

CHAPTER XVI.

Imbedding of the remains of man and his works in subaqueous strata—Drifting of bodies to the sea by river-inundations—Destruction of bridges and houses—Burial of human bodies in the sea—Loss of lives by shipwreck—Circumstances under which human corpses may be preserved under a great thickness of recent deposits—Number of wrecked vessels—Durable character of many of their contents—Examples of fossil skeletons of men—Of fossil canoes, ships, and works of art—Of the chemical changes which certain metallic instruments have undergone after long submergence—Effects of the subsidence of land in imbedding cities and forests in subaqueous strata—Earthquake of Cutch in 1819—Submarine forests—Berkley's arguments for the recent date of the creation of man—Concluding remarks.

WE shall now proceed to inquire in what manner the mortal remains of man and the works of his hands may be permanently preserved in subaqueous strata. Of the many hundred million human beings which perish in the course of every century on the land, every vestige is usually destroyed in the course of a few thousand years, but of the smaller number that perish in the waters, a considerable proportion must frequently be entombed, under such circumstances, that parts of them may endure throughout entire geological epochs.

We have already seen how the bodies of men, together with those of the inferior animals, are occasionally washed down during river-inundations into seas and lakes, of which we shall now enumerate some additional examples.

Belzoni witnessed a flood on the Nile in September, 1818, where, although the river only rose three feet and a half above its ordinary level, several villages, with some hundreds of men, women, and children, were swept away*. We mentioned in a former volume that a rise of six feet of water in the Ganges in 1763, was attended with a much greater loss of lives.

In the year 1771, at the time of the bursting of the Sol-

* Narrative of Discovery in Egypt, &c. London, 1820.

way moss before alluded to, when the inundations in the north of England appear to have equalled the recent floods in Morayshire, a great number of houses and their inhabitants were swept away by the rivers Tyne, Can, Wear, Tees, and Greta; and no less than twenty-one bridges were destroyed in the courses of these rivers. At the village of Bywell the flood tore the dead bodies and coffins out of the churchyard, and bore them away, together with many of the living inhabitants. During the same tempest an immense number of cattle, horses, and sheep, were also transported to the sea, while the whole coast was covered with the wreck of ships. Four centuries before (in 1338), the same district had been visited by a similar continuance of heavy rains followed by disastrous floods, and it is not improbable that these catastrophes may recur periodically. As the population increases, and buildings and bridges are multiplied, we must expect that the loss of lives and property will rather augment*.

If to the hundreds of human bodies committed to the deep in the way of ordinary burial, we add those of individuals lost by shipwreck, we shall find that, in the course of a single year, a great number of human remains are consigned to the sub-aqueous regions. We shall hereafter advert to a calculation by which it appears that more than five hundred *British* vessels alone, averaging each a burden of about one hundred and twenty tons, are wrecked, and sink to the bottom, *annually*. Of these the crews for the most part escape, although it sometimes happens that all perish. In one great naval action several thousand individuals sometimes share a watery grave.

Many of these corpses are instantly devoured by predaceous fish, sometimes before they reach the bottom; still more frequently when they rise again to the surface and float in a state of putrefaction. Many decompose on the floor of the ocean where no sediment is thrown down upon them, but if they fall upon a reef where corals and shells are becoming agglutinated into a solid rock, or subside where the delta of a river is ad-

* Scots Mag, vol. xxxiii. 1771.

vancing, they may be preserved for an incalculable series of ages in these deposits.

Often at the distance of a few hundred feet from a coral reef there are no soundings at the depth of many hundred fathoms. Here if a ship strike and be wrecked, it may soon be covered by calcareous sand and fragments of coral detached by the breakers from the summit of a submarine mountain, and which may roll down to its base. Wrecks are known to have been common for centuries near certain reefs, so that canoes, merchant vessels, and ships of war may have sunk and have been enveloped in these situations in calcareous sand and breccia. Suppose a volcanic eruption to cover such remains with ashes and sand, and that over the tufaceous strata resulting from these ejections, a current of lava is afterwards poured, the ships and human skeletons might then remain uninjured beneath the superincumbent rock, like the houses and works of art in the subterranean cities of Campania. That cases may have already occurred where human remains have been thus preserved in a fossil state beneath masses more than a thousand feet in thickness, is by no means improbable, for in some volcanic archipelagos a period of thirty or forty centuries might well suffice for such an accumulation of matter.

