CHAPTER XI.

Action of running water, *continued*—Course of the Po—Desertion of its old channel—Articial embankments of the Po, Adige, and other Italian rivers—Basin of the Mississippi—Its meanders—Islands—Shifting of its course—Raft of the Atchafalaya—Drift wood—New-formed lakes in Louisiana—Earthquakes in the valley of the Mississippi—Floods caused by land-slips in the White mountains—Bursting of a lake in Switzerland—Devastations caused by the Anio at Tivoli.

Course of the Po.—THE Po affords a grand example of the manner in which a great river bears down to the sea the matter poured into it by a multitude of tributaries descending from lofty chains of mountains. The changes gradually effected in the great plain of Northern Italy, since the time of the Roman republic, are very considerable. Extensive lakes and marshes have been gradually filled up, as those near Placentia, Parma, and Cremona, and many have been drained naturally by the deepening of the beds of rivers. Deserted river-courses are not unfrequent, as that of the Serio Morto, which formerly fell into the Adda, in Lombardy; and the Po itself has often deviated from its course. Subsequently to the year 1390, it deserted part of the territory of Cremona, and invaded that of Parma; its old channel being still recognizable, and bearing the name of Po Morto. Bressello is one of the towns of which the site was formerly on the left of the Po, but which is now on the right bank. There is also an old channel of the Po in the territory of Parma, called Po Vecchio, which was abandoned in the twelfth century, when a great number of towns were destroyed. There are records of parish-churches, as those of Vicobellignano, Agojolo, and Martignana, having been pulled down and afterwards rebuilt at a greater distance from the devouring stream. In the fifteenth century the main branch again resumed its deserted channel, and carried away a great island opposite Casalmaggiore. At the end of the same century it abandoned, a second time, the

bed called " Po Vecchio," carrying away three streets of Casalmaggiore. The friars in the monastery de' Serviti took the alarm in 1471, demolished their buildings, and reconstructed them at Fontana, whither they had transported the materials. In like manner, the church of S. Rocco was demolished in 1511. In the seventeenth century also the Po shifted its course for a mile in the same district, causing great devastations *.

To check these and similar aberrations, a general system of embankment has been adopted; and the Po, Adige, and almost all their tributaries, are now confined between high artificial banks. The increased velocity acquired by streams thus closed in, enables them to convey a much larger portion of foreign matter to the sea; and consequently the deltas of the Po and Adige have gained far more rapidly on the Adriatic since the practice of embankment became almost universal. But although more sediment is borne to the sea, part of the sand, and mud, which in the natural state of things would be spread out by annual inundations over the plain, now subsides in the bottom of the river-channels, and their capacity being thereby diminished, it is necessary, in order to prevent inundations in the following spring, to extract matter from the bed, and to add it to the banks, of the river. Hence it has arisen that these streams now traverse the plain on the top of high mounds, like the waters of aqueducts, and the surface of the Po has become more elevated than the roofs of the houses of the city of Ferrara †. The magnitude of these barriers is a subject of increasing expense and anxiety, it having sometimes of late years been found necessary to give an additional height of nearly one foot to the banks of the Adige and Po in a single season. The practice of embankment was adopted on some of the Italian rivers as early as the thirteenth century; and Dante, writing in the beginning of the fourteenth, describes, in the seventh circle of hell, a rivulet of tears separated from a burning sandy desert by embankments " like those which, between Ghent and Bruges, were raised against the ocean, or those which the Paduans had

* Dell' Antico Corso de' Fiumi Po, Oglio, ed Adda dell' Giovanni Romani, Milan, 1828.

† Prony, see Cuvier, Disc. Prelim., p. 146.

erected along the Brenta to defend their villas on the melting of the Alpine snows."

> Quale i Fiamminghi tra Guzzante e Bruggia,
> Temendo il fiotto che in ver lor s' avventa,
> Fanno lo schermo, perchè il mar si fuggia,
> E quale i Padovan lungo la Brenta,
> Per difender lor ville e lor castelli,
> Anzi che Chiarentana il caldo senta—
>
> *Inferno*, Canto xv.

