THE ROCKS OF AMERICA.

PRINTED BY BALLANTYNE AND COMPANY
EDINBURGH AND LONDON

THE

LIFTED AND SUBSIDED

ROCKS OF AMERICA

WITH THEIR INFLUENCES ON THE

OCEANIC, ATMOSPHERIC, AND LAND CURRENTS,

AND THE

DISTRIBUTION OF RACES.

BY

GEO. CATLIN.

LONDON:
TRÜBNER & CO., 60 PATERNOSTER ROW.
1870.

PREFACE.

AMERICAN rocks are, and will be through all ages to come, monuments of extreme interest to science, from the geological truths they unfold; and of pecuniary interest to the commercial world, whose pockets will for ever be lined with their shining treasures.

No other portion of the globe presents so vast and sublime a spectacle of uplifted rocks as the American continent, extending in continuous chains nearly from pole to pole, holding up to view the hidden secrets of the interior system of the earth, and with them the golden treasures which were created in darkness, and beneath the knowledge and penetration of man; as if the Supreme Author who made them, by some power yet mysterious, had lifted and piled them up for the gaze and admiration of greater than mortals to look at, as well as for solitary man to creep through and over, and amongst them acknowledge his insignificance.

The nature, the dimensions, the contents, and the mysteries of these majestic piles will be eventually taught and learned in books, but their real grandeur and beauty must be seen and felt to be appreciated.

The awfully grand and inspiring contemplations which the author of the following chapters has had amongst scenes of this nature, during his fourteen years of roaming amongst the Indian tribes of North and South America, through the Rocky Mountains and the Andes; and the undoubted effects, as yet unexplained, of those majestic monuments on the phenomena of currents in the ocean, the atmosphere, and on the land, have led him to prolonged studies in the field, and to the compilation of the ensuing remarks.

He who roams through the vast solitudes of North and South America meets geological phenomena in many forms and on the grandest scale. When he clambers to the tops of the upheaved mountains whose bases rest upon eternal fire, and whose tops are capped with perpetual snows, and picks up a water-worn pebble there, he is amazed, but with a moment's thought an explanation comes for this. But when, from the niches and fractures of the highest edifices and pyramids of the ruined cities of Palenque and Uxmal, he scrapes out with his hand marine sand and gravel charged with rounded pebbles and fragmentary coral, things which no wind could have

blown there, his amazement is a fixture, and has no relief. And when he contemplates the Gulf Stream, its magnitude and characteristics (authenticated by reliable facts), incessantly and eternally pouring out of the Caribbean Sea and Gulf of Mexico into the Atlantic Ocean, with a current thirty-two miles in breadth, and 1200 feet deep, moving at the rate of four miles per hour, and with an impetus that carries it along the whole coast of the United States to the southern cape of Greenland, and back, by the coast of the continent of Europe, near to its starting-point, amazement becomes consternation, and contemplation an unanswered question.

For effects so amazing and stupendous there must be a stupendous cause; and for the solution of that cause, not yet explained, unevadable contemplations of the author elicit the suggestions and deductions made in the following pages, and which will be offered in all cases with deference, and with profound respect for the published opinions of men known to be more deeply versed in the sciences of cosmogony and geology than himself, but whose theories, in some cases, he will be obliged to oppose.

THE AUTHOR.

CONTENTS.

CHAPTER IV.

CHAPTER V.

CHAPTER VI.

CHAPTER VII.

CHAPTER VIII.

CHAPTER IX.

APPENDIX.

LIFTED AND SUBSIDED

ROCKS OF AMERICA.

CHAPTER I.

MOUNTAIN DRAINAGE OF AMERICA.

ROCKS, which in the geological sense comprise all mineral and earthy substances found on the surface of the globe, such as clays, schists, earths, stones, &c., are intended to be considered in the present work (orographic rather than geological) only in the common sense, as forming, or as having formed, portions of the consolidated crust of the earth; and in their three phases—their native beds, their uplifted and subsided conditions—and the singular results from their changed positions, it is the author's intention to study them in the following pages.

Though not intended as a geological work, geological truths and terms will necessarily be often used in it; and that the reader may not be kept in suspense as to some of the leading results to be

herein set forth, of the upheavals of the Rocky Mountains and other mountain chains, they will be here briefly named and assumed, and more definitely exposed, and supported by proofs, in the further progress of the work.

Amongst those probable results (and which I consider the most important) are the phenomena of vast water-sinks *into*, and water-courses *under*, the Rocky Mountains and the Andes,—the subsidence of the Antilles,—the equatorial current,—and the Gulf Stream issuing from the Gulf of Mexico.

Universally admitted to be subjects of great interest, the two latter have been puzzling enigmas for scientific men for many years, and subjects for many theories, but remain, as yet, without a settled solution; and the first is, perhaps, my own especial suggestion, which I shall put forth on strong proofs, and which, I believe, will be received as the cause and rational solution of the other three.

The Gulf Stream, one of the striking anomalies of the globe, and which has elicited perhaps a greater variety of theories of scientific men as to its cause than any other phenomena of the ocean, I shall contend, as already suggested, is yet unexplained, and traceable to influences not before named, arising out of the vast chains of upheaved rocks in North and South America, the Rocky Mountains, and the Andes, converging in the latitude of the Gulf of Mexico and the Caribbean Sea, and continually discharging into those estuaries the accumulating waters in the rocky cellars underneath them.

This hypothesis, which I here propose and shall endeavour to sustain, implies the existence of a river under the Rocky Mountains many times larger than the Mississippi, and nearly twice the Mississippi's length, gliding through the clean and vast rocky cellars of the upheaved mountains without the losses by alluvial absorptions and solar evaporations which diminish valley rivers, taking along in its course the sinking streams and lakes of the mountains of Mexico, and with them, perhaps by a hundred mouths, in its deep bed, débouching unseen into the Caribbean Sea and the Gulf of Mexico.

Through the heated vaults underneath the Andes, I contemplate a similar river, running from near the 30th degree of S. latitude to the north, and conveying *their* overflowing waters also, into the Caribbean Sea.

The Lesser Antilles, now partially sunk in the ocean, I have ascertained are but a chain of mountain tops, which six thousand years ago stood up in their grandeur, a part (and probably the glory) of the Andes; and at that date, the two mighty sub-montagne rivers, meeting and débouching together into the ocean, east or north of the Antilles, combined with extraordinary volcanic influences underneath, undermined the Antilles chain, which went down in the cataclysm, well established in Indian traditions which I have gathered, both in North and South America; and also by unimpeachable records on the rocks themselves—by shapes and grooves left in the giant standing walls at Carraccas in Venezuela, and at Santa Martha, in Grenada, where

this mighty chain was broken—records which I have twice seen ; which may be read by all ages to come, and which are not myths or fables.

In this tremendous catastrophe, probably the most stupendous that ever took place on the globe, the peninsula of Yucatan, with its splendid Aztec cities, sank, and since has partially risen, leaving the two grand sunken estuaries, the Gulf of Mexico, and the Caribbean Sea, into which the two subterranean rivers, from the constant overflow of their vast cisterns under the mountains, now spread their clear and blue waters, heated by the volcanic furnaces they have passed.

By the joint influx of these rivers into the Caribbean Sea, its western surface is elevated several feet above the level of the ocean ; and pouring into the Gulf of Mexico, this vast descending tide sweeps its western coast, and taking in its course the waters of the Rio del Norte and the Mississippi, débouches with them into the ocean at the Cape of Florida, and there becomes the "Gulf Stream"—until now, as I have said, one of the mooted puzzles of the world.

The mode by which water is taken from the sea, and transported and spread over the earth for the support of animal and vegetable life, is well known ; but the manner in which it returns to the ocean, and the effects which, in some cases, it produces on its way, are subjects which I believe have in a measure escaped the scrutinies of science.

In the above recital of facts, if they be true, there is illustration, on a grand scale, of the power of

accumulated waters when they have accomplished their mission on the land, and are again seeking the bed of the ocean—waters which have not fallen in valleys, to run the wasting gauntlet of absorptions and evaporations, but waters embraced and conveyed by agencies grander than valleys, conducting them back undiminished, and in all their strength and purity, to the ocean from which they came.

In approaching a problem so grand and so imposing as the one before us, cause and effect must in turn be considered in our course, and weighed together in the end.

The effects of our problem are now in brief before the reader, where they will rest until we come back to them—until we have taken a brief view of their cause or causes—a tour into the Rocky Mountains, to the sources of the submontagne river and back, tracing its subterranean shores to the Caribbean Sea and the Gulf of Mexico.

Travelling in a light and handy balloon, and following the course of the clouds conveying the waters from the equatorial current to the Rocky Mountains and prairies of North America, will be the easiest and quickest mode we can adopt, and afford us the most general view; and we will return by water, as above proposed.

Our view, at first, from the clouds, is that of a "bird's-eye"—the vast and countless ridges of upheaved rocks, parallel (and here and there divergent), sometimes twenty or thirty abreast, and embracing a breadth of from one to three hundred miles, with now

and then solitary peaks, and, at intervals, long ranges of wave-shaped mountains capped with glistening snow.

Such is our view before and beneath us when we start over the southern limits of Mexico (for the Rocky Mountains commence there); the scene vanishes in blue in the distance, as our faces are turned to the north; and, like a moving panorama, the ever-varying groups of gray, and green, and snow-white mountains with intervening valleys, and lakes, and ravines, are passing under us as we move on.

Three thousand miles, and when our eyes are dimmed with the myriad, endless ridges, peaks, and chains of uplifted rocks, varying from 1000 to 1800 feet in height, and these rising from a surface several thousand feet above the level of the ocean, we arrive at the northern extremity of the Rocky Mountains, the sources of the Missouri, and the head of the Rocky Mountain river, which needs no other name until the facts of its existence and its effects are established.

In our aërial voyage things have looked small—they have passed under our view by thousands, and been but imperfectly appreciated; we will take a closer view of them, and at their bases, estimate more nearly some of the uplifted piles we have passed over, and the moving forces which they gather from the clouds and send back to the ocean.

It is a settled maxim amongst scientific men, that all mountains are upheavals of fractured portions of the earth's crust, by some mysterious power acting underneath, but beyond the vision and certain comprehension of man.

Various and dissimilar theories have been advanced by distinguished geologists and orographists, as to the manner in which such upheavals have been made, and the power which has produced them.

For my present purpose, it is immaterial by what cause and by what process they have been produced; it is enough to know that such upheavals have taken place; and some remarks on those various theories, with my own opinions of the causes of mountain elevations, will be introduced in future pages.

All mountain elevations bear on their tops and sides the unimpeachable evidence that they have been *uplifted*, and man's reason decides, without the necessity of proofs, that all mountains uplifted vacate a space in their deserted beds equal to the space of atmosphere which their summits displace above the surface level; and the simple process of digging a trench or sinking a well of a few feet in depth, in the ground (if we lacked the proof of it), will show that the space left by mountain elevations must be filled with water at least as high as the level of the ocean, unless some other material from a lower source follows the uprising rocks and fills the vacuum.

If this be not a *maxim* in science, it is an *axiom* in the mind of every reasoning man, and therefore ground that may be safely assumed as basis for opinions which I shall advance.

The Rocky Mountains, from the 55th degree of north latitude to the Caribbean Sea, form one continued chain, and their base-line having a descent corresponding to the descent of the Missouri and

Mississippi rivers, rising in the same latitude, the waters filtered into their subterraneous cavities, having at their source the same elevation above the ocean's level as the sources of those rivers, would flow in an equal descent towards the Gulf of Mexico.

If it be a truth that cavities vacated by uplifted mountains were equal to the space which the upheavals occupied in the atmosphere above the surface of the earth at the time of upheaval, it will be a fair assumption, that at the present day, from the diminished size (and in many cases the utter demolition) of the mountains by degradations, the present space they occupy above the surface is but half (or a fourth) equal to the cellars left underneath them.

We have something then like a basis for the vastness of cisterns and caverns underneath the Rocky Mountains, by which their accumulating waters might be carried to the ocean. It is a law of nature that water will run down hill, if there be a channel for it to run in, and nothing to arrest its course.

Do such vast cisterns of water, accumulated under the Rocky Mountains, exist, and have they an unobstructed channel to the Caribbean Sea and the Gulf of Mexico?

In contemplating cause and effect in phenomena so grand as the subject before us, it is necessary, for a due estimation of the former, to revert occasionally to the latter—to its grandeur—the certainty of its existence, and the fact that it yet calls for a solution.

The Gulf Stream, as has been said, with a breadth of 32 miles, a depth of 1200 feet, and a velocity of four miles per hour, steadily and perpetually (and unaffected by the caprice of winds) pouring from the Gulf of Mexico into the Atlantic! It must be so—and who has told us, truly, where this vast, this steady, this blue and clear, and unceasing volume comes from?

Valley rivers are varied by freshets and droughts; have clear water and muddy; but a submontagne river, gliding amongst the clean, upheaved, and broken rocks, fed by every rain and every snow-fall, and undiminished by alluvial absorptions and solar evaporations, we are now tracing to the ocean; and let us estimate its grandeur and unchangeable volume as we travel on.

We are in the latitude of 55 degrees, and by the tortuous windings of the principal mountain chains, three thousand miles from the Caribbean Sea; in the midst of piled-up ridges, rising sometimes in sharpened peaks apparently to the skies, and in countless numbers spread (in forms like vast ocean waves) over one or two hundred miles in breadth, where, from their lofty summits, "hills peep o'er hills, and Alps on Alps arise;" and such the endless chaos around us till we reach the latitude of the Caribbean Sea. We are in the midst of almost perpetual rain and snow, and estimates of these will help us in the solution before us.

The known and long-established fact that rains and snow-falls are much more frequent and abundant

in mountain ranges than in the valleys and plains, applies with an unusual force to the ranges of the Rocky Mountains.

Persons who have travelled or resided in the vicinity of high mountains in any country, will have judged for themselves, as to the correctness of the maxim, when they have beheld the mountain tops frequently enveloped in mists and clouds, whilst in the valleys there was fair weather and sunshine. Clouds are seen following the mountain chain, and others crossing the valley, gliding up the mountain sides and over, and deluging the mountain top, whilst fair weather remains on its side and at its base.

The mountain attraction of pluvious clouds is exhibited on a grand scale in the Rocky Mountain ranges, and no better illustration perhaps can be seen on the globe of the rapid degradation produced on their sides and summits by the enormous forces of rain-falls and of snow, and by the expansion of ice in their clefts and crevices.

The reader can draw something like adequate conclusions as to the vast disproportion between the quantity of rain-fall amidst these mountains and the rain that falls in the valleys and on the arid plains, and easily imagine these incessant torrents shed upon the mountain tops to be gushing down the mountain sides, filling the ravines, and making their way to the Missouri or to the Pacific Ocean.

This is in a measure true; but the tourist who happens to stand in the midst of the suffocating deluge, holding on to a bush or a rock till the tempest

has gone by, draws different conclusions when he descends the mountain's side: he has seen and felt the flood as if poured from cauldrons, dashing like waves under his feet and down the mountain's side, but when he descends it has disappeared—it is not there; the ravine is silent, not roaring nor foaming; its little brook has got a tinge of colour and a tithe of water, and the ever-yawning and thirsty rocks have inhaled the rest.

The axis of every upheaval, as far as it is exposed, is an immediate and insatiable receptacle for all the rain and snows which fall upon it; and these, from the vast degradations they have undergone, levelling them down, often extend over immense areas.

The inclines, so far as they are in position, carry the waters that fall upon them into mountain lakes, ravines, and rivulets; and these, more often than otherwise, are traceable to sinks amongst the fractured rocks, where, by crevices and faults, they enter the cellars underneath the mountains, instead of finding their way to the valleys or the ocean.

The Rocky Mountain system stands upon (or rises through) an elevated floor or plateau of several thousand feet, in the centre of its arch, above the level of the ocean — gradually lifted, no doubt, by the long succession of upheavals of the numerous mountain ridges, consisting only of the sedimentary rocks, and probably supported at each successive lift by detached and falling masses of rock, or by boulders of granite driven laterally by the explosion, and

under the sedimentary floor, and acting as pillars supporting the gradually lifted inclines.

These inclines, both on the east and west sides of the mountain chain, in many places extend off into the plains for a great distance, and the rain-falls upon them are carried off by numerous streams to the valley of the Missouri and Mississippi, or to the Pacific Ocean.

The rain-fall, as has been said, is much less on these vast and arid inclines than on the mountain ranges; and even that, disproportionate as it is, runs the gauntlet of absorptions and solar evaporations; and of what is left from a hundred rivers flowing in from the east and the west, the Mississippi eventually marches with its gathered trophies into the Gulf of Mexico.

The Mississippi River, having joined its waters with the Missouri, supposed to be the greatest water-course on the American continent or on the globe, and with a length, following its sinuosities, of more than 3500 miles from its extreme source to its mouth, deserves a little passing attention before we take it into the general view of mountain drainage of the American continent.

Valley rivers form a *species*, and with river species, as with all other species, there is a pervading family resemblance. The Mississippi therefore differs from other valley rivers more in its grandeur and length than in any peculiar feature or character.

When we contemplate it on a map, or, more impressively, when we see it and feel it as we are

descending it in a canoe, we meet phenomena which seem inexplicable at first sight, but which astonish us less when a more deliberate view, suited to the magnitude of the subject, is taken of its real character and effects.

Literally speaking, neither the Mississippi nor the Missouri conduct any portion of the waters flowing out of the Rocky Mountains to the ocean. This may be a startling assertion, yet it is easily solvable by those who have made themselves familiar with those giant rivers, their vast proportions, and the manner in which they receive and dispose of the waters of their numerous confluents.

In 1832 I descended the Missouri in a canoe, from the mouth of the Yellow Stone River to St Louis, a distance, by the course of the river, of 2000 miles; and in two successive summers, in 1834 and 1835, descended in the same manner the Mississippi, from the Fall of St Anthony to St Louis, a distance of 900 miles, and in all the three voyages with my paddle steered my own canoe; and in my subsequent Indian campaigns, made myself familiar with all parts of the lower Mississippi, ascended the Arkansaw and Red River near to their sources; and in 1855 descended the Rio del Norte in a canoe, from Santa Fé to Matamoros.

Such a familiarity with the great water-courses supplying the Mississippi from the west, and generally supposed to be transporting the rainfalls of the Rocky Mountains through the banks of the Mississippi to the Gulf of Mexico, has enabled me to draw conclusions,

and authorised me to issue the startling paradox above introduced, and the more astounding one which follows—to wit, that if the whole waters of the Mississippi and Missouri, and all their tributaries—and with them all the rivers on the globe, could be embodied in one valley river, and spread out in proportion like the Mississippi and Missouri, with an alluvial valley of sufficient length, like the valley of those rivers, to run in, beyond a certain distance not one drop of water would ever flow in its bed.

The cause of this forms a problem that must be solved here, and that done, it will aid in the solution of the greater problem which has been advanced as the primary object of this work, and to the further consideration of which we shall in due time return.

The wasting effects, by alluvial absorptions and solar evaporations, upon valley rivers, have been philosophically and ably treated by many scientific men ; and though the subject has by these means been generally appreciated, there may yet be features new, or on a grander scale, in the waste of waters in the great valley of the Mississippi, when their reality is made known.

Were it not for the current, a foreign navigator, not knowing the geography of the country he was in, might pilot a steamer from the Mississippi's mouth, to the mouth of the Yellow Stone, a distance of more than 3000 miles, by the course of the river, almost without knowing (from any change of its magnitude) which way the river had run.

The Yellow Stone river, at its junction with the

Missouri, itself appears nearly as large as the Mississippi where it enters the Gulf of Mexico, and has its "delta," much resembling that at the mouth of the Mississippi, though of course not so large, and its current about the same, though not so deep.

The Missouri, at this junction, is fully equal in volume to the Yellow Stone, and, like that river, has yet an upward course full 800 miles to its extreme source in the Rocky Mountains, uniting in its way several large tributaries.

Below this junction the Missouri takes into its embrace the Little Missouri, the Knife River, the Cannon-ball, the White Earth, Dahcota, Big Sioux, Platte, and Kansas rivers, and the Mississippi (which is in fact but a tributary of the Missouri), and with them, the world suppose, débouches into the Gulf of Mexico. But what a popular error! If this were true, and that all the waters which these rivers pour into the Missouri and Mississippi were, by the Mississippi, emptied without loss into the Gulf of Mexico, the Gulf Stream might reasonably have been attributed to a much more probable origin than the far-fetched causes of several theorists who have recently written on the subject.

The best proof of facts on which rest such phenomena as are now before us, is probably that of long and toilsome experience with and amongst them; and of such I will take a few moments to name the following. On the 1st of March 1832 I was admitted a passenger in the steamer *Yellow Stone*, at St Louis (then starting on the first steamboat navigation of the Upper Missouri), owned and freighted by the Mis-

souri Fur Company. There was a sweeping freshet on the Mississippi, and the state of the water therefore considered favourable for the voyage.

During the first day's steaming we passed into the Missouri, out of which the boiling waters of the freshet were rolling, and leaving the Mississippi, which from that point upwards was at low ebb.

Nine hundred miles took us safely and rapidly above the mouth of the river Platte, from which it was easily visible the freshet had come.

From this point our progress was slow—the channel unknown, and the vessel hitching along, and running on to sand-bars; and at length, getting entangled amongst groups of such, came broadside upon the head of one, from which there was no present means of escape, and all hands decided that we must there remain until a rise of the water—"till the freshet of the Yellow Stone came down." The water was then falling, and in a day or two the steamer lay high and dry on the sand, many rods from the water's edge.

Three weeks was the time our vessel was stranded there, and the flood from the Yellow Stone came pouring along. Our vessel was soon afloat, and again on its way for the mouth of the Yellow Stone.

Terrible were the struggles, and all but discouraging, stemming such a tide, with its snags and floating logs, and other impediments, in our total ignorance of the shape and depth of the channel; but against all we succeeded, and in just three months of constant efforts from our start at St Louis, we reached

Fort Union, the Fur Company's factory, at the mouth of the Yellow Stone River, when the last drippings of its freshet were just running out, and the Missouri, above the junction, in a low and undisturbed state.

I remained at the mouth of the Yellow Stone about six weeks, when the freshet on the sources of the Missouri came down. It was tremendous—sweeping over all the meadow lands and through the low forests quite to the base of the bluffs.

I waited until it was on the decline, and then set off in my canoe, with two men, for St Louis, as has been before mentioned. We travelled fast for a few days; and when we reached Fort Pierre, a trading-post at the mouth of Little Missouri, and about half the way to St Louis, the river was low; and Mr Laidlaw, the factor of that post, assured me there had been no freshet there as yet—that the flood on the head waters of the Missouri had run out before they reached that place.

We continued our course, and had low water until we reached the junction of the Missouri with the Mississippi, the latter of which, to my astonishment, was flowing over its banks, and its flood of waters moving towards New Orleans.

Unless the Ohio and Tennessee were also swollen, in all probability this freshet would have run out before it reached the mouths of Arkansaw and Red River, leaving them and their tributaries to supply the Lower Mississippi and the Gulf of Mexico with their usual quantum of fresh water, and but little of which comes from the base of the Rocky

Mountains. These facts show that the Missouri River, leaving the mouth of the Yellow Stone, and taking the waters of that river with it, without receiving the waters of the Little Missouri, Cannon Ball, Platte, Kanzas, and a dozen other rivers, would be dry before it reached St Louis; and that the Mississippi, leaving that place in full banks, without the waters of the Ohio, Tennessee, Cumberland, Arkansaw, Red River, and many others, would be exhausted before it reached the Gulf of Mexico.

The above facts authorise the statement above made, that no portion of the rain-fall in the Rocky Mountains reaches the Gulf of Mexico through the banks of the Mississippi, how much soever of those rain-falls may descend on the sedimentary declines of the mountains, and be shed into the extreme head waters of the tributaries of the Missouri and Mississippi rivers.

And the same extraordinary facts, with the aid of reason, lead us again to these following conclusions, the correctness and importance of which I believe all will admit :—

First, That this almost inconceivable waste of water, spread out between and over the banks and meadows of the vast water-courses of the valleys of the Mississippi and Missouri, is caused by solar evaporation, and absorption into the deep alluvial and sandy beds through and over which it is spread.

Second, That by evaporation, that portion of these journeying waters which is not used for fertilising the soil, and for the support of animal and vegetable

life, is thus lifted into the clouds, and dropped again in the mountains, to take its chances once more of reaching the ocean.

And, *Thirdly*, That but for the wise and beneficent order of Providence in dissipating and disarming these vast accumulations of waters in the manner above described, their united force and flood would sweep the valleys of the Missouri and Mississippi, in their way to the ocean, destroying all animal and vegetable life within them.

It is an order of nature, that the water taken from the ocean, and conveyed by the clouds and scattered over the mountains and plains, should have the means and channels by which to get back again to the ocean. This constant and perpetual circulation is as necessary for the healthiness of the land and the sea, as the circulation of the blood for the support of animal, and the sap for vegetable life.

I have conveyed thus far a slight idea of the vast and increased proportion of rain-fall in the mountain regions, and barely hinted at its probable destination and effects after it has disappeared amongst the mysteries of the lifted and broken-up rocks; and, with the estimates just above made of the immense floods of water that are perpetually starting for the ocean through the channels of a hundred valley rivers (and with the maxim before us, that all waters which leave the ocean return to it again), we stand below New Orleans, and realise, to our astonishment, the wasted residuum of all these mighty and overwhelming floods of the great valleys of the Missouri

and Mississippi, on their way to the Gulf of Mexico, quietly moving through a channel (in a level meadow) of half-a-mile in width, and at the funereal pace of two and a half miles per hour.

This synopsis of facts and their results, relative to valley rivers, fills the mind with amazement, and, with useful data, prepares it for a return to the contemplation of submontagne drainage—to mountain rivers, where rain falls not in drops, but in sheets and waves, and is swallowed, not by the slow process of evaporation, but by the rents and crevices of insatiable rocks, and sent on its speedier way to the ocean.

Rock absorptions, though limited to a smaller area, I consider to be far greater than the waste of waters in the valleys by the causes already explained.

The Rocky Mountain ranges, from the southern limit of Mexico to the 55th degree of north latitude, occupy an area of country equal to the whole valley of the Mississippi and Missouri, and receive a rain-fall at least double or treble in amount; of that, a large proportion, falling on the great inclines, reaches the sources of the Missouri and other rivers rising in the mountains, and flows into the valleys to the east and the west; and the rest sinks where it falls, through cellular and fractured rocks, to the vast reservoirs which were once the beds of the uplifted mountains.

Those beds, vast as they are, have their limits; and as they are perpetually receiving, and never overflow, it is a reasonable conclusion that they deliver their waters to the ocean.

The illustrations supporting such facts as the above, which the mountain traveller meets, are at times almost incredible. I have been encamped at the base of a mountain, when its top and its sides were enveloped in a pluvious cloud; and so vast were the descending torrents, that I could see waves dashing and leaping over the shelving rocks at a distance above me, and yet not a drop of that water reached the mountain's base!

And in another similar storm, when the water was shed down the mountain's side and into a deep ravine, though its rocky bed was foaming with the irresistible flood, I crossed the same but a mile below, where there was barely water for my horse to drink!

Ten thousand of such ravines exist in the Rocky Mountains, their beds filled with immense boulders jammed together, amongst which the descending floods from the mountains disappear, and descend to regions unknown.

Some of these ravines have courses of living water, and conduct to the extreme sources of mountain rivers; but the greater portion of them are dry, except in the season of rains, and their dry beds are traceable to sinks, where they terminate in deep sunken vortices, generally in front of immense faults, filled with boulders and logs jammed together.

In crossing the mountains in 1855, from the great Apachee village on the Ghila to Santa-Fé, I had an opportunity of witnessing one of these singular features in full operation, and on a grand scale. After riding several days near the base of the "White

Mountains," our guide, who was a Frenchman, seeing me making sketches and examining the minerals of the country, proposed that we should leave our track for a while, to visit "*Les Roches qui tremblent.*"

The reader will easily imagine that I embraced without hesitation his offer to guide us; and though I had difficulty in enlisting the rest of the party in his project, yet I succeeded, and we went to the "Trembling Rocks."

We crossed with some difficulty a high and stubborn ridge, to save a long ride in going around; and getting over, descended a gradual decline for several miles, leading to a high and precipitous wall facing us, and at right angles to our approach.

On this incline, and to our left, was a deep ravine, carrying parallel to our course, judging by the noise issuing from it, a strong cataract towards the facing wall.

Getting within one hundred yards of the wall, the declivity became very steep; and beneath us, at its bottom, the foaming current was dashing in amidst rocks and broken driftwood, amongst which it disappeared and sunk at the foot of the wall.

This wall, which was of a bluish geodiferous limestone, was no doubt the standing part of a recent fault, for its summit surface was level, and vertical grooves plainly proved the subsidence that had taken place, and on which we were standing.

Our guide took us to the side of the wall, and exulted in convincing us, when resting our heads against it, that the rock "trembled." This trembling

I found was sensible at a mile distant; and though I attributed it to the falling cascade, our guide assured us that it was always the same, even when the ravine was dry.

If this were so, it would furnish strong proof (with others I shall present) of the existence of submontagne cascades, which are easily within the scope of possibility; but for the present—where went this foaming torrent? Surely not to the Mississippi, nor to the Pacific Ocean; for we had already crossed half-a-dozen mountains coming from the last, and had as many more between us and the head waters of streams leading to the other.

Here, then, was a river (or the branch of a river) running under the Rocky Mountains; and I have seen a number of such, and of these some hundreds are known in the mountains of Mexico and the Rocky Mountains.

Not only by this mode of sinking, by which the rain-falls upon the inclines are sliding off and pitching into the faults and crevices in all directions, but through mountain lakes which have no apparent outlets, mountain springs and ravine products are constantly passing, and to the same destination.

Of these there are thousands; and amongst them, Humboldt's Lake and the Great Salt Lake, with large streams running into them, and with no apparent issues running from them. These sinking lakes and rivers, at all altitudes, in the Rocky Mountains, in the mountains of Mexico and the Andes, turning in their waters, and uniting them as they are descending into

the great reservoirs, would form submontagne torrents, with cascades, producing not only the "*trembling of rocks*," but the "*blowing caves*," and the "*montagnes qui fument*," which are met in various parts of the Rocky Mountains, and as well in Mexico as in latitudes further to the north.

The "smoking mountains," occurring in the northern and middle sections of the Rocky Mountains, are held in superstitious awe by the Indians, who are ignorant of their cause, and also by the trappers, who keep them in view as landmarks to guide their wilderness roamings. Their "*smoke*" (as it is termed) may be seen at all hours in the day, and in all sorts of weather; and when approached, is found to be a thin and watery vapour, similar to that rising over all cataracts; and in many places is distinctly seen issuing from the crevices of the rocks and caverns.

There can be no other possible cause for this unceasing phenomenon than that of broken and agitated water underneath; and the "blowing caves," which are yet more frequent, equally prove the fact, that waterfalls, as well as cascades, exist under the mountains, and probably on a magnificent scale, if they could be seen.

Such a system of drainage—if the facts have been correctly stated—on so grand a scale, eternally at work, both night and day, and at all seasons, gathering the falling waters over a tract of country (already said) larger than the valleys of the Missouri and Mississippi together, and carrying them to the ocean, prepares us for rational conclusions as to the probable

mode of their conveyance, and of their effects when they arrive there.

If a row of lofty and connected houses was built, running at right angles from the shore of the sea, and up a gradual incline of a sandy plain, with deep and stone-bound cellars connected with each other—the doors and stairways all open, and the roofs on one side removed,—a heavy fall of rain would give us something like an illustration of the drainage of the Rocky Mountains and the Andes.

The standing roofs, like the great inclines of the mountains, shedding their half of the rainfall upon the plain, to be absorbed in the sand, and the unroofed parts swallowing their portions of the flood, sending it in leaping cascades from floor to floor, to the rock-bound cellars, whence, with its constantly accumulating forces, it is rapidly and surely passed into the ocean.

These broken roofs and rock-lined cellars, do they thus exist?—who denies it? All cellars are below the pavement, and the God of Nature, who made and fashioned the earth, has lined it quite around with a sedimentary pavement of rocks. This pavement upbroken, cellars are formed, with broken roofs over them. Through these the thievish clouds drop their heaviest prey, and the plundered ocean calls it home again.

The vast inclines extending off and into the plains, from the bases of the mountains, both to the east and the west, and at their axes several thousand feet above the level of the ocean, and from which (or through which) the mountain ridges rise, I shall here assume

are the gradual elevations of the sedimentary system (as before suggested), caused by the successive upheavals passing through them, lifting them and propping them at the fractured edges, and forming vast cellars or cisterns beneath them, through which, and above the granite surface, the sunken waters flow.

That these mighty floods sink into and beneath the rocks, and that they do flow to the ocean, and the effects they produce there, are the more immediate objects for consideration ; and the probable mode by which their river-bed was formed will be more appropriately discussed in future pages.

In speaking, in former pages, of the mutual supporting relationship between cause and effect, I briefly alluded to the vastness of the anomaly of the Gulf Stream, and claimed its magnitude and unsolved mystery as evidence of its cause existing in the mountain drainage which I have explained ; and I now tender the grandeur of that assumed cause as the cause of that effect, on the ground that the ultimate effects of such a cause are nowhere else developed, and that no less an effect of that cause could anywhere result than the Gulf Stream.

When I say "the *cause*," I should say "the *causes*," for the effect is sublime enough to call for the strength of both. I have said that the Gulf Stream was caused by submontagne rivers from under the Rocky Mountains and the Andes, converging in the latitude of the Caribbean Sea, and discharging their combined waters into that estuary ; and pouring through the Gulf of Mexico, taking with them the waters of the Rio del

Norte and Mississippi, they debouch with them into the ocean at the Cape of Florida, and there become the Gulf Stream. One of the most singular and striking of the phenomena of the Rocky Mountains and the Andes we now approach, — the "DRY RAVINES," a phrase of the country applied to deep gorges running from the mountain's base into the valleys, and always dry, and termed by the French trappers and traders "*Eau sec.*"

No observant and discriminating traveller through the Rocky Mountains can fail to be struck with the singularity and apparent mystery of this, as yet, unexplained phenomenon; and when understood, there is nothing else that furnishes so conclusive proof of the submontagne drainage being explained.