We stated that at the distance of about forty miles from the base of the delta of the Ganges, there is a circular space about fifteen miles in diameter where soundings of a thousand feet sometimes fail to reach the bottom. As during the flood season the quantity of mud and sand poured by the great rivers into the Bay of Bengal, is so great that the sea only recovers its transparency at the distance of sixty miles from the coast, this depression must be gradually shoaling, especially as during the monsoons the sea, loaded with mud and sand, is beaten back in that direction towards the delta. Now if a ship or human body sink down to the bottom in such a spot, it is by no means improbable that it may become buried under a depth of three or four thousand feet of sediment in the same number of years.

Even on that part of the floor of the ocean whither no accession of drift matter is carried, (a part which we believe to constitute, at any given period, by far the larger proportion of the whole submarine area,) there are circumstances accompanying a wreck which favour the conservation of skeletons. For when the vessel fills suddenly with water, especially in the night, many persons are drowned between decks and in their cabins, so that their bodies are prevented from rising again to the surface. The vessel often strikes upon an uneven bottom and is overturned, in which case the ballast consisting of sand, shingle, and rock, or the cargo, frequently composed of heavy and durable materials, may be thrown down upon the carcasses. In the case of ships of war, cannon, shot, and other warlike stores, may press down with their weight the timbers of the vessel when they decay, and beneath these and the metallic substances the bones of man may be preserved.

When we reflect on the number of curious monuments consigned to the bed of the ocean in the course of every naval war from the earliest times, our conceptions are greatly raised respecting the multiplicity of lasting memorials which man is leaving of his labours. During our last great struggle with France, thirty-two of our ships of the line went to the bottom in the space of twenty-two years, besides seven fifty-gun ships, eighty-six frigates, and a multitude of smaller vessels. The navies of the other European powers, France, Holland, Spain, and Denmark, were almost annihilated during the same period, so that the aggregate of their losses must have many times exceeded that of Great Britain. In every one of these ships were batteries of cannon constructed of iron or brass, whereof a great number had the dates and places of their manufacture inscribed upon them in letters cast in metal. In each there were coins of copper, silver, and often many of gold, capable of serving as valuable historical monuments; in each were an infinite variety of instruments of the arts of war and peace, many formed of materials, such as glass and earthenware, capable of lasting for indefinite ages

when once removed from the mechanical action of the waves, and buried under a mass of matter which may exclude the corroding action of sea-water.

But the reader must not imagine that the fury of war is more conducive than the peaceful spirit of commercial enterprise to the accumulation of wrecked vessels in the bed of the sea. From an examination of Lloyd's lists from the year 1793, to the commencement of 1829, it has appeared that the number of *British vessels* alone lost during that period amounted, on an average, to no less than one and a half *daily* *, a greater number than we should have anticipated, although we learn from Moreau's tables that the number of merchant vessels employed at one time in the navigation of England and Scotland, amounts to about twenty thousand, having one with another a mean burden of one hundred and twenty tons †. Out of five hundred and fifty-one ships of the royal navy lost to the country during the period above mentioned, only one hundred and sixty were taken or destroyed by the enemy, the rest having either stranded or foundered, or having been burnt by accident ‡, a striking proof that the dangers of our naval warfare, however great, may be far exceeded by the storm, the hurricane, the shoal, and all the other perils of the deep.

Millions of dollars and other coins have been sometimes submerged in a single ship, and on these, when they happen to be enveloped in a matrix capable of protecting them from chemical changes, much information of historical interest will remain inscribed and endure for periods as indefinite as have the delicate markings of zoophytes or lapidified plants in some of the ancient secondary rocks. In almost every large ship, moreover, there are some precious stones set in seals, and other articles of use and ornament composed of the hardest substances in nature, on which letters and various images are

* I am indebted to my friend Captain W. H. Smyth, R. N., for this information.

