A solid bed of lime-stone crosses the river a little above the place where it descends. The rock there divides itself into so many distinct masses, that when the water is low or scanty, it rushes through four different chasms between the calcareous walls. When the river is swelled with rains, all these fissures and interposing mounds are covered, and the

\* Morse.

distinction of currents is in some measure lost for about half the distance of their irregular descent. The streams there assume a new modification, and arrive at the bottom by three principal channels. Over these three streams there are many bridges, affording to travellers the singular spectacle of beholding the roaring and foaming cataract beneath them, at the very place where they cross. From the highest part of the largest of these, the distance to the water beneath is about thirty-five or forty feet.

The masses of limestone, which direct the courses of the waters, and separate their currents, are disposed in horizontal strata as regularly as if they had been laid by a level. In several places they are very abrupt, and terminate with the perpendicularity of a wall. Between them are profound openings, through which the torrent forces its way. At the bottom all the streams re-unite, and proceed in conjunction toward Fort Edward.

This cataract is uncommonly variegated and wild, insomuch that it is impossible to give any tolerable description of it. But all persons who have a taste for grandeur and rudeness in natural scenery, are highly delighted with the prospect which it affords.

The central mass of limestone forms an island of such height, as never to be overflowed entirely. A pine tree is growing on the summit of it; and between this summit and the water level there are several long and large excavations in the rock, through which spectators may pass, under natural arches, and obtain advantageous views of this noble work of nature. From this insulated spot, too, can be seen

to great advantage, the saw-mills, grist-mills and forges, which are moved by portions of the water led off from the main channel of the river to its two sides, and by their well adapted machinery are performing daily a great amount of work, in wood, grain and iron.

The highest fall made by one of the four currents has a great resemblance to that of the Passaic. The water pitches obliquely into a terrible chasm; after rushing violently through the narrow channels, it soon grows calm in the great and deep bason which receives it.

A few miles below *Glen's Falls*, in the *Hudson*, about half a mile from the ordinary travelling road, may be seen a cataract, having considerable resemblance to the upper fall of the Potowmac, fourteen miles above Georgetown in Maryland. This is picturesque and grand, but in a style remarkably different from the preceding; though, like it, the scene is eminently deserving to be beheld by persons of curiosity and taste.

A branch of *Kadir's Kill*, New York, after a pretty rapid descent along its bed, first pitches more than two fathoms, and then running a few rods further, falls in a most beautiful sheet down a steep, which measured a little distance off one hundred and fifteen feet. At no great distance below, the water again falls more than one hundred feet, and continues descending with such violence and rapidity along its channel, that the whole descent, has been estimated within one quarter of a mile, to be four hundred feet. The going down and coming up the rocks which form the sides of the valley are so

difficult, that the bones of bears and deer, are said to be frequently met with below them, owing probably to the animals having descended to drink, and, not being able to return, starved to death there. The face of the rocks is worn somewhat circular, and is considerably excavated below. The stream is of course, precipitated to the bottom without impediment, and very much divided into spray, by so long a passage through the air. Between the fallen water and the rock, the space is covered with verdure, and the whole distance from the bottom to the top is beautified with plants, which find room for their roots between the crumbling layers and among the mouldering parts of the rock. The mosses, maiden hairs, strawberries, shumacks, and spruces, which have fixed themselves here, give to the scene a very lively and pleasant air; and, owing to the abundant evaporation, there is so little heat prevalent at this place, that snow remains unmelted until near the middle of June, between the descending torrent and the rock from which it is projected. Both sides of the valley through which the water hastens away, are composed of steep and lofty rocks, supporting huge trees, chiefly of the evergreen kind; and along this there is an extensive view of the mountain sides towards the east. Among the fragments, which, by the undermining of the water below, are from time to time, breaking off in masses of many tons weight, and rushing to the bottom, and some of which are now hanging almost in equipoise, just ready to drop; the most luxuriant vegetation keeps out of sight the bare and disordered appearance, and, in a good degree, conceals behind its perpetual foliage, those ra-



inous and wreck-like appearances of nature. It unluckily happened when we were there, the quantity of water was small, but from the size of the logs drifted down, and left by the subsiding freshets among the rocks of the channel, there was no difficulty in imagining how great and impetuous the flow must sometimes be, that could float such pieces of timber along, and split them to shivers in their fall. From the edge of the bank, a little way off, where several large trees afford a firm hold, securing the spectator from slipping, a tolerable view can be obtained. There is something in it exceedingly picturesque, which, under the pencil of an artist, would afford a sketch possessing much novelty and peculiarity.

Another cataract, called *Michell's Falls*, is on the *Kader's Kill* itself. Exactly at the precipice the mountain seems to have been rent asunder, and, receding to the right and left, leaves between its enormous and craggy piles, a deep and dreadful opening. This takes a turn towards the left, and winding along in that direction, the view is soon intercepted. From a point of elevated rock, a little to the left of the falls, the whole bend is full in prospect, extending like a vast amphitheatre from its commencement, just on the right hand, to its termination, by the intervening objects at the other extreme. A border of hemlocks (*Pinus Abies Canad.*) and pines adorns the brow of the rocks; a like covering, mixed with laurels (*kalmia major*) and white cedars (*thuya occidentalis*) down the steep, impart to them perennial greenness; and the whole distance thence to the bottom of the chasm, is skirted

with similar trees and shrubs. Whether you look down, or round, the prospect, though not extensive, is sublime and awful. The water first falls one hundred and sixty-two feet perpendicular, into a large bason or excavation, in the rock below, of about forty yards in diameter; then issuing from this pool, it suffers a second fall of eighty feet more, making in the whole, a descent of two hundred and forty-two feet. To look down from the projecting layer of stone which forms the brink, is too dangerous for the most steady head.

Upon the whole, however, it may be observed, that though the quantity of water is less, these falls are more worth a sight than those of Passaick, the Cohoes, or the upper ones of the Mohawk.\*

The *Cohoes* in the *Mohawk* river also deserves notice among the cataracts of the American rivers. The river pours over a rock which nearly extends across the channel, 900 yards, and about thirty feet high. These falls are about three miles from its entrance into the Hudson river.

The *falls* of the river *Passaick*, N. Jer. are justly deemed one of the chief objects to which the attention of strangers is directed. The river is about 40 yards wide, and moves slowly on until it arrives within a small distance of a rock, crossing the channel, and in which there is a deep cleft. Down this the river descends in one sheet, 70 feet perpendicularly: one end of the cleft is closed, and at the other the stream rushes out with great violence, and is received into a large bason, whence it takes a winding course

\* Dr. Mitchell.

through rocks, and spreads into a broad smooth stream.

The *Wind Gap*, and *Water Gap*, as they are called, or the openings through the Blue or Kittatinny ridge or mountain, above Easton, are appearances too curious to be omitted in a work of the present nature. The *wind gap* is about a mile broad,\* and the height of the mountain at the gap is about 100 feet above the present bed of the river. Mr. Charles Thompson,† supposes, that the place where the Delaware now flows through the mountain, was not its original course, but that it passed through the wind gap. "To this opinion, however, the height of the mountain in the gap, compared with the level of the country, on either side, seems to be a decisive objection."‡

"The *Water Gap* is a majestic scene. On either side it is of vast height; the disrapture is not of greater extent than merely to afford a passage for the river, and the faces of the mountain are abrupt almost to a perpendicular. It is only within a few years, that a very bad road has been cut out of this extreme declivity, through the gap; and there are here indications, which without much aid of fancy, might induce a belief, that this aperture was not originally formed by nature, but that the waters collected behind the mountain, have forced here a passage for themselves by rending the mountain asunder. But to this opinion there is also a powerful objection,

\* This refers to the top of the mountain, the bottom of the gap or undulation in the mountain, is not a quarter of a mile broad.