Through the whole Rocky Mountain chain, the principal ridges, where they have a latitudinal trend, furnish, more or less often, instances of this singular feature.

In following up a valley stream between the mountains, we are on an active stream, fed by living springs, and also swollen, when rain-falls get concentrated within its banks. We pass ravines bringing in their accumulating waters, and occasionally we enter one that is dry, deep-furrowed, and ploughed out, and filled with huge rocks, piled one upon another, and overshadowed by lofty trees.

We trace its deserted bed, and wonder at the strength of the torrent that has once dredged it out, piled up the moveless rocks on its sides, and uprooted the stately trees on its banks. There has been rain

for several days, and the ravines on the opposite side of the stream are running fresh, and the one we are walking in is dry!

We walk and clamber on, and at length, before us (and to which the ravine is approaching at right angles) we behold a huge mountain's side, and a black and yawning cave in the rocks, some forty or fifty feet above our heads. It is large enough to admit "a coach and four," or perhaps a railway train; but all around and within is dry and silent and desolate; and so for hundreds of years it has probably stood, without the least change or alteration!

That is enough; it is the description of a "*dry ravine*," and answers for the thousands that may be seen in the Rocky Mountains and the Andes: but let us *contemplate* them—*for what*, and *when*, and *how*, they were made, and the *deductions* that we must draw from them. They are certainly not produced by the rain-falls gathering on the mountain sides and pouring through them; for in the heaviest rains there is nothing in them—just enough to moisten the absorbent clay at their bottoms, and nothing more.

A better clue to them perhaps will be given by the appellation I would apply to them, of *mountain gates*, or *mountain sluices*, for carrying off the overflow of waters that gather periodically in the submontagne reservoirs, from excessive rain-falls or from local and temporary impediments in their channels amongst the rocks.

We are struck with the frequency and the magni-

tude of these, and their evident antiquity, and the appearance that most of them present, of not having been used for thousands of years; and we are again struck (in some instances) with the marks of modern convulsions which have swept them out, and inundated the valleys below them.

From the great antiquity of these, the caverns of many of them are eventually entirely obscured and filled by the falling debris of the overlying rocks, or covered with sand and decayed vegetation; and from their numbers we infer that they were produced at a period when volcanic influences were more active than they now are, when, by successive internal pressures and explosions, the channels of the submontagne waters were more frequently obstructed, causing overflows of the accumulating waters, which discharged through these gates into the valleys; and if similar obstructions were now presented to the egress of the submontagne waters, the valleys of the Missouri and the Columbia would soon be inundated!

The extreme rarity of their discharges at the present day is evidence that they have no influence or connexion with the regular flow of accumulating waters in the submontagne vaults, and their great antiquity and numbers show what the accumulations and pressure of those waters anciently were; and as rain-falls and snows have not diminished, the submontagne currents are the same now as they were at that ancient date, but confined to more regular and unchangeable beds.

After many hard marches and hard climbings among the salmon-river mountains and other places, in studying these, on my way from St Diego to Santa Fé, in 1855, I had the singular good luck to learn much more than I had before discovered, of the phenomena of "dry ravines."

The "Sierra Blanca," in the southern section of the Rocky Mountains, trending, for a hundred miles or more, in a north-easterly and south-westerly direction, and throwing off the principal branches of the "Little Colorado," and apparently connecting two of the principal ranges in that latitude, lies south and east of the Rio Colorado of the west, and some hundreds of miles north of the Rio Ghila and the Mexican boundary.

Fifteen years ago, and before any settled routes were established across the Rocky Mountains, and the present "passes" little known, our ride along the little and numerous valleys at the base of this sierra for many days was fatiguing and discouraging in the extreme, from the almost endless number of ravines we were crossing, not at their deepest points, but where they were sufficiently deep and precipitous to make our progress slow and laborious.

One of these, which our guide had announced as "*Eau sec*" (the Dry Ravine), was ahead of us, and we were to reach it that night, and bivouac on its opposite bank; but long before we reached it, he turned his horse, and came riding back with amazement in his face, and on his lip, "*Diable—l'Eau sec! Écoutez, Monsieur!*"

Our path was leading us through a scrub-oak forest, and the base of the "*Sierra Blanca*" was half-a-mile or more on our right. The roaring of the "*dry water*" was every moment more prophetic and distinct as we advanced, and a few minutes brought us to its brink—*not a ravine* (to look at) but a maddened stream, apparently plunging along over a level country (for its bed was full); its surface rising and sinking in long waves, and its shores, and the trunks of trees and rocks which it was washing, encircled with rings of snow-white foam.

We could not see, from any position we could get, either end of this fury of waters. I tried to approach the mountain's side, to get a nearer view, but irresistible obstructions were in the way; and yet I saw it at a distance—"a river under the Rocky Mountains," and saw it plunging out!

Night was approaching, and we retired into the forest of oaks, and bivouacked for the night. Morning came, and all was silent and calm. I left my companions asleep, and strolled to the brink of the ravine. All was quiet; the ravine was deep, and awful, and desolate to look into. I looked, but with trembling, into the deep, sunken chaos of huge rocks that had been hurled, and stately pines and cedars uprooted and prostrated, in its slimy chasm!

I got a distant view of the yawning cavern from which the flood had been disgorged: it was partly obscured by the falling rocks from above, and the flow of water had entirely ceased.

It took us the whole of a day to descend into the little valley below (which had been inundated), and to reach the dry land beyond it, owing to the softness of the ground, and the mud we had to wade through; and there was no possible way for us to get around it.

We found, in the midst of the little valley, several deserted huts of Apachee Indians, and on the dry land where we landed, the affrighted Indians, who had fled for their lives. The chief, who was an aged man, told us he had lived there forty years, and that he never knew the waters to come from that cavern before, and never had heard of such an event. He spoke Spanish tolerably well, and assured me that he had several times penetrated this cavern to a great distance, with others of his tribe—that wind was always blowing out of it, and sometimes a great deal of fog; and our guide assured us that he had crossed the ravine many times, and that he never had seen a drop of water in it before.

I was exceedingly anxious to make some examination of the interior of this cavern, and with some difficulty persuaded the rest of the party to halt for a day for that purpose; but the vast quantities of yellow mud thrown out, and the falling of the overhanging rocks of a talc schiste, made the entrance impracticable, and we resumed our journey.

Whether this short and terrible flood, lasting but a few hours, was caused by the bursting of some local reservoir, or whether it was the result of heavy rains to

the north, causing a sudden overflow of the submontagne cisterns, it is difficult to determine; but it may be decided by the fact that the contiguous streams were not swollen, and the singular phenomenon of great quantities of curious fish that were deposited in the valley, and brought to us by the Indians.

They were small, from three to five inches in length, without scales, and resembling eels. Their bellies were white, and their sides and backs of an olive green; and from the closest examination I could make, they proved to be a mollusc existence, and without eyes.

What conclusions are we compelled to draw from the sudden and singular deluge that has been described, and the deep marks of such events that have been successively happening for thousands of years?

Inevitably that the rain-falls and melting snows in these vast chains of mountains sink through their crevices into vaults beneath them, through which they are conducted to the ocean; that in ancient times, when volcanic forces were more active under those mountains, those vaults were subject to continual changes and obstructions, causing frequent overflows of the water, which was launched into the valleys through caverns, forming sluices or gates, and by its descending forces dredging out the gullies and ravines which no time will ever fill up; that at various ancient periods, from these obstructions, these sluices have poured out for lengths of time *en masse* the

accumulated waters of the mountains, which have descended in a thousand streams into the valleys, and by their terrific force have dredged out those deep channels, the river-beds, evidently too deep and too broad for their present purposes, and too gigantic for their present waters to have produced; that, in the lapse of time, as volcanic action has gradually diminished and ceased, those submontagne water-courses have become more established; and that through their undisturbed highways the vast torrents of the Rocky Mountains and the Andes are at present delivered into the Caribbean Sea, where they can't remain, nor become anything less than a "*Gulf Stream*," passing into the ocean.

We ascend the Missouri, the Platte, the Yellow Stone, and the other rivers, to the mountain's base, and we are astonished at their high and terraced banks of clay and pebbly drift, and at the mighty force they once have had.

The mind is filled with amazement when it realises the magnitude of the *Gulf Stream;* but when we contemplate the "*dry ravines*," and fully appreciate them, and the established system above explained, by which the mountains now bear their regular portion of water to the ocean, we are no longer astonished at either. The valleys of the Mississippi and Missouri, to the Gulf of Mexico, have anciently been again and again deluged and devastated by the overflow of the submontagne vaults; and an earthquake at this day, to break up the mountains in Mexico, so as to obstruct

the course of these waters to the ocean, would open the ancient gates, and fill the ravines, and flood the whole meadow-lands of those valleys to the Gulf of Mexico. This cataclysm may again happen, and the inhabitants of the Mississippi and Missouri valleys are consequently now but "*tenants at sufferance.*"

CHAPTER II.

THE "GULF STREAM."

AT the middle of the last chapter we had arrived at the western shore of the Caribbean Sea, and were thus at the convergence of two of the longest and most stupendous mountain ranges of the world. They each have a descent of several thousand feet to this point; their subterranean rivers, unaffected by floods, here meet; and from this spot, not in the sea, but in an estuary, starts an ocean current that runs perpetually through the sea, and without change, to the southern cape of Greenland, and crossing the Atlantic, returns to the south-western coast of Africa!

What relationship exists between these two great moving systems?—are they cause and effect, or are they one stupendous current, rising in the Rocky Mountains and the Andes, with its unoceanic blueness and warmth, gotten from the heated furnaces it has passed through, and here ushered into the ocean?

From near the 30th degree of south latitude, the waters of the Andes have a descent to the north—the Yucayali to the Amazon, exactly what the Yellow Stone is to the Missouri, and the Madeira (rising still farther to the south) answering to the River Platte.

This river, rising in Bolivia, has a direction north-east for a distance of two thousand miles; and the upper half of the Orinoko has the same direction, until turned by the mountains of Venezuela; and the rivers of Bogota and Grenada all trend to the Caribbean Sea.

The mountain system in South America is much like that of the Rocky Mountains, differing chiefly in its more volcanic activity. Its rocks are alike; its upheavals have been similar; its disposal of rain-falls and snow is the same; and its subterranean drainage no doubt resembles that of the Rocky Mountains, and its contributions to the ocean, if not equal, of secondary magnitude.

Following the principal ridges of the Andes through Venezuela and Grenada to the coast, at Carraccas, and near to Santa Martha, where they are abruptly broken, and the course of the lesser Antilles chain, as the ancient continuation of the Andes, there are strong proofs that, three thousand years ago, the lesser Antilles stood up in their grandeur, a part of the Andes system; and that at that time the united submontagne rivers at their base debouched at their northern or eastern extremity into the ocean; that the ruined cities of Yucatan and Guatemala, with other cities of equal or greater extent over the vast and fertile plains where the waters of the Gulf of Mexico and the Caribbean Sea now lie, were teeming with an intelligent and civilised people; that the vast and dissolving powers of these undermoving waters, together with extraordinary volcanic influences,

undermined the Antilles chain, the subsidence of which, with the peninsula of Yucatan and Guatemala, caused the cataclysm recorded in the Mexican hieroglyphs, in Indian traditions, and on the rocks themselves, as has been before stated; that the Antilles (in part) have partially risen again, and with them the peninsula of Yucatan and Guatemala, leaving the two great estuaries, the Gulf of Mexico and the Caribbean Sea, into which the two submontagne rivers are now received, and from which they debouch as the Gulf Stream. (*See the Diagrams.*)

The proofs of this stupendous cataclysm and its immediate causes will be discussed afterwards; but for the moment, assuming its occurrence, we will briefly consider some of its effects. And first—

THE "GULF STREAM."

A book might be written reviewing the various and differing theories which have been advanced by scientific men, as to the cause, or connected causes, of this phenomenon, and of its actual proportions and peculiar characters; but a brief reference will be here made to a few of them, that my own ideas on that puzzling enigma may be more correctly weighed.

The various estimates which have been made of the grandeur of the Gulf Stream, differ very much; but the last survey of it, by Commander Maury, of the United States Navy, I believe to be the most reliable. From it we learn that it passes out of the Gulf of Mexico at the Florida Cape, with a

current of four miles per hour, with a depth of twelve hundred feet, and a breadth of thirty-two miles.

In the estimates alluded to, there is a general accordance as to the peculiar characteristics of this current, which consist in the singular phenomena that its waters are *more blue, more salt, more warm,* and *more heavy,* than the waters of the ocean; and that it runs some three or four thousand miles through the ocean, with colder and lighter water on its sides and underneath it, without intermingling with it.

Several writers have attributed this vast flood of water to the Mississippi River, which theories are rather amusing than satisfactory, as the waters of that river are not *salt,* and very far from being *blue;* and from the actual surveys of Commander Maury, the volume of water in the Gulf Stream was found to be more than one thousand times greater than that of the Mississippi!

Other authors have looked to the "Trade Winds" as the cause, forcing the waters of the Atlantic between the Lesser Antilles into the Caribbean Sea and through the Gulf of Mexico. This theory is a little more plausible than the other, as there is a possibility of water enough to produce the Gulf Stream being passed between the Antilles into the Caribbean Sea, and also a possibility of its acquiring additional saltness, and also volcanic heat, while passing through the two great estuaries; but there would be no possibility of their changing their colour from "ocean green" to "indigo blue," nor of running in a "per-

petual and unvaried current," when the Trade Wi
are exceedingly irregular, often at a lull, and as of
changing in their course.

Commander Maury discards this theory, and a
vances his own, which is, that the Gulf Stream
caused by the Equatorial Current. He says—"T
Equatorial Current takes up the waters which t
Trade Winds have made more salt by excess
evaporation, and forces them into the Caribbean S
between the lesser Antilles, and from that into t
Gulf of Mexico."

"Two causes," he adds, "act to produce the G
Stream—increased saltness of the ocean wat
forced into the Caribbean Sea, and the diminish
quantum of salt in the Northern seas. The wa
in the Northern seas is always less salt than t
Equatorial waters, and it is necessary that the wate
of the Northern seas should be supplied with salt
water, which they call out from the Equator."

Such a "*necessity*" seems very problematical; an
how mysterious the influence that could "call out
from the Equatorial seas, to wend its way throug
the tortuous course of the Caribbean Sea and Gu
of Mexico, at three or four thousand miles' distanc
such a stream (its banks and bottom of colder an
fresher water) for its supply! And if the wate
composing the Gulf Stream are actually *forced* int
the Caribbean Sea by the Equatorial Current (whe
they certainly cannot remain), how extraordinary tha
they should be "called out."

And if the Gulf Stream be formed by the water c

the Atlantic being forced into the Caribbean Sea by the Equatorial current, then the Gulf Stream begins in the Atlantic, south of the Antilles, and not in the Gulf of Mexico, leaving the Equatorial Current, and not the Gulf Stream, the mystery. The vulgar phrase of "digging one hole to fill another" applies exactly to such arguments as these.

What is the course of the Equatorial Current, and where comes it from? It is called "Equatorial" because it runs under, and sometimes crosses, the Equator. What Equatorial Current is there of a similar character, and in the same latitude, on the coast of the Pacific? Is there the same "necessity" for salter water to supply the Northern Pacific and the Northern Indian Ocean, and have they Equatorial currents at *command,* to supply their necessities?

The Equatorial Current, it is contended, runs through the Caribbean Sea and the Gulf of Mexico to the southern cape of Greenland; crosses the Atlantic, and, following the coast of the European continent, leaves the south-western coast of Africa; re-crosses (in diminished force) the Atlantic, and spreads out amongst the reefs of the Antilles; and yet the advocates of this theory (of which there are several) admit that oftentimes for weeks together the Equatorial current flows in a southerly direction, from the Antilles down the coast of Brazil, and yet they say, "The Gulf Stream, issuing out of the Gulf of Mexico, is perpetual and unchanged!"

The causes of the Trade Winds and Equatorial Current have been accounted for by as many dissimilar

theories as the causes of the Gulf Stream, and they remain as yet amongst theorists as much a mystery.

Winds, which are currents in the air, are much more obedient to currents in the water than water currents are obedient to currents in the air. This can be exemplified in a variety of ways. In a quiet atmosphere, drop a feather into a running stream of water, and the change of its falling course shows at once a current of air obedient to the water surface; but an ordinary wind over the surface of a lake creates no current in the water. Waves are raised; but waves, having a reaction, are not a current.

In the midst of conflicting theories, hypotheses are admissible; and let us suppose (for a moment, at least) that the Trade Winds and the Equatorial Current are both caused by the Gulf Stream; that this marvellous body of water, "thirty-two miles wide, twelve hundred feet deep, and with a movement of four miles per hour" (as yet but hypothetically accounted for) issues from under the Rocky Mountains and the Andes in the manner that has been described, and enters the two grand estuaries, the Caribbean Sea and Gulf of Mexico, bringing with it a borrowed heat from the volcanic regions it has passed, and, combining with the influences of the very volcanic centre of the continent, in its march from the Caribbean Sea draws in its wake currents in the air and currents in the sea.

A steam-vessel in motion makes no current before it, either in the air or in the water, but draws a current in both behind it.

From the fractured and shattered and utterly confused condition of the rocks in the Andes chain, at its severed end in the mountains on the coast of Venezuela and Grenada,—the evidences, stronger than all history, of excessive convulsions—we are led to conclude, that under that region and the lesser Antilles chain exists the grand and living focus of volcanic heat; and that the accumulating waters in the Caribbean Sea, with such a volcanic battery facing them on the south, get an impetus from that propelling force, as water in a pot, before it boils, runs in a current from the side where the heat is strongest; and that the volcanic battery, forcing the waters through and out of the Caribbean Sea, create a "necessity" for the Atlantic waters to flow in through the lesser Antilles, and so cause the Equatorial Current.

The fact is a well-established one, that the Gulf Stream, when it leaves the Gulf of Mexico, is steady and unchangeable, and a steady and inexhaustible source must supply it. And though steady and regular in its course, the winds and currents which are drawn in its wake may vary in their courses and strength at times, occasioned by temporary counter-currents in the air and in the water.

Maury says, "The Gulf Stream leaves the Gulf of Mexico, and runs to the northern seas; its banks and its bottom of colder and less salt and lighter water, with which it does not unite." And all the other authorities on the subject agree with him on this point.

Here, then, is perhaps the most remarkable char-

acteristic of this strange anomaly, and certainly the most difficult to reconcile with the theories which have been heretofore advanced.

It is inconceivable that water passing out of the Atlantic into the Caribbean Sea, and through that and the Gulf of Mexico, should assume a character so different, that, in a voyage of several thousand miles (its banks and bottom of colder and less salt water), it should not mingle with the waters of its ocean bed.

A little extra saltness, which Mr Maury attributes to the excessive evaporation of the Trade Winds, certainly could not produce such an effect, according to his own theory; for he maintains that the salter waters of the Gulf of Mexico are carried to the north to give additional saltness to the northern seas (and yet he says they don't mingle with them!)

And surely a little additional warmth could not prevent the amalgam of the two waters on so long a voyage, the one actually embraced by, and in contact with the other. "And the Gulf Stream, being a little more salt, is heavier than the ocean water;" and yet, against the laws of gravitation, always occupies the superposition!

This latter singular fact helps strongly to establish the impossibility of the Atlantic waters deriving such anomalous qualities by passing through the Caribbean Sea and Gulf of Mexico; and goes to support the probability that subterranean waters lying in the vicinity and heat of volcanoes, by some chemical process not yet explained, may contract repulsive

qualities which would account for the singular phenomena which, though advanced by Mr Maury, decidedly interferes with his own theory.

The vast floods of fresh water which I have been tracing from the clouds, and from the mountain tops in the Rocky Mountains and the Andes, filtered through the cellular rocks into the spacious cisterns below, cannot remain there; and these cisterns do not overflow: they are pushed on by other floods that come behind them, and under the sedimentary series are spread out, and, probably in the vicinity of volcanic heat (and perhaps lakes of liquid lava), are there mingled with errant waters from the sea, which, from their change of temperature, have become more salt, and with them, through myriads of pores, are oozing into the Caribbean Sea.

The movement of these waters in the vicinity of the sea, from their great depths, must be slow; and, by the process above-named, all the characteristics which give to the Gulf Stream its singularity, and consequently its mystery, it is believed, may be produced.

If from salt water salt be precipitated by heat, then is it easy for salt and fresh water combined, in such a region as has been described, to acquire a degree of saltness equal to that of the Gulf Stream, and a little extra heat still more easy to be accounted for. And it is easy and natural to suppose that the other peculiarity of the Gulf Stream, "*indigo blue*," instead of *green*, like the ocean, gets its blue tinge from the minerals in the rocks through which it percolates, and

perhaps is increased in its intensity by chemical agents in the vicinity of volcanic heat.

By those gentlemen who maintain that the Gulf Stream is caused by the influx of the Equatorial Current into the Caribbean Sea (to get rid of the difficulty that faces them of the "indigo blue" of the Gulf Stream) we are ingeniously told that the "indigo blue" is but an "optical illusion." How absurd and how unscientific is this! The eyes of such men as Commander Maury, Captain Livingstone, and thousands of other navigators during the last three hundred years, to have been under an "illusion!" *Geologists* tell us this. Do they judge more correctly of rocks?

The travellers and navigators of the ocean see the ocean *green*, and the Gulf Stream *blue*. If the blue of the Gulf Stream is an "optical illusion," it is a fair inference that the green of the ocean is also an illusion: and if the blueness of the Gulf Stream be an *optical illusion*, or a *reality*, how does the ocean water, by passing through the Caribbean Sea and Gulf of Mexico, obtain the one or the other,—the actual change in colour, or the chemical properties enabling it to deceive the eyes of all the world, unless, in passing through these estuaries, some mineral or volcanic influences lend their aid in this strange and staggering metamorphosis?

That the water of the Gulf Stream, passing out of the Gulf of Mexico, is more blue than the waters of the ocean, and that the waters of the Atlantic flowing into the Caribbean Sea through the Antilles (and

denominated the Equatorial Current) are of an ocean green, are facts not *geologically* demonstrated, but clear and evident to the minds of all reasoning men, who see and judge things for themselves.

The eye of an artist, perhaps, is as good as anything else in judging of colours; and as such, I have had the best opportunities for drawing my own conclusions on that subject, having seen and crossed the Gulf Stream in nearly every latitude, several times traversed the Gulf of Mexico, and twice sailed through the group of the lesser Antilles. In all of these voyages I have closely scanned the varying colours of the waters, and if I had deemed it of sufficient importance at the time, I could have obtained evidence enough from the commanders of the vessels in which I sailed, that the blueness of the Gulf Stream is no illusion, and that it commences in the Caribbean Sea, and only gets its intensity whilst making the tour of the Gulf of Mexico.

These facts I suggested to the Baron de Humboldt in Berlin, in 1855, on my return from my first voyage to South America; and on taking leave of him for a second voyage to the Antilles and the coast of Venezuela, he handed me the letter printed in Chapter VIII., in which he says—"I enclose a memorandum for your voyage, which may lead you to examinations which you might otherwise overlook," &c. And in that memorandum—"Don't fail to transmit to me, hermetically sealed, three bottles of water, taken from mid-ocean, between Liverpool and Cuba, the Gulf of Mexico, and in the Equatorial Current flowing be-

tween the lesser Antilles, for chemical and optical tests, which I am anxious to make."

These instructions were carried out with precision, and with great satisfaction to myself, and two bottles (instead of one) from each locality were shipped at St Thomas to "Starr & Co. of Liverpool," with instructions to be forwarded to Berlin. On my return voyage, two years afterwards (intending to see my faithful friend again, as he had desired me to do), I heard of his death, and I never yet have been able to ascertain whether the contemplated tests were made, or whether the waters ever reached him.

Such observations as I made under the above-named circumstances, and with the eye of an artist, convinced me that the "indigo blue" of the Gulf Stream is not an "optical illusion," and also, that the Atlantic waters flowing into the Caribbean Sea are of an ocean green: facts sufficient to prove that though a portion of the Equatorial Current constantly flows into the Caribbean Sea, there are grander and hidden impulses which set this "ocean river" in motion, and give to it its unoceanic colour.*

From all the accredited accounts of this great phenomenon of the ocean, it would seem that, after passing out from the Gulf of Mexico, it travels to the northern seas, crosses the Atlantic, washes the coasts

* The reader who takes an interest in this subject, may use me as a living and an eye witness that the waters of the Great Salt Lake, Humboldt Lake, and a hundred other sinking lakes and rivers in the Rocky Mountains, the Andes, and mountains of Mexico, are all blue; precisely the colour of the Gulf Stream.—*Author.*

of Scandinavia and Ireland, and leaving the south-western cape of the coast of Africa, it recrosses the Atlantic as the Equatorial current, and, spread out, in part passes between the lesser Antiles into the Caribbean Sea, and becomes again the Gulf Stream. It thus becomes a great and perpetual horizontal wheel; certainly losing impetus and velocity as it travels, and as certainly and necessarily recruiting its force and velocity whilst passing through the estuaries of the Caribbean Sea and Gulf of Mexico.

All its theorists agree that it is a river that runs without a descent, and yet all admit their ignorance of the propelling power which gives it its impetus and motion.

A law of nature forbids the motion of any water without an impelling force. A wheel cannot turn itself: and what so likely to turn this mighty wheel of water as the unceasing, cloud-emptied torrents, here converging, from the vast cellars of the Rocky Mountains and the Andes, returning to the ocean, and descending upon its rim, with the increased warmth and additional impulse from the volcanic batteries they have passed.

Commander Maury speaks of the "briny waters of the Equatorial Current"—the fresher and lighter portions taken up in evaporations. He says, the salter the waters, the heavier they are; and if this be so, those "briny waters," robbed of their vital and floating qualities, we should suppose would sink, instead of crossing the ocean on its surface, to pour into the Caribbean Sea.

The subaqueous islands of salt being discovered in front of the mouth of the Mississippi may yet be decided to be a more rational source for the extra saltness of the Gulf Stream, than that of ocean evaporation; and more profound research may yet prove that those islands of salt are brought from underneath the great Salt Lake (much more salt than the ocean), and other portions of the Rocky Mountains and the Andes, and deposited in the Gulf of Mexico.

If the above suggestions be sustainable, and the grand system of mountain drainage which I have traced from the Rocky Mountains and the Andes really exist, perpetually delivering such vast floods of water into the vortex of volcanic heat, we have rational causes for all the peculiar and seemingly mysterious effects existing in the Gulf Stream, independent of ocean currents, evaporations, and Trade Winds.*

* Since the above was written, a long discussion has been held in the London *Times*, on some of the phenomena of the Gulf Stream; and in this, both parties (amusingly) agree that the Gulf Stream is caused by an "*absolute necessity*" in the Northern seas for additional saltness and warmth, which they derive from the Equator in the Equatorial Current, and which becomes the Gulf Stream when it passes out of the Gulf of Mexico.

The surface of the Atlantic, outside of the lesser Antilles, has the same altitude as it has at the Cape of Florida, where the Gulf Stream debouches. By what system, then, does the Equatorial Current "*pour*" into the Caribbean Sea between the Antilles, and make the circuitous tour of the Caribbean Sea and the Gulf of Mexico, at least 1500 miles out of its course, and then enter the Atlantic at the Cape of Florida, with a current *doubled* in velocity, and with an *impetus* that sends it 3000 miles to the north, ploughing through the heavy waters of the level ocean?

But "necessity," the "mother of invention," begets many strange things, and (it would seem) a solution of these questions. An *ocean's "necessity"* for warmer and salter water (deficiencies of nature!) calling for relief from the other end of the globe, and getting it! How *sympathetic* are oceans! But *is this so?* or do the over-heated and over-salted waters of the Southern seas make a tour to the North, to regale on a little freshness and coolness picked up in the seas there? This, of the two, would seem to have more of the plausible in it, inasmuch as this mysterious current disdains to mingle with the watery bed through which it passes.

An ocean's "*absolute necessity!*" Drop it, gentlemen, and get something better.

Lake Ontario has the *same necessity*, and were it not supplied by the Niagara River with living waters, which it "calls" from Lake Erie, Lake Ontario would be a dead sea.

Note.—A circulating report of the day is, that since the remarkable earthquakes of the West Indies and Peru, at the beginning of the present year (1869), the current of the Gulf Stream has increased to nearly double its usual velocity, and, of course, with a double volume of water. Is this from a *double "necessity,"* a *double demand* in the Northern seas? or is it caused by increased heat in the volcanic beds under the Grenada Andes, propelling the waters of the Caribbean Sea with unusual velocity to the north, and indicating the near approach of another cataclysm?

CHAPTER III.

LIFTED ROCKS.

THE system of mountain upheavals, already named, and volcanic action and effects, will now, in turn, be briefly considered.

To place in a clear light my opinions with regard to the first, it will be proper here to take a hasty glance at some of the theories set forth by scientific men as to the manner in which mountain chains have been thrown up, and the relative positions in which mountain rocks are found, for with some of those theories my system will interfere.

To come at the effects of upheavals and subsidences of rocks, which is the main object of this work, it is necessary to determine the manner in which, and the power by which, those upheavals and subsidences have probably been produced. Geology takes cognisance of this.

Philosophers and astronomers have weighed the earth and measured its orbit and its motions, and have handed it over to geologists to study its age and write the history of its life.

Astronomy beckons the penetrating mind of philosophic man into the heavens, where he sees revolving

worlds innumerable, but sees them through a mist; whilst geology, nearer home, teaches him the nature and the age of the ground he stands upon.

Geology is a science of truth, of time, of dates, about which and in which there is no mystery, no hypothesis; it assumes no sphere beyond the limits of the earth, nor any time beyond that for which it has within itself the proofs.

The earth *has had* a *beginning;* but who so weak as even to contemplate what, or where, or when that beginning was, and what it was made from? Geology attempts it not, but takes it in its progress, at the time when the rocks tell us it was but a molten globe, surrounded with chaos and darkness, and when a rocky crust commenced forming, like ice on the surface of a lake.

That crust is the first page of a book, in which the date of every earthy deposit, and the dawn of every organic existence, to the present day, is entered and registered.

That book, regularly paged, shows the series of successive formations over the earth's surface, contains the self-proving truths, admitted by all geologists, as to the modes and the order by which they came into existence and took their forms, as found in their native beds.

In the darkness of those impenetrable beds they would have lain to the end of time, unknown and unthought of, but for an unseen Power, wiser and mightier than man, which has broken and lifted them up in mountains and precipices, and by (as yet) un-

known convulsions, swept and scattered and mingled their debris over the earth's surface, with their gems and precious minerals exposed for man's use; and with them, and their infinite capacities, presented an encyclopedia of knowledge and wealth that is boundless, for the intelligence and acquisition of man.

But for these mountain upheavals of the earth's crust, which are, no doubt, a part of the great plan of their Creator, these hidden treasures would have been unknown, man a miserable and helpless being, and geology a sealed book, to the present day.

What an unevasive command to every rational and intelligent human being to worship and adore that incomprehensible Power whose omnipotent will it was to create and to open this book for man to read, every leaf of which is distinguished in the successive layers of rocks, from the deposit of the very first disintegrated particle of granite that was set in motion by the waves of the sea, to the present time.

He who said, "Let there be light, and there was light,"—He who "created man from the dust of the earth," and the rocks that encircle the globe, has also said, Let the rocks be broken and lifted up into mountains, to give currents and life to the ocean and to the atmosphere; and let their tops, with their hidden treasures for man's use, be swept down, and scattered over the valleys by vast commotions of the winds and the seas, which I will command.

Inscrutable these mighty works are of one hand: they are alike mysterious, and they *exist;* and they

demand, as has been said, man's adoration, but not his scrutiny.

Rocks have been created in the same manner and at the same time on all parts of the globe; and alike on all parts have been broken up and lifted into mountains for man to read, and for man to use for the comforts of his existence.

Profound philosophers and geologists have read this book of nature, and lucidly translated it for the perusal of mankind. They have without doubt emphatically and correctly solved the problem of all rock formations, but are not agreed as to the agencies and the modes by which they have been raised up into mountains, and the various effects produced by their elevation.

Here, then, is a standing problem; and from what I have read, not in printed books, but in the *book of nature*, I have designed the comments to be given in the following pages: not to dictate to men profoundly wiser than myself, but to submit suggestions as to the agencies employed in the upheaval of rocks, and certain effects resulting from such upheavals, believed to have been produced, and to exist, on the American continent.

The subject which we now approach is one of awe, of majesty, demanding our reason, and rejecting every prejudice.

These endless piles, which we climb, and from whose tops we observe the clouds beneath, and the pictured landscape like a coloured map rising from their base, up, up, and up, to the horizon! whence

came they, and when and how, and by what mighty power, were they raised? Here human reason is paralysed—all is unseen and mere conjecture, excepting the two facts, that the mountains are here, and that they have been lifted from their beds below by some force equal to the magnitude of their weight.

In encountering so grand and so difficult a problem, it will be necessary to start with, and keep constantly in view, the primary truths that the earth is round—that it has a centre—that its body is either a rigid or an igneous mass, or other matter heavier than water—that it is everywhere encompassed by a rocky crust, which limits the penetration and actual knowledge of man—and that above and below its surface all corporeal bodies, undisturbed, obey the laws of gravitation.

All mountains are formed of portions of this crust, lifted up from its native bed by some latent power beneath, either explosive or expansive, contending in its mighty struggles with the power last named. As to the localities of these powers, and the mode of their operation,—which probably ever will be, as they now are, merely conjecture,—there have been a great variety of opinions advanced by scientific men of the present century; and of them—most lamentable to say—the most recent have treated as chimerical the opinions of their predecessors, and advanced new theories absolutely mystifying the system of upheavals, and bewildering the reader with contraventions of the laws of nature.