† Cæsar Moreau's Tables of the Navigation of Great Britain.

‡ I give these results on the authority of Captain W. H. Smyth, R. N.

carved—engravings which they may retain when included in subaqueous strata, as long as a crystal preserves its natural form.

It was a splendid boast, that the deeds of the English chivalry at Agincourt made Henry's chronicle

———— as rich with praise
As is the ooze and bottom of the deep
With sunken wreck and sumless treasuries ;

for it is probable that a greater number of monuments of the skill and industry of man will, in the course of ages, be collected together in the bed of the ocean, than will be seen at one time on the surface of the continents.

If our species be of as recent a date as we suppose, it will be vain to seek for the remains of man and the works of his hands imbedded in submarine strata, except in those regions where violent earthquakes are frequent, and the alterations of relative level so great, that the bed of the sea may have been converted into land within the historical era. We do not despair of the discovery of such monuments whenever those regions which have been peopled by man from the earliest ages, and which are at the same time the principal theatres of volcanic action, shall be examined by the joint skill of the antiquary and the geologist.

There can be no doubt that human remains are as capable of resisting decay as are the harder parts of the inferior animals; and we have already cited the remark of Cuvier, that “in ancient fields of battle the bones of men have suffered as little decomposition as those of horses which were buried in the same grave*.” In the delta of the Ganges bones of men have been found in digging a well at the depth of ninety feet †; but as that river frequently shifts its course and fills up its ancient channels, we are not called upon to suppose that these bodies are of extremely high antiquity, or that they were buried when that part of the surrounding delta where they occur was first gained from the sea.

* Vol. i. p. 154.

† Hoff, vol. i. p. 379.

Several skeletons of men, more or less mutilated, have been found in the West Indies, on the north-west coast of the mainland of Guadaloupe, in a kind of rock which is known to be forming daily, and which consists of minute fragments of shells and corals, incrustated with a calcareous cement resembling travertin, which has also bound the different grains together. The lens shows that some of the fragments of coral composing this stone, still retain the same red colour which is seen in the reefs of living coral which surround the island. The shells belong to species of the neighbouring sea intermixed with some terrestrial kinds which now live on the island, and among them is the *Bulimus Guadaloupensis* of Férussac. The human skeletons still retain some of their animal matter, and all their phosphate of lime. One of them, of which the head is wanting, may now be seen in the British Museum, and another in the Royal Cabinet at Paris. According to Mr. König, the rock in which the former is inclosed is harder under the mason's saw and chisel, than statuary marble. It is described as forming a kind of glacis, probably an indurated beach, which slants from the steep cliffs of the island to the sea, and is nearly all submerged at high tide.

Similar formations are in progress in the whole of the West Indian archipelago, and they have greatly extended the plain of Cayes in St. Domingo, where fragments of vases and other human works have been found at a depth of twenty feet. In digging wells also near Catania, tools have been discovered in a rock somewhat similar.

When a vessel is stranded in shallow water, it usually becomes the nucleus of a sand bank, as has been exemplified in several of our harbours, and this circumstance tends greatly to its preservation. About fifty years ago, a vessel from Purbeck, laden with three hundred tons of stone, struck on a shoal off the entrance of Poole harbour and foundered; the crew were saved, but the vessel and cargo remain to this day at the bottom. Since that period the shoal at the entrance of the harbour has so extended itself in a westerly direction towards Peveril Point

in Purbeck, that the navigable channel is thrown a mile nearer that Point *. The cause is obvious; the tidal current deposits the sediment with which it is charged around any object which checks its velocity. Matter also drifted along the bottom is arrested by any obstacle, and accumulates round it just as the African sand-winds, before described, raise a small hillock over the carcasses of every dead camel exposed on the surface of the desert.

We alluded, in the former volume †, to an ancient Dutch vessel, discovered in the deserted channel of the river Rother, in Sussex, of which the oak wood was much blackened, but its texture unchanged. The interior was filled with fluviatile silt, as was also the case in regard to a vessel discovered in a former bed of the Mersey, and another disinterred where the St. Catherine Docks are excavated in the alluvial plain of the Thames. In like manner many ships have been found preserved entire in modern strata, formed by the silting up of estuaries along the southern shores of the Baltic, especially in Pomerania. Between Bromberg and Nakel, for example, a vessel and two anchors in a very perfect state were dug up far from the sea ‡.