† The venerable secretary of Congress during the whole of the American war.

‡ Samuel Sitgreaves, Esq. of Easton.

arising from the previous course of the river, which is not at a right angle to the mountain, but which for 40 miles is parallel with it, and at the base of it; and which here turns suddenly to the left without meeting anything of equal magnitude with the mountain to obstruct its first direction."\*

The only remarkable cascade in Virginia, is that of the *Falling Spring*, in Augusta. It is a water of James River, where it is called Jackson's river, rising in the warm spring mountains, about 20 miles south-west of the warm spring, and flowing into that valley. About three-quarters of a mile from its source, it falls over a rock 200 feet into the valley below. The sheet of water is broken in its breadth by the rock in two or three places, but not at all in its height. Between the sheet and rock, at the bottom, you may walk across dry. This cataract will bear no comparison with that of Niagara, as to the quantity of water composing it; the sheet being only 12 or 15 feet wide above, and somewhat more spread below, but it is half as high again.

The passage of the Potowmac through the Blue Ridge is perhaps one of the most stupendous scenes in nature. You stand on a very high point of land. On your right comes up the Shenandoah, having ranged along the foot of the mountain a hundred miles to seek a vent. On your left approaches the Potowmac, in quest of a passage also. In the moment of their junction they rush together against the mountain, rend it asunder, and pass off to the sea.† The first

\* Samuel Sitgreave, Esq

† The water does not descend perpendicularly, excepting in one part close to the Virginian shore, where the height is about thirty

glance of this scene hurries our senses into the opinion, that this earth has been created in time, that the mountains were formed first, that the rivers began to flow afterwards, that in this place particularly they have been dammed up by the Blue ridge of mountains, and have formed an ocean which filled the whole valley ; that, continuing to rise, they have broken over this spot, and have torn the mountain down from its summit to its base. The piles of rocks on each hand, particularly on the Shenandoah, the evident marks of their disruption and avulsion from their beds by the most powerful agents of nature, corroborate the impression. But the distant finishing which nature has given to this picture, is of a very different character. It is a true contrast to the foreground. It is as placid and delightful as that is wild and tremendous. For the mountain, being cloven asunder, presents to the eye, through the cleft, a small catch of smooth blue horizon, at an infinite distance, in the plain country, inviting you, as it were, from the riot and tumult roaring around, to pass through the breach, and participate of the calm below.\* Here the eye ultimately composes itself; and that way too, the road actually leads. You cross the Potowmac above the junction, pass along its side through the base of the mountain for three miles, its terrible precipices hanging in fragments over you,

feet, but comes rushing down with tremendous impetuosity over a ledge of rocks, in several different falls. The best view of the cataract is from the top of a pile of rocks about sixty feet above the level of the water, and which, owing to the bend in the river, is situated nearly opposite to the falls.... Weld.

\* The fine view here alluded to, is only seen from the top of the mountain.

and within about twenty miles reach Fredericktown, and the fine country round that. This scene is worth a voyage across the Atlantic. Yet here, as in the neighbourhood of the natural bridge, are people who have passed their lives within half a dozen miles, and have never been to survey these monuments of war between rivers and mountains, which must have shaken the earth itself to its centre.

The height of the mountains has not yet been estimated with any degree of exactness. The Alleghany being the great ridge which divides the waters of the Atlantic from those of the Mississippi, its summit is doubtless more elevated above the ocean than that of any other mountain. But its relative height compared with the base on which it stands, is not so great as that of some others, the country rising behind the successive ridges like the steps of stairs.\*

The following brief description of a cave, vulgarly called the "*Devil's Hole*," lying in Durham township, Bucks county, Pennsylvania, and about fifty miles north of Philadelphia, may not, perhaps, be unacceptable to some of our readers. It certainly ranks among the natural curiosities of this country, and deserves greater publicity than that which has been given it by historians.

The entrance into this grotto is about one hundred yards west of the Delaware river; and from one hundred and fifty to two hundred, north, from the point of land at the confluence of Durham creek and said river. The height of the eminence inclosing the cavity, is from two hundred to two hundred and thirty feet above the level of the circumjacent land,

\* Jefferson's Notes.

From the pathway of the entrance to the top of the rock above, the measurement is upwards of forty feet. Three or four persons may easily enter abreast; but no more, as the mouth, though wide enough for admitting a great number, is rendered inaccessible by a ledge of rocks running partly across. The cave is naturally divided into three grand apartments, out of each of which into the other, the descent is steep, caused also by rocks, prominent and jutting. After a descent of about thirty feet, the first apartment or chamber, displays its greatest height and width; of which it is not an easy matter to form a true estimate, on account of the irregularities in the vault, occasioned by deep searching interstices and low dependent stone. A faint idea of its dimensions may, however, be formed from the following statement.

	Length.	An average	
	Ft.	Width.	Height.
		Ft.	Ft.
First apartment	90	33	20
Second do.	96	40	20
Third do.	93	16	17
<hr/>			
Length of the whole cave to the waters' edge at the bottom.	279		
Breadth of the water	20		
<hr/>			
Total	299		

October 12th, in the open air, the thermometer stood at 64 deg., at the partition between the first

and second apartments it descended to 59 deg., between the second and third apartments it sunk to 54 deg., which it preserved throughout the whole of the innermost chamber.

August 5th. The thermometer was very differently affected by the enveloped air, standing then, in the open, at 78 deg., and at the lower end of the first chamber at 54 deg., but at the farther end of the lowermost, rose to 63 deg.

The rock encompassing the cavern is entirely limestone, through which, in many places, there is a perpetual percolation of water.

By supposition, the descent, in a right line, forms an angle of 40 deg. with the horizon.

At the bottom is a basin of excellent water, which measured twenty feet to the place where it came into contact with the rock, terminating the cave as far as it has been, or can be explored. Beyond the meeting of the rock and water there is a conduit running farther into the earth than could be measured with a long pole; and is undoubtedly continued, though it may ramify into many subordinate channels before it advances to the beds of the river and creek. The many springs on the verges; the proportionable rising and falling of the water contained in the cavern, with the flowing of the waters in the river and creek, demonstrate their connection; and prove the surface of the one to be on a level with the other. When there is a high fresh in the river, the lowest chamber is nearly filled.

At the partition between the first and second apartments, a small branch of the cave, thirty-two feet in length, seeks a course in an easterly direction;



and so wide as to permit, in some places, two persons to pass....From this branch are two others, still smaller, the one extending twenty-two feet north, the other fourteen south; and, in width, admitting one person.

