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HOW AND WHY STORIES

SENIOR

MADAM HOW AND LADY WHY

(ABRIDGED)

By CHARLES KINGSLEY

With Illustrations

359

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MADAM HOW AND LADY WHY

By CHARLES KINGSLEY

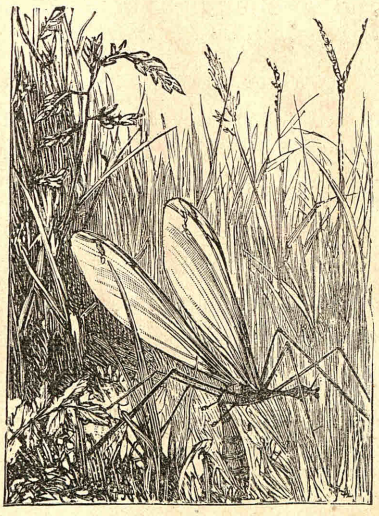
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CHAPTER I.

THE GLEN.

YOU find it dull walking up here upon Hartford Bridge Flat this sad November day? Well, I do not deny that the moor looks somewhat dreary, though dull it need never be. Though the fog is clinging to the fir-trees, and creeping among the heather, till you cannot see as far as Minley Corner, hardly as far as Bramshill woods—and all the Berkshire hills are as invisible as if it was a dark midnight—yet there is plenty to be seen here at our very feet. Though there is nothing left for you to pick, and all the flowers are dead and brown, except here and there a poor half-withered scrap of bottle-heath, and nothing left for



you to catch either. for the butterflies and insects are all dead too, except one poor old Daddy-long-legs, who sits upon that piece of turf, boring a hole with her tail to lay her eggs in, before the frost catches her and ends her like the rest: though all things, I say, seem dead, yet there is plenty of life around you, at your feet, I may almost say in the very stones on which you tread. And though the place itself be dreary enough, a sheet of flat heather and a little glen in it, with banks of dead fern, and a brown bog between them, and a few fir-trees struggling up—yet, if you only have eyes to see it, that little bit of glen is beautiful and wonderful,—so beautiful and so wonderful and so cunningly devised, that it took thousands of years to make it; and it is not, I believe, half-finished yet.

How do I know all that? Because a fairy told it me; a fairy who lives up here upon the moor, and indeed in most places else, if people have but eyes to see her. What is her name? I cannot tell. The best name that I can give her (and I think it must be something like her real name, because she will always answer if you call her by it patiently and reverently) is Madam How. She will come in good time, if she is called, even by a little child. And she will let us see her at her work, and, what is more, teach us to copy her. But there is another fairy here likewise, whom we can hardly hope to see. Very thankful should we be if she lifted even the smallest corner of her veil, and showed us but for a moment if it were but her finger tip—so beautiful is she, and yet so awful too. But that sight, I believe, would not make us proud, as if we had had some

great privilege. No, my dear child: it would make us feel smaller, and meaner, and more stupid and more ignorant than we had ever felt in our lives before; at the same time it would make us wiser than ever we were in our lives before—that one glimpse of the great glory of her whom we call Lady Why.

But I will say more of her presently. We must talk first with Madam How, and perhaps she may help us hereafter to see Lady Why. For she is the servant, and Lady Why is the mistress; though she has a Master over her again—whose name I leave for you to guess. You have heard it often already, and you will hear it again, for ever and ever.

But of one thing I must warn you, that you must not confound Madam How and Lady Why. Many people do it, and fall into great mistakes thereby,—mistakes that even a little child, if it would think, need not commit. But really great philosophers sometimes make this mistake about Why and How; and therefore it is no wonder if other people make it too, when they write children's books about the wonders of nature, and call them "Why and Because," or "The Reason Why." The books are very good books, and you should read and study them: but they do not tell you really "Why and Because," but only "How and So." They do not tell you the "Reason Why" things happen, but only "The Way in which they happen." However, I must not blame these good folks, for I have made the same mistake myself often, and may do it again: but all the more shame to me. For see—

you know perfectly the difference between How and Why, when you are talking about yourself. If I ask you, "Why did we go out to-day?" You would not answer, "Because we opened the door." That is the answer to "How did we go out?" The answer to Why did we go out is, "Because we chose to take a walk." Now when we talk about other things besides ourselves, we must remember this same difference between How and Why.

But now that we know that How and Why are two very different matters, and must not be confounded with each other, let us look for Madam How, and see her at work making this little glen; for, as I told you, it is not half made yet. One thing we shall see at once, and see it more and more clearly the older we grow; I mean her wonderful patience and diligence. Madam How is never idle for an instant. Nothing is too great or too small for her; and she keeps her work before her eye in the same moment, and makes every separate bit of it help every other bit. She will keep the sun and stars in order, while she looks after poor old Mrs. Daddy-long-legs there and her eggs. She will spend thousands of years in building up a mountain, and thousands of years in grinding it down again; and then carefully polish every grain of sand which falls from that mountain, and put it in its right place, where it will be wanted thousands of years hence; and she will take just as much trouble about that one grain of sand as she did about the whole mountain. She will settle the exact place where Mrs. Daddy-long-legs shall lay her eggs, at the very same time that she is settling what shall happen

NURUL ISLAM HIGH SCHOOL

hundreds of years hence in a star millions of miles away. And I really believe that Madam How knows her work so thoroughly, that the grain of sand which sticks now to your shoe, and the weight of Mrs. Daddy-long-legs' eggs at the bottom of her hole, will have an effect upon suns and stars ages after you and I are dead and gone. Most patient indeed is Madam How. She does not mind the least seeing her own work destroyed; she knows that it must be destroyed. There is a spell upon her, and a fate, that everything she makes she must unmake again: and yet, good and wise woman as she is, she never frets, nor tires, nor fudges her work, as we say at school. She takes just as much pains to make an acorn as to make a peach. She takes just as much pains about the acorn which the pig eats, as about the acorn which will grow into a tall oak, and help to build a great ship. She took just as much pains, again, about the acorn which you crushed under your foot just now, and which you fancy will never come to anything. Madam How is wiser than that. She knows that it will come to something. She will find some use for it, as she finds a use for everything. That acorn which you crushed will turn into mould, and that mould will go to feed the roots of some plant, perhaps next year, if it lies where it is; or perhaps it will be washed into the brook, and then into the river, and go down to the sea, and will feed the roots of some plant in some new continent ages and ages hence: and so Madam How will have her own again. You dropped your stick into the river yesterday, and it floated away. You were sorry, because it had cost