Basin of the Mississippi.—The hydrographical basin of the Mississippi displays, on the grandest scale, the action of running water on the surface of a vast continent. This magnificent river rises nearly in the forty-ninth parallel of north latitude, and flows to the Gulf of Mexico in the twenty-ninth—a course, including its meanders, of nearly five thousand miles. It passes from a cold arctic climate, traverses the temperate regions, and discharges its waters into the sea, in the region of the olive, the fig, and the sugar-cane *. No river affords a more striking illustration of the law before mentioned, that an augmentation of volume does not occasion a proportional increase of surface, nay, is even sometimes attended with a narrowing of the channel. The Mississippi is a mile and a half wide at its junction with the Missouri, the latter being half a mile wide; yet the united waters have only, from their confluence to the mouth of the Ohio, a medial width of about three quarters of a mile. The junction of the Ohio seems also to produce no increase, but rather a decrease of surface †. The St. Francis, White, Arkansas, and Red rivers, are also absorbed by the main stream with scarcely any apparent increase of its width; and, on arriving near the sea at New Orleans, it is somewhat less than half a mile wide. Its depth there is very variable, the greatest at high water being one hundred and sixty-eight feet. The mean rate at which the whole body of water flows, is variously estimated. According to some, it does not exceed one mile an hour ‡. The alluvial plain of this great river is bounded on the east and west by great ranges of mountains stretching along their respective oceans. Below the junction

* Flint's Geography, vol. i., p. 21. † Ibid., p. 140.
‡ Hall's Travels in North America, vol. iii., p. 330, who cites Darby.

of the Ohio, the plain is from thirty to fifty miles broad, and after that point it goes on increasing in width till the expanse is perhaps three times as great! On the borders of this vast alluvial tract are perpendicular cliffs, or "bluffs," as they are called, composed of limestone and other rocks. For a great distance the Mississippi washes the eastern "bluffs;" and below the mouth of the Ohio, never once comes in contact with the western. The waters are thrown to the eastern side, because all the large tributary rivers enter from the west, and have filled that side of the great valley with a sloping mass of clay and sand. For this reason, the eastern bluffs are continually undermined, and the Mississippi is slowly but incessantly progressing eastward *.

The river traverses the plain in a meandering course, describing immense and uniform curves. After sweeping round the half of a circle, it is precipitated from the point in a current diagonally across its own channel, to another curve of the same uniformity upon the opposite shore †. These curves are so regular, that the boatmen and Indians calculate distances by them. Opposite to each of them, there is always a sand-bar, answering, in the convexity of its form, to the concavity of "the bend," as it is called ‡. The river, by continually wearing these curves deeper, returns, like many other streams before described, on its own tract, so that a vessel in some places, after sailing for twenty-five or thirty miles, is brought round again to within a mile of the place whence it started. When the waters approach so near to each other, it often happens at high floods that they burst through the small tongue of land; and, having insulated a portion, rush through what is called the "cut off" with great velocity. At one spot called the "grand cut off," vessels now pass from one point to another in half a mile, to a distance which it formerly required twenty miles to reach §. After the flood season, when the river subsides within its channel, it acts with destructive force upon the alluvial banks, softened and diluted by the recent overflow. Several acres at a time, thickly covered with wood, are precipitated into the stream; and the islands formed by the pro-

* Geograph. Descrip. of the State of Louisiana, by W. Darby, Philadelphia, 1816, p. 102.

† Flint's Geog., vol. i., p. 152. ‡ Ibid. § Ibid., vol. i., p. 154.

cess before described, lose large portions of their outer circumference.