At first, a solitary gloom impresses the spectator; while a ray of light makes its way among the indentures of the ingulphing rock, faintly touching the sides and roof of the lower abyss, but just so as to display the awful grandeur of the scenery. Another opening is perceived, leading into a still lower region, where light appears to have, comparatively speaking, no dominion. A sound made above is heard reverberating, and dying below, as if it was in an unfathomable deep. There also is an amazing contrast of light and darkness; the one strikes terror, the other creates joy. However, although darkness in a natural sense is fancied to be an instrumentality of misery, yet it is a consoling reflection to know in a spiritual sense, that light and darkness, as well as heat and cold, height and depth, are but relative terms; and that, with that BEING, who is the Author of nature, there is neither the one nor the other....All are alike to him, who

“Lives thro’ all life, extends thro’ all extent,  
Spreads undivided, operates unspent;  
To him no high, no low, no great, no small,  
He fills, he bounds, connects and equals all.”

The following account of the cave on the Swatara river, is given in the words of the late rev. P. Miller of Ephrata.\*

\* Trans. Amer. Phil. Soc. vol. 2.

It is situate on the east side of Swatara, close to the river. Its entrance is very spacious, and there is somewhat of a descent towards the other extremity. The upper part is like an arched roof, of solid limestone rock, perhaps twenty feet thick. On entering, are found many apartments, some of them very high, like the choir of a church. The water drops incessantly from the roof upon the floor; by which, and the water petrifying as it falls, pillars are gradually formed to support the roof. I saw this cave about thirty years ago, and observed above ten such pillars, each six inches in diameter, and six feet high; all so ranged that the place inclosed by them resembled a sanctuary in a Roman church; and I can assure you, that no royal throne ever exhibited more grandeur, than the delightful prospect of this *lusus nature*. A piece of stone, issuing out of the roof, when struck sounds like a bell.

Some of the stalactites are of a colour like sugar candy, and others resemble loaf sugar; but it is a pity that their beauty is now almost destroyed by the country people. The water, as it falls, runs down the declivity; and it is both wholesome and pleasant to drink, when it has discharged its petrifying matter.

It is remarkable, that we found several holes at the bottom of the cave, going down perpendicularly, perhaps into the abyss, which renders it dangerous to be without a light. At the end of the cave there is a pretty run, which takes its course through part of it, and then loses itself among the rocks; here is also its exit, by an aperture which is very narrow. Through this the vapours continually pass outwards,

with a strong current of air; and at night, these vapours ascending, resemble a great furnace."

In the limestone country of Virginia there are many caverns of very considerable extent. The most noted is called Madison's Cave, and is on the north side of the Blue Ridge, near the intersection of the Rockingham and Augusta line with the south fork of the southern river of Shenandoah. It is in a hill of about two hundred feet perpendicular height, the ascent of which on one side is so steep, that you may pitch a biscuit from its summit into the river which washes its base. The entrance of the cave is in this side, about two-thirds of the way up. It extends into the earth about three hundred feet, branching into subordinate caverns, sometimes ascending a little, but more generally descending, and at length terminates in two different places, at basins of water of unknown extent, and which appear to be nearly on a level with the water of the river. It is probably one of the many reservoirs with which the interior parts of the earth are supposed to abound, and which yield supplies to the fountains of water, distinguished from others only by its being accessible. The vault of this cave is of solid limestone, from twenty to forty or fifty feet high, through which the water is continually exuding. This, trickling down the sides of the cave, has incrustated them over in the form of elegant drapery; and dripping from the top of the vault, generates on that, and on the base below, stalactites of a conical form, some of which have met, and formed massive columns.

Another of these caves is near the North Mountain, in the county of Frederick. The entrance into

this is on the top of an extensive ridge. You descend thirty or forty feet, as into a well, from whence the cave then extends, nearly horizontally, 400 feet into the earth, preserving a breadth of from 20 to 50 feet, and a height of from 5 to 12 feet. After entering this cave a few feet, the mercury, which in the open air was at 50 deg. rose to 57 deg. of Fahrenheit's thermometer.

At the Panther Gap, in the ridge which divides the waters of the Cow and Calf Pasture, is what is called the Blowing cave. It is on the side of a hill, and emits constantly a current of air of such force, as to keep the weeds prostrate to the distance of 20 yards before it. This current is strongest in dry frosty weather, and in long spells of rain weakest. Regular inspirations and expirations of air by caverns and fissures, have been probably enough accounted for, by supposing them combined with intermitting fountains, as they must of course inhale the air while the reservoirs are emptying themselves, and again emit it while they are filling. But a constant issue of air, only varying in its force as the weather is drier or damper, will require a new hypothesis. There is another blowing cave in the Cumberland mountain, about a mile from where it crosses the Carolina line. All we know of this is, that it is not constant, and that a fountain of water issues from it.

In the county of Monroe, near the Kanhawa, there is a remarkable cave, extending entirely through the base of a high mountain, the distance of upwards of two miles. Persons have passed from one side of this mountain to the other through this subterraneous

passage. The earth on the bottom of this cave is strongly impregnated with nitre; and saltpetre in any quantity may be made from it.\*

In the Summer of 1806, another cave was discovered near Madison's, but much more extensive. Sparry concretions, some of which are of very great size, and of many forms, abound in it. One of the specimens in the museum of Mr. Peale, resembles a mushroom, and other is very like a cauliflower.

About the distance of fourteen miles, south-west from Esopus, in Ulster county, New York, there is a cavern, which is more remarkable, and the dimensions greater, than any other yet explored in this country. It is but a small distance from the habitation of Mr. Z. Rosekrans, by whose servant it was discovered a few years ago.

The cavern is estimated to be three quarters of a mile in length. The breadth varies from twenty to forty feet. Its height is at least twenty feet. A stream which issues from the mountain to the north-west, turns two mills before it runs through it. It emerges about a quarter of a mile from the Rondout creek, and falls into it. The passage into the cavern is a considerable distance from its western extremity, and is very narrow, and so perpendicular that there is some difficulty in descending. It is evident, from the forms of the blocks of stone which lie under the opening, that it has been made by the splitting of the rock, caused by the expansion of the ice in its cavities. On the sides and roof of the cavern, which is composed of dark coloured limestone, are seen impressions of shells, calcareous spar, and

\* Jefferson's Notes on Virginia.

beautiful white and yellow stalactites, of different size and shape; some of which have the appearance of a honey-comb. The roof is flat, and appears as if it had been cut by a chisel. At the distance of a few rods from the opening, on the west side, the cavern divides itself into two vaults of nearly the same dimensions. Near the eastern extremity there is a fall of water, of unknown depth, beyond which no person has yet ventured. The common eel, and a species of the sucker, have been caught in this subterraneous stream. Fahrenheit's thermometer stood at 65, when in the common atmosphere it was 57. Rotten timber is seen in the chinks of the rock, which doubtless engenders impure air. The water oozes and drops from the roof, and occasions so great a mistiness, that, at a small distance, the flame of a candle is little more than perceptible. After violent rain, the cavern is not capacious enough to receive all the water of the stream: that which it cannot admit rushes past the inlet, and runs in the direction of the cavern. It crosses the road, and the body of water is sometimes so great that it is troublesome to travellers. The dry bed of the stream is very visible, as it is a smooth rock, from which a shallow soil has been washed away.

In some of the mountainous parts of Virginia, Kentucky, and Tennessee, the strata consists chiefly of limestone. These vast masses of calcareous matter contain numerous caves: these are of various shapes and sizes; for, while certain of them extend but a few rods, there are others which may be traced, by aid of candles, for half a mile or more. From a low and narrow entrance the caverns sometimes

enlarge to a great width and height, and wind and branch curiously through the rocks. Generally they are dry, though a few of them are penetrated by rains or crossed by brooks.