you a great deal of trouble to cut it, and peel it, and carve a head and your name on it. Madam How was not sorry, though she had taken a great deal more trouble with that stick than ever you had taken. She had been three years making that stick, out of many things, sunbeams among the rest. But when it fell into the river, Madam How knew that she should not lose her sunbeams nor anything else : the stick would float down the river, and on into the sea ; and there, when it got heavy with the salt water, it would sink, and lodge, and be buried, and perhaps ages hence turn into coal ; and ages after that some one would dig it up and burn it, and then out would come, as bright warm flame, all the sunbeams that were stored away in that stick : and so Madam How would have her own again. And if that should not be the fate of your stick, still something else will happen to it just as useful in the long run ; for Madam How never loses anything, but uses up all her scraps and odds and ends somehow, somewhere, somewhen, as is fit and proper for the Housekeeper of the whole Universe. Indeed, Madam How is so patient that some people fancy her stupid, and think that, because she does not fall into a passion every time you steal her sweets, or break her crockery, or disarrange her furniture, therefore she does not care. But I advise you as a little boy, and still more when you grow up to be a man, not to get that fancy into your head ; for you will find that, however good-natured and patient Madam How is in most matters, her keeping silence and not seeming to see you is no sign that she has forgotten. On the contrary, she bears a grudge

(if one may so say, with all respects to her) longer than any one else does ; because she will always have her own again. Indeed, I sometimes think that if it were not for Lady Why, her mistress, she might bear some of her grudges for ever and ever. I have seen men ere now damage some of Madam How's property when they were little boys, and be punished by her all their lives long, even though she had mended the broken pieces, or turned them to some other use. Therefore I say to you, beware of Madam How. She will teach you more kindly, patiently, and tenderly than any mother, if you want to learn her trade. But if, instead of learning her trade, you damage her materials and play with her tools, beware lest she has her own again out of you.

Some people think, again, that Madam How is not only stupid, but ill-tempered and cruel ; that she makes earthquakes and storms, and famine and pestilences, in a sort of blind passion, not caring where they go or whom they hurt ; quite heedless of who is in the way, if she wants to do anything or go anywhere. Now, that Madam How can be very terrible there can be no doubt ; but there is no doubt also that, if people choose to learn, she will teach them to get out of her way whenever she has business to do which is dangerous to them. But as for her being cruel and unjust, those may believe it who like. You, my dear boys and girls, need not believe it, if you will only trust to Lady Why ; and be sure that Why is the mistress and How the servant, now and for ever. That Lady Why is utterly good and kind I know full well ; and I believe that,

in her case too, the old proverb holds, "Like mistress, like servant;" and that the more we know of Madam How, the more we shall be content with her, and ready to submit to whatever she does: but not with that stupid resignation which some folks preach who do not believe in Lady Why —that is no resignation at all. That is merely saying—

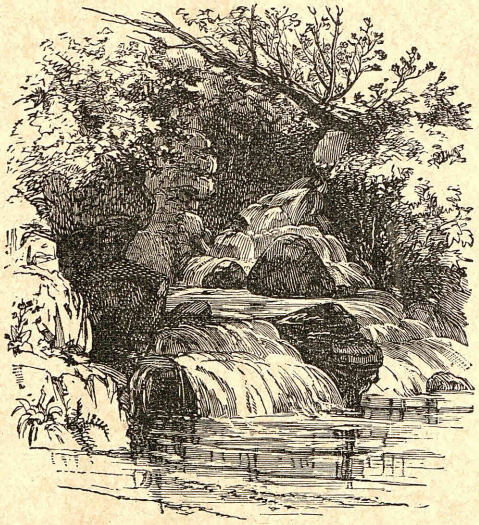
"What can't be cured
Must be endured,"

like a donkey when he turns his tail to a hail-storm,—but the true resignation which is fit for grown people and children alike, the resignation which is the beginning and the end of all wisdom and all religion, is to believe that Lady Why knows best, because she herself is perfectly good; and that as she is mistress over Madam How, so she has a Master over her, whose name—I say again—I leave you to guess.

So now that I have taught you not to be afraid of Madam How, we will go and watch her at her work; and if we do not understand anything we see, we will ask her questions. She will always show us one of her lesson books if we give her time. And if we have to wait some time for her answer, you need not fear catching cold, though it is November; for she keeps her lesson books scattered about in strange places, and we may have to walk up and down that hill more than once before we can make out how she makes the glen.

Well—how was the glen made? You shall guess it if you like, and I will guess too. You think, perhaps, that an earthquake opened it?

My dear child, we must look before we guess. Then, after we have looked a little, and got some grounds for guessing, then we may guess. And you have no ground for supposing there ever was an earthquake here strong enough to open that glen. There may have been one: but we must guess from what we do know, and not from what we do not.



The Waterfall.

Guess again. Perhaps it was there always, from the beginning of the world? My dear child, you have no proof of that either. Everything round you is changing in shape daily and hourly, as you will find out the longer you live; and therefore it is most reasonable to suppose that this glen has changed its shape, as everything else on earth has done. Besides, I told you not that Madam How had made the glen, but that she was making it, and as yet has only half finished. That is my first guess; and my next guess is that water is making the glen—water, and nothing else.

You open your young eyes. And I do not blame you. I looked at this very glen for fifteen years before I made

that guess; and I have looked at it some ten years since, to make sure that my guess held good. For man after all is very blind, my dear boy, and very stupid, and cannot see what lies under his own feet all day long; and if Lady Why, and He whom Lady Why obeys, were not very patient and gentle with mankind, they would have perished off the face of the earth long ago, simply from their own stupidity. I, at least, was very stupid in this case, for I had my head full of earthquakes, and convulsions of nature, and all sorts of prodigies which never happened to this glen; and so, while I was trying to find what was not there, I of course found nothing. But when I put them all out of my head, and began to look for what was there, I found it at once; and lo and behold! I had seen it a thousand times before, and yet never learnt anything from it, like a stupid man as I was; though what I learnt you may learn as easily as I did.

And what did I find?

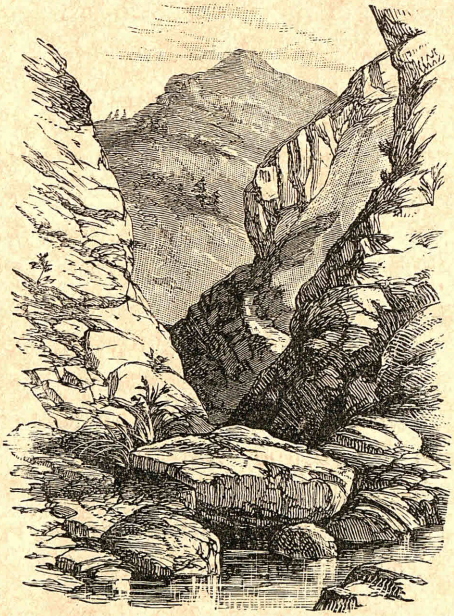
The pond at the bottom of the glen.