It is less the object to weigh men than theories in this work; for I have a profound respect for all scientific men, but not always the same for the unsustainable theories they may have put forth.

A few of these, relative to the supposed modes and causes of mountain upheavals, will be briefly reviewed, and the scientific reader will be able to assign to each theory its author, and thus save me the unpleasant task of labelling them.

The names most illustrious and honourable for the light which their indefatigable labours have thrown upon the principles and science of geology, and especially on the manner of mountain formations, are those of the Baron de Humboldt, Herschell, Carl Ritter, Von Buch, Beaumont, Agassiz, Dana, Lyell, Murchison, Rogers, Dr Jackson, Silliman, Hitchcock, Jukes, Hunt, Phillips, La Beche, Hall, Logan.

Amongst the distinguished names here quoted—distinguished as the principal geologists and philosophers of the present century—there are as many different conjectures as to the probable thickness of the earth's crust, and the material of which the earth's body is composed, as there are of the probable manner and causes of mountain upheavals.

In a brief example (and which will be found more amusing than instructive) one author shows that the rocky crust of the earth is from 50 to 100 miles in thickness; another finds it necessary to be from 800 to 1000 miles in thickness; another 2000 to 2500 miles; another, less extravagant, claims 768 miles; and another 2700; and others limit it to 25 or 30

miles; and the *general* opinion seems to adopt the first named, from 50 to 100 miles.

Some of these philosophers tell us that the body of the earth is composed of an igneous fluid, with an intensity of heat infinitely beyond the maximum of heat that can be produced on the surface by any known process; and others believe that the earth's centre is of solid granite; and another very gravely tells us of an "*aqueous-igneous* fluid" between the rocky crust and the granite centre, without enabling us to comprehend exactly the meaning of the "aqueous-igneous" compound, or its thickness, or explaining how water in that position accords with the unevadable laws of heat and of gravitation.

These dissimilar conjectures are here alluded to, not from any settled geological result that can be got from them, but from their connexion with, and resemblance to, the theories of mountain upheavals that are to be considered, and of which they are supposed to form the bases.

It is rather a pity for science that some of the latest expounders of geology and orography have treated as "utterly without foundation," and as "the baseless vision of a dream," the opinions of Von Buch, Carl Ritter, and the Baron de Humboldt, as to the nature of the interior of the globe, and the mode of mountain upheavals; and we shall see, perhaps, in the sequel, how much wiser, and how much nearer the truth, some of these more modern philosophers have come in the theories they have advanced. The latest should be the wisest, but it is feared that,

under the scrutiny of the rational, their own language will defeat such conclusions.

"In a multiplicity of counsel there is safety." In a multiplicity of theories is there truth? and if so, let us try to sift it out.

Theory first.—"The rocky crust shrinks as the globe cools, and thus becoming folded and wrinkled, is ruptured, and uplifted by the molten mass into mountains. All mountains are uplifted in this manner, and the upheaving pressure is often oblique, making the mountain steeper on one side than on the other, and in some cases overturning a mountain on its side."

This theory, advanced by a giant in science, clearly implies that the whole crust of 50 or 100 miles in thickness, and of solid granite, is broken and lifted up by some imprisoned power in the molten mass; and in the case of "oblique pressure," the thickness and strength of the crust increases in proportion to the angle of obliquity, and the resistance consequently is as 50 or 100 to one!

So incomprehensible a theory as this, from so learned and justly celebrated a man, may easily and thoughtlessly be *adopted* as sound; but on closer scrutiny may be *disabled.*

The first part of this theory—that is, the vertical lifting of the crust by some power beneath—has, at the first glance, an appearance of possibility; but the second, that that latent power sometimes drives "obliquely" through a granite crust of fifty or a hundred miles in thickness, throwing up a mountain with a stand

ing wall on one side of it, or driving it a little further and overturning it, is a supposition beyond reason, and therefore incomprehensible. For the simplest of these powers, both of which seem to be assumed, the author gives us no proofs; and for the last it would be futile to attempt it.

Herschell, De Humboldt, and other profound philosophers, have expressed their opinion that the molten body of the globe is a quiet, incandescent, and motionless mass; and consequently, if this be so, with its intense heat and excessive specific gravity, it would exclude the existence of all gases, and of all materials for generating them; and if there be no active powers of this description, surely excessive heat alone could not produce such effects; for if it could, either no rocky crust would ever have been formed, or, if formed, would have been ruptured hundreds of thousands of years ago, and on all sides of the globe alike.

If "mountains are raised by the upward pressure of the molten matter against the crust," the molten matter must rise and fill the void left by the rising rocks. And if "all mountains" on the earth are raised in that way, how many vacuums would be formed in the molten mass of the globe? and what its effects on the process of crystallisation, which is inconsistent with disturbance, and requires rest? what could fill the voids left by the rising of molten matter, where neither water or air could penetrate or exist?

If mountains rising under the sea are raised by the process which seems most rational to the author, and which will be subsequently explained, the voids

formed by the rising mountains would be filled with water, and the equilibrium thus kept up. But if the mountains and mountain chains in the oceans (which cover two-thirds of the globe) were raised by the process advanced in this theory, the igneous fluid rising and filling the spaces they left, the displacement of water by their intrusion would have deluged the continents.

If an area equal to the area of all the mountains on the globe be vacated in the molten mass by its following out of its shell the rising mountains, from the diminution of the body of the liquid mass, crystallisation must cease. The molten mass assuredly could not lift itself and fifty miles of solid rock; and what power below could struggle thus against the laws of gravitation? These important questions are not answered, and here this one-ended theory leaves us.

For the singular feature in most mountain chains on various parts of the globe, of steeper declivities on one side than on the other, endeavoured to be accounted for in this theory,—as well as the more singular fact, that these declivities generally face from the grand or central ridge,—will be considered (and perhaps a more rational cause for them will be assigned) in future pages of this work.

"All mountains" (says this learned author) "are raised in this way—the crust of the earth has had its storms, which have thrown up *waves* 20,000 feet high."

"Mountain waves" is a pardonable metaphor; but "wave mountains," I am inclined to believe, is a figure of speech not well adapted to the science of orography, and will be short-lived. Mountains are

of all sizes and of a thousand shapes. If mountain chains are raised by the wave undulations of the earth's crust, how are the small and isolated mountains and mountain peaks raised? These occur on all parts of the globe, oftentimes several hundred miles from any mountain chain, and sometimes of great height. Does the molten mass of the globe rise and break up the granite crust of fifty miles in thickness, set it afloat, and dash it up in waves to form these? How strange is this!

If the singular process suggested in this theory be applicable to mountains of magnitude only, where is its application and agency to stop?

If it applies to mountain chains only, where is the limit between a mountain and a mountain chain?—how many links are required to make a chain?

Theory Second.—"The wave structure of the Apalachian chain of mountains, and all other plicated zones, is due to an actual undulation of the crust of the earth. From the expansion of the molten matter and the gaseous vapours, the rocky crust is forced up, and the undulation is propagated by a horizontal pulsation from the liquid interior of the globe, and the uplifted crust is keyed into its present position by the intrusion of molten matter."

This astonishing theory, evidently "propagated" by the former one, far exceeds its progenitor in extravagance; and its *impossibilities* (if possible) are more *impossible.*

"Necessity is the mother of invention," says an old proverb, and it applies with equal force in all arts and

sciences, as well as in the common avocations of life. From the striking resemblances in form which mountain chains often present to ocean waves, this geologist has adopted the idea already set forth by his predecessor, and more ingeniously sets the thing in motion by the amusing and handy apparatus explained in his theory just quoted—the undulation (that is, of the solid granite crust of fifty or a hundred miles in thickness, resting on the igneous fluid surface) is propagated by a horizontal pulsation from the liquid interior of the globe, pushing the folds up into mountain waves, which are "keyed up into their present position by the intrusion of molten matter!"

The former theory left us in rather painful ignorance as to the *modus* of this wonderful subterrestrial operation; but we are here pleasurably relieved by an insight into the machinery that sets it in motion.

If this wonderful pulsation were simply local, and pushed up only a mountain peak, it would be a thing within our comprehension; but a horizontal, longitudinal pulsation and undulation of the earth's granite crust for a latitudinal distance of 8000 miles (such is the length of the Rocky Mountains and the Andes, one continuous chain) is a thing amusing to conceive.

But what a fever—what a pulse! In the preceding theory it was an "*oblique pressure;*" here, a *horizontal pulsation* from the liquid interior of the globe! In the former the fever was *typhus*, shoving up mountains in oblique directions to stand upon one leg; and in the latter, *spasmodic*, driving the crust, of fifty or a hundred miles in thickness of solid granite, in moun-

tain waves, and keying them there by the intrusion of molten matter!

All this is very amusing; but how much more *philosophical* if this gentleman had said, "The Apalachian chain, and *many* other mountain ranges, have the singular and unaccountable form of ocean waves, from causes as yet beyond the scrutiny of man.

"*Keyed up* by the molten matter"—what a beautiful geological term! but how unfinished. Why not tell us what *keyed up* the molten matter?

"The whole of the Apalachian chains" (1500 miles in length and 150 in breadth), "and all other plicated zones" (the Rocky Mountains of course included—the Andes, the Alps, and other mountain ranges of the earth), driven up into mountain waves by a "horizontal pulsation of the liquid mass of the globe!"—(fever enough to have annihilated all equilibrium and all crystallisation 500,000 years ago, and consequently to have defeated the inscrutable design of quiet and progress for which the earth was made).

Fifty or a hundred miles in thickness of solid rock, and, as some of these *savants* would have it, 2000, and others 2500 miles, floating at large on a sea of liquid fire, driven up and crushed into mountains; and yet the geologist, with his note-book in hand, travels over these vast masses of uplifted strata, which are undisturbed except in their inclinations, and reads their unchanged paging in his book!

This ingenious writer tells us that, "from the expansion of the molten matter and the gaseous vapours, the rocky crust is forced up," &c.

Expansion of molten matter! Beautiful assumption!—what a scientific way to prop a theory! Incandescent matter, obeying no law but that of gravitation, is capable of no expansion, and emits no gases, and the intensity of its heat and its specific gravity are such that no water or air can penetrate it to produce such effects.

"By the expansion of the molten matter the rocky crust is forced up," and then the horizontal pulsation of the liquid mass is set in motion. (A vertical and horizontal force! how convenient if our mechanics could have it!) The granite crust, in its natural position, is above the molten liquid surface; and when from that it is "*forced up*," one would suppose that the "horizontal pulsations" would pass under it.

If we agree to this vast moving, floating mass, forming the Apalachian chain of 1500 miles in length and 150 in breadth, having been doubled and crushed up into wave forms, we must contemplate two necessary facts—first, that the floating wreck must have had a positive resistance at its extreme advancing limit, to have caused the foldings; and consequently the shortening of its superficial area must have left a vast space of uncovered molten fluid, which would now be covered with a very thin crust, if with any crust at all; and the surface of that hissing and smoking crater something like fifty or a hundred miles lower than the surface of the earth! What a frightful hole!

And again, of the eleven parallel ridges which constitute the Apalachian chain, each of which, being a

wave caused by the doubling up of the crust of fifty miles in thickness, would inevitably be one hundred miles in longitudinal diameter!—a new and striking feature in geology!

Theory third.—We have here the opinions of a man whose name is "*Legion*," and whose name and geological fame command the respect of the whole scientific world, that—

"The central ridge of mountain chains is formed by the emission of vast quantities of molten matter." And also that—

"Mountain ridges parallel with the sea-coast are pushed up by the sea."

With all the valuable geological doctrines and geological facts advanced by this great and this good man, how surprising such incongruity! and how unsatisfactory to us who are reading and travelling to learn, that he does not tell us what Titan power in the incandescent mass overcomes the power of gravitation, by forcing itself from its heavy bed, to lift the rocky crust and to rise with it; or what power in the water of the sea (which is lighter than rocks, and able only to move the finest sand in a horizontal direction) to push the sea coast up into mountain ridges; and if this be possible, why is not the whole sea coast is not a mountain ridge? The sea is as strong in one place as in another.

How strange is this! Most great mountain chains run parallel and near to sea coasts (not that the positions of the mountains have been controlled by the sea, but that the border of the sea in some places has

been defined by mountain barriers) their central ridge formed by the rising of molten matter, lifting up the crust, and the lateral ridge or ridges "pushed up by the sea!" What pushes up the parallel ridges on the other side of the central ridge? All central ridges have their parallels on both sides.

The learned gentleman would not tell us, most certainly, that before the rocky crust was formed, the molten mass would "rise up." He would tell us that the laws of gravitation would have prevented it. How, then, if he were called upon to do it, would he account for the molten mass lifting and breaking up 50 or 100 miles in thickness of solid granite, at a later date, and rising up with it? How lucky for the science of geology that theories are not laws, however high and respectable their authority.

Theory fourth.—By another, whose name stands justly famous before the world, for geological facts he has gathered, and geological principles he has taught, at the head of a school of geological science:—

"Mountains owe their origin to the secular cooling of the globe. The exterior crust of the globe does not gradually collapse upon the shrinking nucleus, but becomes separated from the central portion during long periods of repose; and when it gives way, suddenly falls in along determinate lines of fracture. At such times there is great lateral pressure, which bends the pliant parts into elevations and depressions, thus producing the folds or waves called mountains."

If this writer's remarks are intended to express what they seem to convey, there is something very sur-

prising in this theory—the solution of the problem more of a mystery than the problem itself.

That the crust of the earth, which is ever and eternally being formed by the cooling and crystallising of the igneous mass, should for long periods become severed from it, and at length, at certain points of fracture, "raise up mountains" by "falling in," is an assertion involving several impossibilities.

By "long periods," we have a right by geological computation to contemplate some thousands or tens of thousands of years; and by "falling in at certain points," to inquire what the destiny of the remaining portions of the severed crust which do not fall in?

That the forming crust should cease for long periods to be attached to the nucleus from which it is being formed, seems to be an unwarrantable assumption; and the falling in of a district of the earth's crust, to raise up a mountain chain many thousand feet in height, with a base on which it stands five or six thousand feet above the level of the plains, is a thing difficult to conceive. No material substance on earth raises itself by falling—this is a law of nature; and there is nothing in geology or cosmogony against it. We have a right to believe that univeral chaos is at hand when the earth's crust, by falling, raises itself many thousand feet higher than it was before its fall.

All mountain ranges stand upon elevated, not sunken, ground. The Rocky Mountains, the Andes, and the Apalachian chains, all have extensive inclines running off for many miles into the plains, and the

actual bases of these mountains varying from three to six thousand feet above the level of the sea.

These gradual elevations, which are far greater phenomena than the simple mountain elevations, will be subjects for future remarks, and will be found to have been produced in quite a different way than by that of "falling in."

Theory fifth.—"From the secular cooling of the earth's surface, the parts that cooled last, contracted and became compressed. Thus the ocean beds, from cooling last, became depressed by contraction, and by the crust sinking down into the fluid mass at their borders, the crust would be broken, and lifted and folded into mountains."

The "secular cooling" of the earth's crust, assumed by this philosopher and several others as a basis for their theories, and of which there have been no proofs furnished, would scarcely answer in this case, even were it an established fact.

It is a prodigious assumption that the ocean beds have sunk down such vast areas of the crust of the globe. The author of this hypothesis treats as absurd the idea of continents rising, advanced by some geologists, but the idea of ocean beds sinking seems equally if not more improbable; either would disturb the equilibrium, and call for balancing disturbances on other parts of the globe. And if the last part of this gentleman's theory also could be established as a truth, the questions might with propriety yet be put, What proportion of the coast of the sea is bordered by mountain chains? and where was the border of the ocean when the Rocky

Mountains, the Alps, and the mountains of Switzerland were thrown up? and how many times have the ocean beds sunk down to produce the numerous mountain chains on various parts of the earth?

If the ocean beds were the last to be cooled and contracted, why should their contraction sink them down into the fluid mass? Their specific gravity is not increased by contraction, and the weight of the water covering them is not one half equal to the weight of the rocks on the continents, rising many thousands of feet above the surface of the ocean.

The ocean beds of the globe are large areas to be sunk down into the molten mass; and if such be the case, the question should be answered, What becomes of the liquid incandescent mass displaced by their descent? If a downward force were applied to the earth's crust at a given point, sufficient to break it through, by the power of the erupting force the displaced fluid would rise up; but the gradual sinking down of the crust under such vast areas as the ocean beds of the earth, so as to throw up mountain chains on their borders, would produce different results.

Mountain chains and mountain peaks have risen, both in the beds of the oceans and on the continents, quite independent of "ocean borders;" and by this author's own showing, we learn that the beds of the oceans, at this date, cover more than two-thirds of the earth's surface, and that more anciently they covered the whole of it.

Theory sixth.—This bold philosopher tells us, that the "Apalachian chain, of 1500 miles in length and 150 in breadth, was caused by the great depth of

ocean sediments, from 30,000 to 40,000 feet in depth, the weight of which sunk down the crust of the earth, causing it to wrinkle and fold, and rise in mountain chains. All mountain chains are raised in this way; and the greater the depth of the sediment, the higher will be the mountains when built up."

To the singularity that the ancient ocean current should have deposited at this point six miles or more in depth of sediments, the weight of which broke down the solid crust of fifty or a hundred miles in thickness, is added the monstrous assertion that "these sea deposits were all laid in shallow water, the crust sinking down gradually as they were laid!" *i.e.*, sinking not from the weight of the deposit, but *kindly yielding*, to make clear a space for the deposit to be laid.

These deposits, to have been laid by the water, must have been laid *under* the waters, and if so, what their *applied* weight? Only the slight difference between their own actual weight and the weight of the water they displace.

When the sediment had gathered to the depth of 30,000 or 40,000 feet, and forced (followed?) the rocky crust to that depth into the molten liquid of the globe, "the crust became wrinkled and folded" (well it might be; and why not melted?) "and rose up in mountain chains!"

How wonderful is this, that the rocky crust, with 40,000 feet of sediment on it, should sink six miles into the molten mass of the globe, and then "rise up," and stand in mountain ridges, many thousand

feet above the surface! When the crust of fifty or a hundred miles in thickness, with its load of sediment of 40,000 feet upon its back, had descended six miles into the molten mass, what stopped it there? Why did it not continue its downward course? and where went the displaced lava, in the meantime, of 1500 miles in length and 150 in breadth, and with a depth of 40,000 feet?

And, "the greater the depth of sediment, the higher will be the mountain when built up." Thus, if 40,000 feet in depth was required to raise up the Apalachian chain of 3500 feet, what depth of sediment has been required to raise the Rocky Mountains and the Andes, of 18,000 and 20,000 feet in height? Answer—Something like 240,000 feet! *about forty-five miles!!*

So far this is a handy way enough for a philosopher to get his "wrinkles and folds," and "plications," and "lateral pressure;" and this done, he leaves this awful mass, this chaos of sunken rocks, to struggle with the laws of gravitation, and to raise itself into mountains as best it can!

Every reader will comment for himself on this unaccountable theory, which "caps the climax" of orographical monstrosities, by "sinking the earth's crust down" with weights, to make it "rise up" in mountains!

This writer (a state geologist and surveyor), like the other, who set the granite crust afloat upon the molten surface of the globe, and crushed it up in mountain waves upon the ocean of liquid fire, has adopted the wave system of his predecessor; and

having seen the *crests* of waves illustrated in the mountain tops, he has most ingeniously discovered the counterparts, the "*troughs*" of waves, in mountain structures!

He tells us of "*synclinal mountains*," which he says "are frequent." *Snowdon*, in Wales (he says) is a synclinal mountain, and was once the trough of a wave, of which the adjacent anticlinals have been worn away;" and he names several others in America, which he calls synclinal mountains.

How surprising is this! How aghast his pupils must stand when they behold a mountain in Wales 3570 feet high, and are told that it is not a wave, but that its summit has been the bottom (the *trough*) of a wave; and which, to have been so, must have been as far below the surface as the top of the wave was above it!—that its anticlinals (its inclined and elevated sides, the sides of two mountains between which the trough was formed, and probably rising 3000 or 4000 feet above it) had been worn away, and also the whole country, as far as the eye can behold, on all sides around it, carried away, to the depth of 3570 feet, the height of the mountain as it now stands!

This monstrous conclusion is come to, probably, from two important considerations,—that a wave is not completed without a "*trough*," and from the discovery that the mountain summit exhibits the stratified beds in horizontal, and not in inclined, positions, making it necessary that the anticlinals on both sides should have been worn down, and the country around it, of its own formation, removed!

To understand this, let us imagine ourselves standing on the top of this mountain, 3570 feet above the country stretching off around us, and realise (if we can) that the rocks we are standing on formed the trough of a wave when they were thrown up; and that on both sides, to our right and our left, the anticlinals (the sides of the wave or waves, for it takes two waves to make a trough), rising 3570 feet higher above our heads, have been worn away, and all the other waves as far as the eye can behold (for the commotion that raised two waves must have raised many more); that the whole country, 3570 feet in depth above our heads, and 3570 feet below where we are standing (that is, to the base of the mountain we are standing on), has been worn away, leaving this solitary monument to stand by itself! and the troughs of the adjacent waves, where are they, where have they gone, and why?

How painfully our imaginations are taxed in such things, that a geologist's fancy of *wave mountains* and *crust undulations* may be carried out.

The mountains which I have clambered over, and the mountains under which I have had shelter, have taught me to put a different construction on such appearances, and authorise me to say, that, in this gentleman's sense of the word, there is no such thing as a "*synclinal mountain*" on the surface of the globe.

I have seen many mountains similar to the "*Snowdon*," in Wales, but they are more properly called "*tabular mountains*." I met several of these in Vene-

zuela, and in the Acarai Mountains in Brazil; and some of them, for several miles in extent, are perfectly level on their summits, and composed of the sedimentary beds vertically lifted, their strata resting in their bedded horizontal positions.

Others I have seen in the same countries, by degradations sharpened at their summits, like the "Snowdon" mountain, and detected only by the trend of their strata.

Thus have we seen this marvellous man sinking down his 40,000 feet of sediment, with the earth's crust, six miles into the molten mass of the globe, and completing the unfinished waves set in motion by his predecessors by giving them "*troughs*," and thus obtaining all the *lateral pressure* and *plications* required; and perhaps we will next see how he gets his sunken mass to "rise up into mountain chains." This part of his system he might have left for us to imagine, but he has preferred to make it *clear* in the following manner.

To the question, whether, by the rising up of the sunken crust and sediment, the plications and folds obtained by sinking down would not be lost, he distinctly answers, that "the crust and sediment do not rise up;" that "there is no local elevation, but that the mountain elevations are produced by the rising of the continent;" and he tells us also that all mountain chains are formed in this way—and that the Rocky Mountains are of a later formation than the Apalachians, and the Andes later than the Rocky Mountains; suggesting two very significant questions which might be put—How the rising of a continent would

raise a mountain ? and, How many times has the continent risen ? Once for each mountain chain, of course !

What a pity that an international "*commission*" could not be appointed, of *sensible men*, to expunge from geological books such a series of absurdities, to save them from being taught to our children !

Such are, in brief, a few of the popular theories of scientific men of the present era—such the information we draw from books in orographic science, and such the teaching to our children (for the most of these are teachers) of the sacred science of geology, the "science of truths," and strictly so, when the truths can be come at.

I have presented these discordant ideas of men, no doubt wiser in geographical than in orographical science, and the few remarks I have made upon them, not to prejudice the minds of any one, or to decide on their comparative merits, but for two distinct and different objects—to enable the reader to draw his own just conclusions as to the (as yet) unsettled question of mountain upheavals, and also the better to understand my meaning when I shall incidentally refer to some of these opinions in the further progress of this work.

Taken altogether, the above table, without any comment, presents a deplorable state of orographic science. The ablest geologists of the world, who, in regard to the translation of rocks, their ages, qualities, and positions, from the beginning of the world, generally agree, are yet, it would seem, without any settled theory as to how they are lifted into

mountain chains. As has been seen, their opinions are all unlike; and "when doctors disagree, who is to decide?" *

* It has been hinted to me that I shall give great offence to geologists by the allusions I have made to their dissimilar theories, and my remarks upon them, in the foregoing pages—I being, "not a geologist, but only an amateur." But I will offend no unprejudiced and candid geologist by the quotations I have made, or by the remarks I have attached to them, although I am not a geologist, but an amateur who has spent a great portion of his life amongst mountains and rocks.

I may be censured for daring to assail such men as those whose theories I have above quoted; but I assail them not. No man on the earth has a higher respect for the talents, the worth, and the character of those men, and the value of their works, than myself. To object to a man, and a man's opinion, are two different things.

If a dozen clocks point to different figures, it don't require a clockmaker to decide that eleven of them, at least, must be wrong: and if a dozen theories of the most eminent geologists, on mountain upheavals are utterly unlike, common sense, as well as geological sense, may decide (and has a right to decide) that if not all, all but one, are certainly wrong.

I am an artist—a painter; and if I make a bad portrait, geologists, as well as the rest of the world, will condemn it for want of likeness: they have a right to do so, and I have to bear it—they don't condemn *me*, but my *work*. Is there anything so sacred in the profession of a geologist that he can't be told of it when he makes a bad likeness—or a set of geologists, no matter how great, when their pictures are all unlike to each other? If I fail in my portrait, they have a right to dispute its truth, and a perfect right to take colours and brushes, and try it themselves; and if they fail, I laugh at them, but my respect for the men and their talents is not diminished.

I have objected in the foregoing pages to unlike theories of mountain upheavals; and in pages that are to follow, I shall, with great deference, offer my own opinions on the same subject, in the hope (and in the belief) that there may be found amongst them some facts new and of interest to science, gathered in my life of wandering and clambering amongst mountains and rocks: and I shall be quite willing that my opinions may receive any sentence that geologists may pass upon them. (See Appendix C.)

CHAPTER IV.

MOUNTAIN UPHEAVALS.

AFTER the summary view of the different and unconformable theories of the world's most scientific men as to the probable mode of mountain formations, it is but just that I should state my own opinions on that subject, gathered in libraries and in the field, in both of which I have studied long and hard in search of the truth.

In doing this, I shall consider the subject under two heads—*mountains lifted* up, and *mountains* (or mountain peaks) *built* up, each to be noticed in its turn.

MOUNTAINS LIFTED UP.

Discordance of opinion among scientific men as to the causes and manner of mountain upheavals, shown in the foregoing pages, clearly presents the subject as an open problem, and free for all who are disposed to discuss it, or to add their mite to the evidences on which the question, if ever settled, is to be decided. If I could decide it, I would claim to be a philosopher, but, alas! all that I can do is to record my opinions, with the opinions of others, and let them pass for what they are worth.

It is easy to see by the foregoing strange and dissimilar theories, that certain apparent phenomena conspicuous in mountain physignomy, such as wave-like structure, plications, and foldings, the results of great lateral pressure which it is contended could not have been produced by vertical lifting, have led geologists into probable, and sometimes into absurd, errors, in endeavouring to account for them.

In the writings of all of these learned gentlemen, the results of great labour and study, there is much to be learned, and yet it is lamentable to see their theories so discordant, for, as they are all unlike, they *must be* mostly wrong, and they leave us to doubt whether the truth can be extracted from them all.

I have already casually hinted at the probable solution of some of the perplexing phenomena of mountain features, and it will be the object of the ensuing remarks to explain others, without stepping out of natural operations to look for causes which can have no existence except in brains "*upheaved*" by "*depression*," or injudicious bases assumed for the support of bad theories.

With regard to the crystalline rocks, and the causes and manner of their metamorphism (or whether there is such a thing as metamorphism of rocks), which has drawn out as many discordant theories as the question of mountain upheavals, I shall have no motive for discussing in this place, as the objects of this work will be attained by regarding them as they are, forming a material part of most mountain elevations, without agitating the abstruse and difficult

question as to the manner in which they came into existence. Suffice it that these vast sedimentary beds, underlying secondary rocks on almost every portion of the globe, have been laid by the agency of water, with the disintegrated particles of granite, and by some (as yet mysterious) process, become solidified and crystallised much in the same form, and certainly with the same ingredients, as the granite from which they came.

Endless discussion has been, and is being, held on the subject of these vast sedimentary formations—where they came from? how they became changed? And it is even held by some, from their intimate connexion with (and resemblance to) granite, (probably from contact changes), that they are a part of the same rocks.

In their composition, like all rocks, they record the early part of their own history, which no man can deny—that they were composed of the loosened particles of granite, which, swept about over the surface of the granitic crust, were the sole debris for the sport of the winds and the waves for hundreds of thousands of years before calcareous particles were formed to be bedded with them.

The remarks which are to follow will be based on the belief that this sedimentary system rests everywhere on the crust of a cooled and cooling igneous mass, forming the body of the globe, as admitted by most philosophic men, and that the line upon which the two formations, sedimentary and igneous, start, is a geological boundary of greater importance in

orographic demonstrations than has generally been assigned to it.

That being a schistose zone quite around the globe, and undoubtedly more or less an open and defined fissure between the two systems—a receptacle and conductor of electric fluid, of water, of gases, and of heat ēmanating from the incandescent mass of the globe—vast operations therein take place from the combined action of the conflicting elements above ŋamed; and that these perform their part as well in mountain upheavals as in the other volcanic phenomena that will be mentioned.

That all volcanic actions are caused by local heat produced by pressure, or by the descent of water, below the sedimentary floor, in the rents of the granitic bed caused by its contraction in cooling, where the two antagonistic principles of heat and water meet; the one always rising from the incandescent mass, and the other incessantly descending.

That the endless decomposition of the sinking water rises in steam, entering and pressing through this horizontal fissure to great lateral extents, and into chambers formed by local dislocations, both above and below the line of separation, where, from extreme pressure, explosions take place, causing earthquakes—lifting or sinking the earth's surface, and often raising the sedimentary beds into mountains.

That the molten, incandescent mass of the globe, from the date of the first crystals formed in the crust to the present time, has lain inert and self-existent,

subject to the laws of gravitation and crystallisation, and for some object beyond man's knowledge, forming its own shell; and by those laws, and for that end, the stillness and silence of its bed, and its crystallising process have never been disturbed by the breaking in of ocean beds—the sinking of sediments—the crushing of the crust into waves, and driving them into mountain heaps by a horizontal pulsation from the molten mass, or the igneous fluid rising of its own accord, lifting and keying up all the mountains of the globe.

That all the phenomena of volcanoes and mountain upheavals, and the bewildering physiognomy of mountain contortions—foldings, lateral pressure, &c. —may be accounted for without the necessity of the broken crust of fifty or a hundred miles in thickness, falling into shattered and floating rafts, and the igneous fluid of the earth rising from its bed to form mountain axes.

That the granite crust, though cracked at various points, from contraction on cooling, has a limit to which those rents descend, below which, from intense heat, and the pasty and unindurated state that the external border of the molten mass must be in, the contraction has not taken place; and being in an arched shape, and resting on a liquid far more buoyant than water, that no fracture of the crust to the surface of the igneous mass has ever taken place, and that no amount of matter could be concentrated on the surface of the earth to produce that effect.

These positions of my own, like the strange theories

adduced in former pages, are but unproved assumptions, and probably will remain so; but, as I believe I shall show, accompanied with sufficient *presumptive* proofs to establish their *probability.*

Over the mountainous parts of the globe, from the cooling and contracting of the surface portions of the granitic crust, vertical rents are probably opened, from which gases are continually escaping; not from the incandescent mass, but from the constant decomposition of water descending through and under the floor of stratified rocks, and into the granitic fractures; whilst over other sections of the globe, where these rents have not taken place, the sedimentary strata and the granite crust beneath remain undisturbed, and their double formations quietly proceed.

In the dislocated sections it is reasonable to suppose that the rents in the granite crust commenced at a very early stage of its formation, and that these rents, kept open and constantly deepening as the crust has thickened and cooled, by repeated explosions, as above described, have opened chambers and lifted the floor of the sedimentary series, forming vast reservoirs for water, incessantly and for ever sinking to the heated zone.

From this it is sent off in vapours rising above itself, and not only (as has been said) condensing for explosions, but in the midst of minerals for all chemical results, by its decomposition (which is known to produce caloric), with the aid of heat produced by pressure, may form volcanic beds of local heat, independent of the igneous mass of the globe,

capable of melting the adjacent rocks, aiding in the general dislocations, and supplying volcanoes with gases and lava, without calling them through the incredible space of fifty miles or more, in narrow crevices of cold and hardened rocks.

In these fractured and exploded regions, the vast chambers opened beneath the floor of the sedimentary rocks are filled with water, the expansion of which, at a temperature short of decomposition, with the expansion of rocks by heat, would gradually raise the superincumbent strata, and depress them when the water and heat changed their temperature or localities. It is probably from such causes that parts of the Andes have repeatedly risen and fallen in the present century; and from similar causes, that we meet the phenomena of vast inclines running off from the bases of mountains into the plains, gradually dipping for many miles: such is the case at the eastern base of the Andes, and also at both bases of the Rocky Mountains.

And that such reservoirs of water, at various depths, and at various temperatures, do exist, evidence enough presents itself on different parts of the globe: an instance of which was presented in the recent earthquake in Peru, where we read of the earth opening, and vast volumes of steam and hot water issuing from the chasms in one district, and in another, of a populous town being entirely destroyed, and the place where it stood converted into a lake.

It is a tremendous and untenable supposition, that mountain upheavals acquire their impetus from the

molten mass of the globe, and that they rise on the shoulders of fifty or a hundred miles in thickness of unstratified rocks; and not less astonishing that the molten igneous matter of the interior of the globe should be, at a thousand points on its surface, continually and unceasingly creeping through contracted crevices for such a distance, for volcanic eruptions, without coagulating by cooling: and that it lies in volcanic craters for months and for years, without solidifying.