At the mouth of a river in Nova Scotia, a schooner of thirty-two tons, laden with live stock, was lying with her side to the tide, when the bore, or tidal wave, which rises there about ten feet in perpendicular height, rushed into the estuary and overturned the vessel, so that it instantly disappeared. After the tide had ebbed, the schooner was so totally buried in the sand, that the taffrel or upper rail of the deck was alone visible §. We are informed by Leigh, that, on draining Martin Meer, a lake eighteen miles in circumference, in Lancashire, a bed of marl was laid dry, wherein no fewer than eight canoes were found imbedded. In figure and dimensions they were not unlike those now used in America. In a morass about nine

* This account I received from the Honourable A. Harris.

† Vol. i. p. 278.

‡ Hoff., vol. i. p. 368.

§ Silliman's Geol. Lectures, p. 78, who cites Penn,

miles distant from this Meer, a whetstone and an axe of mixed metal were dug up*. In Ayrshire also, three canoes were found in Loch Doon some few years ago; and during the present year (1831) four others, each hewn out of separate oak trees. They were twenty-three feet in length, two and a half in depth, and nearly four feet in breadth at the stern. In the mud which filled one of them, was found a war club of oak and a stone battle-axe.

The only examples of buried vessels to which we can obtain access, are in such situations as we have mentioned, but we are unable to examine those which have been subjected to great pressure, at the bottom of a deep ocean. It is extremely possible that the submerged wood-work of ships which have sunk where the sea is two or three miles deep, has undergone greater chemical changes in an equal space of time, for the experiments of Scoresby before mentioned show that wood may at certain depths be impregnated in a single hour with salt-water, so that its specific gravity is entirely altered.

It may often happen that hot springs charged with carbonate of lime, silex and other mineral ingredients, may issue at great depths, in which case every pore of the vegetable tissue may be injected with the lapidifying liquid, whether calcareous or siliceous, before the smallest decay commences. The conversion also of wood into lignite is probably more rapid under such enormous pressure. But the change of the timber into lignite or coal would not prevent the original form of a ship from being distinguished, for as we find in strata of the carboniferous era, the bark of the hollow reed-like trees converted into coal, and the central cavity filled with sandstone, so might we trace the outline of a ship in coal, and in the indurated mud, sandstone, or limestone filling the interior, we might discover instruments of human art, ballast consisting of rocks foreign to the rest of the stratum, and other contents of the ship.

Many of the metallic substances which fall into the waters,

* Leigh's Lancashire, p. 17, A. D. 1700.

probably lose, in the course of ages, the forms artificially imparted to them ; but under many circumstances these may be preserved for indefinite periods. The cannon inclosed in a calcareous rock, drawn up from the delta of the Rhone, which is now in the museum at Montpellier, might probably have endured as long as the calcareous matrix ; but even if the metallic matter had been removed and had entered into new combinations, still a mould of its original shape would have been left, corresponding to those impressions of shells which we see in rocks, from which all the carbonate of lime has been subtracted. About the year 1776, says Mr. King, some fishermen sweeping for anchors in the Gull stream, (a part of the sea near the Downs,) drew up a very curious old swivel gun, near eight feet in length. The barrel, which was about five feet long, was of brass ; but the handle by which it was traversed, was about three feet in length, and the swivel and pivot on which it turned were of iron. Around these latter were formed incrustations of sand converted into a kind of stone, of an exceeding strong texture and firmness ; whereas round the barrel of the gun, except where it was near adjoining to the iron, there was no such incrustation, the greater part of it being clean and in good condition, just as if it had still continued in use. In the incrusting stone, adhering to it on the outside, were a number of shells and corallines, "just as they are often found in a fossil state." These were all so strongly attached, that it required as much force to separate them from the matrix, "as to break a fragment off any hard rock*."