You know that pond, of course? You don't need to go there? Very well. Then if you do, do not you know also that the pond is always filling up with sand and mud; and that though we clean it out every three or four years, it always fills again? Now where does that sand and mud come from?

Down that stream, of course, which runs out of this bog. You see it coming down every time there is a flood, and the stream fouls.

Very well. Then, said Madam How to me, as soon as

I recollected that, "Don't you see, you stupid man, that the stream has made the glen, and the earth which runs down the stream was all once part of the hill on which you stand." I confess I was very much ashamed of myself when she said that. For that is the history of the whole mystery. Madam How is digging away with her soft spade, water. She has a harder spade, or rather plough, the strongest and most terrible of all ploughs; but that, I am glad to say, she has laid by in England here.



The Ravine.

Water? But water is too simple a thing to have dug out all this great glen.

My dear child, the most wonderful part of Madam How's work is, that she does such great things and so many different things, with one and the same tool, which looks to you so simple, though it really is not so. Water, for instance, is not a simple thing, but most complicated; and we might spend hours in talking about water, without having come to the end of its wonders. Still Madam How

is a great economist, and never wastes her materials. She is like the sailor who boasted (only she never boasts) that, if he had but a long life and a strong knife, he would build St. Paul's Cathedral before he was done. And Madam How has a very long life, and plenty of time; and one of the strongest of all her tools is water. Now if you will stoop down and look into the heather, I will show you how she is digging out the glen with this very mist which is hanging about our feet. At least, so I guess.

For see how the mist clings to the points of the heather leaves, and makes drops. If the hot sun came out the drops would dry, and they would vanish into the air in light warm steam. But now that it is dark and cold they drip, or run down the heather-stems, to the ground. And whither do they go then? Whither will the water go,—hundreds of gallons of it perhaps,—which has dripped and run through the heather in this single day? It will sink into the ground, you know. And then what will become of it? Madam How will use it as an underground spade, just as she uses the rain (at least, when it rains too hard, and therefore the rain runs off the moor instead of sinking into it) as a spade above ground.

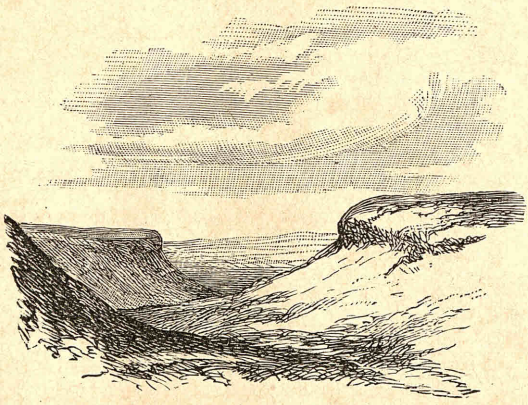
Now come to the edge of the glen, and I will show you the mist that fell yesterday, perhaps, coming out of the ground again, and hard at work.

You know of what an odd, and indeed of what a pretty form all these glens are. How the flat moor ends suddenly in a steep rounded bank, almost like the crest of a wave—ready like a wave-crest to fall over, and as you know,

falling over sometimes, bit by bit, where the soil is bare.

Oh yes; you are very fond of those banks. It is "awfully jolly," as you say, scrambling up and down them, in the deep heath and fern; besides there are plenty of rabbit-holes there, because they are all sand; while there are no rabbit-holes on the flat above, because it is all gravel.

Yes; you know all about it: but you know, too, that you must not go too far down these banks, much less roll down them, because there is almost certain to be a bog at the bottom, lying upon a gentle slope; and there you get wet through.



All round these hills, from here to Aldershot in one direction, and from here to Windsor in another, you see the same shaped glens; the wave-crest along their top, and at the foot of the crest a line of springs which run out over the slopes, or well up through them in deep sand-galls, as you call them—shaking quagmires which are sometimes deep enough to swallow up a horse, and which you love to dance upon in summer time. Now the water of all these springs

is nothing but the rain, and mist, and dew, which has sunk down first through the peaty soil, and then through the gravel and sand, and there has stopped. And why? Because under the gravel (about which I will tell you a strange story one day) and under the sand, which is what the geologists call the Upper Bagshot sand, there is an entirely different set of beds, which geologists call the Bracklesham beds, from a place near the New Forest; and in those beds there is a vein of clay, and through that clay the water cannot get, as you have seen yourself when we dug it out in the field below to puddle the pond-head; and very good fun you thought it, and a very pretty mess you made of yourself. Well: because the water cannot get through this clay, and must go somewhere, it runs out continually along the top of the clay, and as it runs undermines the bank, and brings down sand and gravel continually for the next shower to wash into the stream below.

Now think for one moment how wonderful it is that the shape of these glens, of which you are so fond, was settled by the particular order in which Madam How laid down the gravel and sand and mud at the bottom of the sea, ages and ages ago. This is what I told you, that the least thing that Madam How does to-day may take effect hundreds and thousands of years hence.

But I must tell you I think there was a time when this glen was of a very different shape from what it is now; and I dare say, according to your notions, of a much prettier shape. It was once just like one of those Chines

which we used to see at Bournemouth. You recollect them? How there was a narrow gap in the cliff of striped sands and gravels; and out of the mouth of that gap, only a few feet across, there poured down a great slope of mud and sand the shape of half a bun, some wet and some dry, up which we used to scramble and get into the Chine, and call the Chine what it was in the truest sense, Fairyland. You recollect how it was all eaten out into mountain ranges, pinnacles, steep cliffs of white, and yellow, and pink, standing up against the clear blue sky; till we agreed that, putting aside the difference of size, they were as beautiful and grand as any Alps we had ever seen in pictures. And how we saw (for there could be no mistake about it there) that the Chine was being hollowed out by the springs which broke out high up the cliff, and by the rain which wore the sand into furrowed pinnacles and peaks. You recollect the beautiful place, and how, when we looked back down it, we saw between the miniature mountain walls the bright blue sea, and heard it murmur on the sands outside. So I verily believe we might have done, if we had stood somewhere at the bottom of this glen thousands of years ago. We should have seen the sea in front of us; or rather, an arm of the sea; for Finchampstead ridges opposite, instead of being covered with farms, and woodlands, and purple heath above, would have been steep cliffs of sand and clay, just like those you see at Bournemouth now; and—what would have spoilt somewhat the beauty of the sight—along the shores there would have floated, at least in winter, great

blocks and floes of ice, such as you might have seen in the tideway at King's Lynn the winter before last, growling and crashing, grubbing and ploughing the sand, and the gravel, and the mud, and sweeping them away into seas towards the North, which are now all fruitful land. That may seem to you like a dream : yet it is true ; and some day, when we have another talk with Madam How, I will show even a child like you that it was true.