"Some years ago," observes Captain Hall, "when the Mississippi was regularly surveyed, all its islands were numbered, from the confluence of the Missouri to the sea; but every season makes such revolutions, not only in the number but in the magnitude and situation of these islands, that this enumeration is now almost obsolete. Sometimes large islands are entirely melted away—at other places they have attached themselves to the main shore, or, which is the more correct statement, the interval has been filled up by myriads of logs cemented together by mud and rubbish *." When the Mississippi and many of its great tributaries overflow their banks, the waters, being no longer borne down by the main current, and becoming impeded amongst the trees and bushes, deposit the sediment of mud and sand with which they are abundantly charged. Islands arrest the progress of floating trees, and they become in this manner reunited to the land; the rafts of trees, together with mud, constituting at length a solid mass. The coarser portion subsides first, and the most copious deposition is found near the banks where the soil is most sandy. Finer particles are found at the farthest distances from the river, where an impalpable mixture is deposited, forming a stiff unctuous black soil. Hence the alluvions of these rivers are highest directly on the banks, and slope back like a natural "glacis" towards the rocky cliffs bounding the great valley †. The Mississippi, therefore, by the continual shifting of its course, sweeps away, during a great portion of the year, considerable tracts of alluvium which were gradually accumulated by the overflow of former years, and the matter now left during the spring-floods will be at some future time removed.

One of the most interesting features in this basin is "the raft." The dimensions of this mass of timber were given by Darby, in 1816, as ten miles in length, about two hundred and twenty yards wide, and eight feet deep, the whole of which had accumulated, in consequence of some obstruction, during

* Travels in North America, vol. iii., p. 361.
† Flint's Geography, vol. i., p. 151.

about thirty-eight years, in an arm of the Mississippi called the Atchafalaya, which is supposed to have been at some past time a channel of the Red River, before it intermingled its waters with the main stream. This arm is in a direct line with the direction of the Mississippi, and it catches a large portion of the drift wood annually brought down. The mass of timber in the raft is continually increasing, and the whole rises and falls with the water. Although floating, it is covered with green bushes, like a tract of solid land, and its surface is enlivened in the autumn by a variety of beautiful flowers. Notwithstanding the astonishing number of cubic feet of timber collected here in so short a time, greater deposits have been in progress at the extremity of the delta in the Bay of Mexico. "Unfortunately for the navigation of the Mississippi," observes Captain Hall, "some of the largest trunks, after being cast down from the position on which they grew, get their roots entangled with the bottom of the river, where they remain anchored, as it were, in the mud. The force of the current naturally gives their tops a tendency downwards, and by its flowing past, soon strips them of their leaves and branches. These fixtures, called snags or planters, are extremely dangerous to the steam-vessels proceeding up the stream, in which they lie like a lance in rest, concealed beneath the water, with their sharp ends pointed directly against the bow of vessels coming up. For the most part these formidable snags remain so still, that they can be detected only by a slight ripple above them, not perceptible to inexperienced eyes. Sometimes, however, they vibrate up and down, alternately showing their heads above the surface and bathing them beneath it*." So imminent is the danger caused by these obstructions, that almost all the boats on the Mississippi are constructed on a particular plan, to guard against fatal accidents †.

* Travels in North America, vol. iii., p. 362.

† "The boats are fitted," says Captain Hall, "with what is called a snag-chamber; a singular device, and highly characteristic of this peculiar navigation. At the distance of from twelve or fourteen feet from the stem of the vessel, a strong bulk-head is carried across the hold from side to side, as high as the deck, and reaching to the kelson. This partition, which is formed of stout planks, is caulked, and made so effectually water-tight, that the foremost end of the vessel is cut off as entirely from the rest of the hold as if it belonged to another boat. If the steam-vessel happen to run against a snag, and

The prodigious quantity of wood annually drifted down by the Mississippi and its tributaries, is a subject of geological interest, not merely as illustrating the manner in which abundance of vegetable matter becomes, in the ordinary course of Nature, imbedded in submarine and estuary deposits, but as attesting the constant destruction of soil and transportation of matter to lower levels by the tendency of rivers to shift their courses. Each of these trees must have required many years, some of them many centuries, to attain their full size; the soil, therefore, whereon they grew, after remaining undisturbed for long periods, is ultimately torn up and swept away. Yet notwithstanding this incessant destruction of land and up-rooting of trees, the region which yields this never-failing supply of drift wood is densely clothed with noble forests, and is almost unrivalled in its power of supporting animal and vegetable life.