In the year 1745, continues the same writer, the Fox man-of-war was stranded on the coast of East Lothian and went to pieces. About thirty-three years afterwards a violent storm laid bare a part of the wreck, and threw up near the place several masses "consisting of iron, ropes and balls," covered over with ochreous sand concreted and hardened into a kind of stone. The substance of the rope was very little altered.

* Phil. Trans., 1779.

The consolidated sand retained perfect impressions of parts of an iron ring, "just in the same manner as impressions of extraneous fossil bodies are found in various kinds of strata*."

After a storm in the year 1824, which occasioned a considerable shifting of the sands near St. Andrew's, in Scotland, a gun barrel of ancient construction was found, which is conjectured to have belonged to one of the wrecked vessels of the Spanish armada. It is now in the museum of the Antiquarian Society of Scotland, and is encrusted over by a thin coating of sand, the grains of which are cemented by brown ferruginous matter. Attached to this coating are fragments of various shells, as of the common cardium, mya, &c.

Many other examples are recorded of iron instruments taken up from the bed of the sea near the British coasts, incased by a thick coating of conglomerate, consisting of pebbles and sand, cemented by oxide of iron.

Dr. Davy describes in the Philosophical Transactions †, a bronze helmet of the antique Grecian form, taken up in 1825, from a shallow part of the sea, between the citadel of Corfu and the village of Castrades. Both the interior and exterior of the helmet were partially encrusted with shells, and a deposit of carbonate of lime. The surface generally, both under the incrustation and where freed from it, was of a variegated colour, mottled with spots of green, dirty white, and red. On minute inspection with a lens, the green and red patches proved to consist of crystals of the red oxide and carbonate of copper, and the dirty white chiefly of oxide of tin.

The mineralizing process, says Dr. Davy, which has produced these new combinations, has in general penetrated very little into the substance of the helmet. The incrustation and rust removed, the metal is found bright beneath, in some places considerably corroded, in others very slightly. It proves on analysis to be copper alloyed with 18.5 per cent. of tin. Its colour is that of our common brass, and it possesses a considerable degree of flexibility:—

* Phil. Trans., vol. lxix., 1779.

† 1826, part ii. p. 55.

“It is a curious question,” he adds, “how the crystals were formed in the helmet, and on the adhering calcareous deposit. There being no reason to suppose deposition from solution, are we not under the necessity of inferring, that the mineralizing process depends on a small motion and separation of the particles of the original compound? This motion may have been due to the operation of electro-chemical powers which may have separated the different metals of the alloy.”

Effects of the Submersion of Land by Earthquakes.

We have hitherto considered the transportation of plants and animals from the land by *aqueous* agents, and their inhumation in lacustrine or submarine deposits, and we may now inquire what tendency the subsidence of tracts of land by *earthquakes* may have to produce analogous effects. Several examples of the sinking down of buildings and portions of towns near the shore to various depths beneath the level of the sea, during subterranean movements, were enumerated in a former volume, when we treated of the changes brought about by *inorganic* causes. The events alluded to were comprised within a brief portion of the historical period, and confined to a small number of the regions of active volcanos. Yet these authentic facts, relating merely to the last century and a half, gave indications of considerable change which must have taken place in the physical geography of the globe. If, during the earthquake of Jamaica in 1692, some of the houses in Port Royal subsided, together with the ground they stood upon, to the depth of twenty-four, thirty-six and forty-eight feet under water, we are not to suppose that this was the only spot throughout the whole range of the coasts of that island or the bed of the surrounding sea which suffered similar depressions. If the quay at Lisbon sank at once to the depth of six hundred feet in 1755, we must not imagine that this was the only point on the shores of the peninsula where similar phenomena might have been witnessed.