But what could change a beautiful Chine like that at Bournemouth into a wide sloping glen like this of Bracknell's Bottom, with a wood like Coombs', many acres large, in the middle of it ? Well now, think. It is a capital plan for finding out Madam How's secrets, to see what she might do in one place, and explain by it what she has done in another. Suppose now, Madam How had orders to lift up the whole coast of Bournemouth only twenty or even ten feet higher out of the sea than it is now. She could do that easily enough, for she has been doing so on the coast of South America for ages. She is doing so now steadily on the west coast of Norway, which is rising quietly—all that vast range of mountain wall and iron-bound cliff—at the rate of some four feet in a hundred years, without making the least noise or confusion, or even causing an extra ripple on the sea ; so light and gentle, when she will, can Madam How's strong finger be.

Now, if the mouth of that Chine at Bournemouth was lifted twenty feet out of the sea, one thing would happen,—that the high tide would not come up any longer, and wash away the cake of dirt at the entrance, as we saw it do so

often. But if the mud stopped there, the mud behind it would come down more slowly, and lodge inside more and more, till the Chine was half filled up, and only the upper part of the cliffs continue to be eaten away, above the level where the springs ran out. So gradually the Chine, instead of being deep and narrow, would become broad and shallow; and instead of hollowing itself rapidly after every shower of rain, as you saw the Chine at Bournemouth doing, would hollow itself out slowly, as this glen is doing now. And one thing more would happen,—when the sea ceased to gnaw at the foot of the cliffs outside, and to carry away every stone and grain of sand which fell from them, the cliffs would very soon cease to be cliffs; the rain and the frost would still crumble them down, but the dirt that fell would lie at their feet, and gradually make a slope of dry land, far out where the shallow sea had been; and their tops, instead of being steep as now, would become smooth and rounded; and so at last, instead of two sharp walls of cliff at the Chine's mouth, you might have just what you have here at the mouth of this glen,—our Mount and the Warren Hill,—long slopes with sheets of drifted gravel and sand at their feet, stretching down into what was once an icy sea, and is now the Vale of Blackwater. And this I really believe Madam How has done simply by lifting Hartford Bridge Flat a few more feet out of the sea, and leaving the rest to her trusty tool, the water in the sky.

That is my guess: and I think it is a good guess, because I have asked Madam How a hundred different questions

about it in the last ten years, and she always answered them in the same way, saying, "Water, water, you stupid man." But I do not want you merely to depend on what I say. If you want to understand Madam How, you must ask her questions yourself, and make up your mind yourself like a man, instead of taking things at hearsay or second-hand, like the vulgar. Mind, by "the vulgar" I do not mean poor people: I mean ignorant and uneducated people, who do not use their brains rightly, though they may be fine ladies, kings, or popes. The Bible says, "Prove all things: hold fast that which is good." So do you prove my guess, and if it proves good, hold it fast.

And how can I do that?

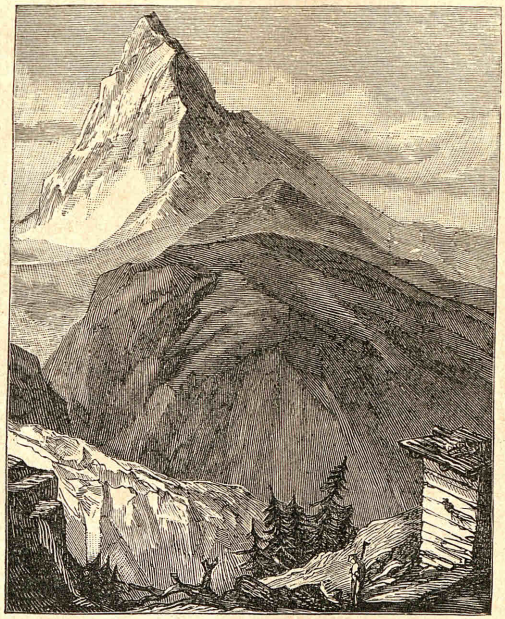
First, by direct experiment, as it is called. In plain English—go home and make a little Hartford Bridge Flat in the stable-yard; and then ask Mrs. How if she will not make a glen in it like this glen here. We will go home and try that. We will make a great flat cake of clay, and put upon it a cap of sand; and then we will rain upon it out of a watering-pot; and see if Mrs. How does not begin soon to make a glen in the side of the heap, just like those on Hartford Bridge Flat. I believe she will; and certainly, if she does, it will be a fresh proof that my guess is right. And then we will see whether water will not make glens of a different shape than these, if it runs over soil of a different kind. We will make a Hartford Bridge Flat turned upside down—a cake of sand with a cap of clay on the top; and we will rain on that out of our watering-pot,

and see what sort of glens we make then. I can guess what they will be like, because I have seen them—steep overhanging cliffs, with very narrow gullies down them: but you shall try for yourself, and make up your mind whether you think me right or wrong. Meanwhile, remember that those gullies too will have been made by water.

And there is another way of "verifying my theory," as it is called; in plain English, seeing if my guess holds good; that is, to look at other valleys—not merely the valleys round here, but valleys in clay, in chalk, in limestone, in the hard slate rock such as you saw in Devonshire—and see whether my guess does not hold good about them too; whether all of them, deep or shallow, broad or narrow, rock or earth, may not have been all hollowed out by running water. I am sure if you would do this you would find something to amuse you, and something to instruct you, whenever you wish. I know that I do. To me the longest railroad journey, instead of being stupid, is like continually turning over the leaves of a wonderful book, or looking at wonderful pictures of old worlds which were made and unmade thousands of years ago. For I keep looking, not only at the railway cuttings, where the bones of the old worlds are laid bare, but at the surface of the ground; at the plains and downs, banks and knolls, hills and mountains; and continually asking Mrs. How what gave them each its shape: and I will soon teach you to do the same. When you do, I tell you fairly her answer will be in almost every case, "Running Water." Either

water running when soft, as it usually is ; or water running when it is hard—in plain words, moving ice.

About that moving ice, which is Mrs. How's stronger spade, I will tell you some other time ; and show you, too, the marks of it in every gravel pit about here. But now, I see, you want to ask a question ; and what is it ?



The Matterhorn.

Do I mean to say that water has made great valleys, such as you have seen paintings and photographs of,—valleys thousands of feet deep, among mountains thousands of feet high ?