Innumerable herds of wild deer and bisons feed on the luxuriant pastures of the plains. The jaguar, the wolf, and the fox, are amongst the beasts of prey. The waters teem with alligators and tortoises, and their surface is covered with millions of migratory water-fowl, which perform their annual voyage between the Canadian lakes and the shores of the Mexican gulf. The power of man begins to be sensibly felt, and the wilderness to be replaced by towns, orchards, and gardens. The gilded steam-boat, like a moving city, now stems the current with a steady pace—now shoots rapidly down the descending stream through the solitudes of the forests and prairies. Already does the flourishing population of the great valley exceed that of the thirteen United States when first they declared their independence, and after a sanguinary struggle were severed from the parent country *. Such is the state of a continent where rocks and trees are hurried annually, by a thousand torrents, from the mountains to the plains, and where sand and finer matter are swept down by a vast current to the sea, together with the wreck of countless forests and the bones of animals which perish in the inundations. When these materials reach the Gulf, they do not render the waters unfit for

that a hole is made in her bow, under the surface, this chamber merely fills with water; for the communication being cut off from the rest of the vessel, no further mischief need ensue." Travels in North America, vol. iii., p. 363.

* Flint's Geography, vol. i.

aquatic animals; but, on the contrary, the ocean here swarms with life, as it generally does where the influx of a great river furnishes a copious supply of organic and mineral matter. Yet many geologists, when they behold the spoils of the land heaped in successive strata, and blended confusedly with the remains of fishes, or interspersed with broken shells and corals, imagine that they are viewing the signs of a turbulent, instead of a tranquil and settled state of the planet. They read in such phenomena the proof of chaotic disorder, and reiterated catastrophes, instead of indications of a surface as habitable as the most delicious and fertile districts now tenanted by man. They are not content with disregarding the analogy of the present course of Nature, when they speculate on the revolutions of past times, but they often draw conclusions concerning the former state of things directly the reverse of those to which a fair induction from facts would infallibly lead them.

There is another striking feature in the basin of the Mississippi, illustrative of the changes now in progress, which we must not omit to mention—the formation by natural causes of great lakes, and the drainage of others. These are especially frequent in the basin of the Red River in Louisiana, where the largest of them, called Bistineau, is more than *thirty miles* long, and has a medium depth of from *fifteen* to *twenty* feet. In the deepest parts are seen numerous cypress-trees, of all sizes, now dead, and most of them with their tops broken by the wind, yet standing erect under water. This tree resists the action of air and water longer than any other, and, if not submerged throughout the whole year, will retain life for an extraordinary period *. Lake Bistineau, as well as Black Lake, Cado Lake, Spanish Lake, Natchitoches Lake, and many others, have been formed, according to Darby, by the gradual elevation of the bed of Red River, in which the alluvial accumulations have been so great as to raise its channel, and cause its waters, during the flood season, to flow up the mouths of many tributaries, and to convert parts of their courses into lakes. In

* Captains Clark and Lewis found a forest of pines standing erect under water in the body of the Columbia River in North America, which they supposed, from the appearance of the trees, to have been only submerged about twenty years.—Vol. ii., p. 241.

the autumn, when the level of Red River is again depressed, the waters rush back again, and some lakes become grassy meadows, with streams meandering through them *. Thus, there is a periodical flux and reflux between Red River and some of these basins, which are merely reservoirs, alternately emptied and filled like our tide estuaries—with this difference, that in the one case the land is submerged for several months continuously, and, in the other, twice in every twenty-four hours. It has happened, in several cases, that a bar has been thrown by Red River across some of the openings of these channels, and then the lakes become, like Bistineau, constant repositories of water. But even in these cases, their level is liable to annual elevation and depression, because the flood when at its height passes over the bar; just as, where sand-hills close the entrance of an estuary on the Norfolk or Suffolk coast, the sea, during some high tide or storm, has often breached the barrier and inundated again the interior country.