If during the short period since South America has been

colonized by Europeans we have proof of alterations of level at the three principal ports on the western shores, Callao*, Valparaiso, and Concepcion, we cannot for a moment suspect that these cities so distant from each other have been selected as the peculiar points where the desolating power of the earthquake has expended its chief fury. "It would be a knowing arrow that could choose out the brave men from the cowards," retorted the young Spartan, when asked if his comrades who had fallen on the field of battle were braver than he and his fellow prisoners; we might in the same manner remark that a geologist must attribute no small discrimination and malignity to the subterranean force, if he should suppose it to spare habitually a line of coast many thousand miles in length, with the exception of those few spots where populous towns have been erected. If then we consider how small is the area occupied by the sea-ports of this disturbed region,—points where alone each slight change of the relative level of sea and land can be recognized, and reflect on the proofs in our possession of the local revolutions that have happened on the site of each port, within the last century and a half, our conceptions must be greatly exalted respecting the magnitude of the alterations which the Andes may have undergone even in the course of the last six thousand years.

We cannot better illustrate the manner in which a large extent of surface may be submerged, so that the terrestrial plants and animals may become imbedded in subaqueous strata, than by referring to the earthquake of Cutch, in 1819, alluded to by us in a former volume †. We shall enter somewhat more fully into details concerning that catastrophe than the

* It is well known that during the great earthquake of Lima, in 1746, part of the promontory south of Callao sank down, and it is a common story at Lima that its former termination became the present isle of San Lorenzo, between which and the main land there is now a navigable channel. The submerged arches of a church, and the present position of other buildings, are said to indicate that the site of Callao underwent, during the earthquakes, a change of level; an interesting fact, the evidences of which we hope will soon be examined by some of our naval officers, and other intelligent persons frequenting that port.

† Vol. i. p. 405.

immediate subject of the present chapter might require, in order to lay before the reader the information obtained during the recent survey of Cutch.

The published account of Lieutenant A. Burnes*, who examined that portion of the delta of the Indus in 1826 and 1829, confirms the facts before enumerated by us, and furnishes the following important particulars. The tract around Sindree, which subsided during the earthquake in June, 1819, was converted from dry land into sea in the course of a few hours, the new-formed mere extending for a distance of sixteen miles on each side of the fort, and probably exceeding in area the lake of Geneva. Neither the rush of the sea into this new depression, nor the movement of the earthquake, threw down the small fort of Sindree, the interior of which is said to have become a *tank*, the water filling the space within the walls, and the four towers continuing to stand, so that on the day after the earthquake the people in the fort who had ascended to the top of one of the towers saved themselves in boats. Immediately after the shock the inhabitants of Sindree saw, at the distance of five miles from their village, a long elevated mound, where previously there had been a low and perfectly level plain. To this uplifted tract they gave the name of "Ullah bund," or "the Mound of God," to distinguish it from an artificial barrier previously thrown across an arm of the Indus.

It is already ascertained that this newly raised country is *upwards of fifty miles* in length from east to west, running parallel to that line of subsidence before mentioned, which caused the grounds around Sindree to be flooded. The range of this elevation extends from Puchum island towards Gharee; its breadth from north to south is conjectured to be in some parts *sixteen miles*, and its greatest ascertained height above the original level of the delta is ten feet, an elevation which appears to the eye to be very uniform throughout.

For several years after the convulsion of 1819, the course of the Indus was very unsettled, and at length in 1826, the river burst its banks above Sinda, and forcing its way in a more

* Now in the Library of the Royal Asiatic Society.

direct course to the sea, cut right through the "Ullah bund," whereby a natural section was obtained. In the perpendicular cliffs thus laid open, Lieutenant Burnes found that the up-raised land consisted of beds of clay filled with shells. The new channel of the river, where it intersected the "bund," was eighteen feet deep, and during the swells in 1826, it was two or three hundred yards in width, but in 1828 the channel was still further enlarged. The Indus, when it first opened this new passage, threw such a body of water into the new lake or salt lagoon of Sindree, that it became fresh for many months, but it had recovered its saltness in 1828, when the supply of river-water was less copious, and finally it became more salt than the sea, in consequence, as the natives suggested to Lieutenant Burnes, of the saline particles with which "the Runn of Cutch" is impregnated.