These suggestions indicate a nearer source of heat in the disturbed districts, caused by the combination of antagonistic elements in the manner that has been described; and a long series of convulsions and local paroxysms resulting from these would, in time, be sufficient, it is believed, to raise all mountain chains; and in the dislocated rocks, perhaps, to deposit lakes of lava, ready to supply the volcanic streams.

These sources of local, spontaneous heat, arising from the combination of local and independent causes, I contend are not inconsistent with the grand system of central heat below them, with which these causes have no connexion, and on which, as it is general, and not local, they have no influence.

By this system, if it be sustainable, mountain elevations, starting from bases less profound, might be uplifted by volcanic forces, without involving the impossibilities advanced in the theories which have been alluded to, and the seeming difficulties in mountain physiognomy which have led geologists to look for foreign and unnatural causes.

The schistose zone that I have spoken of may be

the base of such volcanic explosions, or that base may be a great way below, in the granite crust, fractured and broken up by repeated dislocations,—and no doubt it often is there; for with many mountain ridges, we find them resting on axes of broken and shattered granite, though never on a "granite wedge;" a very ungeological term, though often used.

By a "granite wedge," as the term is used, is meant the solid axis of a mountain, lifted up as an unbroken portion of the solid crust of the globe; but a thing that nowhere exists, except in the imagination.

In the Rocky Mountains and the Andes, granite is very rarely seen, and when met (at the mountain's base, as it most often is, or on its summit), it is uniformly seen in amorphous masses of various sizes, with shapes plainly telling its history,—that it has been shattered and torn from its bed by subterranean explosions or other disturbance, and lifted by (or has followed) the rising mass to the summits of the highest mountains, and flowing out from these, is found at the mountain's base, where it has rolled, while the mountain's top is gneiss.

In all explosions there is a projectile and an inductile force; the main projectile is vertical, upwards, unless a sufficient resistance interferes to give it a different direction.

In all blasting and explosions of rocks, portions of the rock below the blast follow the projected mass; and if an explosion were to take place on the floor of

a house, the contents of the cellar would follow the upheaved *débris* of the shattered tenement.

It is on this principle that granite is chiefly raised in mountain elevations; and from this process that it is always found in amorphous masses, their salient angles worn off in the various transits they have made, and never in the form of a "granite wedge," forming the solid axis of a mountain, nor in positions to show its stratification, which, from its varying structure, and minerals, and colour, from different depths, it clearly has, like the rocks laid over it by water.

MOUNTAINS BUILT UP.

All volcanic action is undoubtedly caused by local heat, generated in the manner already explained, in the granite series, or above it, and never below it. In that series it has been assumed (in the dislocated districts) additional heat ascends through the rents in the granite crust, increasing the intensity of the local heat, and consequently of ascending steam, from the decomposition of the descending waters.

This ascending steam, when not arrested in chambers, where explosions take place, or dispersed amongst the dislocated rocks, passes through confined and narrow crevices to the surface, where it is blown off through craters, and on the principle of a pump, raises the liquid lava from the volcanic beds by suction; not before, but behind it.

Mountains *built* up are but parts of mountains *lifted* up; they belong to most mountain chains, the

formation and peculiar characters of which will be further explained.

It is an erroneous supposition that volcanic mountains are *built* up from their base. The volcanic lava that accumulates under and amongst disturbed rocks, rises through the uplifted piles, and, finding vent at their summits, continues to flow from these points and over their sides, until they generally take conical forms, and often are thus "built up" to great heights.

The proof of this is furnished in all the hundreds of extinguished, as well as in the living volcanoes in the Rocky Mountains, by the nature of the rocks yet uncovered by lava on their sides, and at their base; and even the beautiful cones of Chimborazo and Cotopaxi, by the stupendous blocks of gneiss lying at their feet, unfold the secret of their internal structures.

There are phenomena yet unexplained in volcanic eruptions, but as they are but distantly related to the lifting and subsiding of rocks and their effects, with a passing remark, they will be left for wiser men than myself to settle.

Mountain peaks (but not mountains), it has been said, are built (and are being built) up, on various parts of the globe, by volcanic ejections. They nowhere rise except through the dislocated beds through which water is perpetually descending, and contending with the antagonistic principle of heat beneath it.

It is a well-known fact that water is decomposed

long before it can reach the igneous fluid of the interior of the globe, even if the way were left open for its descent, and it is reasonable to suppose that the explosions are formed at this stage. In these explosions, which produce earthquakes, the vapours get vent, and are dispersed amongst the often shattered (and of course cellular) rocks; and in the other event, where they have channels for escape, they take the lava from the volcanic beds, and discharge it from the craters of their own formation.

Of volcanic explosions it is probable the world will never learn more than they now know, except from their deplorable effects: but of the emptied lava, forming a different rock from granite, and of the mystery of its lying for months and years, between eruptions, in its narrow crevice and in surface craters, without losing its heat and liquidity, unless supported by a nearer fountain than the igneous surface of the globe, are problems for those who are abler than myself to solve, and to whose especial province the question belongs.

CHAPTER V.

MOUNTAIN METAMORPHISM.

MOUNTAINS, like all things perishable, are subject, in time, to great changes, both in structure, in physiognomy, and in magnitude; and, like men in old age, become worn down, wrinkled, and metamorphosed; and to judge of either from what we see in decrepid or degraded old age, is to draw wrong conclusions as to what they have once been.

The able and honourable men whose theories of mountain upheavals have been quoted, whose lives have been devoted to the advancement of geological and orographical science,—whose wisdom and whose indefatigable labours have worked out to mathematical demonstration the progress of all rock formations and the age of all organic species,—in their estimates of mountain upheavals, I believe, have been led into errors by not giving sufficient attention to the changes which time and circumstances have wrought upon their forms and structures since they were uplifted.

In the almost incredible beds of sedimentary rocks said to exist in the Apalachian chain, and the Laurentian rocks of Canada, of 30,000 to 50,000 feet in depth, and endorsed by some other contemporary

geologists as extending over the principal parts of the globe, there is evidence undeniable (if these estimates be correct) of the vast scale on which the principal mountain chains were first built, and of the degradation (and in fact obliteration in some cases) to which they have been subjected during a long series of tens of thousands of years.

Those geologists who hold to the uprising of the granite crust for the production of mountains, contend that the mountain ranges the most recently uplifted are the highest, because the crust has become more thick, and presents a greater resistance—or, to be more explicit, because the recent structure has had one hundred miles of granite crust to lift up, instead of fifty miles in more ancient times!

To me, the difference would seem to be this: that one is manhood, and the other old age—the one in its strength and grandeur, and the other diminished and deformed through the tens of thousands of years through which it has contended with the degrading and violent influences acting on and against and underneath it.

If the astounding estimates of the thickness of sedimentary rocks in the Apalachian chains and the Laurentian rocks, recently made, be correct, they present a new feature in geological science, and almost furnish a mathematical demonstration that, to lay those beds, more rocks have been degraded and moved in sediments by the ocean than now stand above the surface level, in the mountain ranges and mountain peaks of the globe.

The degradation of mountains has been such, that if they had been formed, as has been alleged, by the uprising of the granite crust, the sedimentary series on their sides would have long since been worn away in the manner previously described, leaving their granite axes exposed for the mountains of the present day: but no such mountains exist in North or South America.

I was born in the midst of the Apalachian ranges, and amongst them spent my hunting and fishing days; and neither there, nor in twice crossing both the Rocky Mountains and Andes chains, have I seen anything but the sedimentary and volcanic rocks, excepting here and there beds of shoved-up boulders of granite, raised in the manner already described.

The *débris* from mountains degraded and mountains obliterated, and of which the gneiss rocks are composed, have been laid in the bottom of the sea—in oblivion; but changed to rocks again here and there (from influences already named), have again risen, and are rising, into mountains: and for what? To be looked at, to be contemplated, and to be measured, but not to be arrested on their march through other degradations and revolutions, for which the endless space of time will be all-sufficient.

Besides the causes generally assigned for the degradation of mountains, such as wind, and water, and frosts, &c., gradually wearing down their surfaces, there have been other degrading and deforming causes, periodical and convulsive, which have shaken them to their foundations, swept off their summits,

overturned their inclines, undermined their bases, severed them by ravines, and sunk many of them to the vacant regions from which they arose.

This cataclysm, which metamorphosed the whole surface of the earth, is recorded universally in the rocks themselves, but not in books, nor revealed by inspiration. It was a storm—the manner and form and object of which are known to Him who commanded it, and in which Noah's Ark would have made but a short voyage: and yet a little water-worn pebble picked up on the summit of the Silla, at Caraccas, or found in the drift at Amiens, or in the pavement under our feet, tells undeniably the great fact, but not its vicissitudes, its causes, and its consequences.

A *deluge* that rose not by a flood, but that came with the winds—a darkness and chaos that gave death to all that was living; scooping out the waters of the oceans, and driving them over the valleys and the mountain tops; transporting pebbles and rocks even from continent to continent, and depositing them on every part of the globe.

As if the earth had been instantly arrested in its rotary motion, and the waters of the oceans had rushed from their deep foundations, in their onward course sweeping over the continents in gigantic waves, breaking down and decapitating mountains, and filling the deepened valleys and ravines with their broken and scattered *débris;* and when the shock was done, the paralysis was over; and on its course again the elevated, lost, and foaming waters

were pitching down the mountain sides, with rolling, tumbling blocks to aid in dredging out the deep ravines and valleys on their way to their ancient level.

This was when man was not—when the mastodon and megatherium browsed on the plains of the Mississippi and Missouri, and whose carcases were swept, with rocks and pebbles and ocean *débris,* into the ice-bound regions of Siberia and the frozen ocean.

Of the fact that this vast and destructive commotion has been, there is evidence conclusive; and with that and its effects, inquisitive man may deal, but who so presumptuous or so weak as to demand, or profess to explain, its cause?

Theories are afloat, however, on this mysterious subject, as on everything else; and one (the most modern) that "an errant star, about 30,000 years ago, came in contact with the earth, was broken to pieces (!) and by the shock, the rotary motion of the earth being temporarily checked, caused the waters of the oceans to leave their beds and sweep over the mountain tops."

If we could be made to believe that the Maker of the universe left the heavenly bodies subject to accidents, such a suggestion might be entertained, for the collision might have given the direction and impetus to the waters of the oceans indicated in the marks and effects left behind them. But this philosopher spoils his own theory by making it do too much: "By the oblique blow, the orientation of the earth, and consequently its poles and equation, were

changed; and the star, which was broken to pieces, has been from that time to the present day dropping in aerolites on various parts of the globe."

Strange that these, not obeying the laws of gravitation, when they were in contact with the earth, should have wandered off in etherial space for 30,000 years, and are now by piecemeal, daily yielding to the law of gravitation on various parts of the globe; and, containing ninety per cent. of solid iron, involves something like a mystery, why a globe so solid should fly to pieces in the contact, instead of our own planet, the crust of which, at that date, had no great thickness, and an igneous, molten mass, scarcely solid enough to "break to pieces" a planet of solid iron!

By the frequency of erratic blocks on various parts of the globe (these sometimes of enormous size, and thousands of miles from their native beds), the fact is established beyond question in the minds of all geologists, that such a catastrophe has swept over the earth, whatever its cause; that the waters not only have risen, but have marched over mountains and valleys, changing the physiognomy of both, and features of mountains which have puzzled geologists, and probably driven them to the extravagant theories quoted in the earlier part of this work.

Upheaval, implying an uplifting by a power below, is a natural and vertical movement, unless controlled by some accidental or mechanical force, and understood by all geologists alike, and by all would be applied alike, to the raising of mountains, were it not that in the forms of mountains, wave-like appearances

are found, and plications, and foldings, indicating great lateral pressure; peculiarities which it is contended could not result from a vertical upheaving, but only to be produced by a sinking of the granite crust into the molten igneous mass on which it rests, or the ruptured crust afloat upon the molten mass, by a "horizontal pulsation," to be driven and folded up in mountains like waves; or by some force (not explained) in the liquid mass, the crust is made to rise in an oblique direction, "giving the steeper declivities on one side of mountains than on the other, and often to overturn them on to their sides."

These perplexing peculiarities no doubt all exist; but I contend that by such extraordinary modes of accounting for them, other peculiarities more perplexing are introduced; and, at the same time, it can be shown that the most of these phenomena are solved in the diluvial metamorphism of mountains, and that their original elevations have all been produced by volcanic action and expansive liftings, not of the granite crust of the earth, but of the sedimentary beds, and superior portions of the granite crust, in the manner that has been described.

All writers whose opinions are most valued on the subject of the diluvial drift, agree that its general direction was from south-east to north-west, and the geological surveyors of the Apalachian mountains report that the disturbing force which caused those mountains was at the south-east, and their steepest declivities (often with inversions) are on the north-west.

This singular phenomenon is apparent also throughout the Rocky Mountains: the mountain faults generally face to the west; the western inclines are steeper than those on the eastern slopes, and the sedimentary beds are often overturned; and most of the extinct volcanoes show, by the direction of their deposited scoria and cinders and lava, that their eruptions, instead of being vertical, have inclined to the west.

A general result of this is, that the greater portion of the country, from the western base of the mountains towards the Pacific, is covered with pumice and volcanic ashes, whilst on the eastern side these scoria seldom occur.

The azoic rocks, hurled down from the mountain axes, and piled into the ravines quite to the Pacific coast, form a soil only productive of pines and firs and other dark and pinnated trees, and the plains are covered with scoria and volcanic ashes, where little else than artemesia and rushes take root: and it has been from this cataclysm, overturning the gold-bearing rocks on the western inclines of the mountains, and driving them over the plains, that gold is found in greater profusion on the western than on the eastern slopes, which have been less disturbed.

The above are extraordinary geological features, to which greater attention will be given in future ages than at the present time, and from them deductions will probably be drawn of extreme importance to science.

I was born (as has been said) in the midst of the Apalachian chain of mountains, and have seen the whole of the group; and in my boyhood it was there a proverb, that "the mountains face and lean to the west;" and in my rambles amongst the Rocky Mountains, where they had a latitudinal direction, I have everywhere been struck with the same singular characteristic. And why this? Because they had all been driven up like waves in a horizontal or oblique direction by unknown and assumed forces self-exerted in the liquid igneous mass of the globe? or had they been uplifted in a natural and rational way, in a vertical movement caused by volcanic action, and their contour, their dimensions, and inclinations, subsequently changed by the Titanic weight and power of the convulsed oceans riding in mountain waves against and over them?

The cataclysm that leaned these vast piles to the west, rode over the undisturbed beds and up the eastern inclines, leaving but few of its marks; but at the mountain tops which it decapitated, it hurled the western declines upon their backs, and scattered the broken mountain axes over the plains, or left them standing, denuded, with their dreary blackness to frown over the rugged chaos below: and at the base of these walls, the strata above the metamorphic, if not overturned, are crushed into sharp plications and contortions, and often driven between each other, presenting the most confused and unintelligible masses imaginable; showing, beyond doubt, the results of some prodigious lateral pressure from the

east, whilst they have lain in their present inclined position.*

These striking features in the rocks of the Apalachian and Rocky Mountain chains, which will be apparent to geologists of future ages, have been observed by some geologists of the present day; but I believe have by them been attributed to improbable causes—to unaccountable modes in their theories already quoted, of lateral pressure at the time of their upheaval. The driving, horizontal force of the diluvial current (not "*horizontal pulsation*"), which was able to move mountains, and turn them upon their sides, has made "*lateral pressure*" enough to produce most of the plications, foldings, and contortions which have puzzled the wisest men of the age, and

* In a juvenile book, "Catlin's Last Rambles," &c., I gave an account of a ride across the Salmon River Mountains into the Snake River Valley in 1855. The reader will find in that little book a brief description (but in a maturing work a fuller account) of those dreary rocks, and of the deserts of the Snake and Salmon River Valleys, extending off from the base of the mountains for four or five hundred miles, with a gradual descent of trap rocks, through the bed of which those two rivers have cut their deep channels, and the surface everywhere covered with sand, with scoria and volcanic ashes, much of the way knee-deep to our horses passing through it, and as desolate and difficult to travel as the deserts of Arabia.

The great plains south of the Salt Lake, through which the Colorado of the west wends its way for 800 miles to the banks of the Ghila (and in some parts two or three hundred miles from the base of the mountains), is covered with a similar volcanic drift, overlying Plutonic rocks, which slope off towards (and in many places quite to) the Pacific, clearly demonstrating that, either by the effect of the orientation of the earth, or by the force of the diluvial waves changing the direction of the ancient volcanic jets (or by the effects of both), a western inclination has been given, not only to volcanic ashes, but to volcanic lava, which has laid these vast trappean beds, trending towards the Pacific.

bewildered some of the deepest searchers for geological truths.

The future geologist who wends his way through the broken and rugged heaps of the Rocky Mountains, with these suggestions before him, will find ample means to account for the phenomena of "*plications*" and "*contortions*," without the necessity of sinking down the granite crust of the globe to get the requisite "*lateral pressure*," and then raising it (in the best way he can) into mountains, to exhibit them.

He will find that he is treading upon and climbing, not edifices, with the angles, the domes, and the parapets fluted and plicated by the hands of the Architect who built them; but ruins, worn down with age, and a hundred times lifted and depressed by volcanic convulsions, and again metamorphosed by the diluvial march of the degrading element, which loosened them at their base and to their centres, and scattered all that was movable about them into the plains and ravines.

Such are the mountains of America, and such the mutations through which they have passed; and in the study of them the geologist (like the student in the study of all ruins, who finds a crooked line, a fractured parapet, or a corrugated pavement), should contemplate and note them, not as the errors or caprices of the Builder, but as the changes which time and accident have wrought upon them.

(Note continued, from page 99.)

At the date when the lava, scoria, and volcanic ashes were poured and wafted over the great plains west of the Rocky mountains — when the thousand volcanos of those vast mountain ranges were in full action, it is probable, from the immense quantity of those wafted materials, that little if any, animal or vegetable life existed between the mountains and the Pacific ocean : and at the present day, when those groaning, bellowing, and hissing furnaces, for thousands of years have been mostly silent, their sunken, (though not extinguished) heat shows its effects, though in diminished proportions, in the same direction, producing one of the striking phenomena of the American continent — the difference of temperature, of six or seven latitudinal degrees, on the two sides of the mountains.

The striking feature of this singular phenomenon is the proximity of such different temperatures, with only a mountain ridge, or mountain chain between them — the fact that we sometimes in a days ride from East to West, pass from plains covered with snows of several feet in depth, into plains and valleys envelloped in floating fogs, and with vegetation in full leaf. Leaving San Francisco in the full bloom of spring, in the middle of February, (when its latitudinal parallel on the eastern side of the mountains was yet in the grasp of winter) and coasting up the Pacific, the first of march brought us to the mouth of the Columbia and Nootka Sound, (in the latitude of Lake Superiour) and the middle of march, to queen Charlotte's inlet (in the latitude of Lake Winnepeg and Hudsons Bay, at that date under ice and snow and the full rigour of winter) at both of which places the natives brought to our vessel an abundance of wild strawberries: and coasting through Queen Charlotte's sound towards Sitka, the shores were green with spring verdure, and the mountains tinted with the purple and red of honeysuckles and rhododendron blossoms.

chain ?

This unexplained phenomenon may yet be correctly attributed to one or the other of the causes that have been named — to the vast floods of lava that have flowed, (and clouds of ashes and of cinders that have spread) over the valleys of the west, with superiour powers of attracting and retaining the rays of the sun; or to the diminished heat of the still lingering volcanos, influenced in the direction of its radiation by the Eastern revolutions of the Earth.

As the radiations of heat and light are not obedient to the laws of gravitation, it seems rational to suppose that the heat emanating from these volcanos, like the light and heat that a comet leaves in its train, may linger upon the Orienting disk (moving at 15, or 20 miles per minute) warming the valleys west of the mountains, and producing the differences in the trans montagne temperature that have been named.

If this be so, it will eventually be *proved*, and then will add to the unseen and inscrutable modes by which mountain elevations and their causes, not only create *currents* in the air and in the ocean, but influence the *temperature* of both.

CHAPTER VI.

MOUNTAIN UPHEAVALS—(*Continued*).

SOME general remarks in a former chapter, on mountain upheavals, were delayed for some account of "*Mountain Metamorphism*," which has been given, to enable the reader more clearly to understand what is yet to be suggested on that subject.

How very extraordinary and unaccountable the fact, that of the number of theories quoted in the beginning of this work as to the mode of mountain upheavals, the most of these geologists say that "*all mountains* are raised by the rising of the molten mass," and then apply their theories to *mountain chains* only! Why not tell us that there are various classes of mountains—*mountain chains*, *mountain groups*, *mountains isolated*, and *mountain peaks*—and that they are raised by different modes? that of such there are tens of thousands standing on various parts of the globe, large and small, and varying through every grade in size, from a small hillock to the loftiest mountain, and oftentimes standing solitary, and several hundred miles from any mountain chain?

Certainly these gentlemen would not say that each of these has been raised by the uplifting of the rocky crust of the earth, or by setting its fragments afloat in undulating waves on the surface of the igneous mass, &c.

If these theories are intended only to apply to mountain chains, at what point are their applications to stop? Between large mountains and small ones there is no limit at which one process of upheaval stops and another begins. As has been before inquired, What is a mountain chain? how many links are required to make a chain? Each isolated mountain peak or hillock is as great a mystery as a mountain chain; and how came *they* into existence? How thoughtlessly and carelessly unwise in those gentlemen to tell us that "all mountains are raised in that way;" for if they convince us that all mountains are raised in one way, they defeat their own monstrous theories at once by their own words. It *may be* that all mountains are raised by one mode, but certainly not by the uplifting of the granite crust, setting it afloat in mountain waves, and keying it up with the igneous fluid of the globe.

Mountains are a *species;* and however widely they differ in *genus*, that difference generally consists in accidental contour, and the internal compositions and various modulations attending their upheavals; when I believe that the power by which they have been lifted has been materially the same, and that strictly volcanic,—being expansive or explosive, and

applied in the modes yet to be more fully explained.

Mountains isolated and mountain peaks, which I have said are raised on every part of the globe, and oftentimes several hundred miles from any mountain chain, are probably generally produced by the expansion of rocks, caused by pressure, generating local heat, which is volcanic; and mountain chains either entirely by the same causes, or, more probably, by these causes combined with others which will be explained, giving to them their peculiar characteristics and extended dimensions.

It is probable that this expansive heat is caused by the extreme pressure of the sedimentary beds on the granitic crust, and that the expansion is produced in the granite rocks; that the expansion of the rocks from this spontaneous heat breaks up the granite, the fracture of which differs from that of other rocks, and it rises in amorphous blocks, pushing up the sedimentary beds, forming the hillocks and undulations which are everywhere met, and also the lesser and isolated mountains, and even some of the highest mountain peaks on the earth.

Granite rock broken up by expansion or by explosion is resolved into boulders, which demand a larger space than that which they occupied in their native bed; and the effects of that demand, in displacing the overlying rocks, is easily imagined.

By this Titanic power the solidity of the rock formation may be broken up, and owing to the cellular condition of the disturbed region, spaces are formed

for the admission of volcanic beds and water, both of which become agents for the further uplifting of the disturbed beds by the explosion of steam, and by the expansion of water, caused by heat.

If intense heat can be produced by pressure amongst rocks, and the other hypothesis be sustained—that rocks are expanded by great heat—we have then a power within the rocks themselves sufficient to raise all mountain elevations, without calling on the molten matter of the globe to lift up the granite crust, and to rise with it, and "key" it up in its elevated position.

The most irresistible powers on earth, excepting that of explosion, are probably those of expansion and contraction. It is a known fact that a small seasoned timber laid in the brick or stone foundation of a house, when water gets to it, by its expansion, will raise and break the walls to their tops, no matter how high or how strong they are built: *expansion must have its space.*

Expansion in rocks, or explosion of rocks, if they be solid, must fracture to the surface; and if they be broken by either of the forces above mentioned, they must consequently be lifted; and that lifting, at the axis of force, as will be shown, need be but a very little to upraise a mountain on the surface.

Take a loaf of sugar from its mould, break it to pieces, and the broken fragments will fill two moulds; break another loaf, and the fragments of the two will fill four moulds; and so on. Let us suppose the fracturing force, instead of the hammer, to have been

an explosive or an expansive force at the base of the lower loaf, raising the bottom of the lower loaf but one inch; the fractured mass of the two loaves will then be raised two feet at the top.

We have thus an illustration of the possible raising of the highest mountains by a very slight movement at the source of disturbance, provided that that disturbing force exists within the rocks themselves, and is sufficiently strong for the effects supposed.

Let us halt here, and for a moment suppose the solid granite crust of fifty or a hundred miles in thickness broken and crushed up into mountain waves, as has been contended. What space, on the scale of the broken sugar-loaf, would be required to contain their broken fragments? how many miles high would the mountains have to be shoved up? and what pavier would have been able to replace those stones in their natural positions?

All the granite that I have ever seen (and I have certainly seen it in many places) has been in amorphous blocks, apparently shattered by explosions or fractured by expansive dislocations, with their salient angles worn off by violent movements, and of course, their beds, like the fragments of the sugar-loaf broken by the hammer, intervened by cellular cavities.

The gneiss rocks oftentimes present the same fractured and worn appearance, being broken into angular blocks and jammed together; but more often are in large and inclined masses, sometimes of several miles in extent, forming the whole side of a

mountain, the overlaid strata of later rocks having slid off, or been worn off by degrading agents.

To all great mountain chains there belong phenomena not met in isolated mountains or mountain peaks, such as their protracted length, their wave-like structure, and the vast inclines stretching off at their bases, and which here call for a more special notice.

All mountain chains seem to stand upon elevated ground, which is a delusion; they appear to rise from a surface some hundreds or thousands of feet higher than the level of the ocean and the adjacent valleys. This seems so, from extensive inclines running off from their bases, sometimes to great distances, to the valley levels.

Ascending these inclines, their elevations are almost imperceptible, but when near to the mountain base, we find ourselves some hundreds of feet above the valley level; and from mountain range to mountain range, these elevations become higher and higher, until we reach the base of the main or central ridge; and from that range they decline as we leave it on the opposite side.

Thus, in taking the altitude of some of the highest of the Rocky Mountains and the Andes, their base is said to be 4000 or 5000 or 8000 feet above the ocean level, when the fact is, that they stand upon the level crust of the globe, and they rise *through* the inclined sedimentary beds, which are partially upraised with them.

These vast inclines, which are elevations of the

sedimentary rocks only, are seemingly (and sometimes in fact) greater phenomena than the mountains themselves, forming portions in all upheavals of mountain chains, and performing their part in the effects resulting from them.

The simple uplifting of a mountain by an active force of sufficient power beneath it, is an operation easily understood ; but the consequent rising of those vast plateaus of the sedimentary beds, and holding them up in their positions, with the mountains apparently standing on them, seems to be a mystery in geology, or a feature overlooked, and not sufficiently explained.

Surely those geologists who contend that "all mountains" are caused by the elevation of the granite crust of the earth, will not argue that the granite crust was left for the igneous mass to hold up over such vast areas ; and at the same time they will as assuredly admit that they are displacements caused by the mountain upheavals.

It has been before suggested that these inclines are caused by the mountain axes passing through the floors of the sedimentary beds, which, from their stratified structure, have great stiffness, and are ranged at long distances from the points of disturbance, owing to their own strength, aided by the lateral forces of the successive explosions passing under them ; and, as has also been explained, supported in their elevations by falling portions or intrusive blocks of granite forced underneath them.

The extensive chambers underneath these uplifted

floors are vast reservoirs for water, and the spaces of these floors, between the supporting props, in time, more or less fall in, forming ravines, and, probably by the great weight and violence of the diluvial waves passing over them, others (and to a great extent) were broken or bent down, helping to account for the perplexing phenomena of plications, which, from a seeming necessity, geologists have been attributing to a "great lateral pressure," to be produced, as they say, only by the *sinking down of the granite crust of the earth*, after which they imagine it to rise up again, higher than it was, into mountains.

Most great mountain chains, like the Apalachian, the Rocky Mountains, and the Andes, have a central grand ridge, and several more or less parallel ridges on each side, these diminishing in size as they recede from the main trunk; and, what has excited the notice and astonishment of scientific men, and called for many discordant theories, the groups of ridges bear a striking similitude in length, and proportions, and contour, to the great central ridge, and altogether, in a bird's-eye view, have the appearance in form of vast waves of the ocean.

To the author, who has been more familiar with rocks than with libraries, the whole of these phenomena appear simple and natural, though they have elicited the monstrous theories before quoted, which, for the sake of the sacred science of geology, it is hoped may be forgotten before the end of the present century.

CHAPTER VII.

FORMATION OF MOUNTAIN CHAINS.

MOUNTAIN chains, with several characteristics differing, both in form and in the mode of their upheaval, from other mountains and mountain groups, seem to bear a striking resemblance to each other in those peculiar features on various parts of the globe, worthy of being noticed before we consider the mode by which they probably came into existence.

Their trend is generally latitudinal, but from their frequent deviations from polar bearings, their local positions have been evidently uncontrolled by polar influences. They all have a grand and central ridge, with lateral and more or less parallel ridges on one or both sides, each of which diminishes in size as it is removed from the central ridge—its steeper declivities generally facing from the central ridge; and all together in form present, as has been said, a striking resemblance to the waves of the ocean.

The relative positions of the lateral ranges (and their similarity in shape) to the main ridge, have been admitted by all geologists, and by the rest of the world, to bear an evident "*family resemblance.*"

This relationship, like all other relationships, points to an important truth (not figuratively, but in fact),—if not to an *unity*, at least to a *similarity*, of origin.

The father of a family beholds his likeness in his offspring rising around him; and the giant ridge of a mountain chain stands in the midst of its likenesses, in the waves and peaks that surround it, and evidently of a subsequent, successive, and dependent formation.

This giant (earth-born) is the offspring of convulsed elements—convulsed for rocks but not for man to witness; and the family peculiarities named, and universally admitted to exist, utterly deny the monstrous supposition of their having been formed by the rising and doubling up of the granite crust of the earth.

Many geologists agree in the belief (which seems to accord with reason) that mountain chains follow the directions of rents or fissures in the granite crust, caused by the shrinking of the crust on cooling. Nothing can be more rational than this: the great length of mountain chains, and their corresponding directions, all point to such an origin; and the inevitable contraction of cooled and solidified portions of the granite bed would lead to such results.

It has been already stated, that, in such events, those rents would only descend through that portion of the crust sufficiently cooled to contract and crack, and that through its lower portion, yet in an unhardened

state (and probably of a great thickness), no communication could possibly take place, except the passage of ascending heat, which, in the rents, would encounter descending waters; and that the results of the contact of these antagonistic elements would be the continued decomposition of the water, rising in steam, to be dispersed amongst the overlying sedimentary rocks, or confined in chambers for another mode of escape—by explosion.

It is over these rents, and undoubtedly by these attendant circumstances, that all mountain chains have been thrown up. This (as an *axiom*) advanced, let us contemplate the *time* and the *process*, and then let the common sense of the world, and not the geological sense alone, decide on its sanity.

The relative age of all mountain chains being determined by geologists, as has been said, by the organic remains which they contain, their origins date to the opening of the rents over which they have risen, and those rents to successive periods when the progressive cooling and shrinking of the globe's crust have demanded them; and no man knows at what period, or in what district, the next shuddering of the earth, and the next raising or crumbling of a mountain chain, may take place; but time will be long enough, and the earth is large enough, for many of them.

To contemplate the *time*, or near it, when the mountain chains have been thrown up, is therefore easy, and of little importance; but the *process*,—probably with an instant crash, louder than the peals of thunder,

shaking the quivering earth to its centre, the rocky rent for a thousand miles or more is opened,—no eye sees but the eye of Him who commanded it. The chasm may be fifty feet in width, or it may be a hundred; it may be a thousand miles in length and fifty miles in depth. The rent is open!—it is in the granite crust alone, and the overlying stratified beds, unbroken, hold in smothered silence the catastrophe, —the grand display that is to come, of the rising heat (not lava) from the igneous mass of the globe, enchained between walls of rock with descending waters, swelling and groaning in their conflict, and struggling for vent, and lifting the superincumbent rocks into mountain piles and chains!

In conflicting powers thus imprisoned (not by lifting and doubling up the solid crust of the earth), raising the superincumbent rocks for their escape, we will see the beginning and completion of a mountain chain,—the father of a family, the main or centre ridge, lifted up; and we will then see how the rest of the group rise into existence and take their positions by its side.

In the gradual cooling and crystallising of the igneous mass of the globe there are certain laws of nature at work which cannot be contravened or disputed.

Crystallisation, which is a slow and gradual process, cannot be defined by a line, but must be attended with a pasty and plastic zone of great thickness; and above that, to a great distance, of heated rocks, at a temperature at which they could not shrink or crack;

and therefore, the rent in the granite crust, not reaching the igneous mass, could draw nothing from it but its heat; but the vast and intense volume of this, unceasingly rising between the granite walls of this rent, and encountering the never-ending descent of water, which at a certain depth would be decomposed and sent off in steam, would cause expansion, and consequently fractures and dislocations of the granite walls, filling the rent in various parts, and opening chambers for the condensation of steam, preparing for explosions beneath the sedimentary beds.

Thus, the mine is here laid, with all its Titanic powers in readiness for the lifting of a mountain! The war of the elements of water and heat is begun, never to end; the one struggling to descend, and the other fighting to rise.

At the period when these mountain chains rose into existence, the fury of these contending elements, and the causes which set them in motion, were nearer the surface than at the present day, and their effects, therefore, more terrible and more conspicuous than those they are now producing, as the retiring heat of the globe's interior, by the process of crystallisation, removes the scene of action to a more profound position, with the vast caverns opened by the lifted mountains for the interior dispersion of gases and effects of explosions.