These cavities in the calcareous mountains are famous for affording an earthy substance, which is useful in the manufacture of salt petre. This earth lies in the bottom of the caves, and its thickness is from two to twenty feet. It is said to resemble black mould or soil. Crystals of salt petre can be frequently seen in it as soon as it is carried out to the light. But if this material be united with a sufficient quantity of pot ash prepared on the spot from burned wood, there is produced a copious supply of salt petre. It is computed that there are several of these dark recesses among the limestone mountains, which will afford ten thousand pounds each of this neutral salt, crystallized and fit for market.

When the earth has thus been leached with the vegetable alkali, and deprived of its acid, it is common with the workmen to replace it. For experience has taught them, that, if put back again into its former situation, it renews its salt petrous quality in about three years. Being impregnated, after lying that duration of time, with another supply of acid, it is fit to be treated once more with wood ashes, for the purpose of forming a second portion of salt petre. There seems to be no end to the possible repetition of these processes, of extracting and re-generating the acid ingredient of the salt.\*

Marked by a bold and singular appearance, the precipice of the Table mountain, called the *Lover's*

\* Dr. Mitchell.

*Leap*, is deservedly ranked as one of the greatest natural curiosities of South Carolina.

From the valley below, it looks like an immense wall, stretching up to heaven, presenting its naked, but unchangeable front, ever to the influence of the season. This precipice descends from the summit of the mountain, a depth of near four hundred yards, apparently of solid rock. From its base to the valley, over which it stands, is probably four hundred yards more. Below this proud eminence, rests the whitened bones of various animals, whose incautious steps led them too near the edge of this desperate height. And above, its summit is often enveloped with heavy clouds. Towards the base of this precipice, and in many parts of the mountain, are caverns, which attract the notice of travellers.

The Great Flat rock of South Carolina, is approached through a valley, at the head of which it is situated. It is so called to distinguish it from the Flat rock on the road from Camden to Lancaster court-house; and it consists of a huge body of solid rock, covering at least fifty acres of land. On the side of the valley to the west, it is elevated above the tops of the trees, and is inaccessible; to the east, the rock is not so high; and a little up the side of it are two caverns. The cavern having the smallest entrance, is said afterwards to widen considerably; and to extend farther. The walls of the cavern are highly polished.\*

*Flower under ground.* In May, 1800, a labourer, in digging a mill-race on the Opeckon creek, a branch

\* Drayton's View of South Carolina.



of the river Potowmac, in Virginia, through a rich bottom of low ground, covered with trees, particularly oak, poplar, and walnut, several of which trees were from three to four feet through, between five and six feet under ground, chiefly a loamy, solid clay, discovered a blossom, not in full bloom, nearly of the colour of the lilac. On examination it proved to be a similar flower to one that grew upon the surface of the ground, near the place from whence it was dug. The body of earth, where the plant was found, must have been formed perhaps some centuries, judging from the size of the trees which it contained.

In communicating this account to the American Philosophical Society (from whose transactions it is taken) Dr. Barton observes "I see no good reason to doubt the accuracy of the observation. We have abundant proof, that many species of animals are capable of subsisting, for a long time, in the *bowels* of the earth, though the *surface* of the earth appears to be, and no doubt is, the natural place of residence of these very animals. Why, then, should we doubt, that the same species of vegetables are capable of accommodating themselves to these two situations? It is never safe, nor right, to draw extensive inferences from solitary facts, especially when those facts are somewhat equivocally related. But in some sciences (I mean those which are merely speculative) conjectures, however improbable or feeble, cannot do much harm. Perhaps many of those impressions of vegetables upon slate, freestone, coal, and other stony matters, which are so abundantly diffused through the earth, are the impressions of vegetables

*which have passed through all the stages of their existence in the bowels of the earth."*

*Surprising extrication of inflammable air.* Near one of the sources of Licking river, in Kentucky, there is a separation of phlogistous gas from something in the interior strata of the earth, in greater quantity than is perhaps known in any part of the world. This light and inflammable fluid is discharged through water into the atmosphere. It bubbles incessantly through the centre of a muddy pool of about two rods in diameter. The gas readily takes flame on burning gun powder in it, or by the approach of any blazing body. The volume of it is so great, that a man who approached near enough to snap a pistol in it, which he held in his hand, was suddenly enveloped in the flame, and sorely singed before he could escape. When set on fire, it burns with remarkable splendour and vehemence, not only for hours, but days and weeks in succession, mounting to the height of ten or twelve feet or more. The relator of this (Mr. Senator Breckenridge) was one of a party that encamped near this aërial fountain, on an excursion through the woods; they discovered, that after the inflammable air had been on fire for six or eight hours, the water of the pond was heated to an uncomfortable degree, and emitted copious exhalations; and the ebullition at the spot, through which the air ascended, was more vehement. It was judged, that if the flame had been sufficiently continued, the water would have been made to boil, and all have been evaporated. Then the surrounding space would have been heated and dried. And, lastly, there was reason to suppose.

that the feculent and carbonic matter at the bottom of the pond would have been put into a state of combustion. From the crater, at the place through which the gas rose, and the excavation of the surrounding ground, it appeared as if this had really happened on some former occasion; and for fear the like might occur again, the gentlemen of the party extinguished the flame, by flapping, agitating, and dissipating it with green boughs, before the water rose to a temperature too hot to enable them to approach near enough for this purpose by wading into it. When once in a blaze, there seems to be no end to its burning, but the stop which a storm of wind and rain may put to it.\*

*Prestons salines*, are on the north fork of Holston, half a mile south of the river, seventeen or eighteen miles easterly from Abington.

Many thousands of inhabitants are now supplied from it with salt of a superior quality, at a low price. The tract consists of about 300 acres of flat marsh land, of as rich a soil as can be imagined. In this flat, pits are sunk in order to obtain the salt water. They are from sixty to ninety feet deep; after passing through the rich soil or mud, you come to a very brittle limestone rock, with cracks or chasms, through which the salt water issues into the pits, whence it is drawn by buckets and put into the boilers, which are placed in furnaces adjoining the pits. The hills that surround this flat are covered with fine timber. Near this, Mr. King has a well more than 200 feet deep, 10 feet square, constantly more than half full of wa-

\* *Méd. Repos. Hexade 2d, vol. iii.*

ter. Thirty-two gallons of this, and some of the other wells, make one bushel of salt. Two hundred bushels have been made in a day. It is equal to Liverpool salt. Mr. Preston can supply the state of Tennessee and the south-west of Virginia, with this essential article.\*

Among the curiosities of the Mississippi Territory, particular mention is made of chasms and sinkings of the earth, in various places; of the rapid encroachments of the river upon its eastern bank, wasting it away very fast; and of large portions of undermined ground tumbling into the water. This goes on so violently, that the very place on which the town of Natchez stood, as lately as the year 1780, is now under water at some distance in the river, as the inhabitants, who then lived there, and are still alive, assert. Corresponding to this, the low land on the west side of the river, subject to be flooded by the rise of its waters, is above thirty miles wide, and seems to be a direliction of the river, as its channel has gradually shifted by encroachment to the eastward.†

At the upper part of Charleston district, in the neighbourhood of Nelson's ferry, a stratum of fossil oyster shells stretches in a south-westwardly course, nearly parallel with the sea, towards the Three Runs, on Savannah river; and are probably connected with those which Mr. Bartram describes, as being fifteen miles below Silver Bluff, on the Georgia side. These shells are uncommonly large; towards

\* Morse.