Besides *Ullah bund*, there appears to have been another elevation south of Sindree, parallel to that before mentioned, respecting which, however, no exact information has yet been communicated. There is a tradition of an earthquake, which, about three centuries before, upheaved a large area of the bed of the sea, and converted it into land in the district now called "the Runn," so that numerous harbours were laid dry and ships were wrecked and engulfed; in confirmation of which account it was observed in 1819, that in the jets of black muddy water thrown out of fissures in that region, there were cast up numerous pieces of wrought iron and ship nails.

We must not conclude without alluding to a *moral* phenomenon connected with this tremendous catastrophe, which we regard as highly deserving the attention of geologists. The author above cited states that "these wonderful events passed *unheeded* by the inhabitants of Cutch," for the region convulsed, though once fertile, had for a long period been reduced to sterility by want of irrigation, so that the natives were indifferent as to its fate. Now it is to this profound apathy, which all but highly civilized nations feel in regard to physical events, not having an immediate influence on their worldly fortunes, that we must ascribe the extraordinary dearth of

historical information concerning changes of the earth's surface, which modern observations show to be by no means of rare occurrence in the ordinary course of nature.

It is stated that, for some years after the earthquake, the withered tamarisks and other shrubs protruded their tops above the waves, in parts of the submerged tract around Sindreë ; but after the flood of 1826 they were seen no longer. Every geologist will at once perceive that forests sunk by such subterranean movements, may become imbedded in subaqueous deposits both fluvatile and marine, and the trees may still remain erect, or sometimes the roots and part of the trunks may continue in their original position, while the current may have broken off, or levelled with the ground, their upper stems and branches.

But although a certain class of geological phenomena may be referred to the repetition of such catastrophes, we must hesitate before we call in to our aid the action of earthquakes, to explain what have been termed submarine forests, observed at various points around the shores of Great Britain. We have already hinted that the explanation of some of these may be sought in the encroachments of the sea, in estuaries, and the varying level of the tides, at distant periods on the same parts of our coast*. After examining, in 1829, the so called submarine forest of Happisborough in Norfolk, I found that it was nothing more than a tertiary lignite of the "Crag" period, which becomes exposed in the bed of the sea as soon as the waves sweep away the superincumbent strata of bluish clay. So great has been the advance of the sea upon our eastern shores within the last eight centuries, that whenever we find a mass of submerged timber near the sea side, or at the foot of the existing cliffs which we cannot suppose to be a mere accumulation of drift, vegetable matter, we should endeavour to find a solution of the problem, by reference to any cause rather than an earthquake. For we can scarcely doubt that the present outline of our coast, the shape of its estuaries, and the formation of its cliffs are of very modern date, probably within the human

* Vol. i. p. 270.

era, whereas we have no reason whatever to imagine that this part of Europe has been agitated by subterranean convulsions, capable of altering the relative level of land and sea, at so extremely recent a period.

Some of the buildings which have at different times subsided beneath the level of the sea, have been immediately covered up to a certain extent with strata of volcanic matter showered down upon them. Such was the case at Tomboro in Sumbawa, in the present century, and at the site of the Temple of Serapis, in the environs of Puzzuoli, probably in the 12th century. The entrance of a river charged with sediment in the vicinity, may still more frequently occasion the rapid envelopment of buildings in regularly stratified formations. But if no foreign matter be introduced, the buildings when once removed to a depth where the action of the waves is insensible, and where no great current happens to flow, may last for indefinite periods, and be as durable as the floor of the ocean itself, which may often be composed of the very same materials. There is no reason to doubt the tradition mentioned by the classic writers, that the submerged Grecian towns of Bura and Helice were seen under water; and I am informed by an eye-witness that eighty-eight years after the convulsion of 1692, the houses of Port Royal were still visible at the bottom of the sea*.