These rents, it has been said, have probably been opened in an instant. The granite crust of the globe, crystallised and formed precisely like the ice on a lake, when rent by cooling and contraction,

would probably crack in the same manner,—its line of fracture in curves, and its opening like an instant explosion. Thus are opened the fractures in the glacial crust of the great lakes Erie, Ontario, &c., often, in the severity of winter, extending from shore to shore, a distance of several hundred miles; and these rents always in a succession of curved and counter-curved lines, strikingly resembling the trend of mountain ridges.

The mine, I have said, is laid, and we now come, probably, to one of the grandest and most sublime spectacles (if it could be seen and heard) that have ever taken place on the globe,—the province proper of *engineers*, and not of *geologists*, as has been clearly shown by their theories, advanced in former pages, These *savants* can tell us, not how many thousand years ago, but relatively only, by the traces of animal and vegetable life which they contain, when these stupendous piles were raised; but they have shown themselves unequal as yet to any rational exposition of the process by which they were raised. Mechanical and engineering, rather than geological, principles, I am inclined to believe, will come nearest to the truth in defining the process by which mountains have been lifted up and pulled down, and gulf-streams pushed through the ocean.

The *astronomer* glances his eye over the surface only of the earth, and then to the heavenly bodies, caring little for its rents and its mountain protuberances. The *philosopher* looks complacently into and at them all, and smiles. The *geologist* goes *into* them

and *over* them; tells us to a religious truth their comparative ages, and explains their mineral and organic contents; and the *chemist* (by his side), the hidden elements of power and destruction within them; but *Archimedes* alone can tell us how those elements have been used and applied to lift, not from earth, but from their beds of solid rock, and prop them up for time without end, the vast piles of the Rocky Mountains and other mountain chains of the world.

The fissure opened in the granite crust, with the overlying sedimentary bed unbroken, and filling, for a thousand miles or more, with waters from above, and with heat of infinite intensity from below, the mind of an engineer instantly estimates the effects that must follow, and the process by which those effects are to be produced.

The condensation of steam in the opened fracture, which *must* have vent, by successive explosions and constant pressure has elevated the sedimentary beds at certain points of escape along and over the line of fracture; and to these points subsequent explosions and pressures have concentrated for vent, each explosion adding to their elevation, and bringing with it and lodging the dislocated boulders of granite, detached and errant in the cavities formed below, until these uplifted piles, with granite blocks driven and wedged together for their base, become so enormous and heavy, rising several thousand feet above the surface, that the subsequent eruptions break out at their bases over the line of fracture, raising new and

successive piles, until, between the originally elevated points, these intervening eruptions form a continued and connected chain of elevations, the first raised always the most colossal, and denominated "the mountain peaks."

From the pinnacles of these, the crest lines to the summits of the inferior piles are always curved, and between the lesser mounds generally, but not always so.

By these powers, and by this process (perhaps in a few centuries, or even in a few days, for no man will ever know the amount of time), from the midst of smoke and the groans and thundering of explosions, and the crumbling and tumbling of rocks, we behold the birth of a mountain—the central ridge of a mountain chain; a stately and terrible, but a simple thing. And we now come to the *mysteries*—the parallel ridges—their wave-like forms, and their steeper declivities facing from the central ridge. The puzzles of plications, contortions, and foldings have been in a measure explained, and we are now at the real and embarrassing orographic enigmas.

The main or central ridge of the mountain chain raised in the manner described, and the disturbing forces unceasingly at work, and probably with the aid of local volcanic beds formed in the vicinity from the enormous weight and density of the upheaved masses over the fracture, and solidified by the process explained, the subsequent eruptions sought easier and nearer vents, which were found already open at the mountains' bases, formed by the

fractures of the sedimentary series, which has been affected and more or less elevated, for long distances, as before stated, but which abruptly breaks at the mountain's base from its steeper declivity.

These fractures, through the whole sedimentary system, with the elevated inclines at thirty or forty degrees, open immense vacuums, trending, not in straight, but curved lines, more or less parallel with the main ridge, and consequently in wave forms.*

Subsequent eruptions, instead of struggling against the vast concentrated weight of the overstanding mountain, incline to these open fractures, which are many thousand feet nearer; and through them, in a more or less oblique direction, another mountain ridge is raised, parallel, but inferior, to the first—the central ridge—in wave form, and with its steeper declivity, of course, facing from the central ridge, from under which the new-born mountain has risen.

Time has been long enough, and volcanic convulsions numerous enough, for each successive ridge to become a giant, and to form its diminished adjunct by the agency of the same causes, applied in the same way; and by the vast diminution of the ridges by degrading agents, and the elevation of the intervening valley surfaces by deposits, and by the successive liftings of the inclines by volcanic action, the ridges of the mountain chains are apparently

* Of this central mountain ridge, and the fractures at its base, the little mole that runs under and throws up our foot-path, has given us perfect models.

much further separated at this day than they were at the time of their upheaval.

If the system of the upheaval of mountain chains above suggested be rational and approved, it will explain some of the important phenomena which I have said I believe have led geologists into palpable errors in their orographic theories.

The wave-like groups and forms, as seen from the summit of a mountain peak, are calculated to strike (as they have) the beholder with an instant conviction that they must have been subjected to wave-motions, begetting the far-fetched absurdities of the crust of the earth having undulated like the surface of the sea to have produced them, when the simplest mechanic can see, by the process above described, how the singularity of their groups and forms have been produced.

By this system we have a key to the apparent mystery of *mountain groups*, met on various parts of the globe, and differing from mountain peaks and mountain chains.

How often do we meet these groups, which at once remind us of a *family*—the surrounding elevations diminishing as they are further separated from the central parent elevation, first lifted; not over and subject to, a fracture in the earth's crust, but by local volcanic action, and its lesser and surrounding adjuncts thrown out at its base, on the principle above described. And how easily it accounts for the striking singularity we often meet of tri-formed mountains, which are everywhere, and form one of

the most eccentric orographic mysteries of the globe.

In the Rocky Mountains and their vicinity, we have the "*Trois Tetons*," the "*Trois Griffes*," the "*Three Sisters*," and at least half-a-dozen denominated the "*Trois Buttes*;" and I met them repeatedly in the plains of Venezuela.

These are mostly three conical peaks, sometimes of 1000 or 2000 feet in height, standing generally in a line, their bases nearly joined together, and oftentimes with a number of smaller eruptions around their bases. The central, first formed, of these cones, is the highest; and we are forced to the conclusion that the two lateral cones have been pressed out at its base in the same manner that the lateral ridges have been formed in the mountain chains, as above described.

Sir Roderick Murchison tells us, that in the Alps, the steeper declivities generally face *from* the main or central ridge. Geological surveyors of the Apalachian chain tell us the same thing of those mountains, and other authors the same of the other mountains of the earth; and the author's observations amongst the Rocky Mountains and the Andes support the same singular fact: and a giant in science gets a jet of igneous fluid from the centre of the globe to thrust a portion of the granite crust in an "*oblique*" direction to produce them! The oblique thrust necessary to produce these singular effects is seen to be obtained by the above process, without descending to the igneous fluid of the globe for it, and there

moving by it, in an "*oblique direction*," fifty miles in thickness of solid granite! And all the plications, and foldings, and lateral pressure in rocks, not produced by the diluvial waves already explained, can easily be accounted for by the theory above advanced, and save geologists from the necessity of sinking down the crust of the earth to produce them.

And not the least perplexing phenomena which have been named as belonging to mountain chains, and for which no theory yet advanced would furnish the least solution, is the evident and universally admitted diminution of the associate ridges in proportion as they separate from the main ridge, though still preserving their relative parallelism and contour resemblance—proof incontestable (as has been suggested) of unity of origin and family relationship.

By the process of upheaval above advanced, the cause of the gradual diminution in the last-formed and most distant ridges will be apparent.

At the period when the rent of the crust was first opened, and the central ridge was thrown up, as the resistance was more positive, and the disturbing forces nearer to the surface, the upheaval was on its grandest scale and in its greatest force.

Of the rapidity and endless succession of earthquakes and explosions under the forming central ridge at that date, no man's imagination can form an adequate picture: nor will mortal man ever realise its awfulness and grandeur, until another instant crash and an instant rent may be opened on some other part of the globe. It may happen in the ocean,

causing the deluge of continents, or it may traverse the cultivated fields and railways, throwing up rivers and cities, with millions of human and animal beings, mingled with bricks and paving stones, and smoke and flames, to the clouds, and from the mountain top ejected by successive explosions, to fall in the valleys like cinders from a volcano.

The main or central ridge, burst forth and built up and strengthened and protected in the manner that has been described, the subsequent explosions, having more space to expand in, and the source of disturbance more profound, each successive eruption and each successive ridge have been of diminished magnitude, and in time the cellular character of the underlying rocks, so as to give space for the dispersion of explosive forces without erupting the sedimentary beds, though often elevating and bending them, as has been frequently witnessed in the earthquakes of the present and last centuries.*

* Many of these slightly elevated and rounded plateaus are met with in South America, and some of them, as Baron de Humboldt has described, with vast fissures or crevices, opened when the sedimentary beds were elevated to a higher position, and kept open by falling masses of the rocks, after the uplifted mass has in a measure subsided.

Such has been the creation of one of the greatest apparent phenomena of America, and one, perhaps, of the grandest spectacles of the world—the "Cañon of the Colorado of the West,"—described in Professor Dana's "Handbook of Geology" as 300 miles in length, with continuous walls of limestone and granite rocks on each side, nearly the whole way perpendicular, and from 3000 to 6000 feet in height, which would be thirty-seven times higher than the Falls of Niagara (about one mile and a quarter in height),—difficult to conceive, and difficult to believe, though endorsed by so high and unquestionable an authority, but probably misrepresented in his excellent work by some

By this system I believe the reader will see a rational cause both for the *beginning* and the *end* of the terrible convulsions which have brought mountain chains into existence; but by the singular schemes of geologists alluded to, if mountain chains were raised by the horizontal undulations and waves of the granite crust, what *commenced* those undulations and what *stopped* them? what was their beginning, and where was their end? If they were raised by the crust sinking down under the weight of accumulating deposits, what caused them to rise up again? and where went, and when were ended, the subsequent deposits?

And if "all the mountains on the earth were caused by the uplifting of the granite crust," and that "keyed up" by the molten matter rising underneath them, what filled the enormous voids caused

typographical error. But whatever amount of such error there may be, there is no doubt of the grandeur and uniqueness of this gulf, amongst the gulfs and crevices of the globe.

Though this learned gentleman has appended his opinion that this cavity has been cut by the force of the stream, I believe that, on further consideration, when he undertakes to compute the necessary time for such an operation, he will join the author in the belief, that in the diminishing and last volcanic struggles which uplifted the vast piles and chains of the Rocky Mountains, a train was laid, and a strain was made, for another mountain ridge of 300 miles in length, which, if it had eventuated, would have been parallel to the adjacent ridges, and no doubt like them in wave forms.

The great plateau traversed by this fissure being 6000 or 7000 feet above the level of the sea, plainly shows that it has been subject to disturbance, and having settled down to its present position, after being partially raised, its opened crevice has become the highway for the waters of the Colorado River.

by the rising of the igneous fluid? and where were the forces of gravitation? Perhaps a second Newton may tell us, though these sage geologists have failed to do it.

The mountains volcanic, "built up," briefly spoken of in former pages, and there described as forming a part of the groups of mountains "lifted up," have had their day in the grand display above described. They have played their part, as seen by their hundred ruined and silenced peaks, which vomited up the overflowing lava of the ignited region through its highest shafts for tens of thousands of years, and "built" them up to the snow-white pinnacles as they now stand—the heated ulcers of a fractured limb. Their feverish heat, in time (and with the healing wound) has died away, and the gray and white monuments thus "lifted up," and thus "built up," in the Rocky Mountains and the Andes, will stand, without change again, for the gaze and wonder of man, as long as humanity will exist.

By the successive and gradual liftings of the sedimentary beds in the manner that has been described, and the intrusion of shattered and displaced granite underneath them, they get an elevation of several thousand feet in the midst of the mountain chains, and the vast cellular and connected cavities under them form aqueducts for submontagne drainage to the ocean.

It is unquestionably by the rents in the granite crust that mountain chains get their *direction;* and I

believe that by the process which has been described, the mountain ridges are successively uplifted, and that by that process their family resemblance is produced, with the other puzzling phenomena which have been noticed. And it is by the result of this system that I trace the vast flow of accumulated waters under the Rocky Mountains and the Andes, and their effects in the subsidence of the Antilles chain and the flood of the Gulf Stream.

The system of mountain upheavals above suggested applies to all extensive mountain chains, for in them all, on all parts of the globe, the groups show the family resemblance and more or less of the parallelism and wave-like forms.

The Apalachian chain, of 1500 miles in length and 150 in breadth, next to the Rocky Mountains, in North America, may correctly be styled a "family group." It has its central ridge, and its diminishing parallel ridges, with their wave-like forms, and their steeper declivities facing from the main trunk, begetting from its geological surveyors the monstrous and laughable theories—by one, of having been "*lifted up* by *sinking down*," and by another, of having been formed by an actual undulation of the granite crust, crushing it up into mountain waves; but future geologists, with brains free from "*sedimentary deposits*" and "*horizontal undulations of the crust*," will form very different opinions of those stupendous upheavals, and of the process by which they were formed.

This chain, as I have said, of 1500 miles in length, and, with its numerous lateral ridges, occupying a dislocated breadth of 150 miles, now claims its important place amongst the influences concentrated and concentrating in the Gulf of Mexico and the Caribbean Sea.

Like the Rocky Mountains, this vast area of uplifted and dislocated rocks gathers the waters which escape the valley streams, and, through its vaulted, subterranean chambers, sends them into the Gulf of Mexico to swell the torrent of the Gulf Stream.

The example to be given in the following chapter of the "Mammoth Cave," under the Cumberland Mountain in Kentucky, a spur of the Apalachian chain, shows the cavernous character of that mountain, and goes to support the statement above made.

The three great families of upheavals of North and South America concentrating their cloud-emptied waters beneath the Antilles chain, aided by volcanic action, lowered those mountains and their adjacent plains into the ocean; and since, by emptying their accumulating waters into the Caribbean Sea and Gulf of Mexico, have given volume and impetus to the Gulf Stream, and an embouchure at the Cape of Florida.

The reasons I have advanced in support of this theory, and of the probable mode of mountain upheavals, have been brief, and I believe explicit, and need no recapitulation. From their novelty,

it will be seen, at least, that they have not been gathered from books; and with their novelty I trust there will be found common sense enough to commend them to the attention of the scientific world.*

* On "lateral pressure" in rocks, see further remarks in Appendix A; and for Indian orography and geology, see Appendix B.

CHAPTER VIII.

SUBSIDED ROCKS.

AS well as the "*lifted*," the "*subsided*" rocks of America have been contemplated in the title of this work, and, in a geognostic view, are of equal interest.

Subsidence of rocks generally implies a previous upheaval, for all rocks, from the commencement of the earth's crust, have been formed on a solid and fixed basis, and no subsidence can take place until they have been uplifted or undermined by causes which have been named—by the action of water or volcanic influences, removing their foundations, and forming cavities, into which they descend.

These causes are constantly at work on various portions of the globe, and their effects in some parts have been on a grand scale, materially changing the face of the earth, dispersing races, and burying millions of human beings in their fatal abyss, or by floods caused by their descent.

All mountain elevations, it has been said (and no one will contradict it), leave a vacant space below them, in some form or other, equal to the space

they occupy in the atmosphere above the surface. This is an axiom as immovable as the mountains themselves; and the ever-ready ingredient to fill those spaces is water.

Under a solitary upheaval, unconnected with a mountain series, this water would probably be stationary, or nearly so, lying in a reservoir; but under mountain chains, with a dip towards the ocean, these reservoirs, being connected like the mountains standing over them, and receiving the constant influx of waters from rains and melting snows, would pour into each other, and, with their accumulating waters, send a current to the sea.

This current, however strong, would not empty these reservoirs, but run off the surface water only, leaving the deep reservoirs to hold their quantum, to whatever depth they may descend.

To roam about amongst the vast and endless piles of the Rocky Mountains and the Andes, and contemplate the quantity of water that lies in their cellars, based upon the measurement of their standing grandeur, fills the mind with astonishment; but when we realise the diminution of those mountains since their upheaval, during the waste upon them (and often actual obliteration) by degrading influences and convulsions for 30,000 or 50,000 years, and the magnitude of the cellars then left beneath them, the mind is overwhelmed with the actual dimensions of those unchangeable vaults, and the amount of water they must contain. The water filling these and the spaces left by erupted volcanic lava, if suddenly raised and let loose upon the sur-

face, would deluge the globe; and it may yet be a question how far the demand of these vast receptacles for water has influenced the depression of the ocean surface, and therefore the apparent elevation of continents.

That this system of submontagne reservoirs everywhere exists, there is abundance of proof; and that submontagne aqueducts, with currents, are the necessary consequence, is proved by a law of nature. Examples of this are close at hand. We have the published report of Dr Bird of the United States, of his survey of the Mammoth Cave of Kentucky, under the Cumberland Mountain, which is a spur of the Apalachian chain. This gentleman was more than two months underground, advancing daily, and sending telegrams regularly to the entrance, reporting his progress; and he explored and measured it for more than twenty miles. Of late years it has become one of the favourite resorts for summer excursionists, who describe it, from its shape and marks, as a vast aqueduct; and portions of it are now traversed only with boats, over a *profondeur* unknown.

When I was visiting the great Camanchee village in Western Texas, with the 1st Regiment of Mounted Dragoons, in 1836, the war-chief of that tribe—whose portrait I had painted, and who was called *Ta-wah-que-na* (the Mountain of Rocks), from having gained his honours by saving a war-party of his tribe from the superior force of an enemy, by conducting them safely, in the night-time, through a subterranean passage underneath the *Ta-wah-que-na*

mountain, then standing (though blue in the distance) in full view of the Camanchee village—described to me a similar cavern.

Several officers of the regiment and myself had made an arrangement with this chief to conduct us through the mountain vault, which, from his description, extended many miles; but from reports brought from the mountain by hunters, it was decided that the water at that season was too high for our transit, and the enterprise was abandoned.

I received many reports from the Indians of similar vaults underneath the Rocky Mountains in various parts, which are entered by caverns at the base of the mountain sides, and, without doubt, by the "mountain gates" and "dry ravines" already described.

Allowing for the marvellous descriptions of a superstitious people, there was evidence enough in their accounts of their having at various places penetrated these caverns to great extents, until their progress was arrested by running waters. They related to me many myths and legends of navigating these submontagne rivers in canoes, introduced through the caverns, and placed upon their waters. The imagery and fancy of these descriptions are curious and marvellous in the extreme, but too long to be recited in this place.

Mountain upheavals thus standing over vaults which are often pervaded by active waters, are subject to subterranean degradations, and in time, to subsidence by slow and gradual undermining, or by volcanic convulsions, which send them back to the

beds from whence they came. Many evidences of these are known to exist, and will become more abundant as the actual proofs of such changes are better understood.

The most frequent evidences of these subsidences are met in lakes and savannahs, on the borders of which are seen massive boulders of granite or gneiss, which are often mysteries to the beholder, but which have anciently rolled down from the summit (perhaps axis) of a mountain which is now buried in the lake (or in the savannah or morass, which has been a lake), and in time has been filled up by the influx of alluvial deposits.

Of these phenomena there are many in various parts of the world, and perhaps nowhere are they more frequent than in the valleys of Venezuela and Grenada, in South America. As a striking illustration, take the Great Salt Lake, in the Rocky Mountains. An island in the middle of it presents the summit of a gneiss mountain, and the country around its shores is strewed with huge boulders of the same material, which have been shed off from its summit before its subsidence.

Lake Superior is another example: the *Isle Royale*, of gneiss rock, and of many miles in circumference, which has been the summit of a mountain, stands in its northern part; and its southern escarpment—called the "Pictured Rocks," for a hundred miles or more, and one of the splendid sights in American scenery—presents, in a vertical wall of six hundred feet overlooking the lake, the whole sedimentary

series—the face of a vast fault. From its brow, and on its summit, are a gradual decline and water-shed, from the very brink of the precipice to the sources of the Wisconsin and Mississippi; and its whole coast, both on the north and the south, is strewed with massive blocks of gneiss and granite, which must have descended from a mountain summit.

This magnificent fault, perhaps the grandest and most picturesque in the world, faces the lake, and rises out of its waters. Where is its other half, and what was it? A stupendous mountain; it could have been nothing else; and it has retired to the bed from which it arose. And was it a *solitary* mountain or a *mountain group?* It might have been one, or one of many, for the area of the lake is 400 miles in length and 150 in breadth.

These stratified beds appear on the opposite side of the lake, and when laid they were one. Where have the rocks gone that filled the intermediate space? They must have been lifted up to have been *degraded* down, or to have been undermined and *sunken* down. It was thus a mountain.

Like the Great Salt Lake, this vast sheet of water has no tributary streams of any magnitude running into it; but the formidable rivers of Wisconsin, Chippeway, St Croix, and Mississippi, all head near its shores, and run from it, as the Missouri, Yellow Stone, Columbia, Snake, and a dozen others, rise near the base of the Rocky Mountain, and from it take their courses in different directions.

Great rivers, all over the globe, rise at mountain

bases; and looking on a map of North America, at the divergence of river sources around the borders of Lake Superior, one is struck with the conviction, as well as from the rocks upon its coasts, that in the present area of that lake once stood a stupendous mountain; and it is not less probable that the sedimentary beds of Lakes Huron, Michigan, Erie, and Ontario were lifted at the same time, and that altogether they formed a mountain group which, under the force and weight of the diluvial waves, sank to their native beds, or that in the glacial deluge they withstood the devastating floods of ice that swept down the mountains of Labrador, until, under their accumulating and irresistible weight and force, they gave way—their tops swept off and scattered in fragments over the prairies of the Northern and Eastern States, and their bases, from the vast mountains of ice heaped upon and grinding over them, sunk to the vaults from which they had risen.*

The length of Lake Superior, it has been said, is more than 400 miles, and the lengths of the other four, added *in extenso*, would make an area of 1300 miles, nearly equal to the whole length of the Apala-

* And why (I have been asked), if these lakes have been formed by the subsidence of mountains which sank so far below the surface as to form the present lakes, were not those cavities filled up by boulders swept over and into them by the glacial current? Because they were filled and consolidated to the surface with floating bergs of ice, loaded with incorporated boulders, over which the *débris* from the Labrador mountains was swept and scattered over the southern prairies; and after the drift, by the melting of the ice these cavities assumed the form and character of lakes.

chian chain, their average breadth, 150 miles, being quite equal.

In contemplating the subsidence of mountains into their own beds, and disappearing in a lake, a seeming difficulty vanishes when we consider the diminution the mountains have undergone, while standing, by degradations and the enlargement of their vaults that may have taken place by the action of water passing through them.

That the group of the great lakes, or "inland seas," as they are often termed, has once been a mountain group, sending off their superficial waters at their bases, in valley rivers in all directions, and their submontagne current to the ocean, I uphold with confidence as a geognostic fact sustainable upon strong evidence, and that evidence existing chiefly in the one apparent truth, that, unlike estuaries or inland seas, no streams of any importance are running into them, and on every side of them are evidently declines in the sedimentary beds, from the numerous rivers taking their rise near their shores, and running from them;—such as the Mississippi, the St Croix, the Chippeway, the Wisconsin, Illinois, Wabash, Ohio, Susquehanna, and Hudson, which run to the west and south; and on the north-east the Ottawa, running to the St Lawrence, and several others running due north to Lake Winnipeg and Hudson's Bay. (See the Diagrams.)

The small streams that flow into these lakes are all of that class that would be formed by the depression of the strata near the shores of the lakes when

the mountains went down, and in no instance have they the magnitude or the character of streams tending to estuaries or inland seas.

I have seen the two most disturbed districts of rocks in America—in Labrador and Grenada; in the one, mountains swept down and strata overturned, and their *débris*, in boulders of all characters and all colours, scattered over the valleys and plains, to the 20th degree of latitude, by the glacial flood; and in the other, from repeated volcanic convulsions, mountains dislocated, contorted, and thrown into the most unintelligible masses of confusion and chaos.

The aspirant in geology, impatient for notoriety by the announcement of some new geological formation or mineral combination, or even geognostic structure, may easily find them here; and if he would combat every rational maxim, and every dogma in the science of geology, orography, and palæontology, the weapons for him to wield are strewed over the surface, and ready for him to pick up.

In Canada, what have recently been denominated the "Laurentian rocks," from their forming the northern beds of the St Lawrence, where bedded, are overlaid sometimes by vast masses of errant rocks of granite and gneiss boulders, and sometimes by inverted strata of calcareous rocks, which have formed the southern inclines of mountains torn down and levelled to the surface by the flood of ice passing over them.

This current, crossing the mountains of Labrador and the St Lawrence, swept everything before it that

lay across its path, except the black and frowning Adirondak, which, like a Colossus, withstood the moving and crushing deluge, turning its glassy bergs and boulders to the right and the left, to graze and flank the Apalachians, which held to their foundations from their latitudinal bearings.

The glacial drift, which has been one of the most striking events on the American continent, and has left the most lasting effects in its physiognomy, it is to be hoped may not confound the geologist, nor mystify geology, though it would seem, from recent "reports," to be threatening both.

A geologist who has been, during the last few years, surveying amongst these dislocated and distorted and confused rocks, to the astonishment of men of profound science, has reported a system in the Laurentian rocks wholly incompatible with the universally-settled theory of rock formations—that the Laurentian sedimentary beds, to the depth of 40,000 feet, consist of alternate strata of gneiss, mica-schists, conglomerates, and limestones, the latter occurring in beds of 1000 and 2000 feet in thickness, underlying gneiss rocks, and containing organic remains!

The surprise which this startling report excited in the "British Association," some four years since, when read by Sir Charles Lyell, was only surpassed by the declaration with which he endorsed it,—that "*the long-established theory of primitive rocks proves to be a delusion!*"

This shock, amongst geologists, was like an earth-

quake. The *report* of a *surveyor* could not be a "delusion." Sir Roderick Murchison was unhinged by it: he at once adopted the 40,000 feet of gneiss rocks, interlaced with fossil-bearing limestones, and coined for it the *very appropriate geological term* of "fundamental gneiss!" and Professor Dana approved the estimate, and endorsed it by adding that "it is everywhere, and underlies everything, on all parts of the globe!"

How long the new theory, so readily grasped by these gentlemen, lasted, or will last, and how well founded may be the basis on which it rested, I am inclined to think, are problems yet to be solved.

For us, who had been for many years adopting in strongest confidence the "Principles of Geology" put forth and taught by these learned men, when we saw, by their own acknowledgments, their "*Principles*" overturned, and the very basis on which all their geological systems rested admitted to be a "*delusion*," our faith in the wisdom of man was shaken, but not our own belief in the lowest, the simplest, and best-established facts in geology—*azoic truth* and *primary position* of gneiss rocks, on which, and above which, all other rock deposits are laid.

Rocks are things which have always the truth within themselves, if they can be rightly understood; and men, even with the best intentions and with the noblest efforts, are liable to err; and amongst the contorted and confused rocks that have been crushed, overturned, and displaced by icebergs in the Laurentian system, it is easier to believe that their estimates

have been in some respects erroneous, than that the universally-admitted truths relating to rock formations should have been, until the present moment and the present instance, a "*delusion*."

Independently of the unprecedented succession of the strata in the sedimentary rocks here given, the *process* by which the actual thickness of these beds (40,000 feet) is ascertained contains something like a mystery requiring a solution.

One of the most difficult things that falls to the lot of the practical geologist, and in which it is the most easy to err, is the measurement of strata; and in the measurement of 40,000 feet of stratified rocks in Canada, or of 40,000 feet of sediments laid, as has been alleged, in the Apalachian chain, it is easier to suppose that, by the fallibility of man, and the difficulty of the process, those estimates have been incorrect, than to believe that such amounts of strata actually exist.

I have surveyed and measured rocks, dips, inclines, faults, out-crops, &c., by every process that has come to my knowledge, and knowing as yet no method by which strata of 40,000 feet in thickness can be with certainty estimated in the Laurentian and Apalachian beds (with both of which I have long been familiar), I confidently pronounce such measurements, with *certainty*, to be impossible; and consequently such estimates, though presented by men of talent and integrity, and honourably labouring for the advancement of science, to be unreliable.

This gentleman represents that he has discovered

gneiss beds at the depth of 40,000 feet, and a stratum of limestone of 2000 feet in thickness, at the depth of 23,000 feet, containing organic remains, and underlying gneiss rocks; and that this bed extends over an area of more than 200,000 square miles! Two hundred thousand square miles in Upper Canada, and transparent to the penetrating eye of a geologist to the depth of 40,000 feet!

(Geologists of the earth! get this man his *decorations*, but don't believe a word of this.)

For the sake of the sacred science of geology, which is all truth, it is a pity that such *undemonstrative suppositions* should be introduced into geological estimates, and more to be regretted that men at the head of that science, and who are teaching our children, should be so ready to adopt them.

That Sir Charles Lyell and Sir Roderick Murchison should have been led, on the suddenness of the presentation of such a theory, to concessions such as they made, is wonderful enough; but that Professor Dana, who took the subject more deliberately, and had due time to consider it, should adopt it, and be ready to clothe the globe in a new suit, is to me a matter of profound astonishment;—that calcareous matter, of 2000 feet in thickness, and teeming with organic life, could have been laid around the globe, and been overlaid by beds of gneiss, formed purely of the disintegrated and errant particles of granite!

Such a theory, if adopted, strikes at the very basis of geology, and shakes the whole fabric; for if there be one such alternation between azoic and palæozoic

rocks, there may be a dozen. "*Eocene*" may be expunged from geological books, and the palæontologist, who is left to gaze into a bottomless pit, may begin to add *salamanders* to his list of organic existences.

That the remains of rhizopod and algæ life may be found below gneiss, and that they may have been formed and have lived there, under certain circumstances, is easily to be accounted for; but that they occurred in regularly stratified beds of limestone, of such thickness, and in such position, is a thing difficult to believe.

Into the caverns formed underneath submarine mountains, which are free from all currents of the ocean, by the infiltration of water from the overlying calcareous rocks, calcareous matter enough is introduced to form, with chemical aid, the finest-grained limestones; and it is probable that in these caverns the first movements of organic life (which could not have existed exposed to the currents of the ocean) began.

These limestones, of infinite varieties and colours, and mostly of magnesian composition, and belonging to the lower silurian and palæozoic times, unlike limestones formed in land caverns, would be deposited in horizontal strata, and in that form would appear in the Laurentian or other rocks, when such mountains should be cut through or torn down (as is the case on the Ottawa and Lake Huron, in Canada) imbedded, and in horizontal strata, beneath azoic rocks, and containing the "*Eozone Canadensis*," and

other rhizopod remains which have excited so much attention of late, and been ingeniously used to undermine the established system of geological formations.

The dislocated and confused state of the Canadian rocks affords abundant exhibitions of the above kind, which might easily lead the geologist into some of the errors embodied in the Canadian geological report above alluded to; and the same submarine cavern-formed limestones, with their rhizopod life, are met in abundance in the disembowelled mountains of Venezuela and Grenada (of which more will be said in a future chapter), repeatedly thrown up and subsided by volcanic action, and in the mountains which occur in many parts of the world, where a mountain rises beneath a mountain, and breaks up and opens a mountain range, exposing its subaqueous cavern-formed enclosures.

The glacial flood that swept over the coast of Labrador, from Greenland and the Northern seas, produced these effects in abundance in Canada, levelling down mountains that stood on the peninsula of Labrador, overturning their southern inclines (many of which are yet to be seen), and strewing their shattered *dêbris*, of all kinds and of all colours, in myriads of boulders over the plains and the prairies of the Western United States, even to the 30th degree of latitude.

From Nain, on the coast of Labrador, running in a south-westerly direction, is yet traceable, near to the northern shore of Lake Huron, for a distance of 500

miles, the degraded remains of a huge mountain that has been mostly levelled down; but here and there portions of it remain, rising to 1000 and 1500 feet; and duplicates of the beautiful blocks of serpentine, syenite, and of felspar which lie around its base, we meet while riding over the Western prairies, even to the banks of the Arkansaw.

In the vicinity of Nain, where the mountain's base is degraded and enters the sea, and not covered by the impenetrable moss that covers most geological and mineralogical features in those regions, we discover at our feet, for miles together, grooves and scratches cut by the rocks embedded and transported in the glaciers that have passed over them.

The evidences that this mountain base still exists under the sea, with a trend towards the coast of Greenland, are the singular traditions of the Esquimaux Indians living on the coast; and still more their conduct when an iceberg appears and is moving down the strait. They all know the trend of the submarine mountain, and when the glacier is near it, in terror of the rumbling noise and trembling of the rocks on which they are standing, by the glacier grinding over it, they leave their wigwams, and prostrate themselves with their faces to the rock, and pray to the Great Spirit for protection, until the noise and the trembling are over.

These immense icebergs are frequently, and at some seasons almost constantly, moving down the strait in that latitude, and passing out into the sea, scratching and grooving the rocks over which

they pass, and dropping their transported boulders in the bed of the ocean, in the same manner, but not on the same scale, as they passed over the rocks and mountains of Labrador, and scattered their boulders over the prairies, in ancient times.

Lakes Mistassinne and Nitcheguon, near the centre of Labrador, and in the range of the dilapidated mountain above named,—the first seventy-five, and the second forty miles long,—from the terrific rocks at their shores, their islands of gneiss, and the surrounding streams all running from, instead of to them,—have evidently been formed, like the Great Salt Lake, by the subsidence of mountains into them.

Lake Champlain, of 150 miles in length, in the State of Vermont, with its islands of gneiss, where the surrounding country is of limestone, plainly evinces a similar origin; and there are many others in the United States of similar character, but not important enough to be noticed in this place. Subsidences and their causes, thus briefly alluded to, we now approach on a grander scale.