† R. v. Mr. Hull's Tour to the Mississippi Territory.

Santee river they are of a circular form, and of a diameter of seven or eight inches. They are thick and heavy; unlike any shells which are found on our sea-shores.

On this subject many conjectures have been made, but none actually conclusive, as to the time or manner in which they were thrown along such an extent of country. When first dug up, they are hard, and in the inner parts present an enamelled appearance; but the effect of external air soon dissolves and decomposes them into a limy powder. Some of them were found when digging the Santee canal, and being opened, contained petrified oysters. And such quantities of them are in the vicinity of Nelson's ferry, as by a strong tincture to mark their connexion with the waters of the Eutaw springs; celebrated as the place, near which one of the best fought engagements took place, which adorns the history of the American revolution.\*

\* Drayton's View of South Carolina.

## WESTERN ANTIQUITIES.

FOR the following excellent account of the supposed fortifications and mounds in the western country, we are indebted to the rev. Mr. Harris's Tour to Ohio.

The vast mounds and walls of earth, discovered in various parts of the western country, have excited the astonishment of all who have seen or heard of them. When, and by whom, they were constructed, and for what purpose, are questions which have hitherto baffled the researches of the most inquisitive antiquarians. The present race of Indians retain no traditions that can lead to any discovery. Their history is lost in the oblivion of ages.

The situation of the works at Marietta, is on an elevated plain, above the present bank of the Muskingum, on the east side, and about half a mile from its junction with the Ohio. They consist of walls and mounds of earth in direct lines, and in square and circular forms.

The largest square fort, by some called the town, contains forty acres, encompassed by a wall of earth, from six to ten feet high, and from twenty-five to thirty-six feet in breadth at the base. On each side are three openings, at equal distances, resembling twelve gate-ways. From one outlet, next the Muskingum, is a covert way, formed of two parallel walls of earth, 231 feet distant from each other, measuring from centre to centre. The walls at the most elevated part on the inside are twenty-one feet in height, and forty-two in breadth at the base.

but on the outside average only five feet high. This forms a passage of about 360 feet in length, leading by a gradual descent to the low grounds, where it probably at the time of its construction reached the margin of the river. Its walls commence at sixty feet from the ramparts of the fort, and increase in elevation as the way descends towards the river; and the bottom is crowned, in the centre, in the manner of a well-formed turnpike road. Within the walls of the fort, at the different corners, are elevated squares, some of which are 188 feet long, and 132 broad, and nine feet high, level on the summit, and nearly perpendicular at the sides. Circular mounds are also seen, thirty feet in diameter, and five in height.

Towards the south-east is a smaller fort, containing twenty acres, with a gate-way in the centre of each side, and at each corner. These openings are defended with circular mounds.

On the outside of the smaller fort, is a mound, in form of a sugar loaf, of a magnitude and height which strike the beholder with astonishment. Its base is a regular circle, 115 feet in diameter; and its perpendicular altitude is thirty feet. It is surrounded with a ditch four feet deep and fifteen wide, and defended by a parapet four feet high, through which is an opening or gate-way towards the fort, twenty feet wide.

There are other walls, mounds, and excavations, less conspicuous and entire, but exhibiting equal proofs of art and design.

The places called graves, are small mounds of earth, from some of which some bones have been

taken, in their natural position, of a man buried nearly east and west, with a quantity of ising-glass\* on his breast. In others the bones laid promiscuously, some of them appeared partly burnt and calcined by fire: stones evidently burnt, charcoal, arrow-heads, and fragments of a kind of earthen ware, were also found.

It is worthy of remark, that the walls and mounds were not thrown up from ditches, but raised by bringing the earth from some distance, or taking it up uniformly from the surface of the plain. The parapets were probably made of equal height and breadth, but the waste of time has rendered them lower and broader, in some parts than others.

It is in vain to conjecture, what tools or machines were employed in the construction of these works; but there is no reason to suppose, that any of the implements were of iron. Plates of copper have been found in some of the mounds, but they appear to be parts of armour. Nothing that would answer the purpose of a shovel, has ever been discovered. Adverting to this circumstance, how astonishing must be the constancy and patience necessary to endure the tediousness, and overcome the difficulty, of such labours, and succeed in spite of the unfitness of the instruments that were employed.

At the commencement of the settlement, the works were covered with a prodigious growth of trees. Judging from the concentric circles, each of which is known to denote an annual growth, the age of one tree, felled for the purpose, was de-

\* *Mica membranacea.*



terminated to be four hundred and sixty-three years. Decayed stumps could be traced at the surface of the ground, which measured from six to eight feet in diameter.

About ninety miles farther up in the country, on a large plain, bounded by one of the western branches of the Muskingum, is a train of ancient works, nearly two miles in extent; the ramparts of which are yet in some places upwards of eighteen feet perpendicular height.

At Licking are very extensive works, some of them different in construction from those at Marietta; particularly several circular forts with but one entrance. They are formed of a parapet from seven to twelve feet in height, without any ditch; the interior being of the same level with the plain on which they are raised. Forts of this kind, which are also found in other places, are from three chains to fifteen, and more in diameter.

That those parapets were erected for defence, I think very probable; indeed this has been a prevailing opinion. It is true, their present height is not such as to secure the besieged from missile weapons; but two circumstances have contributed to lower them several feet: 1st, the gradual washing away of the earth of which they are composed; and, 2dly, the filling up of the interior, and the accretion of soil over the whole surface of the plain, by the annual deposit of leaves and the decay of timber. This accretion is evident by finding logs completely covered, and the utensils, &c. of the ancient posses-

sors, four and five feet below the surface. These utensils, which lie pretty much on the same level, are entirely different in kind and shape from the stone tools and flint arrow-heads of the northern Indians, which are frequently picked up on the surface: they undoubtedly belonged to a people acquainted with the arts, and seem to have been made for other uses than those of the later possessors of the region.

In some of the mounds have been found plates of copper rivetted together, copper beads, various implements of stone, and a very curious kind of porcelain. None of the Indians who now inhabit these regions have the art of making earthen ware, much more of melting metals and forming them into ornaments; nor have they any distinct tradition that their ancestors had. They regard these things when they find them, with the same surprise and curiosity as we do.

Among the antiquities of this territory, though without the limits of the state of Ohio, may be mentioned the inscriptions engraven on a large stratum of rocks, on the south-east side of the river Ohio, about two miles below the mouth of Indian or King's creek, which empties into the Ohio fifty miles below Pittsburg. The greater part of the rocks lie nearly in a horizontal direction, and so close to the edge of the river, that at times the water entirely covers them. At the distance of a few yards, however, from the bank of the river there are several large masses of the same species of rock, on which are inscriptions also. These, it is probable, have been formerly attached to the horizontal stratum, and have either been removed by the hand of man,

or by some violent inundation of the river. It is, at least, certain, that the inscriptions upon both are of the same kind, and there can be little doubt that they have both been engraven at the same time.