* Admiral Sir Charles Hamilton frequently saw the submerged houses of Port Royal in the year 1780, in that part of the harbour which lies between the town and the usual anchorage of men-of-war. Bryan Edwards also says in his *History of the West Indies*, (vol. i. p. 235, oct. ed. 3 vols., 1801,) that in 1793 the *ruins* were visible in clear weather from the boats which sailed over them. I regret to see that Mr. De la Beche, in his valuable *Manual of Geology*, (p. 130,) has evinced so much scepticism in regard to the accuracy of the evidence collected by Sir Hans Sloane, respecting the catastrophe of Port Royal, a town with which Sir H. was well acquainted. To me the original documents collected immediately after the event, appear to bear the intrinsic stamp of truth. The objection against the fact alleged by several eye-witnesses, "that the chimney tops alone of many houses were seen after the shocks, as well as the masts of vessels just projecting above the waves," is quite futile. Perhaps the chimneys in Port Royal might in 1692, have been confined to low kitchens, as Mr. De la Beche says they now are, and they might only have been fifteen or twenty feet in height, still the same subsidence which reduced them to the level of the water might cause the

We cannot conclude this chapter without recalling to the reader's mind a memorable passage written by Berkely a century ago, in which he inferred, on grounds which may be termed strictly geological, the recent date of the creation of man. "To any one," says he, "who considers that on digging into the earth such quantities of shells, and in some places bones and horns of animals are found sound and entire, after having lain there in all probability some thousands of years; it should seem probable that guns, medals and implements in metal or stone might have lasted entire, buried under ground forty or fifty thousand years if the world had been so old. How comes it then to pass that no remains are found, no antiquities of those numerous ages preceding the Scripture accounts of time; that no fragments of buildings, no public monuments, no intaglias, cameos, statues, basso-relievos, medals, inscriptions, utensils, or artificial works of any kind are ever discovered, which may bear testimony to the existence of those mighty empires, those successions of monarchs, heroes, and demi-gods for so many thousand years? Let us look forward and suppose ten or twenty thousand years to come, during which time we will suppose that plagues, famine, wars and *earthquakes* shall have made great havoc in the world, is it not highly probable that at the end of such a period, pillars, vases, and statues now in being of granite, or porphyry, or jasper, (stones of such hardness as we know them to have lasted two thousand years above ground, without any considerable alteration) would bear record of these and past ages? Or that some of our current coins might then be dug up, or old walls and the foundations of buildings shew themselves, as well as the shells and stones of *the primeval world*, which are preserved down to our times *?"

ships *which were previously floating* to disappear entirely, with the exception of the tops of their masts. Besides, we infer from the various narratives, that the subsidences were very unequal at different neighbouring points.

I have great pleasure in stating, that on my requesting Mr. De la Beche to send me more exact particulars, respecting the present state of the harbour of Port Royal, he has ordered a survey to be made.

* Alciphron, or the Minute Philosopher, vol. ii. pp. 84, 85. 1732.

That many signs of the agency of man would have lasted at least as long as "the shells of the primeval world," had our race been so ancient, we are as fully persuaded as Berkely; and we anticipate with confidence that many edifices and implements of human workmanship, and the skeletons of men, and casts of the human form, will continue to exist when a great part of the present mountains, continents, and seas have disappeared. Assuming the future duration of the planet to be indefinitely protracted, we can foresee no limit to the perpetuation of some of the memorials of man, which are continually entombed in the bowels of the earth or in the bed of the ocean, unless we carry forward our views to a period sufficient to allow the various causes of change both igneous and aqueous, to remodel more than once the entire crust of the earth. *One* complete revolution will be inadequate to efface every monument of our existence, for many works of art might enter again and again into the formation of successive eras, and escape obliteration even though the very rocks in which they had been for ages imbedded were destroyed, just as pebbles included in the conglomerates of one epoch often contain the organized remains of beings which flourished during a prior era.

Yet it is no less true, as a late distinguished philosopher has declared, "that none of the works of a mortal being can be eternal*." They are in the first place wrested from the hands of man, and lost as far as regards their subserviency to his use, by the instrumentality of those very causes which place them in situations where they are enabled to endure for indefinite periods. And even when they have been included in rocky strata, when they have been made to enter as it were into the solid framework of the globe itself, they must nevertheless eventually perish, for every year some portion of the earth's crust is shattered by earthquakes or melted by volcanic fire, or ground to dust by the moving waters on the surface. "The river of Lethe," as Bacon eloquently remarks, "runneth as well above ground as below †."

* Davy, *Consolations in Travel*, p. 276.

† *Essay on the Vicissitude of Things*.