It has been assumed, in the early part of this work, that the islands of the Antilles chain once formed a part of the Andes—that their subsidence, which placed them in their present position, was probably the most stupendous catastrophe that has happened on the surface of the globe; its probable causes have also been briefly noticed, viz., the undermining effects of submontagne currents, combined with extraordinary volcanic influences acting underneath them.

This tremendous subsidence sunk below the waves of the ocean an area larger than the kingdom of France, and included the whole range of the lesser Antilles, the extensive banks at their eastern base (which at that date were vast and fertile plains), the peninsulas of Yucatan, Honduras, and Guatemala, and the great estuaries, the Caribbean Sea and Gulf of Mexico.

What are now the lesser Antilles were at that time mountain summits of a portion of the Andes, some of which were entirely submerged, and others but partially so, the water-lines on which are easily discovered from the sea, showing the depths to which they went down, and the amount of their respective elevations since the catastrophe; and by other tests which I made and applied, and which were approved by my friend the Baron de Humboldt, the same results are corroborated and more minutely proved.

With the peninsulas of Yucatan and Guatemala, which have risen again to the light of the world, sank the splendid cities of Palenque and Uxmal, and probably on the fertile plains at the bases of both these ruined mountain ranges, and over the areas of what are now the Caribbean Sea and Gulf of Mexico, other cities of equal or greater splendour, and with tens of millions of human beings. (See Diagram.)

The proofs of these astounding events and their effects exist in Indian traditions (now well translated), in the rocks of the mountain sides, and on every rood of the soil where these exposed ruins exist, and where the traveller treads.

In every tribe of Indians in North America, from the Crows and Mandans on the sources of the Missouri, to the Mexican borders,—including the Crows, the Sioux, Mandans, Cheyennes, Arapahos, Konzas, Pawnees, Osages, Pawneepicts, Kiowas, Camanchees, the Snakes, the Apachees, the Mohaves, Cochimtees, and many others,—I found the existing tradition of the cataclysm of which I am speaking.

Amongst the northern and mountain tribes the belief is, that the waters burst out from under the mountains and filled the valleys; and amongst the Mandans (as has been described in former pages), that the submontagne agencies were four tortoises, on the backs of which the earth rests, each tortoise having rained ten days and nights, which caused the flood.

Amongst the tribes further to the south, the waters were seen coming in waves like mountains from the east; and of the tens of thousands who ran for the mountains to the west, by some, one man only, and by others, two, and seven, succeeded in reaching the mountain tops, and from these have descended the present races of Indians.

The tribes in Central America and Mexico, in Venezuela, and in British and Dutch Guiana, distinctly describe these cataclysms—one by water, one by fire, and the third by the winds.

These tribes, nearer the vicinity of the terrible convulsions, were cognisant of their whole effects of fire and winds, when the remoter tribes were

sensible only of the flood of waters, which went to the base of the mountains.

It is probable, and easy to suppose, that, by a superstitious people, and from the looseness of traditions as to dates and connexion of incidents in great events, the three cataclysms of which these traditions speak were all embraced in one. Fire and terrific flames would be the certain results of mountains sinking into the bosom of volcanoes, such as exist under those regions; and winds and groaning tornadoes, mixed with the uprising and foaming mountain waters, would be sure to act their part.

It is difficult to conceive a cataclysm of fire or of winds only, and easy to imagine them at work together in the terrible scenes to which we are alluding.

That there has been one *post*-diluvian flood, at least, destructive to the greater part of the native populations of the valleys of the American continent, there remains not a doubt; and there may have been two, or there may have been three, and from different causes, though it seems difficult to identify them.

That *one* such happened, and from the causes which have been named, may be received as an axiom, proved in the manner in which I am progressing. Traditions of this, though for a long time received with suspicion, gave us the first account of it.

From the date of the discovery of America by Columbus, to the present day, these traditions have stood, unchanged and unchangeable, as Indian

history, but treated with suspicion or incredulity by historians, until the march of science has led to proofs corroborating all that such traditions had told us.

It is often said of Indian traditions, that they soon run into fables. This is very true, but when they relate to great events, like cataclysms, they may be said to be longer-lived than history. They may take the form and character of a fable, but the *moral* of that fable—the *event*—is never lost.

History, and even monuments, may easily be destroyed, but traditions of great events never die whilst the race exists, for it costs nothing to keep them up, and every member of the race, intelligent or ignorant, helps to keep them alive.

The Indians, therefore, who have no monuments and no history, are better and more generally informed of such events as cataclysms, the first landing of Europeans, and their cruelties in Mexico and Peru, &c., than the uneducated people in civilised societies; for in those societies history takes the place of traditions, and the uneducated classes know little or nothing of history, and lack the intelligence of traditions.

If, therefore, such an event as that of the "deluge" ever took place, and all human monuments and histories on the earth were destroyed, and one pair only, however ignorant, were saved, and again peopled the earth, it is quite impossible that any length of time should ever obliterate the tradition of that event whilst the descendants of that pair continued to exist, or that it should fail to be spread to any part of the

earth to which any portion of the descendants of that pair should emigrate.

And if, consequently, there was an universal post-diluvial deluge, in which all the human race perished excepting the family of Noah, and no tradition of it was handed down to future generations by that family, independently of inspiration, then I should say that Noah's descendants all perished, and that the inspired account of that event is a fiction.

I believe that the Mosaic account of the "deluge" is but a tradition, and not an inspiration. It has just enough of monstrous incongruities in it to be a savage tradition—the *event* (the *moral*) a truth—and those incongruities not enough of probability or of possibility for my veneration of inspiration.

The event, therefore, of which I am treating, the cataclysm caused by the subsidence of the lesser Antilles, I consider sufficiently proved by the Indian traditions, even if there were no other evidences to corroborate them; but I have alluded to others, which here demand their place.

Mexican hieroglyphs, I have said (which are recorded history, and now well translated), afford the most undeniable proofs of the great events now under consideration.

The ancient hieroglyphs at Tezcuco, which, like the inscriptions on the monuments of Palenque, Copan, and Uxmal, have been a sealed book to the present day, are just opening to the historian a new and vast field of contemplation, and a foundation for American history almost as deep and ancient as

the alleged sedimentary strata of the Laurentian rocks.

The scientific world, to all ages, will be indebted to the Abbé Brasseur de Bourbourg for lifting the veil from these heretofore inexplicable mysteries, and bringing them into history.

This indefatigable scholar, whose residence in Mexico for several years, in Guatemala, Palenque, and Uxmal, have given him access to the antiquities of Mexico and the monuments of the ruined cities, has recently published several interesting and valuable works on Mexican history, the last of which is entitled "Quatre Lettres sur le Mexique," being a complete translation of the "Teo Amoxtli," the Toltecan mythological history of the cataclysm of the Antilles.

This symbolic history gives a detailed account of the four days and nights during which the volcanic convulsions lasted; and the different agents employed, and the terrible effects produced, are deified, becoming divinities in their religion.

In the preface to his work he tells us that "he has perfectly succeeded in raising the veil that covered and held in obscurity those symbolic records," and in the body of his book he gives a lucid translation of them.

He says that "he went to Mexico to study the *Occident*," and, to his great surprise, when he had discovered the key to these hieroglyphs, "that he was studying the *Orient*;" that "he found the system of hieroglyphs not only resembling those of Egypt, but

more simple and easier to read, because they are older."

Both in his valuable work and in precious private letters which I have received from him, he confidently asserts that, from the proofs he has found, the first civilisation of the earth was on the ground which sank in the cataclysm of the Antilles,—that the first ceremonial religion commenced there, as well as the first age of bronze, which has spread over the two hemispheres.

This symbolic history, but a part of the sacred history of the Toltecs,—the greater proportion of which was given to the flames by the ruthless hands of the first bishop of Mexico,—the Abbé Brasseur assures us is still sufficient to authenticate the great volcanic convulsions in which sank the lesser Antilles, and with them the races who inhabited the vast and fertile plains around them; and, as will afterwards be seen, the authenticity of these hieroglyphs and their translations will establish them in the minds of all readers as the beginning and basis of American history.

In the above development of long-hidden facts and events, we have not only American history leading us back almost to Silurian ages, but geological and geognostical facts and data which make modern geologists feel as if they were stepping in only at the second or third stage of their science.

Stupendous mountains, that had risen from the bed of the ocean tens of thousands of years before, strong and defiant in their age and grandeur, and their lofty

summits whitened with snow, by insidious enemies beneath them were undermined, and amidst the bellowing groans of vomiting craters, and flames, and smoke, and mountain waves, sank down to the deep beds from which they had been raised amidst a similar war of elements.

With them, as has been said, the vast and fertile plains inclining from their base to the ocean's border on the east, and the peninsula of Yucatan and Guatemala, with their splendid cities, were engulfed in the ocean's waves.

The vast area which is now the Gulf of Mexico, at that time the adjunct of Yucatan and Cuba, with its rich and fertile soil, and traversed by the Rio del Norte and the Mississippi, with a population probably of millions on millions, and their chiselled and sculptured edifices, went to the bottom ; and probably, at the same time, the platform which is now the Caribbean Sea.

It is a known fact, which has been mentioned previously, that most mountain ranges on a grand scale have at their bases long and gradual inclines running off into the plains, caused, beyond a doubt, by the mountain upheavals passing through the floor of the sedimentary beds, which are lifted for a great distance, and propped by falling fragments and by masses of granite rock driven underneath by lateral force of the explosions, and by sediment and rocks underlaid by the agency of water.

These gradually-inclined beds lie along the whole eastern base of the Rocky Mountains and the Andes,

and sometimes extend to the distance of many miles. Their vast chambers are reservoirs and aqueducts for the mountain drainage, and it is through them that the gathered waters of the Rocky Mountains and the Andes wend their way to the Caribbean Sea.

When a mountain subsides, these floors, losing their support at the mountain's base, with the exception of the portions propped up in the manner described, in time fall in, forming ravines and streams dipping towards the lake or estuary thus formed. Such has been the case on the shores of the great lakes, as has been shown, and also on the shores of the Great Salt Lake of the Rocky Mountains.

These inclines, at the eastern base of the Antilles chain, shown by soundings marked in charts, making allowance for their sinking after the subsidence, indicate the amount of subsidence to which the Antilles chain and its surrounding plains have been subjected, and consequently the amount of elevation to which the peninsula of Yucatan and the Antilles have again risen. And with the mountains, such as clearly show the elevation of the water-line mark, there is a striking and conclusive correspondence of these measures; that is, the depth of the water on the banks east of the Antilles and of the Caribbean Sea and Gulf of Mexico, which have not risen, very closely indicates the amount of subsidence to which the Antilles were subjected, and the amount of elevation to which they have again risen, as also proved by water-marks on their sides, and other tests which have been applied, and yet to be named.

These inclines, stretching off from the bases of the ancient Antilles (or Andes), on which probably the first civilisation of the world took place, were undermined by the same causes which undermined the mountain chains; and with them and their populations, in the terrible chaos that left no historians, they sank to a foundation which undermining had not shaken.

In the very centre of the very greatest volcanic zone of the globe, the ever-acting agencies which have already been explained, and which, with their combined forces, caused the decadence, have given a lift again to the mountain chains, and the plains in part, of which Yucatan and Guatemala hold up to view, in their ruined edifices, the civilisation and grandeur strong enough to have battled against all barbarism, but yet too weak to stand against convulsing elements.

It requires no antiquarians, no archæologists or philosophers, to tell us that the people who chiselled those stupendous edifices were civilised, and that no savage foe or epidemic could have entirely obliterated them, or that the limits of such a people were confined to two or three cities; but the simple man of sense, of reason, who walks through and over those vast and splendid structures, decides for himself, that mankind at that date, and in that region, were able to defend themselves, and that their intelligence and wealth and multiplicity were not confined to a point within the walls of two or three cities, but that they extended over the vast plains already described,

where cities and cities, with their millions of inhabitants, existed, and which are now ruins in the sea.

The ruined cities of Palenque and Uxmal have within themselves the evidences that the ocean has been their bed for thousands of years, and the very earth on which one treads, around them, and the whole face of the country in which they stand, bear incontestable proofs of the same fact.

The myriad marks of the chisel in their statuary, their tablets, and other monuments, when no implements have yet been found amidst the ruins by which those marks were made, clearly show that chisels of iron or steel have been their agents, and that nothing but corrosion in the salt bed of the sea, and great time, could have obliterated them.

Amidst the ruins, and over every rod of the peninsula of Yucatan, the surface of the earth is composed of marine deposits, of sand containing fragmentary and pulverised coral and pebbles, everywhere producing a richness of soil which supports the most luxuriant vegetation, when, if blown there by the winds, the peninsula would have been a barren waste, instead of a wilderness of impenetrable vegetation.

Every island of the Antilles, on their plateaus and plains, and on their mountain sides, as high as such sediments would rise in the sea, exhibits the same proofs; and above these, where the rocks are cavernous or schistose, to preserve them, saline incrustations (which are easily detected) mark the heights to which the ocean has washed them.

The banks on the Mosquito coast, and also in front of the harbours of Sisal and Merida, plainly show that the peninsula is still rising; and ruins, traceable into the sea, convince us of its submersion.

In the fall of 1855, on my return from the Pacific —crossing the Rocky Mountains from St Diego to Santa Fé and Matamoras—I visited the Baron de Humboldt in Berlin, and explained to him my views relative to submontagne drainage, the cataclysm of the Antilles, and probable cause of the Gulf Stream. He received me with great kindness, and my views with a profound interest, and presented me to the King and Queen of Prussia at the Sans Souci Palace.

I was then preparing to start on a second voyage to the West Indies and the coast of Venezuela, and before my departure I received the following very complimentary and encouraging letter from him :—

"TO GEORGE CATLIN, ESQ.

"MY DEAR SIR,—I have read with profound interest the papers you left with me. I believe, with you, that the Crows are Toltecs; and I was instantly impressed with this belief when I first saw your portraits of Crow chiefs in London some years since. But I am more struck with your mode of determining the sinking and rising transits of rocks, and the probable dates and extent of cataclysmic disasters.

"I believe your tests are reliable, and perfectly justify you for making the contemplated voyage to

the lesser Antilles. The subject is one of vast importance to science, and if I were a younger man, I would join you in the expedition at once.

"I believe your discoveries will throw a great deal of light on the important subject of the effect of cataclysms on the *distribution of races.*

"I return to you with this the papers you left with me, and I enclose you a *memorandum* for your voyage, which may lead you to examinations that you might otherwise overlook. Let nothing stop you; you are on a noble mission, and the Great Spirit will protect you.

"A. V. HUMBOLDT.

"POTSDAM, *September* 12, 1855."

In this voyage I visited the islands of Jamaica, Guadaloupe, St Thomas, Antigua, Trinidad, and Tortugas, and the coasts of Grenada and Venezuela; and ascended the "Silla" at Caraccas, and the mountain capes near Santa Martha; and made the examinations about the Gulf of Maricaybo which his "memorandum" directed me to make.

From this point I paid a visit to Rio de Janeiro, to the Indian tribes on the Paraguay and Uruguay; and on my return voyage, on my way again to visit my friend the Baron de Humboldt, as he had desired me to do, I heard of his death.

In this voyage I was enabled to compare the rocks on the coast of Grenada and Venezuela with the summit rocks of such of the lesser Antilles as I visited; and from their unquestionable correspondence

as a family group, I gathered the most conclusive and satisfactory evidences of their having been parts of one connected chain, and of one continued elevation and grandeur.

The continuous chain of stupendous mountains extending from Cumana to Coro, in Venezuela, and also at Santa Martha, in Grenada, and near the coast, presenting the frequent faces of immense faults, bear incontestable proofs of the subsidence in which their other halves have gone down to the ocean's bed.

The Silla, at Carracas, one of the standing sections of this mighty chain, has a wall, nearly vertical, on one of its sides, of 9000 feet; and further back from the coast, of the three parallel chains of the Andes trending towards the coast at Santa Martha, the summits of the central chain are 16,000 feet in height, and covered with perpetual snow.

From a point 260 miles north of Quito, and between the latitudes of two and three degrees, the Andes divide into three distinct chains, each having its more or less parallel associate ridges. The eastern of these ranges trends to the north-east, running east of the Rio Magdalena and the Gulf of Maracaybo, and reaching the coast at Coro, and thence, in successive elevations and depressions, extends along the coast to Caraccas and Cumana, disappearing in the ocean at that place, but reappearing in the island of Trinidad, and afterwards in the lesser Antilles chain to the north.

The centre or principal of these Cordillera chains

runs to the west of the lake and gulf of Maracaybo, and to the coast at Santa Martha, in Grenada; and the western chain trends to the north to the Gulf of Darien, and, gradually depressed, enters and passes through the Isthmus of Panama into Nicaragua and Guatemala, where it gradually rises again into its former grandeur, and pushes through Mexico, and becomes the Rocky Mountains of North America.

The main chain, trending to the north-east, to the coast at Santa Martha, with its lofty summits of Guanacas and Quindin, with an elevation of 16,000 feet, and capped with perpetual snows, is traceable from Point Galinas through the islands of Omba, Curraçoa, Buen Ayres, Tortugas, and Margarita; and the rest of the lesser Antilles, Hayti, Jamaica, and Cuba.

On the rugged surfaces of Tortugas and Margarita we recognise under our feet the very material which we trod upon at the summit of the Baragan, 14,000 feet above the ocean's surface, and in the sterile plains at Corona, east of the Lake of Maracaybo, the same thing is under our feet; and landing on the island of Trinidad, and ascending its mountain elevations, we recognise (and prove by bringing them together) the minerals composing the summit of the Silla, at Caraccas, though one is 9000 feet and the other but 900 feet, above the surface of the ocean.

And in the Lake of Maracaybo, which has a length of 150 miles and a breadth of 75, we find, as in Lake Superior and the Great Salt Lake of the Rocky

Mountains, the basis of a mountain or a mountain chain that has sunk to regions below. The evidence of this, as in the other instances, consists in the immense blocks and boulders of gneiss and other sedimentary rocks lying around and adjacent to its shores, which must have descended from a mountain summit, and the trend of streams rising near its shores and running from it, such as the head-waters of the tributaries to the Rio Magdalena, and even of the western branches of the Orinoko.

From the longitude of the head of this lake, a distance of 150 miles from the ocean, the crests of these lofty mountain ranges are seen to decline as they approach the coast; and in travelling over them, we tremble at the awful and yawning crevices which we meet, and faults facing to the ocean, and strata vertical and overturned, and interlaced by the convulsions of elements beneath them.

In sailing or travelling the coast east of the mountain ranges running from Cumana to Caraccas, and from that to Coro and Point Galenas, near Santa Martha, one hundred walls may be counted facing the ocean, varying in height from 50 to 900 feet, and all facing to the Antilles, and revealing a history that cannot be mistaken—the decadence of their counterparts, which are now imbedded in front of them in the waves of the ocean.

Nothing, probably, on the face of the earth, excepting the glacial flood which swept down and levelled the mountains of Labrador, has ever produced chaos and confusion equal to that which exists in the moun-

tains of Venezuela and Grenada, from the zone where their crests are first broken, to the borders of the ocean, and the geologist of future ages, creeping and climbing over and through them, though he will find his match to read them, will have no difficulty in drawing from their broken-up, displaced, and obscured positions, conclusions as to the repetition and force of convulsions they have been subjected to. He will gather evidences enough here, from the fragments of shattered mountains, to account for the powers which have laid low the Antilles, and proofs enough in the glazed crevices of the volcanic beds that are beneath him that he stands over the concentration of volcanic heat of the globe, the thunder and trembling of which are heard and felt to the ends of the continent—the volcanic battery which gives impetus to the Gulf Stream, and the convulsions of which have thrown mountains up, and cast them, with millions of human beings, into the sea; and probably only requires time for a repetition of the awful catastrophes.

The subsidence of American rocks, and with them the cataclysms of the Antilles, and their probable causes and effects, having been thus briefly considered, other and important results flowing from them will now be brought under notice.

CHAPTER IX.

DISTRIBUTION OF RACES.

THE chain of events flowing from the upheaval and subsidence of rocks on the American continent, has thus far been traced, and in the list of those successive events there is one yet to be noticed, in its magnitude equal to, and in its importance surpassing, all the others—the distribution, or dispersion and destruction, of races enveloped in the smoke, the flames, and the waves of the convulsions that have been alluded to.

Evidently the *first civilised*, and perhaps the *first created*, race upon the globe, in the midst of their onward march, surrounded by luxuries, by monuments, by altars, by temples and palaces, have been crushed by the war of elements, and their literature and history with them, save the chiselled entries upon stone, which, without an interpretation, have been saved from the smoking chaos.

That such a people existed, and were advanced in the arts of civilisation, is proved by the splendid edifices they have left behind them; and that they were engulfed in the terrible convulsions of the

elements, is fully proved by the traditions handed to posterity by those who beheld the borders of the cataclysm, and, fleeing to the mountains, escaped its fury; and more authentically established in the "Teo-Amoxtli," above mentioned.

The cataclysm which sunk the Antilles, and engulfed the splendid cities and their inhabitants on their plains, sent its devastating waves to the base of the mountains of Mexico. Consternation and fear drove the inhabitants of those regions into the mountains. Their posterity, with a little of civilisation, but not in a country calculated to foster it, spread through the mountains to the north, carrying their traditions with them.

These scattered and demoralised remnants, mingling with the more savage nations of the mountains, held with them a joint tenancy of the mountains of Mexico and the Rocky Mountains, till a date, conjectured but not known, when, under the familiar appellations of Toltecs and Aztecs, they left their wilder and more primitive neighbours, and commenced a movement to the south, re-entering the mountains of Mexico. The Toltecs, founding the City of Mexico in the mountains above the reach of floods, there started a new civilisation; and the Aztecs, venturing further to the south, spread out upon the slopes of the mountains, and at length into the mountains and plains of Guatemala and Yucatan.

In the stampado which started at the mountain bases of Mexico, and swept over and through the mountains and valleys of the northern wildernesses,

now the United States, artisans travelled, and iron or bronze implements and weapons were carried with them.* They followed the shores of the rivers as well as the mountain ranges; and on the banks of the Mississippi, the Ohio, and Mushingum, and other rivers, their marks are already found, and in time, to the astonishment and conviction of the world, will be more abundantly disclosed.

The wonderful ruins found on the Atlantic coast of New England, and attributed to the "north-men," I believe were built by the "south-men," whose civilisation and numbers were too feeble to withstand the savage preponderance, by which they were here extinguished.

Such are the populations of these vast districts at the present day—the remote descendants of the border of a civilised race, driven in dismay to the mountains for refuge, and mingled with races of a wilder caste.

The present tribes in the Rocky Mountains, to the 50th degree of north latitude—the Crows, the Shoshonees, the Cheyennes, the Yutahs, and the Apachees—preserve yet, in a remarkable manner, in

* These are still preserved amongst the Indian tribes in the Rocky Mountains, and are also obtained from tumuli. There are several of these in my collections exhibited in London and Paris. The weapons, both of bronze and copper (several of which are engraved in my Travels amongst the Indians), are somewhat in the form of a halbert, and a broad "cut and thrust" two-edged sword, of two feet in length, which were certainly not manufactured by any of the present tribes of the countries where they are found; nor can the Indians give any account of them, excepting that "they got them from their fathers."

their physiognomy, the type of the Toltec and Aztec races, as seen on their monuments of stone; and I believe that if my friend the Abbé Brasseur, with his intimate knowledge of the languages and hieroglyphs of those ancient people, could pass from the city of Mexico to the north, through these mountain tribes, he would discover in their languages conclusive evidences of these migrations and their effects; and no one will dispute the importance to science of such information, which can only be gathered whilst the people last.

This learned scholar, whose name will live honourable in science, and who has laid *the deepest foundation-stone in American history*, is the only man to retrace the migrations of the Toltec and Aztec races; and the Government of the United States, if it were necessary for his safe passage, should build for him a macadamised road to travel on, from the Mexican border to the 50th degree of north latitude, and furnish him with an escort of 100 men for his aid and protection.*

From amidst the "thunder and flames that came out of the sea," and "mountains that were sinking and rising," the inhabitants of the mountain sides, who were probably savages at that time, clung to the mountain tops, as the only place of escape; and since the catastrophe descended, into the valleys and plains, where there were such, and such they were found when Columbus landed in Hispaniola.

* The Baron de Humboldt's letter on the Crows as Toltecs is worth turning back to. See page 155.

The Caribs, the principal of the many tribes inhabiting the Antilles at that date, were numerous, warlike, and adventurous; and when the coasts of Yucatan, Venezuela, and Guiana were discovered, they were found everywhere occupied by them, whither, in consternation, and in fear of other catastrophes, they had made their way across the strait in their fragile canoes.

This wonderful immigration, no doubt caused by the cataclysm of the Antilles, I found not only occupying nearly the whole coast of Yucatan, of Honduras, and Nicaragua, but the entire coasts of Venezuela, of British and Dutch Guiana, and of Brazil, to the Amazon; mingled with the numerous tribes in the interiors of those countries for hundreds of miles from the coast.

This numerous race, in their own country crushed, sunk, and dismayed by the terrific convulsions of the elements around them, dispersed upon the troubled waves in their canoes and on rafts, trusting to accident for the safety of their lives, not only landed upon the coasts above named, but on yet more distant shores.

In the turmoil and flood of the elevated waters, the *Gulf Stream*, first bursting out of the sunken Gulf of Mexico, and travelling at a pace which modern days have seen nothing of, swept off the *débris* of sinking and dying humanity in their canoes and on rafts, from the smoking chaos in which they were left, landing them on the coasts of Florida, Newfoundland, and perhaps (which would have been

as probable) on the coasts of Scandinavia and Ireland.

From the coast of Florida, bronze and retrograde civilisation found their way amongst primitive savages to the banks of the Mississippi and the Ohio, which they ascended whilst the Toltecs were pervading the Rocky Mountains, building the monuments already found, and others which will yet come to the light; and on the shores of the Atlantic, in what are now the New England States, they erected the stone monuments which have puzzled archæologists, and which, for want of a more probable origin, have been attributed to Scandinavians, involving the necessity of a discovery of the American coast by those people previous to its discovery by Columbus (of which there is no proof), and long before the art of navigation was known.

The Gulf Stream, at the subsiding of these terrible convulsions of sinking mountains, uprising volcanic islands, and consequently overwhelming floods of waters, as has been suggested, was probably swollen to dimensions and forced to a velocity difficult to be conceived; and with its levelling powers, with the uplifted waters of the flood, swept off at a giant pace for the Northern seas, transporting on its waves everything that was floatable, and with and on them the wreck of civilisation and bronze, to be scattered and lodged wherever accident should land them—upon the American coast, Newfoundland, Scandinavia, and Ireland — throwing out, as it were, by explosion, the shattered fragments of

primitive civilisation to the savage nations of the globe.

The contemplation of races so intelligent, and, as has been shown, at least as ancient as the builders of the Egyptian pyramids, swept and scattered over the earth by convulsions of the elements, suggests the questions, *Who were these people?* and *Where came they from?*

These questions involve matter of very great importance to ethnology and to human education generally, and deserve a much greater space than can be allotted to them here.

If we should look to the Indians themselves to answer the above questions, they would decide for us very briefly (having no history, sacred or profane), "that they are the children of the Great Spirit, created on the grounds on which they live;" and that "they are going to the setting sun."

The first of these beliefs is the unexceptional instinct of all the American tribes; and the second, no doubt, the Indian poetical figure raised by the continual and never-ending encroachments of civilisation upon them, forcing them from their hunting-grounds, and consequently driving them to the west, towards the "setting sun."

Various theories have been advanced, and by very eminent men, as to the origin of the American Indians, who were found, on the first discovery of the American continent, to be inhabiting every part of it, from pole to pole, and every island contiguous to it in the Atlantic and Pacific oceans.

These facts put the questions at once, From whence did these people come? and, By what means, and by what route, did they come? These questions are based upon an established presumption of *necessity*, which may yet be doubted; and ethnologists and geographers have indicated Behring's Strait and other points as the probable routes by which they arrived from the "Old World." All have suggested routes and modes by which it was *possible* they *could* have come, and their theories all stand on the slender ground that not one of them has produced a particle of proof that they *did* come, or that it was *necessary* that they *should have* come.

When the science of human ethnology, which has been for some thousands of years travelling to the West with the advance of civilisation, gets quite around the globe, it will probably be seen whether there has not been some error at the starting-point,—error at its basis, and consequently error heaped upon error as it has advanced,—whether erroneous dogmas, travelling with the wave of civilisation, have not been too much the established rule by which all things ethnological in the New World should be measured,—and whether true ethnological knowledge of a people is best drawn from an independent study of those people and their habits, or from the application of an ethnological education drawn from books *made from books*, with all the dogmatical rules that have been made for, and applied to other peoples?

Is it *necessary* that, on the last quarter of the

globe, a whole continent of human beings, independent and happy in their peculiar modes of life, and never heard of or thought of until the fourteenth century, should be traced, when discovered, back to the opposite side of the globe, because civilisation and books happen to come from there? What an ill conceit of civilised man to believe that, because his ancestors came from the East, all mankind on a new continent (a "new world") must have come from there also! And what a pity for science, and what a blunder *in* science, if such a fact be established before it is proved! And what proof of it is there? I have said—"none whatever."

Ethnologists and other *savants* find amongst the American Indians resemblances in physiological traits to some foreign races. How strange if there were not such! Once in a while a word in their language resembles a word in the Hebrew or other Eastern language. How extraordinary if, in any two languages, there were not some words bearing a resemblance to each other!

And then these *savants* say—"Not only in the language, but in the *structure* of language." But how trivial is all such evidence as this, when all languages are constructed to suit the organs pronouncing them, and which are the same in the whole human race, leaving us to wonder that the resemblance in the structure of languages is not greater than it is!

One distinguished ethnologist of England mentions, in his work on ethnology, one word of only two

syllables, found in use amongst the tribes of the Pacific coast, the same as spoken by a tribe on the opposite coast, the coast of Siberia, as an evidence that the American tribe came from that coast, probably by the way of Behring's Strait.

What a monstrous way to prove a theory, and how bad the theory that grasps at such proofs! If such an isolated word was worth notice, why not rather suppose that probably some poor fisherman of Siberia had been driven in his canoe to the Columbian coast, and that the American Indians who picked him up adopted from him a dying word to recollect him by?

In my Pacific voyage, I went to Petropetrovski, to Sitha, the Aleutian Islands, and to Kamskatka, on the coast of Siberia. I found many words of Siberian languages spoken on the American side of the strait of Behring, and as many or more on the Siberian side, of the American languages. What did this prove? Nothing, except that there had been a mutual crossing of Behring's Strait in their canoes or on the ice, both of which, at certain seasons, are feasible, and that there had been, to a certain extent, a mutual adoption of words in their languages. It proved that those opposite people sometimes cross the strait; while the total absence of resemblance in physiological traits as positively disproved the fact of emigration, or peopling a continent, from one side or the other.

The library-made ethnologist enters the wildest tribe on the United States frontier, and, to his

astonishment, finds the Indians there using occasionally French and English words, and now and then meets a half-white Indian with a French face and a French beard. This is no evidence that these tribes are Frenchmen or Englishmen, but proves only that Frenchmen and Englishmen have been there a hundred years before him.

He finds these people using bows and arrows the same precisely as were anciently used by the Saxon race—the flint arrows and spear-heads exactly the same as those of the ancient Britons—and he is astoundéd. But why astonished? What do these prove? Not that the American Indians emigrated from the British Isles, or that the ancient Britons came across the Atlantic in their canoes from America; but it helps to prove the old adage, that "*Necessity is the mother of invention*,"—that the nations of all the earth, without the use of iron, having *necessity* for food, and the means of getting it, and implements for war and defence, have alike had the ingenuity to take the sharp edge of broken flints for knives and arrow-points, and, by the aid of their inventive powers, granted them alike by the Great Spirit, they have everywhere improved them much in the same way—not from each other, but led to the same results and same forms by the peculiar fracture of the stone, in all countries the same, and by the similar necessities for which their knives and arrow-points were formed.

The flint arrow-head, therefore, and the bow to throw it, have not necessarily been the gift of one

nation to another, but the native invention of every people. They certainly came not from Adam: Adam was a gardener, and his sons farmers and tenders of flocks. These things, then, were purely of human invention, and grew out of human necessities; and if one race invented them, another race, from the same necessity, could as well do it.

Savants who have grown up ethnologists in their fathers' libraries of books, also tell us that some portion of the splendid ruins at Uxmal and Copan, as well as ancient sculptures found in Mexico, and the relics found on the Ohio and Mushingum, are of Egyptian origin, because they resemble Egyptian monuments.

How weak is such evidence, that merely because these ruins and these sculptures happen to resemble some edifices or some sculptures of the Egyptians, therefore they are of Egyptian origin! They admit that they were built by savage tribes, for they bear no Egyptian inscriptions or hieroglyphics, but the inscriptions and hieroglyphs of uncivilised races, who must have brought their art of building and sculpture from Egypt!

How astonishing that such stupendous ruins *are there*, and were built there, and left there, without a living being to tell their history, or who built them, yet covered with inscriptions and hieroglyphs, no doubt telling their own history if they could be read. There exists, however, no similar language in the Old World or the New, to prove that their origin was Asiatic or Egyptian.

Egyptian sculpture and Egyptian architecture were not taught the Egyptians: they were the inventions, and, in their grandeur and magnificence, were but the progress, of native art. Such, too, were the ruined temples and palaces of Palenque and Uxmal.

Talent for art and design are inherent in all mankind; and as wealth and luxury and civilisation increase in all countries, so will sculpture and architecture advance in grandeur and in beauty of design; and these advancements, like those in Indian weapons, suggested by the demands of elegance and comfort in buildings, or of beauty and nature in sculpture, with nature everywhere supplying the same models, will necessarily, in all countries, arrive, sooner or later, at more or less resemblance.