The town of Tomlinson, state of Ohio, is partly built upon one of the square forts. Several mounds are to be seen within a mile. Three of them, which stand adjoining one another, are of superior height and magnitude to those which are most commonly to be met with. In digging away the side of one of these, in order to build a stable, many curious stone implements were found; one resembled a syringe; there were also a pestle, some copper beads of an oval shape, and several other articles. One of the mounds in col. Bigg's garden was excavated in order to make an ice house. It contained a vast number of human bones, a variety of stone tools, and a kind of stone signet of an oval shape, two inches in length, with a figure in relievo resembling a note of admiration, surrounded by two raised rims. Captain Wilson observed that it was exactly the figure of the brand with which the Mexican horses were marked.\* One of the mounds was surrounded by a regular ditch and parapet with only one entrance. The tumulus was about twelve feet high, and the parapet five.

The "*Big Grave*," as it is called, is a most astonishing mound. We measured the perpendicular height, and it was sixty-seven feet and a half. Its sides are quite steep. The diameter of the top is fifty-five feet: but the apex seems to have caved in; for

\* This singular marking stone, is now deposited in Mr. Turell's cabinet of curiosities in Boston,

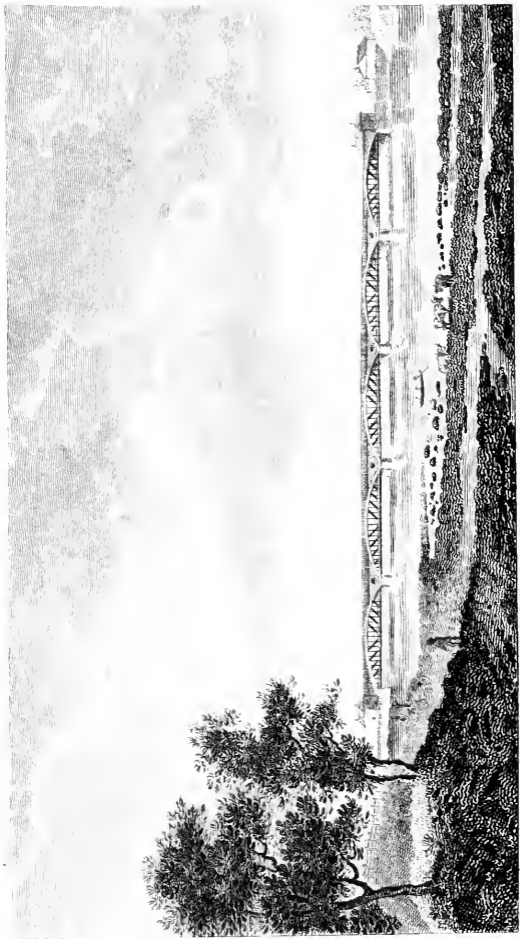
the present summit forms a bason three or four feet in depth. We judged that its base covered more than half an acre. It is overgrown with large trees on all sides. Near the top is a white oak of three feet diameter; one still larger grows on the eastern side, about half way down. The mound sounds hollow. Undoubtedly its contents will be numerous, curious, and calculated to develope, in a farther degree, the history of the antiquities which abound in this part of our country.

As there are no excavations near the mound, and no hills or banks of earth, we infer that it must have been principally formed of sods skimmed from the surface, or of earth brought from a great distance. The labour of collecting such a prodigious quantity must have been inconceivably great. And when we consider the multitude of workmen, the length of time, and the expense requisite to form such a mound; when we reflect upon the spirit of ambition, which suggested the idea of this monument of great but simple magnificence, to the memory of some renowned prince or warrior, we cannot but regret that the name and the glory it was designed to perpetuate are gone....lost in the darkness of the grave.

Mr. Harris illustrates his description by well executed plates, which cannot fail to interest the reader. Indeed his whole work may be considered as a substantial addition to our stock of American topography, and American antiquities.

It ought to be mentioned, that the Rev. Dr. Madison objects to the idea of these earthy elevations having been fortifications. His arguments in support





*Trenton Bridge.*

of his opinion, may be seen at length in the 6th vol. of the Transactions of the American Philosophical Society. He thinks they were fixed habitations.



## BRIDGES.

The bridge at Trenton, over the Delaware, thirty miles above Philadelphia, justly claims a distinguished notice in the present work. It is to be regretted that the ingenious architect, Mr. Burr, has not given to the public a detailed account of a work of such great and general utility, the execution of which does him so much honour. The following account is correct as far as it goes, having been politely furnished by the President of the company, John Beatty, Esq.

On the 21st day of May, 1804, the first corner stone was laid. The front of the abutment on the Pennsylvania side, being sixty-five feet in advance from the bank, it was thought prudent to make it thicker than the one on the opposite shore; accordingly this abutment is fifty feet in front, and eighteen feet thick, with the back part supported by an horizontal arch from its foundation. On the third day of July, the stone work was commenced, and continued without much further interruption, except from the water flowing in, until it arrived at the level of the ground.

The fronts of the abutments from the surface of the ground, and the ends, and about forty feet of the wing walls above the banks, are carried up with cut stone in courses of range work ; varying in depth as they proceed upwards, from twenty to six inches, and *battering* half an inch in the foot : and although no ornament was sought for, this masonry exhibits a solidity of work, and neatness of execution that reflects great credit on the workmen who constructed it. The cut stone, in the abutments, are all clamped together with iron clamps, as high as it presumed the ice or other floating substances will ever assail them ; and in every tier of stone are a number of branch clamps extending diagonally and crosswise the abutment, connecting the whole together. The interior is made up of large rough stone, many of half a ton weight and upwards, compactly filled in with smaller stone, and the whole laid in good lime and sand mortar, and forming one entire, solid mass of masonry. These abutments are nineteen feet above the ordinary flow of the tide, six feet above the highest freshes from ordinary causes, and at least four feet higher than the water has ever been known to rise, from obstructions by ice on the bars below. Besides this, the travelling way is raised nearly three feet higher ; so that no injury can possibly be sustained in the wooden superstructure, by any substances floating on, or carried down the river in the highest freshes.

The wing walls on the east side, at the distance of sixty feet from the front of the abutments, spread or splay seventy-eight feet ; and for the first twenty feet they run into the bank, are laid as deep as the



foundation of the abutment, and seven feet wide in the bottom. From the end of the angle, they are continued in a parallel line with each other, one hundred and three feet further, on a gradual taper to four feet, where they terminate. The exterior of this masonry is battered half an inch to the foot, while the interior is rather more than perpendicular; so that the filling has little or no pressure on the side walls, but will settle in perpendicular lines.

The wing walls on the west or Pennsylvania side, are eighty-five feet in length from the front of the abutment, extend about eighteen feet into the bank, and spread or splay sixty-six feet, being the width of the street leading to the bridge.

In laying the exterior courses of the foundations of the piers, great care was taken to select flat and long stones, running many feet into the piers. On these, and throughout the whole interior, are laid large rough stone of vast weight, and the whole closely filled in with building stone. The depth of these foundations vary several feet in different parts of the piers, owing to the irregular surface of the rock, (in some places forming a pretty regular bason) and this is as an additional security against their being moved by ice, rafts, or other floating substances coming against them.