Yes I do. But, as I said before, I do not like you to take my word upon trust. When you are older you shall go to the mountains, and you shall judge for yourself. Still, I must say that I never saw a valley, however deep, or a cliff, however high, which had not been scooped out by water ; and that even the mountain-tops which stand up miles aloft in jagged peaks and pinnacles against the sky were cut out

at first, and are being cut and sharpened still, by little else save water, soft and hard ; that is by rain, frost, and ice.

Water, and nothing else, has sawn out such a chasm as that through which the ships run up to Bristol, between Leigh Wood and St. Vincent's Rocks. Water, and nothing else, has shaped those peaks of the Matterhorn, or the Weisshorn, or the Pic du Midi of the Pyrenees, of which you have seen sketches and photographs. Just so water might saw out Hartford Bridge Flat, if it had time enough, into a labyrinth of valleys, and hills, and peaks standing alone ; as it has done already by Ambarrow, and Edgbarrow, and the Folly Hill on the other side of the vale.

I see you are astonished at the notion that water can make Alps. But it was just because I knew you would be astonished at Madam How's doing so great a thing with so simple a tool, that I began by showing you how she was doing the same thing in a small way here upon these flats. For the safest way to learn Madam How's methods is to watch her at work in little corners at commonplace business, which will not astonish or frighten us, nor put huge hasty guesses and dreams into our heads. Sir Isaac Newton, some will tell you, found out the great law of gravitation, which holds true of all the suns and stars in heaven, by watching an apple fall : and even if he did not find it out so, he found it out, we know, by careful thinking over the plain and commonplace fact, that things have weight. So do you be humble and patient, and watch Madam How at work on little things. For that is the way to see her at work upon all space and time.

CHAPTER II.

EARTHQUAKES.

Now we must talk a little about earthquakes, and what makes them; and in order to find out that, let us try the very simplest cause of which we can think. That is the wise and scientific plan.

Whatever makes these earthquakes must be enormously strong; that is certain. And what is the strongest thing you know in the world? Think. . . .

Gunpowder?

Well, gunpowder is strong sometimes: but not always. You may carry it in a flask, or in your hand, and then it is weak enough. It only becomes strong by being turned into gas and steam. But steam is always strong. And if you look at a railway engine, still more if you had ever seen—which God forbid you should—a boiler explosion, you would agree with me, that the strongest thing we know of in the world is steam.

Now I think that we can explain almost, if not quite, all that we know about earthquakes, if we believe that on the whole they are caused by steam and other gases expanding, that is, spreading out, with wonderful quickness and strength. Of course there must be something to make them expand, and that is *heat*. But we will not talk of that yet.

Now do you remember that riddle which I put to you the other day?—"What has the rattling of the lid of the

kettle to do with Hartford Bridge Flat being lifted out of the ancient sea ? "

The answer to the riddle, I believe, is—Steam has done both. The lid of the kettle rattles, because the expanding steam escapes in little jets, and so causes a *lid-quake.* Now suppose that there was steam under the earth trying to escape, and the earth in one place was loose and yet hard, as the lid of the kettle is loose and yet hard, with cracks in it, it may be, like the crack between the edge of the lid and the edge of the kettle itself: might not the steam try to escape through the cracks, and rattle the surface of the earth, and so cause an *earthquake* ?

So the steam would escape generally easily, and would only make a passing rattle, like the earthquake of which the famous jester Charles Selwyn said that it was quite a young one, so tame that you might have stroked it; like that which I myself once felt in the Pyrenees, which gave me very solemn thoughts after a while, though at first I did nothing but laugh at it; and I will tell you why.

I was travelling in the Pyrenees; and I came one evening to the loveliest spot—a glen, or rather a vast crack in the mountains, so narrow that there was no room for anything at the bottom of it, save a torrent roaring between walls of polished rock. High above the torrent the road was cut out among the cliffs, and above the road rose more cliffs, with great black cavern mouths, hundreds of feet above our heads, out of each of which poured in foaming waterfalls streams large enough to turn a mill, and above them mountains piled on mountains, all covered with

woods of box, which smelt rich and hot and musky in the warm spring air. Among the box-trees and fallen boulders grew hepaticas, blue and white and red, such as you see in the garden; and little stars of gentian, more azure than the azure sky. But out of the box-woods above rose giant silver firs, clothing the cliffs and glens with tall black spires, till they stood out at last in a jagged saw-edge against the purple evening sky, along the mountain ranges, thousands of feet aloft; and beyond them again, at the head of the valley, rose vast cones of virgin snow, miles away in reality, but looking so brilliant and so near that one fancied at the first moment that one could have touched them with one's hand. Snow-white they stood, the glorious things, seven thousand feet into the air; and I watched their beautiful white sides turn rose-colour in the evening sun, and when he set, fade into dull cold gray, till the bright moon came out to light them up once more. When I was tired of wondering and admiring, I went into bed; and there I had a dream—such a dream as Alice had when she went into Wonderland—such a dream as I dare say you may have had ere now. Some noise or stir puts into your fancy as you sleep a whole long dream to account for it; and yet that dream, which seems to you to be hours long, has not taken up a second of time; for the very same noise which begins the dream, wakes you at the end of it: and so it was with me. I dreamed that some English people had come into the hotel where I was, and were sleeping in the room underneath me; and that they had quarrelled and fought, and broke their bed down

with a tremendous crash, and that I must get up, and stop the fight; and at that moment I woke and heard coming up the valley from the north such a roar as I never heard before or since; as if a hundred railway trains were rolling underground; and just as it passed under my bed there was a tremendous thump, and I jumped out of bed quicker than I ever did in my life, and heard the roaring sound die away as it rolled up the valley towards the peaks of snow. Still I had in my head this notion of the Englishmen fighting in the room below. Then I opened my window—a woman screamed, a dog barked, some cocks and hens cackled in a very disturbed humour, and then I could hear nothing but the roaring of the torrent a hundred feet below. And then it flashed across me what all the noise was about; and I burst out laughing, and said "It is only an earthquake," and went to bed again.

Of course after that I could do no less than ask Madam How, very civilly, how she made earthquakes in that particular place, hundreds of miles away from any burning mountain? And this was the answer I *thought* she gave, though I am not so conceited as to say I am sure.