The frequent fluctuations in the direction of river-courses, and the activity exerted by running water in various parts of the basin of the Mississippi, are partly, perhaps, to be ascribed to the co-operation of subterranean movements, which alter from time to time the relative levels of various parts of the surface. So late as the year 1812, the whole valley, from the mouth of the Ohio to that of the St. Francis, including a front of three hundred miles, was convulsed to such a degree, as to create new islands in the river, and lakes in the alluvial plain, some of which were *twenty miles in extent*. We shall allude to this event when we treat of earthquakes, but may state here that they happened exactly at the same time as the fatal convulsions at Caraccas; and the district shaken was nearly five degrees of latitude farther removed from the great centre of volcanic disturbance, than the basin of the Red River, to which we before alluded †. When countries are liable to be so extensively and permanently affected by earthquakes, speculations concerning changes in their hydrographical features must not be made with-

* Darby's Louisiana, p. 33.

† Darby mentions beds of marine shells on the banks of Red River, which seem to indicate that Lower Louisiana is of recent formation: its elevation, perhaps, above the sea, may have been due to the same series of earthquakes which continues to agitate equatorial America.

out regard to the igneous as well as the aqueous causes of change. It is scarcely necessary to observe, that the inequalities produced even by one shock, might render the study of the alluvial plain of the Mississippi, at some future period, most perplexing to a geologist who should reason on the distribution of transported materials, without being aware that the configuration of the country had varied materially during the time when the excavating or removing power of the river was greatest. The region convulsed in 1812, of which New Madrid was the centre, exceeded in length the whole basin of the Thames, and the shocks were connected with active volcanos more distant from New Madrid than are the extinct craters of the Eyfel or of Auvergne from London. If, therefore, during the innumerable eruptions which formerly broke forth in succession in the parts of Europe last alluded to, the basin of the principal river of our island was frequently agitated, and the relative levels of its several parts altered (an hypothesis in perfect accordance with modern analogy), the difficulties of some theorists might, perhaps, be removed; and they might no longer feel themselves under the necessity of resorting to catastrophes out of the ordinary course of Nature, when they endeavour to explain the alluvial phenomena of that district.

FLOODS, BURSTING OF LAKES, &c.

The power which running water may exert, in the lapse of ages, in widening and deepening a valley, does not so much depend on the volume and velocity of the stream usually flowing in it, as on the number and magnitude of the obstructions which have, at different periods, opposed its free passage. If a torrent, however small, be effectually dammed up, the size of the valley above the barrier, and its declivity below, will determine the violence of the debacle, and not the dimensions of the torrent. The most universal source of local deluges are land-slips, slides, or avalanches, as they are sometimes called, when great masses of rock and soil, or sometimes ice and snow, are precipitated into the bed of a river, either by the undermining of a cliff, by the loosening of a sub-stratum by springs, by the shock of an earthquake, or other causes. Volumes might be filled were we to enumerate all the instances

which are on record of these terrific catastrophes: we may therefore select a few examples of recent occurrence, the facts of which are well authenticated.

Two dry seasons in the White Mountains, in New Hampshire, were followed by heavy rains on the 28th August, 1826, when from the steep and lofty declivities which rise abruptly on both sides of the river Saco, innumerable rocks and stones, many of sufficient size to fill a common apartment, were detached, and in their descent swept down before them, in one promiscuous and frightful ruin, forests, shrubs, and the earth which sustained them. No tradition existed of any similar slides at former times, and the growth of the forest on the flanks of the hills clearly shewed that for a long interval nothing similar had occurred. One of these moving masses was afterwards found to have slid three miles, with an average breadth of a quarter of a mile. The excavations commenced generally in a trench a few yards in depth and a few rods in width, and descended the mountains, widening and deepening till they became vast chasms. At the base of such hollow ravines was seen a wide and deep mass of ruins, consisting of transported earth, gravel, rocks, and trees. Forests of spruce-fir and hemlock were prostrated with as much ease as if they had been fields of grain; for, where they disputed the ground, the torrent of mud and rock accumulated behind till it gathered sufficient force to burst the temporary barrier.