A sculptured statue found amongst the antiquities of Mexico or Yucatan, if it resembles ever so closely an Egyptian statue, bears no evidence whatever that it was transported from Egypt to America, or that the sculptor of it came from that country, bringing his tools and his models with him: it only proves that in both countries men have alike an inherent talent for art, and that, working from similar models, and in the same material, they have arrived at equal perfection. Both copying closely the same model, their works, consequently and necessarily, resemble each other.

An ethnologist finds amongst the American Indians a wooden spoon precisely the same in proportions and shape as the wooden spoons brought from the Kalmuk Tartars in Asia. This, though

only evidence for a bad theory, proves just as much as resemblance in statuary, or of façades, doorways, &c., in ancient palaces: it proves that man's ingenuity and necessities, in both countries, led him to build façades and doorways, and to adapt the length and shape of his spoon to suit the motions of his arm and the size of his mouth.

The ancient Egyptians, before the construction of their stupendous monuments and their grand groups in sculpture, which now stand to astonish the world, lived in tents like the Aztec Indians previous to their building the cities of Palenque, Copan, and Uxmal; and the two native races, developing the talent with which nature had endowed them for those grand purposes, probably constructed those vast edifices on the two continents about the same time.

In the two countries the wonder is, not that there should be a resemblance in their monuments, but that the people who built them, and rose by their own talents to such grandeur in art, and such luxury, should have been devoid of all history which might have recorded their greatness.

To the theory, so often and so strongly advanced, of an Egyptian or Asiatic origin of the American Indians, there are yet other and stronger objections which might be urged. The theory of such a mode of peopling a whole continent involves, as will be seen, difficulties and objections (considering the time at which such supposed immigrations took place) in effect equal to impossibility itself. I say *impossibility*, because the Aztec ruins in Yucatan and

Guatemala, which speak in a language that no one can gainsay, are as old as the most ancient monuments of Egypt, and are unquestionably the results of a growth of civilisation from savage native tribes, which must have required some thousands of years.

The evidence that those monuments were not the works of Egyptian architects is, that though in some respects they bear a resemblance, not an Egyptian inscription or hieroglyphic mark is to be found amongst them; and also, that if the Egyptians, in so advanced a state of civilisation and art, emigrated to the continent of America, and built such stupendous palaces and other edifices, it is quite impossible, though the people have perished, that history should have been, until the date of Columbus, in ignorance of the American continent.

From the above dates, and evidences of dates, we are bound to infer that the American native races are as ancient as any of the races of the "Old World" whose antiquity is known by their monuments.

Then let us see, if the builders of those monuments were Egyptians or Asiatics, what object they had in coming to America—how they found the way there—and how they got there, at least 6000 years ago, if at all, seeing that civilisation, with the art of navigation, unstimulated by commerce, by science, and by the thirst for gold, had never reached there until within the last 400 years.

There is nothing in history, sacred or profane, to prove a peopling of the one continent from the other;

and probably for ever, as at the present time, *presumption* will be the only ground on which such a theory will stand; and if the fact could be proved to have transpired, there is nothing yet to show that it might not as well have been from West to East as from East to West.*

The most enthusiastic theorists on this subject have never yet entertained the idea of a savage emigration across the Atlantic or Pacific oceans, but look to Behring's Strait, where, by possibility, at certain seaons of the year, they *can* cross from continent to continent on the ice or in canoes. But what motive existed for doing that, in the state in which savage society was in the frozen regions of Kamskatka 6000 years ago, when, at the present time, with all their modern improvements in boat-building, in weapons, and with some idea of commerce to stimulate them, no Indians on either coast venture across, except under the

* If we were obliged to admit the fact that all the human race have descended from one pair of ancestors, and consequently that one continent must have been peopled from the other, then I would say that Adam and Eve were Americans, and that portions of their enlightening posterity, crushed in the war of the elements, were swept off, as has been suggested, by the Gulf Stream, and landed on the continent of Europe; the only possible way in which a savage people could, at that period, have crossed the ocean.

At the usual rate of the Gulf Stream, of four miles per hour, a canoe or raft would drift from the Cape of Florida to the Cape of Greenland in eighteen days, and in twelve days more to the Scandinavian coast, or coast of Ireland; and at the rate at which that stream probably swept off from the Gulf of Mexico, in the commotion and flood of the cataclysm of the Antilles, it is probable that the voyage would have been accomplished in half or a quarter of the time.

advice and escort of civilised men who accompany them.

Savages, of all the human family, are the least disposed to emigrate; like animals, their instinct is against it. Driven from their homes, like animals, they will return to them; and, without the stimulants of science, of commerce, or of gold, like animals they are content to remain in them.

If the barren and frozen coast of Siberia had been overstocked with a surplus population, and *the American coast opposite a luxuriant garden* instead of a coast equally barren and desolate, such an emigration might have been a possible thing for Asiatics, and in the space of 6000 years they might possibly have increased and spread over North America, and perhaps through Central and South America to Terra del Fuego. But if so, where are they?

In the whole extent of the American continent, from Behring's Strait to Terra del Fuego, there is not to be seen amongst the savage tribes a Mongol, a Kalmuk, or Siberian Tartar, nor a word of their language to be heard. Languages, to be sure, may be lost or changed, but physiological traits of people are never lost while the race exists.

Some travellers through South America, as if to aid the theory of Asiatic emigration, have represented the tribes of the Upper Amazon and its affluents with bridled eyes, like the Chinese, and even caricatured the Chinese obliquity in their portraits of them, and put these more than Chinese peculiarities forward as "types." But I have seen most of the tribes on the

Amazon and its tributaries, and though the natives in those regions are generally a low degree of American aborigines, they exhibit nothing of the Mongol general character of face, nor Mongol obliquity of eye, other than the occasional muscular approach to it produced by their peculiar habits of life, living mostly (in their fishermen's lives) in their canoes, their eyes affected by the refraction of the vertical rays of the sun on the water, on which they are looking, and on land walking with naked feet, requiring their eyes to be constantly on the ground before them.

The effect thus produced in the expression of their eyes is very striking, but is neither Mongolic nor a "type," but *aberration* from type, produced by the external causes above named.

I have said, that if an Asiatic population had crossed at Behring's Strait, they might in time have advanced through North and South and Central America, and have stocked the whole continent; and this has been claimed by the advocates of Asiatic immigration. This is a *possibility*, and therefore, they contend, is *probable;* but here possibility stops, and certainly proof with it.

The Sandwich Islands, with a population of 500,000, are more than 2000 miles from the coast of South America. How did the population of those islands get there? Certainly not in canoes, over ocean waves of 2000 miles. But, I am told, "the Sandwich Islanders are Polynesians." Not a bit of it—they are 2000 miles north of the

Polynesian group, with the same impossibility of canoe navigation, and are as different in physiological traits, and in character and language, from the Polynesians as they are different from the American races.

However voluminous and learned the discussions may be on the mysterious subject of the origin of races, they must all come to the conclusion at last that, even if Asiatic, or Egyptian, or Polynesian populations found their way to the American continent, at whatever date, they found and intermingled with an aboriginal American race as ancient as, or more ancient than, the races they descended from.

It is easily learned from the above remarks, that, from information which I have gathered during fourteen years, not from books, but from familiar intercourse with the nations of every latitude in the two Americas, I am strongly impressed with the belief that the tribes of the American continent are all integral parts of one great family, and that He who made man from the dust of the earth created those people from the dust of the country in which they live, and to which dust they are fast returning. I can find nothing in history, sacred or profane, against this ; and from their colour and physiological traits, which are different from all other races on the earth, as well as from reasons advanced above, I am compelled to believe that " He who created the cattle of the fields, the fishes of the sea, and fowls of the air " of this vast and glowing continent " for man's use," (not that they should grow and decay for thousands

of centuries, until man should accidentally reach them to enjoy them), placed these "red children" there, and said to them in some way, "I am your Father—your Maker; I give you these things; go forth and enjoy them:" and that, in the undisputed enjoyment of this rich inheritance given them, of unlimited fields and forests abounding in game, and unbounded liberty for using it, they were, in Mexico, in Yucatan, and Peru, duly and successfully using those faculties which God had given them, intended for raising them gradually into civilisation and splendour, when cataclysms sunk the edifices and the people in the one, and more than barbarous or savage cruelties of mercenary men crushed their rising power, robbed them of their gold, and carried the sword and death amongst the others, and sent a drowning wave of discouragement through the remotest tribes of the continent.

The American Indians are as distinct from all the other races of the earth as the other races of the earth are distinct from each other, and, both in North and South and Central America, exhibit but one great original family type, with only the local changes which differences of climate and modes of life have wrought upon it.

I believe they were created on the ground where they have been found, and that the date of their creation is the same as that of the human species on the other parts of the globe. This belief is founded on the reasons advanced in the foregoing chapter, supported by the traditions of the Indians which will be noticed,

and a strong and unavoidable intuitive *disbelief* that all the races of man, of different colours, have descended from one pair of ancestors; involving, from necessity, the crime of *incest*, after the holy institution of marriage, as the means of peopling the earth; and the inconceivable plan of the whole surface of the earth, teeming with luxuries "created for man's use," vegetating and decaying for tens and hundreds of thousands of years, until wandering man, from one point and from one pair, by accident arrives there to use them.

Some writers have advanced the belief that South America and the continent of Europe were anciently united, and that the American continent received its population by that means; but as this is mere hypothesis, and probably will ever remain so, it refers us, for a last remaining remark, to Behring's Strait, by which route, if the American Indians are the descendants of "Adam and Eve," at the rate that an infant savage population would spread over an uninhabited and desolate country, several thousand years would have been required to populate and move through the vast regions of Kalmuk Tartary and Siberia to Behring's Strait, a distance of more than 10,000 miles; and from Behring's Strait to Central and South America and Terra del Fuego, 10,000 miles more; and an equal time required—1000 years at least—for a civilisation to rise sufficient to have built the splendid monuments of Yucatan, and the vast space of time that has transpired since these monuments were depopulated; in all, a space of

time far transcending that allowed by sacred history, or even by geology, for man's appearance on the earth!

The American Indians know nothing of this, yet their traditions and monuments prove beyond a doubt their great antiquity; for of one hundred and twenty different tribes which I have visited in North and South and Central America, every tribe has related to me, more or less distinctly, their traditions of the *deluge*, —in which "one," or "three," or "eight," persons were saved above the waters, on the top of a high mountain—and also their respective and peculiar theories of the *creation*.

Some of these tribes, living at the base of the Rocky Mountains, and in the plains of Venezuela and the Pampa del Sacramento, in South America, make annual pilgrimages to the fancied summits where the antediluvian species were saved, in canoes or otherwise, and, under the mysterious regulations of their medicine (mystery) men, tender their prayers and sacrifices to the Great Spirit, to ensure their exemption from a similar catastrophe.

Though Indian traditions are generally conflicting, and merging into fables, how strong is the unanimous tradition of the aboriginal races of a whole continent of such an event! how strong a corroboration of the Mosaic account! and what an unanswerable proof that the *American Indian* is an antediluvian race! and how just a claim does it lay, with the various modes and forms which these poor people practise in celebrating that event, to the inquiries and sympathies

of the philanthropic and Christian, as well as to the scientific world!

Some of the writers who have endeavoured to trace the American Indians to an Asiatic or Egyptian origin, have advanced these traditions as evidence in support of their theories, which are as yet but unconfirmed hypotheses; and as there is not yet known to exist, either in the American languages, or in the Mexican or Aztec or other monuments of these people, one single acceptable proof of such an immigration, these traditions are strictly American indigenous, and not exotic.

If it were shown that inspired history of the *deluge*, and of the *creation*, restricted those events to one continent alone, then it might be that the American races came from the Eastern continent, bringing these traditions with them; but until that is proved, the American traditions of the deluge are no evidence whatever of an Eastern origin.

Though there is not a tribe in America but what has some theory of man's creation, there is not one amongst them all that bears the slightest resemblance to the Mosaic account. How strange is this, if these people came from the country where inspiration was prior to all history!

The Mandans believed they were created under the ground, and that a portion of their people reside there yet.*

* See an account of their astonishing mode of celebrating annually the subsiding of the deluge, accompanied with their various modes of voluntary torture, recently published by Trübner, 60 Paternoster Row,

The Choctaws assert that "they were created crawfish, living alternately under the ground and above it as they chose; and coming out at their little holes to get the warmth of the sun one sunny day, a portion of the tribe was driven away, and could not return: these built the Choctaw village, and the remainder of the tribe are still under the ground."

The Sioux relate with great minuteness their traditions of the creation. They say that the Indians were all made from the "*red pipe-stone*," which is exactly of their colour; that the Great Spirit, at a subsequent period, called all the tribes together at the pipe-stone quarry, and told them this, that "the red stone was their flesh, and that they must use it for their pipes only."

Other tribes were created under the water; and at least one-half of the tribes in America represent that man was first created under the ground, or in the rocky caverns of the mountains.

Why this diversity of theories of the *creation*, if these people brought their traditions of the deluge from the land of *inspiration?*

How far these general traditions of a flood relate to an *universal deluge*, or to local cataclysms (of which there have evidently been one or more over portions of the American continent), or whether there *has been* an *universal* post-diluvial *deluge*, and at what period, it is difficult to determine.

London—"*O-kee-pa*, a Religious Ceremony of the Mandans, with thirteen coloured illustrations, by George Catlin."

One thing, however, is certain—the Indian traditions everywhere point distinctly to at least *one* such event; and amongst the central and southern tribes, *two* such catastrophes are distinctly spoken of, in which their race was chiefly destroyed; and the rocks of their countries bear evidence yet more conclusive of the same calamities, which probably swept off the populations in the plains, and, as their traditions say, left scattered remnants on the summits of the Andes and Rocky Mountains.

Since that epoch, or those epochs, their descendants have wandered off into the fertile plains, whither climate and greater abundance of game and fish have enticed them, peopling in time the whole continent from the Atlantic to the Pacific coasts, and the West Indies and other islands.

These scattered people have arranged themselves into different tribes, with languages dialectic or idiomatic, but, without exception, bearing evident physiological traits of the ancient parent stock, with local and tribal differences produced by different habits of life, and varieties of climate, and differences of food on which they subsist.

The Maya tribe, found occupying the ruins of Yucatan, are traceable to the west, and by some are supposed to be the remains of the people who built the cities of Uxmal and Copan. This opinion was first advanced by Landa, who was weak enough to offer his belief that the stupendous edifices of those ruined cities were built and occupied by the Maya Indians, as many of the sculptured figures on their

stones were represented in breech-cloths and leggings. But there were more conclusive proofs than these at his service if he had known how to use them—the Maya language, engraved on their monuments; and this, though a truth, yet doubtful as proof that the Maya Indians or their ancestors, however remote, had anything to do with the building of those grand and noble structures.

The "Maya Indians came from the west," and yet their ancestors might have been a part of the posterity of the builders of the Aztec cities, retrograded to a state of barbarism; and arriving in those ruins, which furnished them comfortable shelter, and with a partial preservation of the language, they were able to read many of the inscriptions and hieroglyphs on the walls and tablets, and were able to add others; and a succession of Mexican princes, for centuries previous to the reign of Montezuma, occupied the same ruins and did the same thing,—lintelled and roofed the palaces, painted the frescoes and tablets, and added Mexican inscriptions, until the ablest archæologists are unable to expound them.

By some writers, who have questioned the great antiquity of these ruins, the lintels of timber and fresco paintings found on the walls and tablets have been used as proofs that these edifices must have been built subsequent to the cataclysm; but such proofs fall to the ground when it is known how they originated.

The walls of those noble edifices, which stood through the convulsions which destroyed their occu-

pants, uphold the mangled history of a race more ancient than the pyramids of Egypt; *and their sepulchral vaults, yet unexplored and untouched by vandal hands, will soon more fully uphold and interpret their mysteries*, which for 6000 years have remained a sealed book.

Civilisation extinguished and races dispersed by convulsions of the elements of nature in the manner above described, let us see, for a moment, where the flame kindled up again from its ashes, and what the elements of Christian civilisation have done to strangle and arrest it—to distribute, disperse, and extinguish the descendants of races whom God enlightened, and the convulsions of fire and water annihilated.

The Caribs, probably one of the most ancient races on the globe, who survived the convulsions of the Antille-Andes only in the mountain tops, and whose numerous posterity spread through most of the islands, were doomed, in the age of Christian civilisation, to catastrophes less sudden and less appalling, but more destructive, than the war of elements of which their forefathers were spectators.

A man, by his noble ambition to discover, and by his discoveries, made himself great; by his thirst for gold, made himself a monster.

The *drama* of American Indian history commences here. Christopher Columbus, probably the first European who ever saw an American Indian, in October 1492, landing on the island of San Salvador, one of the Bahamas, "discovered savages running to the shore, naked, and gazing at the ships."

In Hayti, where he met greater numbers, he was received in the most friendly manner by the natives; and in a letter to Louis de St Angel, he says—"True it is, that after the natives felt confidence and lost their fears of us, they were so liberal with what they possessed, that it would not be believed by those who had not seen it. If anything was asked of them, they never said No, but gave it cheerfully, and showed as much anxiety as if they gave their very heart; and if the things given were of great or little value, they were contented with whatever was given in return."

"Columbus was afterwards wrecked on the island of Hispaniola. The cacique (chief), *Gua-can-e-gan*, living within a league and a half of the wreck, shed tears of sympathy, and sent all his people in canoes to his aid; and the cacique tendered all the aid he could, in person, both on sea and on land, consoling Columbus by saying that all he possessed should be at his disposal. All the effects of the wrecked ship were deposited near the cacique's dwelling, and not the slightest article, though exposed to the whole population, was pilfered."

And Columbus, in his letter to the King and Queen of Spain, says—"So tractable and peaceable are these people, that I swear to your majesties there is not in the world a better nation; they love their neighbours as they love themselves, and their discourse is even sweet and gentle, and accompanied with a smile: and though it is true that they are naked, yet their manners are decorous and praiseworthy."

Amongst these people Columbus was loaded with presents the most costly that they possessed ; and, as he says himself, "this generous chief and several others placed coronets of pure gold on his head." And what was the sequel ? what the justice of Christian civilisation ? This generous cacique, and the "several other chiefs," and their people, who had not even bows and arrows to defend themselves with (so peaceable were they), were driven from their dwellings into the mountains, and their villages were burnt to the ground.

The Caribs, more warlike, were armed with bows and arrows, and made a more formidable resistance. But they were at length defeated by one of the most disgraceful stratagems ever recorded in the history of civilised or savage warfare.

Silver, for the first time, was introduced amongst these people by the ships of Columbus, and represented to be of far greater value than gold, of which the Indians possessed great quantities, and a rapid exchange was commenced, at the rate of ten ounces of gold for one of silver ; and to turn this even to a better account, a massive pair of steel manacles, highly polished for the purpose to resemble silver, and, of course, of immense value, were represented to *Ca-on-ne-bo*, the chief of the Caribs, at the head of his army, and otherwise unapproachable, as a magnificent pair of bracelets of silver, sent to him by the King of Spain.

Dazzled by so brilliant a present from the king, he submitted to mount a powerful steed and have

them put on. They were locked to his wrists, and, by a mailed troop of horse in readiness, he was galloped through the Indian line to the coast, where he was put in additional irons, and sent a prisoner to Spain. And in the space of five years of deadly and the most cruel warfare, waged with guns and coats of mail and sabres against these harmless and inoffensive people, by the man whose honours were to be immortal, over 200,000 of these poor people were slain on their own ground, and more than 5000 were made prisoners and shipped to Spain and sold as slaves, where they slew themselves, or perished prematurely from diseases of the country.

Here was begun, but not finished, the second cataclysm of the Antilles, the flood, the deluge, of Christian civilisation, which continued to pour in ; and in a few years the populations of those islands, exceeding 2,000,000, were engulfed in its waves, and the gold of the country transported for gilding crowns and altars and golden candlesticks.

As has been said, the straggling and struggling remnants of the ancient civilisation having spread in dismay, and wandered, and sometimes tarried, in the mountains and valleys of Mexico and in the Rocky Mountains, at length from the embers kindled into a flame, concentrated in the city of Mexico.

The war in the Antilles had been waged for gold, but the shining god was believed to be farther west, and another fleet and another army were on its track, and another monster at their head. *Hernando Cortez* was this man, this civilised demon, with a fleet and

with an army of mounted and mailed soldiers under his command, and the gold and jewels and blood of Mexico as his idols.

History has well recorded the more than savage cruelties and massacres and robberies of this civilised expedition, in which the second growth of spontaneous civilisation was crushed and smothered and strangled into a degraded and sickening amalgamation of the conquered and subjugated with their selfish and fiendish victors.

A rich and beautiful Indian city was sacked and robbed of its gold; 100,000 of its inhabitants were slain; its king, Montezuma, was deceived, dethroned, and murdered; its palaces destroyed, its religion trodden under foot, and its sacred temples thrown down; and yet the thirst for gold and for massacre was not satisfied. There was another sun of Indian civilisation above the horizon, and another mine of gold—it was Peru.

Pizarro, from the same civilised school, was the merciless wretch for this. Like Cortez in Mexico, with a fleet and an army of mailed soldiers, with fire-arms and sabres in hand, he cut and slaughtered his way through the defenceless ranks of the unoffending Peruvians, on their own ground; with the most disgraceful breach of proffered faith known to history. robbed the city of its gold, imprisoned and murdered its monarch, the Inca, and with the blades of his soldiers gave 150,000 peaceable and civilised Indians, as Cortez had done in Mexico, their first lesson in European civilisation.

The "El Dorado" was yet an *idea*, still unsolved. The plundered heaps of gold were yet too small, and the river of Indian blood must again be flooded. Civilisation required another glorification, and De Soto was the ready cavalier for that. A knight Castilian was he, blood-snuffing, and mad for gold; and soon after the scenes of blood related, his little fleet anchored and disembarked his cavalry legion on the coast of Florida. His men were in coats of mail, and his horses also, which were of the noblest Castilian breed; and his cannons were drawn by horses covered with polished steel and helmets plated with gold!

In helmet of gold himself, and sword in hand, he mounted his milk-white steed, and facing the west, where he dreamed of native cities, and of waggon-loads of gold to be drawn back by his splendid troop of Castilian chargers, he entered the swamps and glades of Florida.

He penetrated the impassable and interminable swamps and lagoons, and dragged his heavy cannons through them; and after wading the swamps, and through the blood of the poor savages, the cruelty and butchery of which have no parallel in history, he at last arrived on the banks of the Mississippi, in which his body found a grave, and his visioned cities and mines of gold were never reached.

After such examples of white man's injustice and cruelties, such illustrations of "glorious civilisation"—the news of which, of course, spread like the waves of a rising flood, over and through every tribe from ocean to ocean, both in South and North America,—is it

wonderful that the American Indians should be suspicious of the white man and his fair promises—his civilisation, his faith, and his proffered religion?

And *is it not wonderful*, under their traditions, taught to their children, of such civilised barbarities and treacherous massacres, that these poor people should everywhere, in first interviews, as history informs us, receive white men with open arms, with hospitality and welcome, in their wigwams?

Columbus has already told us, that the "Caciques of Hispaniola embraced him in their arms, shed tears for his misfortunes, and placed upon his head coronets of pure gold." This is not *wonderful*, for it was *natural*. Man has been made everywhere, not a brute, but human; ready and disposed to meet his fellow-man in friendship and kindness, where there has been no cause given for a different reception.

Subsequent to the shocking invasions and cruelties recited above, colonisation in North America commenced, and the beginning of this was the little colony of Puritans who sailed from England, and landed, with their wives and children, on the Rock of Plymouth. "They were hungry and in distress, and the Indians received them with open arms, and fed them with maize and other food which they brought them."

This was not *wonderful*, but *natural* and *noble*, because these discriminating people contemplated, in this little domestic group of husbands, wives, and children, the elements of fellowship and peace, instead of the signals of war and plunder.

The entrance of this colony opened the door for others, and the stream of immigration that has continued ever since, peopling the whole Atlantic coast, and constantly advancing towards the west, and displacing and moving the Indian populations by treaty stipulations or by force.

And we now come to what is *strictly wonderful*, and even *astonishing*—that, under all the invasions, the frauds, the deceptions, and tricks, as well as force, that have been practised upon them, to push them from their lands, and towards the "setting sun," these poor and abused people have exercised so little cruelty as they have; that rum, and whisky, and small-pox, of the white man's importation amongst them, have been submitted to, and border warfare, until they have been reduced, tribe after tribe, to mere remnants, and still are pushed again and again to the West; and that even there, and under these irritating circumstances, white men travel unprotected, their lives secure, and their property transported with safety.

That Lasalle and Father Hennepin, in 1678, with only thirty men, should have passed in their voyages of discovery through the whole of the great lakes, the Illinois, and Mississippi, during eight years of continual travelling and explorations amongst more than twenty tribes as yet ignorant of civilisation; and Father Hennepin, as he relates, with only two men ascending the Mississippi to the Fall of St Anthony (the first explorer there); and under all the exposure and trying vicissitudes of those eight years,

as they say, they were uniformly treated with hospitality and kindness by the Indians.

That Lewis and Clarke, with a small detachment of men, in 1805, should have ascended the whole length of the Missouri river, crossed the Rocky Mountains, and reached the Pacific Ocean, and returned, a distance of more than 8000 miles, in which they paid the first visits of white men to more than thirty of the wildest and most warlike tribes on the continent, without having to wield a weapon in self-defence! And, as I had it from General Clarke's own lips in his old age, "we visited more than 200,000 of those poor people, and they everywhere treated us with hospitality and kindness." And, that hundreds of other travellers, and amongst them *myself*, whose lives and whose property have been at their mercy, should have found them so merciful, and so friendly, and honourable, under the sense they have of white man's cruelties and wrongs, is *truly* a matter of *wonder.*

In the past pages we have seen these unhappy people in the midst of convulsions and the cruel onslaughts for gold—by cataclysms *sunk* down, and by sabres *struck* down, in the progress of their own civilisation; and we have contemplated them in "*floods*," from which, tradition tells us, a few only were saved on the tops of high mountains; but we have yet to view them in another deluge more fatal, and from the drowning waves of which it is to be feared the mountain tops will save no one of them—the *flood* of immigration!

After cataclysms, the Indians' misfortune in South America, in Mexico, and Hispaniola, was in their gold; and that done, there is a chance yet of their living. Their misfortune in North America was, that they owned the broadest and richest country on the globe, teeming with all the luxuries tempting to white man's cupidity—the temperature of its climate, the richness of its soil, its vast prairies speckled with buffaloes, and its rivers and mountains abounding in valuable furs, in latitudes most suitable for immigration, and that immigration led and pushed on by a popular Government, which could have but one motion, and that onward, to the Rocky Mountains and the Pacific Ocean.

Under such accumulated circumstances the Indians' final fate was sealed—their doom was fixed; and in that "flood," which has been for half-a-century spreading over their country, the last of them are now being engulfed; and as if *gold* must necessarily have its share in their destruction, its shining scales are being turned up in various parts of the Rocky Mountains, adding fury to the maddened throng who are now concentrating for its search in the very centre of the vast solitudes to which advancing civilisation has been driving the poor Indians, both from the east and the west, as their last possible hold on existence.

Unlike the gold-searchers in Mexico and Peru, who *struck* their *blows, got* their *gold* in masses, and were off, the gold-seekers in the Rocky Mountains will hold on; *their* mines will last, and the poor

Indians, between gold-diggers, and squatters, and whisky-sellers, who are all armed with rifles and revolvers, will lengthen their days as long as they can, but there will be few of them.

Such have been the vicissitudes, and thus ends the career, of a native and noble race—checked and thrown back in their first advances in civilisation by convulsions of the elements, and in their subsequent progress by the wickedness of Christian civilisation matured ahead of them; and the dispersed and discouraged remnants driven by the sword and bayonet from their lands and the graves of their parents and children, to famish and die under military supervision.

Such is their position in the last quarter of the nineteenth century, beaten in warfare by the Government of the United States, which now holds all their lands and their forfeited annuities. How strange and how lamentable!—a free and independent *native* people, who owned the whole continent, *disfranchised* and dispossessed, and placed under military surveillance, just at the time when the same Government has granted *freedom* and *all the rights and privileges of American citizenship* to 4,000,000 of *Africans!*

How strange will be the page which this will add to American history, accompanied with the following appendix: that the Government of the United States, for the last century, has assumed and claimed the guardianship over these poor people, calling them its "*red children*," and instructing them to call the President of the United States their "*great father*,"

which they have everywhere obediently done; and that the world now witnesses, in their approaching extinction, the *singular anomaly of a father inheriting a whole continent from his dying children!*

GEO. CATLIN.

1869.

APPENDIX.

A.

LATERAL PRESSURE IN ROCKS.

IN the foregoing pages, reference has been repeatedly made to plications, foldings, and contortions in the sedimentary rocks, as occurring on all parts of the globe, and often in conditions so difficult to account for, as to form one of the problems in geology the most difficult of solution. The shapes and relative positions of these singular phenomena are such as to lead all geologists to the conclusion that they have been produced by forces acting on or against them in lateral movements, independent of the forces which move rocks in vertical directions.

When geologists meet everywhere such vast masses of rocks bearing these singular marks, which must have been the results of prodigious force, it is natural that they should look for their cause; and in doing so, I believe (as I have already said) that they have sometimes lost sight of important principles, and done much to mystify the science which is "all truths," when those truths can be come at.

These plications and folds in the sedimenary series, which all geologists attribute to lateral pressure, and which most geologists decide could not be produced by the vertical lifting of rocks, some distinguished geologists and orographists contend could only be produced by a descending motion, and in that belief have been led into the singular theories quoted in the beginning of this work, of sinking down the earth's granite crust into the molten mass of the globe, as the means of raising mountains bearing the marks of lateral pressure on their sides.

As a reader of geological works, and a spectator of many stupendous orographic structures, I have been pained to see such unsustainable theories advanced in the science of orography; and by them I am led to present the remarks here to be made, in addition to those before advanced, on the modes and probable cause or causes of lateral pressure in rocks, and their visible effects.

"Lateral pressure," in the geological sense, is the gradual application of some force differing from explosive, and also, seemingly, from vertical forces; moving stratified rocks, apparently, at least, in lateral and horizontal directions, doubling them into plications and folds—often overlapping, and sometimes even overturning them.

The explosive and the gradual lifting and depressing forces are already understood; but there seems yet to hang a mystery over that invisible force which has moved such vast masses of rocks in lateral, and often apparently horizontal, directions,

and this is the enigma which is here endeavoured to be solved.

"Lateral pressure" is a term only applied to the sedimentary rocks, and certainly to them only after they have been disturbed, lifted or depressed from their native beds, by one or the other of the forces above named; and in either of these new conditions, in the various transitions through which they pass, it is easy to suppose they might, in portions, be subject to those pressures, and get the plications and folds found in them.

But though many geologists have looked to the sinking down of their strata with the granite crust as the only means of subjecting them to lateral pressure, I deny that pressure such an origin: not that the sinking down of the strata would not produce it, but on the ground which I defend—that from the beginning of the crystallisation forming downwards, and the sediments forming upwards, to the present day, no parts of the sedimentary beds on any section of the globe have sunk down until after they have been uplifted, or undermined by some degrading process; and if uplifted and sunk down, their descent has nowhere been lower than the bed from which they arose, unless that bed has been depressed by some one of the degrading modes that have been named.

The tens of thousands of years probably required for the settling down mass of the molten globe to have formed a definite surface at all—the hundreds of thousands of years through which that surface and its motionless consolidation and crystallisation have

been going on, and the busy waters of the ocean laying and cementing with infinite particles the solid and indurating pavement around it, present a system of masonry which my reason tells me no downward force on earth that ever existed, or was ever intended to exist, or could be made to exist, could break ; and the only erupting force to which it has ever yielded has been in its superior portions, and caused by the antagonistic principles contained within itself, and, as has been explained, by these forces acting in a vertical direction.

Lateral pressure in rocks, as has been stated in former pages, might have been produced on a grand scale by the march of the diluvial waves, and what was not produced in that way, is now before us, in rocks *rising*, or in *rocks sinking down after rising*.

There are existing evidences enough, and I have seen them, to prove what I have before stated, that "more mountains have disappeared than now stand on the face of the earth." And amongst the principal of the evidences of this surprising fact are the very features we have now in question, and which are seen on all parts of the globe, where mountains exist or not—the features which no time can obliterate, the ancient marks of lateral pressure, which, of mountains gone by, mountains pre-historic, stand the landmarks and the proofs, as implements of bronze and of stone bear testimony to the existence of prehistoric man.

We meet them at the mountain bases, and we meet them in the valleys and on the plains, where

mountains are not, but where, as their unlying testimony tells us, mountains have stood; and the remaining groups, and platoons of stupendous boulders upon and amongst them, which could only have descended from mountain tops, bear corroborating testimony to the same facts.

By the vast scale on which mountains have disappeared, and the system of submontagne degradation yet further to be considered, we shall see the greater height to which mountains originally arose, compared with their present altitudes; and we shall then be able more easily to appreciate the lateral pressure which has wrinkled and folded, not only the inclines resting on the mountain sides, but which, as has been said, we meet in valleys and plains, and often apparently in undisturbed and bedded rocks.

The system of submontagne degradations to which I have alluded, itself bears strong testimony to the fact of mountain subsidences and of original mountain elevations.

By the system of upheavals of mountain chains that has been described, the first fractured and the first uplifted of rocks are the highest and the largest, and, forming the superior portion of all upheavals, have there stood free from the hundreds and perhaps thousands of subsequent explosions which have fractured the lower portions of the uplifted mass into smaller fragments, occupying less space; and the enormous mass above, forming the mountain axis, at each explosion at its base, if not actually raised, settles down.

In the lapse of tens or hundreds of thousands of years that volcanic explosions were at work underneath the disturbed mountainous districts of the globe by these shattering and diminishing and pulverising effects upon the lower rocks, amongst which alone they take place, the bases of mountains are wasted away, and thousands of them disappear.