An offset of six inches is made on these foundations, when the cut stone commences, the pier here receiving its proper shape and dimensions, which, in this place, is sixty-eight feet in length, and twenty-two in breadth, with the end up stream of a semicircular form. The levelling up of the foundation, and all

the cut stone, are laid in terras mortar. On the pier next to the Pennsylvania shore, three courses of cut stone are laid, rising above the foundation to the height of four feet seven inches. On each of the other piers one course only of cut stone is laid, of twenty and twenty-two inches in depth; in which situation ice and every other floating substance will run over them during the winter and spring seasons.

The span between the Pennsylvania abutment and the first pier, as also between each of the other piers, is one hundred and ninety-four feet; and from the New Jersey abutment to the first pier, the span is one hundred and fifty-six feet, leaving a waterway of nine hundred and thirty-two feet, out of eleven hundred, the distance across the river from the top of one bank to the other.

The piers are all carried up with cut stone, in courses of range work, varying in depth, as they proceed upwards, from twenty-five to eight inches, until they rise to the top course, which is twelve inches, with the sides and lower end battering half an inch in the foot; these stones extend into the body of the work, from eight inches to five feet. The exterior or cut stone, as high as the water has ever been known to rise, is laid in terras mortar; and throughout the whole extent, lengthways, every second or third course, clamped together with iron clamps. Crosswise also of the piers, every third or fourth course, eight or more iron cramps are extended from side to side, and let into the courses of cut stone. These, together with a vast number of branch cramps, it is presumed will effectually secure the whole from spreading or giving way in any

direction. The ends of the piers, up stream, are semicircular, and after rising four and a half feet from their foundations, with the usual batter of the sides, they recede or batter at an angle of sixty-seven degrees, until they rise to the further height of ten perpendicular feet, when they are again carried up with the former batter to the square, where they terminate; and receive their finish, with a coping of cut stone, in the form of a half dome. The stones of which this angular part is composed, are all deep in their bed, extending from two to five feet into the pier, and are each secured with a clamp of iron. At this point the cut stone ceases, and the dimensions of the pier are here sixty-two feet in length, and twenty feet in breadth.

An offset of eight inches is then made on the sides, and the square part of the piers again carried up, with a skue back, to the further height of three feet nine inches. The feet of the arches rest on this offset and spring from this angle. The height of the piers next the shores, from the foot of the arches to ordinary low water mark, is twenty-seven feet five inches, and of those in the middle, twenty-eight feet seven inches each. The distance between the abutments is one thousand and eight feet, and the whole length of the bridge, including the wing walls, will be one quarter of a mile.

The whole of the stone work done consists of *one hundred and sixty-nine thousand, two hundred and twenty-three feet of cut stone*, contained in *sixteen thousand six hundred and fifty perches of masonry*.

On the execution of this branch of the work committed to their care, the board of managers rely with the fullest confidence, and do not hesitate to pronounce it as solid and complete a piece of masonry, as is any where to be found in the United States.

The superstructure consists of five arches, or five setts, or series of arches, each composed of five sections or *ribs*, as they are usually called, and rising from the *chord* line, in the proportion of 13 feet in 100. These sections or ribs, are formed of white pine plank, of from thirty-five to fifty feet in length, four inches thick, and twelve inches wide (except the middle section which is thirteen), and repeated one over the other, breaking joints, until they form a depth of three feet through. This mode of constructing wooden arches, is considered as a great improvement in bridge architecture, and we have reason to believe was first introduced into practice by Mr. Burr, the architect of this bridge. Be this as it may, it is supposed to possess many advantages over those formed of solid, and massy pieces of timber. The relative situation of these sections is such as to leave two openings of eleven feet each in the centre for carriages, and two of four feet six inches each, on the sides for foot walks. The general width of the bridge is therefore 36 feet from out to out, and the travelling ways will be on the chord line between these sections. Outside of the two exterior sections, wing arches of 50 feet in length, and of the same convexity and depth, are placed, which, inclining towards the centre, are united to these sections, and securely bolted through them. This gives the bridge an additional base of 16 feet, and a bearing of 52

*feet on each pier.* On the top or circumference of these sections and wing arches, beams or ties and diagonal braces, are laid and let into each other, in the form of *lattice* work, and the whole firmly connected with the arches, by iron bolts with screws, going through them at the distance of every eight feet....thus they are made to form one entire connected arch, which can neither admit of any side-way or intestine motion between the sections, nor be readily injured or endangered by high winds.

The platform on which the travelling is performed, is suspended from these arches, by means of iron chains or links, which hook into the eye bolts, firmly fixed through the arches, at the distance also of every eight feet, in the three middle sections, and 16 feet in the two exterior ones. To the lower ends of these chains is appended a *stirrup*, in which the beams lay, which sustain the joists and flooring. To prevent the platform from having any swinging motion, wing chords and diagonal braces are again interposed, which effectually perform this service.

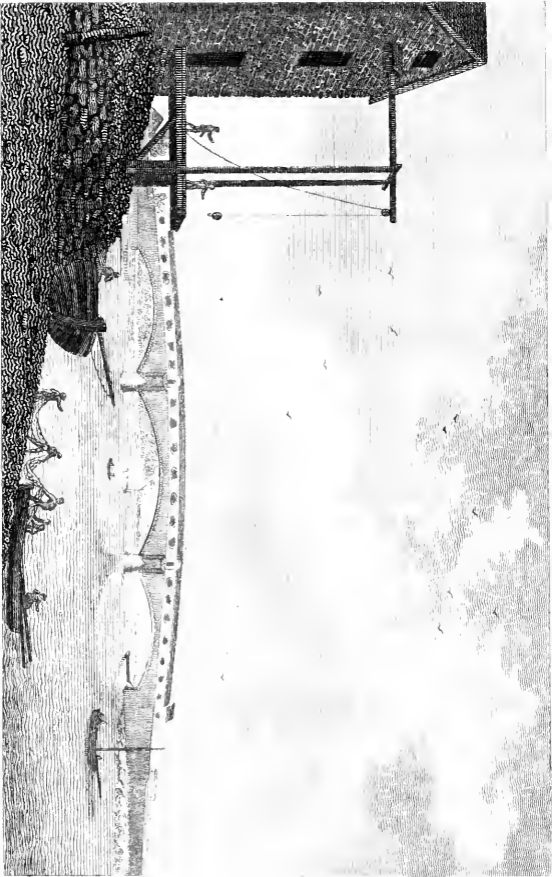
The expansion of the arches (were not the solidity and weight of the piers and abutments of themselves sufficient) is completely guarded against by the intervention of wooden chords which embrace and connect the several feet of these arches together. These serve also a further important purpose, to wit....of stiffening and strengthening the arches, by means of upright bracing, which takes place between them and the chords; so that by the application of great weights, to either end of the arch, no vibratory motion can ensue, as the pressure is by this means distributed throughout the whole extent of the segment.

The three great objects, *convenience of travelling*, *strength*, and *durability*, are all happily united in the model adopted....nor has *ornament* been wholly thrown aside. The access to the bridge on either side, and throughout the whole extent of the platform, presents to the traveller a plane without any sensible rising.

With regard to *strength* we can only speak by a comparison with other structures upon a similar principle. The two bridges across the Hudson river, at Waterford and Fort Miller, constructed under the superintendance of Mr. Burr, and the one across the Connecticut river at Springfield, by Mr. Walcott, are all spoken of in terms of high approbation. Our bridge, we are assured by Mr. Burr, combines double the strength of either of them; but what constitutes the greatest excellence of the Delaware bridge, is the prospect of its durability....the permanency of the stone work is not to be questioned, and by the proposed covering, the stamina, or main parts of the wooden superstructure, will be effectually protected from decay by the wet, while those parts exposed to injury from the weather, are all susceptible of the most complete repair.