The valleys of the Amonoosuck and Saco presented, for many miles, an uninterrupted scene of desolation, all the bridges being carried away, as well as those over their tributary streams. In some places, the road was excavated to the depth of from fifteen to twenty feet; in others, it was covered with earth, rocks, and trees, to as great a height. The water flowed for many weeks after the flood, as densely charged with earth as it could be without being changed into mud, and marks were seen in various localities of its having risen on either side of the valley to more than twenty-five feet above its ordinary level. Many sheep and cattle were swept away, and the Willey family, nine in number, who in alarm had deserted their house, were destroyed on the banks of the Saco: seven of their mangled bodies were afterwards found near the river, buried

beneath drift-wood and mountain-ruins *. It is almost superfluous to point out to the reader that the lower alluvial plains are most exposed to such violent floods, and are at the same time best fitted for the sustenance of herbivorous animals. If, therefore, any organic remains are found amidst the superficial heaps of transported matter, resulting from those catastrophes, at whatever periods they may have happened, and whatever may have been the former configuration and relative levels of the country, we may expect the imbedded fossil relics to be principally referrible to this class of mammalia.

But these catastrophes are insignificant, when compared to those which are occasioned by earthquakes, when the boundary hills, for miles in length, are thrown down into the hollow of a valley. We shall have an opportunity of alluding to inundations of this kind when treating of earthquakes, and shall content ourselves at present with selecting an example, of modern date, of a flood caused by the bursting of a lake; the facts having been described, with more than usual accuracy, by scientific observers.

Flood in the Valley of Bagnes, 1818.—The valley of Bagnes is one of the largest of the lateral embranchments of the main valley of the Rhone, above the Lake of Geneva. Its upper portion was, in 1818, converted into a lake by the damming up of a narrow pass, in consequence of the fall of avalanches of snow and ice, precipitated from an elevated glacier into the bed of the river Dranse. In the winter season, during continued frost, scarcely any water flows in the bed of this river to preserve an open channel, so that the ice-barrier remained entire until the melting of the snows in spring, when a lake was formed above, about half a league in length, which finally attained a depth of about two hundred feet in parts, and a width of about seven hundred feet. To prevent or lessen the mischief apprehended from the sudden bursting of the barrier, an artificial gallery, seven hundred feet in length, was cut through the ice, before the waters had risen to a great height. When at length they accumulated and flowed through

* Silliman's Journal of Science, vol. xv., No. 2, p. 216, Jan. 1829.

this tunnel, they dissolved the ice, and thus deepened their channel, until nearly half of the whole contents of the lake were slowly drained off. But, at length, on the approach of the hot season, the central portion of the remaining mass of ice gave way with a tremendous crash, and the residue of the lake was emptied in half an hour. In the course of its descent, the waters encountered several narrow gorges, and at each of these they rose to a great height, and then burst, with new violence, into the next basin, sweeping along rocks, forests, houses, bridges, and cultivated land. For the greater part of its course the flood resembled a moving mass of rock and mud, rather than of water. Some fragments of primary rock, of enormous magnitude, and which, from their dimensions, might be compared without exaggeration to houses, were torn out of a more ancient alluvion, and borne down for a quarter of a mile. The velocity of the water, in the first part of its course, was thirty-three feet per second, which diminished to six feet before it reached the Lake of Geneva, where it arrived in six hours and a half, the distance being forty-five miles *. This flood left behind it, on the plains of Martigny, thousands of trees torn up by the roots, together with the ruins of buildings. Some of the houses in that town were filled with mud up to the second story. After expanding in the plain of Martigny, it entered the Rhone, and did no further damage; but some bodies of men, who had been drowned above Martigny, were afterwards found at the distance of about thirty miles, floating on the further side of the Lake of Geneva, near Vevey. Inundations, precisely similar, are recorded to have occurred at former periods in this district, and from the same cause. In 1595, for example, a lake burst, and the waters, descending with irresistible fury, destroyed the town of Martigny, where from sixty to eighty persons perished. In a similar flood, fifty years before, one hundred and forty persons were drowned. For several months after the débâcle of 1818, the Dranse, having no settled channel, shifted its position continually from one side to the other of the valley, carrying away newly-erected bridges, under-

* See an account of the inundation of the Val de Bagnes, in 1818, in Ed. Phil. Journ., vol. i., p. 187. Drawn up from the Memoir of M. Escher, with a section, &c.

mining houses, and continuing to be charged with as large a quantity of earthy matter as the fluid could hold in suspension *.