As I had come up the valley I had seen that the cliffs were all beautiful gray limestone marble; but just at this place they were replaced by granite, such as you may see in London Bridge or at Aberdeen. I do not mean that the limestone changed to granite, but that the granite had risen up out of the bottom of the valley, and had carried the limestone (I suppose) up on its back hundreds of feet into the air. Those caves with the waterfalls pour-

ing from their mouths were all on one level, at the top of the granite, and the bottom of the limestone. That was to be expected; for, as I will explain to you some day, water can make caves easily in limestone: but never, I think, in granite. But I know that besides these cold springs which came out of the caves, there were hot springs also, full of curious chemical salts, just below the very house where I was in. And when I went to look at them, I found that they came out of the rock just where the limestone and the granite joined. "Ah," I said, "now I think I have Madam How's answer. The lid of one of her great steam boilers is rather shaky and cracked just here, because the granite has broken and torn the limestone as it lifted it up; and here is the hot water out of the boiler actually oozing out of the crack; and the earthquake I heard last night was simply the steam rumbling and thumping inside, and trying to get out."

And then, my dear child, I fell into a more serious mood. I said to myself, "If that stream had been a little, only a little stronger, or if the rock above it had been only a little weaker, it would have been no laughing matter then; the village might have been shaken to the ground; the rocks hurled into the torrent; jets of steam and of hot water, mixed, it may be, with deadly gases, have roared out of the riven ground; that might have happened here, in short, which has happened and happens still in a hundred places in the world, whenever the rocks are too weak to stand the pressure of the steam below, and the solid earth bursts as an engine boiler bursts when the steam within it is too

strong." And when those thoughts came into my mind, I was in no humour to jest any more about "young earthquakes," or "Madam How's boilers;" but rather to say with the wise man of old, "It is of the Lord's mercies that we are not consumed."

Most strange, most terrible also, are the tricks which this underground steam plays. It will make the ground, which seems to us so hard and firm, roll and rock in waves, till people are sea-sick, as on board a ship; and that rocking motion (which is the most common) will often, when it is but slight, set the bells ringing in the steeples, or make the furniture, and things on shelves, jump about quaintly enough. It will make trees bend to and fro, as if a wind was blowing through them; open doors suddenly, and shut them again with a slam; make the timbers of the floors and roofs creak, as they do in a ship at sea; or give men such frights as one of the dock-keepers at Liverpool got in the earthquake in 1863, when his watchbox rocked so, that he thought some one was going to pitch him over into the dock. But these are only little hints and warnings of what it can do. When it is strong enough, it will rock down houses and churches into heaps of ruins, or, if it leaves them standing, crack them from top to bottom, so that they must be pulled down and rebuilt.

But the strangeness of some of the tricks which the earthquake shocks play is hardly to be explained, even by scientific men. Sometimes, it would seem, the force runs round, making the solid ground eddy, as water eddies in a brook. For it will make straight rows of trees crooked;

it will twist whole walls round—or rather the ground on which the walls stand—without throwing them down; it will shift the stones of a pillar one on the other sideways, as if a giant had been trying to spin it like a teetotum, and so screwed it half in pieces. There is a story told by a wise man, who saw the place himself, of the whole furniture of one house being hurled away by an earthquake, and buried under the ruins of another house; and of things carried hundreds of yards off, so that the neighbours went to law to settle who was the true owner of them. Sometimes, again, the shock seems to come neither horizontally in waves, nor circularly in eddies, but vertically, that is, straight up from below; and then things—and people, alas! sometimes—are thrown up off the earth high into the air, just as things spring off the table if you strike it smartly enough underneath. By that same law (for there is a law for every sort of motion) it is that the earthquake shock sometimes hurls great rocks off a cliff into the valley below. The shock runs through the mountain till it comes to the cliff at the end of it; and then the face of the cliff, if it be at all loose, flies off into the air. You may see the very same thing happen, if you will put marbles or billiard-balls in a row touching each other, and strike the one nearest you smartly in the line of the row. All the balls stand still, except the last one, and that flies off. The shock, like the earthquake shock, has run through them all; but only the end one, which had nothing beyond it but soft air, has been moved; and when you grow old, and learn mathematics, you will know the law of motion

according to which that happens, and learn to apply what the billiard-balls have taught you, to explain the wonders of an earthquake. For in this case, as in so many more, you must watch Madam How at work on little and common things, to find out how she works in great and rare ones. That is why Solomon says that "a fool's eyes are in the ends of the earth," because he is always looking out for strange things which he has not seen, and which he could not understand if he saw; instead of looking at the petty commonplace matters which are about his feet all day long, and getting from them sound knowledge, and the art of getting more sound knowledge still.

Another terrible destruction which the earthquake brings, when it is close to the seaside, is the wash of a great sea wave. The sea moans, and sinks back, leaving the shore dry; and then comes in from the offing a mighty wall of water, as high as, or higher than, many a tall house; sweeps far inland, washing away quays and houses, and carrying great ships in with it; and then sweeps back again, leaving the ships high and dry.

Now, how is that wave made? Let us think. Perhaps in many ways. But two of them I will tell you as simply as I can, because they seem the most likely, and probably the most common.

Suppose, as the earthquake shock ran on, making the earth under the sea heave and fall in long earth-waves, the sea-bottom sank down. Then the water on it would sink down too, and leave the shore dry; till the sea-bottom rose again, and hurled the water up again against the land.

This is one way of explaining it, and it may be true. For certain it is, that earthquakes do move the bottom of the sea ; and certain, too, that they move the water of the sea also, and with tremendous force. For ships at sea during an earthquake feel such a blow from it (though it does them no harm) that the sailors often rush upon deck fancying that they have struck upon a rock ; and the force which could give a ship, floating in water, such a blow as that, would be strong enough to hurl thousands of tons of water up the beach, and on to the land.

But there is another way of accounting for this great sea wave, which I fancy comes true sometimes.

Suppose you put an empty india-rubber ball into water, and then blow into it through a pipe. Of course, you know, as the ball filled, the upper side of it would rise out of the water. Now, suppose there were a party of little ants moving about upon that ball, and fancying it a great island, or perhaps the whole world—what would they think of the ball's filling and growing bigger ?

If they could see the sides of the basin or tub in which the ball was, and were sure that they did not move, then they would soon judge by them that they themselves were moving, and that the ball was rising out of the water. But if the ants were so short-sighted that they could not see the sides of the basin, they would be apt to make a mistake, because they would then be like men on an island out of sight of any other land. Then it would be impossible further to tell whether they were moving up, or whether the water was moving down ; whether their ball was rising

out of the water, or the water was sinking away from the ball. They would probably say, "The water is sinking, and leaving the ball dry."