By the illustration given in former pages, the sugar-loaf broken into angular blocks fills two moulds, but, pulverised, it packs again into the mould from which it was taken.

One volcanic explosion amongst the deep-bedded rocks may make more sand than the flowing of a river for a hundred years. These sands are further dissected by the action of water, and carried to the ocean, and by this process at the bases, with the degrading influences for ever at work upon their sides and summits, more mountains have probably sunk into their beds and disappeared than are now standing on the earth.

It has no doubt been by the never-ending volcanic explosions underneath the Northern Andes, the pulverising of the rocks, and the unceasing removal of their *débris* into the ocean by the currents of the submontagne rivers, that those lofty mountains were undermined and sunk into the ocean, in the cataclysm of the Antilles.

Arrived at a just and rational estimate of the actual elevation and grandeur that mountains have originally had, and the wasting means that have levelled them down, we are prepared to solve the

mystery of "lateral pressure," of plications and foldings that have taken place upon their sides and at their bases, and also those that we meet in the levelled rocks, which are the lowered inclines of mountains whose axes have gone to the realms from which they arose.

We approach a mountain's base, and we clamber up its sides; they are not steep: we are standing on its incline, and near its base. The rocks we are standing on are corrugated, and in some places bent into folds; and by what mysterious power? Uplifting could not have done it, and certainly their present inclination, as their surface is nearly level, could not have caused the crushed effects that are visible.

But let us apply the measures that have been given. This mountain, when first raised up, had probably an elevation three or four times greater than it now has; its inclines, rising to so great a height, were more vertical, and standing on their edges, were subjected to a greater condensation of pressure—not lateral, but vertical—from their own enormous weight; and through a thousand years of trembling and shaking from volcanic explosions below, got the wrinkles and contortions that are around us.

Before the mountain's axis settled down, this lowered incline on which we stand, but a little above the level, was a thousand feet above us. Simple vertical pressure, the force of gravitation, has given it these features which, when lowered down, become a mystery.

We are in the midst of a mountain chain, and in their whole vicinity, between the mountains, all is

confusion of rocks horizontal, rocks vertical, rocks lateral, faults and fissures, and crevices, and ravines, and in them all we meet plications, foldings, and endless contortions, which show us that they have all in their turns rested on mountain sides, there got their kinks and folds, and when the mountain axes on which they rested retired to their beds, they were lowered to the prostrate levels where, in endless and unregistered confusion, they now lie, and will lie to the end of time, as ruins, readable by geologists, and evidences of pre-historic mountains.

From the mountain basis we descend for long distances the gradual inclines, curving and twisting down into deep ravines, and at long distances from the mountain's base, their denuded surfaces and faces of extensive faults explain to us the deformities they have got by the undermining process that has left them to drop and double down between the errant boulders that have propped them up at intervals.

All mountainous parts of the world show us, as well as mountains, the remains, the ruins, of mountains. Over and on these we may be standing when we little suspect it; but when we realise the important geological truth that there is, and can be, no lateral movement in stratified rocks except from a downward pressure by their own weight, and that after they have been lifted up, we have everywhere a key in the stratified beds beneath our feet, whatever their positions, to the grandeur of the scale on which mountains have stood, and wasted away, and sunk, on various parts of the globe, leaving their plicated,

folded and contorted shells, flattened down upon the surface, to testify to their ancient existence and their decay. And we yet come to the final feature in mountain elevations which, when correctly appreciated, will help to solve, not only the questions of plications and folds on mountain inclines and at mountain bases, but the more puzzling enigma of lateral pressure in valley rocks, and rocks of the plains.

Over most parts of the globe we meet mountains of various heights (and some of them of great altitudes), over the tops of which the sedimentary strata hang unbroken; and such have existed and wasted away in ancient times to a much greater extent than at the present day; and when their axes subside, from the undermining causes above named, their sedimentary roofs, with their vast weight, sink down and flatten upon the surface, throwing out lateral pressure in all directions, where their movement is resisted, and twisting and crushing into plications and folds in a thousand forms.

Slighter elevations, such as hillocks and mounds, raised by similar forces, and depressed by the same process, produce the same appearances (as seen in most parts of the world), though with less abrupt and rigid effects. A simple experiment will perfectly illustrate this universal process: The surface of your bed being levelled to a plain (at its centre), with your thumb and fingers lift the blanket some two feet high; you have then the perfect model of such a mountain before you, and the sedimentary covering

in your hand. Lower it gradually down, allowing the air to escape, and upon your bed you will have a panorama of waving folds—of plications, contortions, ravines, and even inversions, the results of *lateral* pressure, caused by *vertical* pressure, and no longer a *mystery*, but the simple and undeniable proofs (as we pass over them, even in valleys and on extensive plains) of a pre-historic mound or mountain.

B.

INDIAN OROGRAPHY AND GEOLOGY.

It is a fact, which will be rather curious than instructive for geologists, that the American savages everywhere entertain notions, vague (and sometimes exceedingly tenacious) as to the phenomena of mountains, the manner in which they have been produced, and the position they hold in Indian mythology.

The Indian doctors (sorcerers, or "medicine men," as they are called), in every tribe, hold treasured up as secrets in their own keeping, to awe into obedience the superstitious minds of their people, the most ingenious, and sometimes the most absurd and awful, theories of mountain formations, of mountain destructions, and of mountain influences on the air, on life itself, and even on the shades of death, and all that is after,—prognostics for everything, for fair weather and for foul, for accidents, for epidemics, for war and for peace, in the rising of fogs from their summits, and the breaking of clouds against their sides.

All tribes recognise the existence of fire and of running waters underneath them; and in some of the tribes of South America, these doctors translate the groans of the rumbling earthquakes into mandates

and fiats, for the thraldom of the superstitious minds of the people, on whose benevolence they live.

In the Mandan village, on the Upper Missouri, which I visited in 1832, one of the wise men of the above class, who was held in superstitious awe by the tribe for the profound lectures he was occasionally giving to his people, on geology and demonology, took a great fancy to me, and on all occasions when I was in a crowd, was sure to be by my side; and amongst other theories that were new to me he informed me that "The earth, which was hollow, and very deep down, rested on the backs of four large tortoises; that once in a hundred years, two of these tortoises, a male and a female, went on a long journey to the south, and on their way back, the place where they had travelled being filled with water, they took a new route, and a new mountain was raised on their backs as they returned. These tortoises, which are great medicine, no man can see, but the evidence that they exist is seen in the mountains which they have lifted up! They have lived there from the time that the earth was made, and will there remain until the fire and the water will pour forth again to cover the earth."

Here are gleamings, certainly, however vague and badly supported, of history and prophecy, and some pretensions, at all events, to orographic science.

The simple and faithful attachment which was begetting for me these precious and guarded tenets from this celebrated *savant*, undoubtedly grew out of the following singular facts:—This was about the

time (1832) that "lucifer-matches" were brought into public use; and having supplied myself with a number of boxes of them when starting from St Louis, I was no doubt the first person who introduced them on the Upper Missouri. My last box was at this time being used, and being carried in my pocket when I was in the Mandan village, this inquisitive old gentleman, seeing me light one of them, pryed into the surprising mystery; and taking him aside, I presented him with the half-box remaining, and explained their character and the mode of using them.

He was sagacious enough to hold the secret from his people, and daily entertained and astonished the crowds around him, and gained new celebrity in magic, by igniting them by drawing them between his teeth, "making fire (as he called it) in his mouth."

He gained fame and respect very fast for a few days; but his matches getting done, he appealed to me in great distress. I pitied the old man for the length of the fall he was about to be subjected to, and luckily thought of a pocket sun-glass that was amongst my luggage.

With this, we took a stroll together for a little distance on the prairie; and showing him how to light his pipe by the sun, I presented the glass to him, explaining to him, to his inexpressible surprise and satisfaction, that it was much greater medicine than the lucifer-matches, and had the advantage that it would never give out, but last him just the same through all the days of his life.

Who on earth but this simple creature and myself, next to him, could ever appreciate the value of that gift, and the thankfulness with which he received it, and the satisfaction with which he was daily showing to the astonished crowds by whom he was surrounded how he could "draw fire from the sun?"

After unfolding his orographical theory to me, as above stated, I found I was raising some inquietude in this native philosopher's mind, by inquiring if he knew where the two tortoises started from, and how far they went to the south? and I expressed myself contented with his reply, that "no man knew, and that it was not necessary to know; it was enough to know that they went to the south, and on returning lifted up a new mountain on their backs."

The never-failing little present I had made him rendered him constantly lavish of his mythological as well as orographical secrets; and from amongst them, too lengthy to be all repeated in this place, he told me that "the Mandans were first created in the hollow of the earth; and that by a vine in one of their corn-fields, which grew up through a hole in the crust of the earth, a few of the Mandans climbed up and came out upon the surface; that they were pleased with the light of the sun, and with the buffalo-meat, which they commenced drying to take below; that a very fat woman was at length trying to climb the vine, but was stopped by the chiefs; but that when she got a favourable opportunity, she ascended nearly to the top, when the vine broke under her great weight, and she fell and was killed for her

disobedience; and by her fall, and the withering of the vine, those on the surface were prevented from descending, and none others could get up. A few of those who had got up had carried corn (maize) in their pouches, which they began planting, and they then began building the Mandan village where it now stands; and the remainder of the Mandans are still living under the ground, as their calling and cries frequently evince."

Whilst I was visiting a large village of Sioux Indians, at the mouth of the Little Missouri, I got further enlightened on Indian orography and geology by one of the "wise men" of that tribe.

Amongst the various celebrities who were sitting to me for their portraits was a facetious and consequential old gentleman, whose name was *Toh-ky-e-to* (The Stone with Horns). I remarked to him, through the interpreter, that it was a new idea to me that a stone should have horns. He assured me, however, that it was a fact, and he was supported by the affirmations of his friends sitting around him; and it was soon arranged that he, with several of his companions and the interpreter, should make a journey with me the next day to the "great medicine," the "stone with horns," a place known to all the Sioux tribe, and especially so to the "medicine man," who had been the first discoverer of it, and taken his honourable cognomen from it.

A party of seven of us, on horseback—the old doctor taking the lead—had a hard day's ride; and

encamping there over the night, we returned the next day to the Sioux village; and I, wiser for the pains I had taken, as follows. "A stone with horns" constantly in my mind, and my anticipations, made me inquisitive; and on our way I asked the doctor whether the stone had one horn only, or two? His reply, which enlarged my amazement and increased my curiosity, was, that "it had a thousand horns!" Knowing but a few words of the Sioux language, and the interpreter having been stopped as we were starting, his services being wanted in the village, I was less inquisitive than I might have been, and rode on under the prodigious anticipation of seeing a "stone with a thousand horns!"

Near sundown, on a gently rolling prairie, and at a mile or so in the distance, the doctor very contentedly signalled a large boulder lying by itself, of some ten or fifteen feet in diameter, whilst nothing of its kind was in view around it. "That," said he, pointing to it, "is the stone with horns." "But where are the horns?" I asked, as I was galloping by the side of him. "They are very small," said he, "but we shall see them by and by."

No horns, to my great surprise, appeared to my view, even when we were at a halt at a line of demarcation drawn around it in the prairie at five or six rods' distance, and over which our horses were not allowed to tread. Dismounting, and leaving our horses in charge of one of the party, the doctor scattered a few bits of tobacco into the grass ahead of him, and then took the lead alongside of the wonderful "stone

with horns." "There," said the doctor, "you can see, but not touch, a thousand horns."

A calcareous boulder of secondary formation, of fifteen feet in diameter, and filled, not only with a "thousand," but with ten thousand petrified shells was before us. No human being could tell where it came from; and substituting "shells" for "horns," helped greatly to solve the mystery.

On our return to the village, which was by the side of a fur-trading factory, I invited the old doctor and his friends, *savants* who had accompanied us to the "stone with a thousand horns," with the factor's permission, to sup with me inside of the fort. The conversation for a while ran upon geological and astronomical facts, during which the doctor had no hesitation in advancing his opinions which he had taught to his tribe, that the shell-fish never "ate their way into the solid rock," as some had supposed, but that they had lain in the mud, where they lived, and when the mountain was lifted up by fire, this part of the rock got baked by the heat, and these shells —"horns"—were caught up in it.

He had seen the Rocky Mountains, and had heard that there were a great many other large mountains on the earth; that they had all been raised up by heat, as there was a great fire under the earth; the evidence of which was, that there are many places in the mountains where it is constantly coming through and burning out, and that the sun, which is very hot in the middle of the day, gets quite cool towards night as it is going down, and gets heated again

during the night while it is passing under the earth, to come up again replenished in the morning.

I expressed some doubts as to the correctness of his theory, and on a canvas, with a crayon, marked out a figure of the globe; and in endeavouring to explain to him that the earth was round and revolved on its axis every twenty-four hours, he interrupted me by taking the crayon and drawing the figure of an Indian and a buffalo standing on the globe; and turning it round so as to bring the two figures on the under side with their heads downwards, "There!" said he triumphantly, "you see, my friends, what all this great 'medicine' amounts to."

There was no use in my attempting to explain any further, and the conversation changed to simpler subjects.

C.

The reader of the foregoing pages will have learned from their perusal that I have spent the greater part of a long and toilsome life in the endeavour to perpetuate the looks and customs of a numerous and dying race; and by the perusal of the following *memorial*, which is now before the Congress of my country, he will learn the wicked use that a man, under Government protection and Government support, has made of the Government "*authority*" in which he was clothed, to throw discredit on my statements, and, by thus destroying the value of my works, to open and clear the way for a great work on the

North American Indians which he was appointed to write and publish for the Congress of the United States.

The custom which he has seen fit to deny in his great work—the most extraordinary and interesting custom found amongst the North American Indians (the Mandan religious ceremonies)—was witnessed by me in the summer of 1832.

A description of those scenes of torture, as witnessed by myself and three other men, was written in the Mandan village, and published at the time in the New York journals; and my four original oil paintings of the four days' ceremonies were made in the Mandan village, and submitted to the chiefs and the whole tribe for their approval.

As has been stated in my original description of those scenes, I, with my three companions, were undoubtedly the first white men ever admitted to the interior of the medicine-lodge when those ceremonies took place; and though in my descriptions, given to the New York press, I advised missionaries to go to the Mandans, and use their influence against so cruel and disgusting a custom, they were prevented at St Louis by the Fur Company, who at that time controlled the whole of the Missouri river, from reaching the Mandan village; and in the second year after I witnessed those annual ceremonies, the tribe was wholly destroyed by the small-pox, introduced by the fur-traders' steamboat.

Mr Schoolcraft, who never had the courage or the industry to go and see those people, could say nothing of them in his great work unless from the accounts

I had published, and which he was unwilling to repeat; or from the statements of the whisky-sellers, who of course regarded my works amongst the Indians with great dislike and fear.

Mr Schoolcraft, supposing, as the Mandans were dead, that this custom rested *on my testimony alone*, and, in conspiracy with a whisky-seller, as will be seen in my memorial, has ventured to tell the world, "*under Government authority*," that my descriptions of these ceremonies and of the Mandan religion are false.

In consequence of this wicked attempt to impeach my veracity, Mr Trübner, of 60 Paternoster Row, in London, has recently published for me, in one octavo volume, with thirteen coloured plates from my original paintings, the "*O-kee-pa*" (the religious ceremony of the Mandans), with the certificates of the three companions I had with me, and also a letter from the Prince Maximilian of Neuweid, with whom I travelled on the Upper Missouri, and who spent the winter with the Mandans subsequent to the summer in which I witnessed the *O-kee-pa*.

This work, the "*O-kee-pa*," will stand as the only history of those remarkable scenes, which were extinguished with the people; and the perfectly-attested letter of the Prince Maximilian, embodied in the following memorial, establishes beyond the doubt of any one, the truth of my descriptions and the wickedness of the *infamous* attempt of Mr Schoolcraft to impeach them.

That rum and whisky sellers, whose nefarious

system I have seen, and in my writings have condemned, should endeavour, as they constantly have done, to impeach my veracity, is not strange, and is easily accounted for; but that such a man as Henry R. Schoolcraft, for whom his political friends in Congress *created* an office, "Indian Historiographer to the Congress of the United States," under the cloak, and with the influence, of that "authority," should resort to so mean and so disgraceful a mode to deprive ethnology of the most extraordinary custom of the North American Indians, and to destroy the value of the works which have cost me a lifetime of labour and all my earthly means to gather, will be a matter of surprise and of condemnation for those who read with care and consideration the following "*memorial*," and the "*O-kee-pa*," with its accompanying attestations.

MEMORIAL *of* GEORGE CATLIN *to the Honourable the President of the Senate, and the Speaker and Members of the House of Representatives of the United States, now assembled in the City of Washington.*

The *Memorial* of myself, George Catlin, artist, citizen of the United States, and now in Belgium, *respectfully represents:*

That in the year 1832 I conceived the plan of visiting the various tribes of North American Indians, and of making a *pictorial history* of them and their modes, for the information of ages to come, after those races shall have become extinct.

That I started, without Government or individual aid, and at my own expense; and that during eight

years of travels I visited more than fifty tribes, and made a collection of 640 oil paintings, including portraits, views of their villages, and various customs, and an extensive museum of all their manufactures which could be found.

That I exhibited that collection in New York and Washington, and also in London and Paris.

That while in London I offered the said collection to the Government of the United States for the sum of 65,000 dollars.

That a committee to whom it was referred reported in favour of the purchase by the Congress, and that the price which I demanded was *moderate.*

That whilst a bill was resting before the Congress for the appropriation, I had two offers for the collection from noblemen in England, both of which I declined, on the ground that I preferred disposing of the collection in my own country.

That in the meantime H. R. Schoolcraft made a visit to London, and, as he represented to me, to effect an arrangement with me for the privilege of using my paintings to illustrate a large work which he contemplated editing for the Government of the United States. General Cass, he said, had promised him an appointment as *Indian Historiographer to the Congress;* and that if he could effect the arrangement for the use of my paintings it would help to insure his success; and he brought to me a letter from General Cass (then a member of the Senate) intimating the same thing, and advising me to agree to the arrangement.

That Mr Schoolcraft stated to me that I had all the material for illustrating his great work, and that he should have an unlimited authority and means from the Government to publish so large and so complete a work on the North American Indians, that no Indian book need be published afterwards;

and that if I agreed to his proposition, he could make it a fortune for me, &c.; and that, as a bill was pending in the Congress for the purchase of my collection, he could, with the influence he would then have, easily secure its passage.

That I replied to Mr Schoolcraft that I had already incurred great labour and considerable expense towards a publication of my own, and that I therefore must decline his proposition.

That Mr Schoolcraft returned to Washington, and (as I learned from several members of Congress and other correspondents) used his utmost efforts with the members of both Houses to defeat my bill when it came up, by representing to them that "if they would reject *my* collection, a more extensive and better-executed collection could be had by the Government for *nothing*, if the Government would only provide a suitable place to receive it."*

That the bill for the purchase of my collection was discussed in the Senate, and lost by one vote.

That unfortunate speculations which I had entered into in London soon after subjected my collection to liens, under which it was seized and advertised to be sold at public auction.

That whilst it was in this state, and I was in great distress of mind (my friends advising it, though I was ashamed to do it), I made another appeal to the Congress, explaining the position I was in, and the application being referred to a committee to report, Mr Schoolcraft went before that committee, and succeeded in getting them to report against it. (*The Honourable Mr Seward and the Rev. R. R. Gurley will bear testimony to this.*)

* The collection here alluded to was commenced by an officer of the United States army, several years after I went to London with my collection; and whether it will be *presented* to the Government, I think is yet problematical.

That in the helpless condition in which I was then placed, an act unexpected, and so noble and patriotic that I hope my countrymen will not forget it, saved my collection from being dispersed in a foreign country.

That Mr Joseph Harrison (engineer) of Philadelphia, then passing through London, generously paid off the liens on the collection, and took it with him to Philadelphia, where it now remains in its cases, beyond my means of control, and incurring heavy accumulating expenses.

That under these discouraging circumstances, I left London and visited the West Indies, Venezuela, British and Dutch Guiana, ascended the Amazon, crossed the Andes, reached Vancouver and Queen Charlotte's islands, and having visited most of the tribes of Indians of the Pacific coast, crossed the Rocky Mountains from San Diego to Santa Fé and Matamoros, adding 125 full-length portraits and many other paintings to my North American collection, enabling me to say at this time, that with the labour of thirteen years, I have visited and recorded the looks and customs of nearly every tribe (and remnant of tribes) now existing in North America: a list of which tribes, and outlines of my portraits in all of them, will be laid before the members of your honourable body by my brother, Francis P. Catlin.

That I anticipated the satisfaction of laying these designs and this memorial before the Congress myself, but that loss of hearing and critical illness have made it impossible for me to do so: and I confide them to my brother above named, who is duly authorised to act in all respects for me.

And in memorial, I would further state—

That whilst in Uruguay, in 1856, at the residence of the Baron Bonpland, to whom my friend the

Baron de Humboldt had given me a letter of introduction, I received a letter from the Baron de Humboldt, from which the following is an extract :—

To GEORGE CATLIN, Esq.

POTSDAM, *June* 9, 1856.

MY DEAR FRIEND,— . . . An immense *Scrap-book* on the North American Indians, written by Schoolcraft, for the Government of the United States, in three huge volumes, has been sent to me as a present ; and I find, in looking into it, that he denies the truth of your descriptions of the "*Mandan religious ceremonies*," distinctly saying that they are contrary to facts, and that they are the works of your imagination, &c.

Now, my dear and esteemed friend, this charge, made by such a man as Schoolcraft, and, "*under the authority of the Government of the United States*," to stand in the libraries of the scientific institutions of the whole civilised world, to which they are being sent as presents from your Government, is calculated not only to injure your hard-earned good name, but to destroy the value of your precious works through all ages, unless you take immediate steps with the Government of your country to counteract its effects.

I have often conversed with our illustrious traveller in America, the Prince Maximilian of Neuwied, who spent a winter with the Mandans subsequent to your visit to them, and gained information from the chiefs entirely corroborating your descriptions. You should write to the Prince at once, and getting a letter from him (with your other proofs), lay it before the Government of your country, which cannot fail, by some legislative act, to do you justice.—Your sincere friend,

A. HUMBOLDT.

That since my return from South America, in 1856, in pursuance of the Baron de Humboldt's advice, the following correspondence with Prince Maximilian was held :—

Letter from GEORGE CATLIN *to* PRINCE MAXIMILIAN *of Neuwied.*

BRUXELLES, *December* 2, 1866.

DEAR PRINCE,—Since we travelled together on the Upper Missouri, Mr Schoolcraft, who has published a large work on the North American Indians for the United States Government, and who never had the industry or the courage to go within 1000 miles of the Mandans, has endeavoured to impeach my descrip-

tions of the Mandan religious ceremonies, which, as the tribe has become extinct, he has supposed rested on my testimony alone. In his great work under the authority of the Government, and presented to the literary and scientific institutions of the whole civilised world, he has denied that those voluntary tortures ever took place, and has attributed them to my "very fertile imagination," tending, therefore, to deprive ethnology of the most extraordinary custom of the North American Indians, and to render my name infamous in all future ages, unless I can satisfactorily refute so foul a calumny.

Your Highness spent the winter with the Mandans subsequent to the summer season in which I witnessed these ceremonies, and of course lived in the constant society of Mr Kipp, the fur trader at that post, who witnessed in company with me the whole of those four days' ceremonies, and interpreted everything for me, and from whom you no doubt drew a detailed account of those scenes as we saw them together.

I send you with this letter my four oil paintings of those four days' ceremonies, made as they now are in the Mandan village, and seen and approved by the chiefs and the whole tribe, and having attached to their backs the certificates of Mr Kipp and two other men who were with us that those paintings represent strictly what we saw, and without exaggeration.

I send you also herewith the manuscript of the "*O-kee-pa*," descriptive of those ceremonies, which I am about to publish; and on reading this and examining my paintings, you will be able to inform me and the world how far my descriptions of those scenes will be supported by information gathered by yourself, from Mr Kipp and others, during the winter which you spent in the Mandan village, and for which I shall feel deeply indebted.—Your Highness's obedient servant,

GEO. CATLIN.

Letter from PRINCE MAXIMILIAN *of Neuwied to* Mr GEORGE CATLIN.

NEUWIED, PRUSSIA, *December* 20, 1866.

DEAR SIR,—Your letter of 2d December came safely to hand, and revived the quite forgotten recollections of my stay amongst the Indian tribes of the Missouri, now thirty-three years past.

The Mandan tribe, which we both have known so well, and with whom I passed a whole winter, was one of the first to be destroyed by a terrible disease, when all the distinguished chiefs, *Mah-to-toh-pa*, *Char-a-ta*, *Nu-ma-ka-kie*, &c., &c., died; and it is doubtful if a single man of them remained to record the history, customs, and religious ideas of his people.

Not having been, like yourself, an eye-witness of those remarkable starvations and tortures of the *O-kee-pa*, but having arrived later, and spent the whole of a winter with the Mandans, I received from all the distinguished chiefs, and from Mr Kipp (at that time director of Fort Clarke, at the Mandan village, and an excellent interpreter of the Mandan language), the most detailed and complete record and description of the *O-kee-pa* festival, where the young men suffered a great deal; and I can attest your relation of it to be a correct one, after all that I heard and observed myself.

In my description of my voyage in North America (English edition) I gave a very detailed description of the *O-kee-pa*, as it was reported to me by all the chiefs and Mr Kipp, and it is about the same that you told,—and nobody would doubt our veracity, I hope.

I know most of the American works published on the American Indians, and I possess many of them; but it would be a labour too heavy for my age of eighty-five years to recapitulate them all.

Schoolcraft is a writer who knows well the Indians of his own part of the country, but I do not know his last large work on that matter. If he should doubt what we have both told in our works, of the great medicine festivities of the *O-kee-pa*, he would be wrong, certainly.

If my statement, as that of a witness, could be of use to you, I should be very pleased.—Your obedient,

MAX, *Prince of Neuwied.*

The *autograph* letter of Maximilian (of which the above is a literal extract) duly attested, since his death, by Baron Brida, director of the finances of his Highness the Prince, and the Burgmestre of Neuwied, with the seal of the town of Neuwied attached, accompanies this memorial; and also my four original oil paintings of the Mandan ceremonies made in the Mandan village, and approved by the chiefs, &c., before alluded to, with the certificates attached to them in the Mandan village of three educated American citizens that they were with me, and witnessed the whole of those ceremonies as they are represented in the paintings.

And this memorial further represents:

That in the first volume of his great work Mr

Schoolcraft says—"Mr Catlin's account of the Mandans suspending the weight of their bodies by splints run through their flesh, &c., is contrary to the facts, and that all his accounts of their religion are untrue:" and in the third volume he introduces a letter on the Mandans, signed "*Col. Mitchell, Superintendent* of *Indian Affairs*," in which he states "that the account given by Mr Catlin of the religious ceremony of the Mandans is all but entirely the result of that gentleman's very vivid imagination."

That this *self*-styled "Col.," when I was at the mouth of the Yellow Stone, in 1832, was a partner of M'Kenzie in the "Missouri Fur Company," and was retailing whisky to the Indians at the rate of eighteen dollars per gallon; and since (if I am rightly informed) has for a number of years held the appointment (after Maj. Sanford) of Indian agent for the Upper Missouri; and since that, for many years, the office of "*Superintendent* of *Indian Affairs*," having control over the whole country from the border settlements to the Pacific Ocean; though, for the character and honour of my country, and for the sake of the poor Indians, I hope not.

That my account of the "*Mandan religious ceremony*" was first written in the Mandan village, and published in the "New York Commercial Advertiser," in 1832, four years before the destruction of those people, and afterwards in my "Notes of Travels," &c., published in 1842. And that Mr Schoolcraft, thinking (as the tribe was extinct) that those ceremonies rested on my testimony alone, in conspiracy with this Col. Mitchell, wickedly endeavoured to impeach my veracity, and thereby destroy the value of my works.

That the statements above made, with the autograph letter of Prince Maximilian, establish the truth of my account of the religious ceremony of the Mandans; and that, refraining from all epithets, which my respect for the members of the Govern-

ment and for the grave, forbid me from using, I will allude, in as few words as possible, to the wickedness of the libel, and the peculiarly cruel effects it is calculated to have upon me and my works.

That here is a man who has for more than forty years fed upon the Government crib—for whom a *new office* was *created* by his political friends in the Congress; whose easy task was to sit in his parlour in Washington, and, in the enjoyment of a salary with perquisites, to compose a book from the gatherings of others; and that whilst I have been risking my life and spending all my earthly means in gathering information in the Indian solitudes, from a feeling of jealousy, endeavours, in conspiracy with a whisky-seller, to impeach my veracity and destroy the value of my collections.

That his libellous and truthless charges he has had the satisfaction of seeing printed "*under authority* of *the Government*," and by himself sent, under that authority, into the libraries and scientific institutions of the whole civilised world, and my name thus endorsed as infamous, there to stand and be read as long as human history lasts.

That Mr Schoolcraft knew well the truth of my descriptions. That he saw my original paintings now accompanying this memorial, with the certificates attached to them, and heard from my own lips the whole explained as I witnessed them. And that, making use of a whisky-seller (who was never permitted to see those ceremonies) and the "Government authority," he has seen a way to destroy my name, and to shut out from the pages of American ethnology the most extraordinary and interesting custom of the North American Indians, because he had not the industry or courage to go and see it.

That in his great work, what has Mr Schoolcraft said of the Mandans? Nothing—he has given not a portrait, not a sketch of their village, or of their cus-

toms—nothing but the insertion in his book of the letter of "Col. Mitchell" before alluded to, endeavouring to show that the Mandans are still living, and rapidly increasing under the *fostering auspices* of the Missouri Fur Company, and that my accounts of their religion and of their destruction are false.

That on the screen of illustrations submitted to the members of Congress by my brother, by a little attention will be seen what *I* have done for the history of those unfortunate and unoffending people, and of the other American tribes; and yet, without ever having eaten a meal of victuals at the expense of the Government of my country.

That that collection of designs is the concentration of all my works, and that the publication of them in that form, as the illustrations of a great work, has been the ambition of my life. But what prospect have I? It was the defeat of this publication and the sale of my collection that Mr Schoolcraft aimed his libel at, and what has been the consequence?

The following letter, here attached, shows that a plan was spontaneously proposed by the French Government, recently, for purchasing my collection for the Louvre:—

MINISTÈRE DE LA MAISON DE L'EMPEREUR
ET DES BEAUX-ARTS.
SURINTENDANCE DES BEAUX ARTS.
MUSÉES IMPÉRIAUX.

PALAIS DU LOUVRE, *le* 25 *octobre* 1864.

MONSIEUR,—Sur la proposition de M. Mérimée, M. le Maréchal Vaillant, Ministre de la Maison de l'Empereur, a désiré avoir un rapport sur vos collections américaines, et il m'a chargé de me rendre à Ostende à cet effet. Je n'ai point votre adresse, et je ne sais pas s'il vous serait agréable de me recevoir samedi ou dimanche 29 ou 30. Je vous prie donc d'avoir l'obligeance de me mettre à même de remplir ma mission.—Veuillez, Monsieur, me croire tout à vous.

ADRIEN DE LONGPÉRIER,
Membre de l'Institut,
Conservateur des Musées Impériaux.

That, as proposed in the above letter, M. de Longpérier came to see me at Ostende, and took an inventory of my collections and my conditions, and laid them before the French Government, and (as he subsequently wrote me, in his opinion and hope) with a strong prospect of success.

That that apparent prospect, however, has died away; and that, though I have not been informed by the French Government from what cause, I have learned through a reliable correspondent in Paris, that the negotiation was stopped from information received, that the Government of my country had condemned and rejected my works, as deficient in truth!

That I have recently published the "*O-kee-pa*" (Mandan religious ceremony) in full, with thirteen coloured illustrations, and at considerable expense (a copy of which accompanies this memorial), in self-defence, with the letter of Prince Maximilian inserted in it.

That this book I cannot sell, and that no institution or library calls for it, because they are told by "*authority of the Government of the United States*" that it is a fiction.

That if I had the means to send this book as a present into the institutions and libraries where Schoolcraft's great work has been presented, that truth, perfectly attested, might stand by the side of malicious falsehood, it would be a relief to me; but this I cannot do.

That it should be borne in mind, that the libel on me is not the ephemeral calumny of a newspaper, to have its day, and be forgotten; but a calumny "*under authority of the Government*" of my country, to stand upon the shelf in the principal libraries and institutions of the world (for into them all it has been sent), to be read through ages to come, and as long as books and paper can be made to last.

That this wicked impeachment affects no body

politic or scientific; but that, without the remedy which a *legislative act* alone can give, it destroys the reputation and the works of an individual whose life has been one of perils and privations in gathering materials for the history of his country, and who has given his country no offence.

That the libel has gone forth, and been read for several years—my name, with the charge of disgraceful falsehood attached to it, placed upon the shelves of more than 4000 libraries, public and private, by which, as has been shown, my works are already depreciated; and that, at the termination of my life, which is close at hand, without some action of Congress, as suggested by my friend the Baron de Humboldt, I anticipate the pain of seeing them scattered to the winds.

That the grounds and object of this memorial, I believe, have been sufficiently explained, and that I pray for some speedy action hereon. That I ask for no *emolument*, but for *justice* only; that alone which a dying man has a right to *demand*—a correction of the most damning, and the most *effectually*, and the most *perpetually published* libel that history will record. That an act of Congress, authorising Mr Trübner, of 60 Paternoster Row, London (who is now the proprietor of the "*O-kee-pa*," attested by Prince Maximilian's letter), to supply me with a number of copies of that work equal to the number of copies of Schoolcraft's book circulated, for presentation to the same institutions and libraries, as far as possible (and in which I would have no emolument), would be the only *amende* that I ask; an *amende* which I confidently believe no member of the Congress of my country will oppose.—And your memoralist will ever pray, &c.

GEO. CATLIN.

BRUXELLES, BELGIUM, *December* 1868.