The waters, on escaping from the lake, intermixed with mud and rock, swept along, for the first four miles, at the rate of above twenty miles an hour; and Mr. Escher, the engineer, calculated that the flood furnished three hundred thousand cubic feet of water every second,—an efflux which is five times greater than that of the Rhine below Basle. Now, if part of the lake had not been gradually drained off, the flood would have been nearly double, approaching in volume to some of the largest rivers in the world. It is evident, therefore, that when we are speculating on the excavating force which running water may have exerted in any particular valley, the most important question is not the volume of the existing stream, nor the present levels of the river-channel, nor the size of the gravel, but the probability of a succession of floods, at some period since the time when some of the land in question may have been first elevated above the bosom of the sea.

Flood at Tivoli, 1826.—We shall conclude with one more example, derived from a land of classic recollections, the ancient Tibur, and which, like all the other inundations to which we have alluded, occurred within the present century. The younger Pliny, it will be remembered, describes a flood on the Anio, which destroyed woods, rocks, and houses, with the most sumptuous villas and works of art †. For four or five centuries consecutively, this headlong stream, as Horace truly called it, has often remained within its bounds, and then, after such long intervals of rest, at different periods inundated its banks again, and widened its channel. The last of these catastrophes happened 15th Nov. 1826, after heavy rains, such as produced the floods before alluded to in Scotland. The waters appear also to have been impeded by an artificial

* I visited this valley four months after the flood, and was witness to the sweeping away of a bridge, and the undermining of part of a house. The greater part of the ice-barrier was then standing, presenting a vertical cliff, one hundred and fifty feet high, like the lava-currents of Etna or Auvergne, intersected by a river.

† Lib. viii., Epist. 17.

dike, by which they were separated into two parts, a short distance above Tivoli. They broke through this dike, and, leaving the left trench dry, precipitated themselves, with their whole weight, on the right side. Here they undermined, in the course of a few hours, a high cliff, and widened the river's channel about fifteen paces. On this height stood the church of St. Lucia, and about thirty-six houses of the town of Tivoli, which were all carried away, presenting, as they sank into the roaring flood, a terrific scene of destruction to the spectators on the opposite bank *. As the foundations were gradually removed, each building, some of them edifices of considerable height, was first traversed with numerous rents, which soon widened into large fissures, until at length the roofs fell in with a crash, and then the walls sank into the river, and were hurled down the cataract below.

The destroying agency of the flood came within two hundred yards of the precipice on which the beautiful temple of Vesta stands; but fortunately this precious relic of antiquity was spared, while the wreck of modern structures was hurled down the abyss. Vesta, it will be remembered, in the heathen mythology, personified the stability of the earth; and when the Samian astronomer, Aristarchus, first taught that the earth revolved on its axis, and round the sun, he was publicly accused of impiety, "for moving the everlasting Vesta from her place." Playfair† observed, that when Hutton ascribed instability to the earth's surface, and represented the continents which we inhabit as the theatre of incessant change and movement, his antagonists, who regarded them as unalterable, assailed him, in a similar manner, with accusations founded on religious prejudices. We might appeal to the excavating power of the Anio as corroborative of one of the most controverted parts of the Huttonian theory; and if the days of omens had not gone by, the geologists who now worship Vesta might regard the late catastrophe as portentous. We may, at least, recommend the modern votaries of the goddess to lose no time in making a pilgrimage to her shrine, for the next flood may not respect the temple.

* When at Tivoli, in 1829, I received this account from eye-witnesses of the event.

† Illustr. of Hutt. Theory, § 3, p. 147.