Do you understand that? Then think what would happen if you pricked a hole in the ball. The air inside would come hissing out, and the ball would sink again into the water. But the ants would probably fancy the very opposite. Their little heads would be full of the notion that the ball was solid and could not move, just as our heads are full of the notion that the earth is solid and cannot move; and they would say, "Ah! here is the water rising again." Just so, I believe, when the sea seems to ebb away during the earthquake, the land is really being raised out of the sea, hundreds of miles of coast, perhaps, or a whole island, at once, by the force of the steam and gas imprisoned under the ground. That steam stretches and strains the solid rocks below, till they can bear no more, and snap, and crack, with frightful roar and clang; then out of holes and chasms in the ground rush steam gases—often foul and poisonous ones—hot water, mud, flame, strange stones—all signs that the great boiler down below has burst at last.

Then the strain is eased. The earth sinks together again, as the ball did when it was pricked; and sinks lower, perhaps, than it was before: and back rushes the sea, which the earth had thrust away while it rose, and sweeps in, destroying all before it.

Of course, there is a great deal more to be said about all this: but I have no time to tell you now. You will

read it, I hope, for yourselves when you grow up, in the writings of far wiser men than I. Or perhaps you may feel for yourselves in foreign lands the actual shock of a great earthquake, or see its work fresh done around you. And if ever that happens, and you be preserved during the danger, you will learn for yourself, I trust, more about earthquakes than I can teach you, if you will only bear in mind the simple general rules for understanding the "how" of them which I have given you here.

But you do not seem satisfied yet? What is it that you want to know?

Oh! There was an earthquake here in England the other night, while you were asleep; and that seems to you too near to be pleasant. Will there ever be earthquakes in England which will throw houses down, and bury people in the ruins?

My dear child, I think you may set your heart at rest upon that point. As far as the history of England goes back, and that is more than a thousand years, there is no account of any earthquake which has done any serious damage, or killed, I believe, a single human being. The little earthquakes which are sometimes felt in England run generally up one line of country, from Devonshire through Wales, and up the Severn valley into Cheshire and Lancashire, and the South-west of Scotland; and they are felt more smartly there, I believe, because the rocks are harder there than here, and more tossed about by earthquakes which happened ages and ages ago, long before man lived on the earth. I will show you the work of these earth-

quakes some day, in the tilting and twisting of the layers of rock, and in the cracks (*faults*, as they are called) which run through them in different directions. I showed you some once, if you recollect, in the chalk cliff at Ramsgate —two sets of cracks, sloping opposite ways, which I told you were made by two separate sets of earthquakes, long, long ago, perhaps while the chalk was still at the bottom of a deep sea. But even in the rocky parts of England the earthquake-force seems to have all but died out. Perhaps the crust of the earth has become too thick and solid there to be much shaken by the gases and steam below. In this eastern part of England, meanwhile, there is but little chance that an earthquake will ever do much harm, because the ground here, for thousands of feet down, is not hard and rocky, but soft—sands, clays, chalk, and sand again; clays, soft limestones, and clays again—which all act as buffers to deaden the earthquake shocks, and deaden too the earthquake noise.

And how?

Put your ear to one end of a soft bolster, and let some one hit the other end. You will hear hardly any noise, and will not feel the blow at all. Put your ear to one end of a hard piece of wood, and let some one hit the other. You will hear a smart tap; and perhaps feel a smart tap, too. When you are older, and learn the laws of sound, and of motion among the particles of bodies, you will know why. Meanwhile you may comfort yourself with the thought that Madam How has (doubtless by command of Lady Why) prepared a safe soft bed for this good

people of Britain—not that they may lie and sleep on it, but work and till, plant and build and manufacture, and thrive in peace and comfort, we will trust and pray, for many a hundred years to come. All that the steam inside the earth is likely to do to us, is to raise parts of this island (as Hertford Bridge Flats were raised, ages ago, out of the old icy sea) so slowly, probably, that no man can tell whether they are rising or not. Or again, the steam-power may be even now dying out under our island, and letting parts of it sink slowly into the sea, as some wise friends of mine think that the fens in Norfolk and Cambridgeshire are sinking now. I have shown you where that kind of work has gone on in Norfolk; how the brow of Sandringham Hill was once a sea-cliff, and Dersingham Bog at its foot a shallow sea; and therefore that the land has risen there. How, again, at Hunstanton Station there is a beach of sea-shells twenty feet above high-water mark, showing that the land has risen there likewise. And how farther north again, at Brancaster, there are forests of oak, and fir, and alder, with their roots still in the soil, far below high-water mark, and only uncovered at low tide; which is a plain sign that there the land has sunk. You surely recollect the sunken forest at Brancaster, and the beautiful shells we picked up in its gullies, and the millions of live Pholases boring into the clay and peat which once was firm dry land, fed over by giant oxen, and giant stags likewise, and perhaps by the mammoth himself, the great woolly elephant whose teeth the fishermen dredge up in the sea outside? You recollect that? Then remember

that as that Norfolk shore has changed, so slowly but surely is the whole world changing around us. Hartford Bridge Flat here, for instance, how has it changed! Ages ago it was the gravelly bottom of a sea. Then the steam-power underground raised it up slowly, through long ages, till it became dry land. And ages hence, perhaps, it will have become a sea-bottom once more. Washed slowly by the rain, or sunk by the dying out of the steam-power underground, it will go down again to the place from whence it came. Seas will roll where we stand now, and new lands will rise where seas now roll. For all things on this earth from the tiniest flower to the tallest mountain, change and change all day long. Every atom of matter moves perpetually; and nothing "continues in one stay." The solid-seeming earth on which you stand is but a heaving bubble, bursting ever and anon in this place and in that.

CHAPTER III.

VOLCANOS.

In the province of Quito, in the year 1797, from thirty to forty thousand people were killed at once by an earthquake. One would have thought that warning enough: but the warning was not taken: and since then thousands more have been killed in the very same country, in the very same way.

They might have expected as much. For their towns are built, most of them, close to volcanos—some of the highest and most terrible in the world. And wherever there are volcanos there will be earthquakes. You may have earthquakes without volcanos, now and then; but volcanos without earthquakes, seldom or never.

How does that come to pass? Does a volcano make earthquakes? No; we may rather say that earthquakes are trying to make volcanos. For volcanos are the holes which the steam underground has burst open that it may escape into the air above. They are the chimneys of the great blast-furnaces underground, in which Madam How pounds and melts up the old rocks, to make them into new ones, and spread them out over the land above.

And there are many volcanos in the world? You have heard of Vesuvius, of course, in Italy; and Etna, in Sicily; and Hecla, in Iceland. And you have heard, too, of Kilauea, in the Sandwich Islands, and of Pele's Hair—the yellow threads of lava, like fine spun glass, which are blown from off its pools of fire, and which the Sandwich Islanders believed to be the hair of a goddess who lived in the crater;—and you have read too, I hope, in Miss Yonge's *Book of Golden Deeds*, the noble story of the Christian chieftainess who, in order to persuade her subjects to become Christians also, went down into the crater and defied the goddess of the volcano, and came back unhurt and triumphant.