The bridge was finished in the month of February, 1806.

*Schuylkill Bridge*...The westernmost pier of the bridge is sunk in a depth of water, unexampled in hydraulic architecture in any part of the world.... the top of the rock on which it stands, being forty-one feet nine inches below common high tides. Both piers were built within cofferdams. The dam for the western pier was of original and peculiar con-



*North view of Schwabell Bridge.*





struction; the design furnished by William Weston, esq. of Gainsborough in England, a celebrated hydraulic engineer. An idea of its magnitude may be framed, when it is known that 800,000 feet of timber (board measure), were unavoidably employed *in and about* it. Every disadvantage to which such difficult undertakings are subject (the rock being in sundry parts, nearly bare, and affording no footing for the piles), opposed the progress of this, so that it could not be ready for the commencement of the masonry until the 25th of December, 1802, when the first stone was laid, and the work continued in a severe winter to the height then proposed.

The masonry is executed on a plan suggested by the mason, (T. Vickers,) uncommon, if not new. The walls of the abutments and wings are perpendicular, without buttresses; and supported by interior offsets. These are found completely competent to support the pressure of the filling, without battering or contreforts. The abutments are 18 feet thick. The wing walls nine feet at the foundations retiring by offsets, till at the parapets they are only 18 inches. The eastern abutment and wing walls are founded on a rock. Those on the western side are built on piles. There are upwards of 7,500 tons of masonry in the western pier. Many of the stones, composing both piers, weigh from three to twelve tons. A number of massive chains are stretched, in various positions, across the piers. These are worked in with the masonry, the exterior whereof is clamped, and finished in the most substantial and workmanlike manner.

The frame of the superstructure was designed and

erected by Timothy Palmer of Newburyport in Massachusetts. It is a masterly piece of workmanship, combining in its principles that of king posts and braces, with that of a stone arch. Half of each post with the brace between them, will form the vousseur of an arch; and lines through the middle of each post would describe the radii, or joints. There are three sections of the frame. That in the middle divides the space into two equal parts; so that those passing in opposite directions are prevented from interfering with each other. The platform for travelling rises only eight feet from a horizontal line; and the top, or cap pieces, are parallel to this. Of the sections the middle one has the most pressure; owing to the weight of transportation being thrown nearer to that section than towards the sides; to which the footways prevent its approach... These footways are five feet in width; elevated above the carriage-ways, and neatly protected by posts and chains. Thomas Palmer is the original inventor of this kind of wooden bridge architecture. He considers the Schuylkill bridge superstructure the most perfect of any he has built.

The underwork of the side covering is done in imitation of masonry, by sprinkling the work with stone dust on the painting while fresh. The smalt-ing or sprinkling was performed with so much ease and cheapness, that it is hoped it will introduce a like mode of ornamenting and protecting the surface of wooden elevations of other descriptions, where protection and ornament are required.

Commodious wharves, on each side of the river, have been made by the company; not only to protect

the foundations of the abutments and wings, but with a view to profit. They co-operate with the other improvements, to give a new and interesting front to our city.

It is a peculiar and interesting fact, that except the valuable assistance rendered in its commencement by W. Weston, (who was then about returning to England) no scientific engineer has been employed in any part of this great undertaking. Yet difficulties have been encountered and overcome, which would have called forth the talents, and practical knowledge, of the ablest engineer. The mechanics and workmen (T. Palmer and his assistants excepted) had, from the beginning of the undertaking, new and unknown branches of their business to learn. Even T. Palmer is *self-taught* in the art of wooden bridge building; though he has carried it to such high perfection. It is however believed that this bridge, in all its parts, both of masonry and wood-work, will not suffer by a comparison with one so composed, in any part of the world. Both the plan and its execution, reflect credit upon those concerned in the enterprise. This is now the only *covered* wooden bridge in any country,\* except, perhaps, one over the Limmat, built by the same Swiss carpenter who erected that of Schaffhausen, since destroyed.

The bridge has been six years in building, and cost about 275,000 dolls. including the cash moiety of the purchase of the site; for which 40,000 dolls. were paid to the City Corporation, half in cash and half in bridge shares.

\* This was written before the erection of the Trenton Bridge.

	<i>Feet. Inch.</i>
Length of the bridge	550 00
Abutments and wing walls	750 00
Total length	1,300 00
Span of small arches each	130 00
Ditto of middle arch	194 10
Width of the bridge	42 00
Curvature of the middle arch	12 00
Ditto of small arches	10 00
Curvature or rise of the carriage way or road	8 00
Height in the clear over car. way	13 00
Ditto from the surface of the river to the carriage way	31 00
Thickness of the pier	20 00
Length of ditto	62 00
Depth of water to the rock at the western pier	41 9
Ditto at the eastern pier	21 00

*dolls.*

Amount of toll when the work began for the year 1799, arising from the floating bridge	5000
Present amount of toll on an average (1805) the rates of toll in several instances being lower than over the old floating bridge*	13,600

\* Young Builder's and Carpenter's Assistant, by Owen Biddie.

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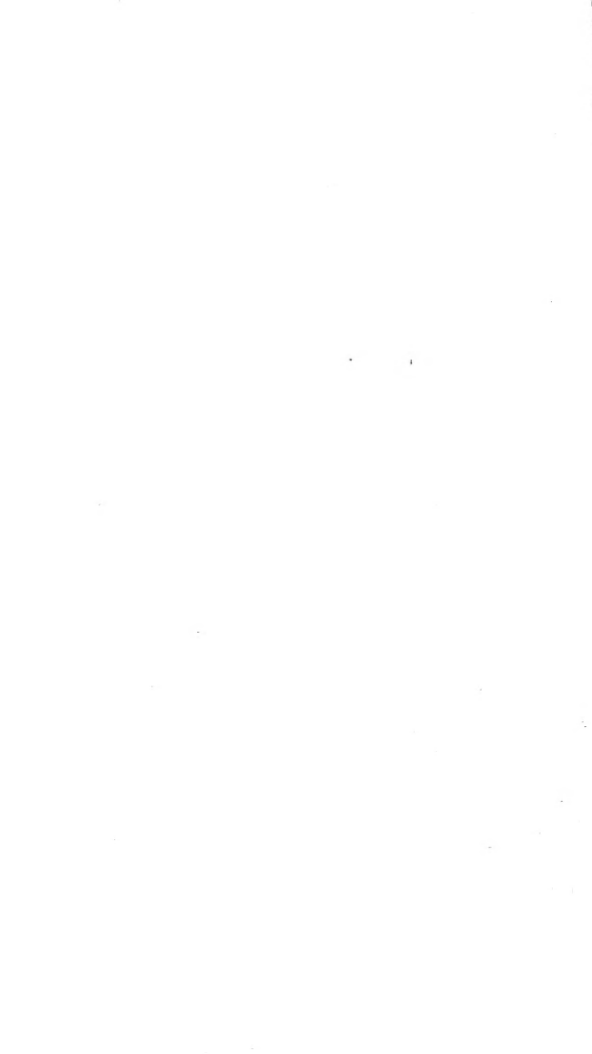
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