But if you look at the map, you will see that there are many, many more. Get a Physical Atlas from the school-

room—of course it is there (for a schoolroom without a physical atlas is like a needle without an eye)—and look at the map which is called "Phenomena of Volcanic Action."

You will see in it many red dots, which mark the volcanos which are still burning: and black dots, which mark those which have been burning at some time or other, not very long ago, scattered about the world. Sometimes they are single, like the red dot at Otaheite, or at Easter Island in the Pacific. Sometimes they are in groups, or clusters, like the cluster at the Sandwich Islands, or in the Friendly Islands, or in New Zealand. And if we look in the Atlantic, we shall see four clusters: one in poor half-destroyed Iceland, in the far north, one in the Azores, one in the Canaries, and one in the Cape de Verds. And there is one dot in those Canaries which we must not overlook, for it is no other than the famous Peak of Teneriffe, a volcano which is hardly burnt out yet, and may burn up again any day, standing up out of the sea more than 12,000 feet high still, and once it must have been double that height. Some think that it is perhaps the true Mount Atlas, which the old Greeks named when first they ventured out of the Straits of Gibraltar down the coast of Africa, and saw the great peak far to the westward, with the clouds cutting off its top; and said that it was a mighty giant, the brother of the Evening Star, who held up the sky upon his shoulders, in the midst of the Fortunate Islands, the gardens of the daughter of the Evening Star, full of strange golden fruits; and that Perseus had

turned him into stone, when he passed him with the Gorgon's Head.

But you will see, too, that most of these red and black dots run in crooked lines; and that many of the clusters run in lines likewise.

Look at one line: by far the largest on the earth. You will learn a good deal of geography from it.

The red dots begin at a place called the Terribles, on the east side of the Bay of Bengal. They run on, here and there, along the islands of Sumatra and Java, and through the Spice Islands; and at New Guinea the line of red dots forks. One branch runs south-east, through islands whose names you never heard, to the Friendly Islands, and to New Zealand. The other runs north, through the Philippines, through Japan, through Kamschatka; and then there is a little break of sea, between Asia and America: but beyond it, the red dots begin again in the Aleutian Islands, and then turn down the whole west coast of America, down from Mount Elias (in what was, till lately, Russian America) towards British Columbia. Then, after a long gap, there are one or two in Lower California (and we must not forget the terrible earthquake which has just shaken San Francisco, between those two last places); and when we come down to Mexico we find the red dots again plentiful, and only too plentiful; for they mark the great volcanic line of Mexico, of which you will read, I hope, some day, in Humboldt's works. But the line does not stop there. After the little gap of the Isthmus of Panama, it begins again in Quito, the very country

which has just been shaken, and in which stand the huge volcanos Chimborazo, Pasto, Antisana, Cotopaxi, Pichincha, Tunguragua,—smooth cones from 15,000 to 20,000 feet high, shining white with snow, till the heat inside melts it off, and leaves the cinders of which the peaks are made all black and ugly among the clouds, ready to burst in smoke and fire. South of them again, there is a long gap, and then another line of red dots—Arequiba, Chipicani, Gualatieri, Atacama,—as high as, or higher than those in Quito; and this, remember, is the other country which has just been shaken. On the sea-shore below those volcanos stood the hapless city of Arica, whose ruins we saw in the picture. Then comes another gap; and then a line of more volcanos in Chili, at the foot of which happened that fearful earthquake of 1835 (besides many more) of which you will read some day in that noble book *The Voyage of the Beagle;* and so the line of dots runs down to the southernmost point of America.

What a line we have traced! Long enough to go round the world if it were straight. A line of holes out of which steam, and heat, and cinders, and melted stones are rushing up, perpetually; in one place and another. Now the holes in this line which are near each other have certainly something to do with each other. For instance, when the earth shook the other day round the volcanos of Quito, it shook also round the volcanos of Peru, though they were 600 miles away. And there are many stories of earthquakes being felt, or awful underground thunder heard, while volcanos were breaking out hundreds of

miles away. I will give you a very curious instance of that.

If you look at the West Indies on the map, you will see a line of red dots run through the Windward Islands: there are two volcanos in them, one in Guadaloupe, and one in St. Vincent (I will tell you a curious story, presently, about that last), and little volcanos (if they have ever been real volcanos at all), which now only send out mud, in Trinidad. There the red dots stop: but then begins along the north coast of South America a line of mountain country called Cumana, and Caraccas, which has often been horribly shaken by earthquakes. Now once, when the volcano in St. Vincent began to pour out a vast stream of melted lava, a noise like thunder was heard underground, over thousands of square miles beyond those mountains, in the plains of Calabozo, and on the banks of the Apure, more than 600 miles away from the volcano, —a plain sign that there was something underground which joined them together, perhaps a long crack in the earth. Look for yourselves at the places, and you will see that (as Humboldt says) it is as strange as if an eruption of Mount Vesuvius was heard in the north of France.

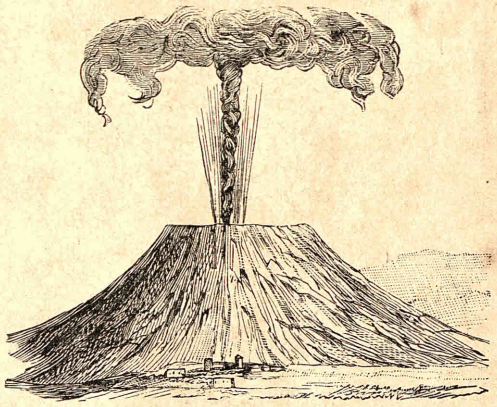
So it seems as if these lines of volcanos stood along cracks in the rind of the earth, through which the melted stuff inside was for ever trying to force its way; and that, as the crack got stopped up in one place by the melted stuff cooling and hardening again into stone, it was burst in another place, and a fresh volcano made, or an old one re-opened.

Now we can understand why earthquakes should be most common round volcanos ; and we can understand, too, why they would be worst before a volcano breaks out, because then the steam is trying to escape ; and we can understand, too, why people who live near volcanos are glad to see them blazing and spouting, because then they have hope that the steam has found its way out, and will not make earthquakes any more for a while. But still that is merely foolish speculation on chance. Volcanos can never be trusted. No one knows when one will break out, or what it will do ; and those who live close to them—as the city of Naples is close to Mount Vesuvius—must not be astonished if they are blown up or swallowed up, as that great and beautiful city of Naples may be without a warning any day.

For what happened to that same Mount Vesuvius nearly 1800 years ago, in the old Roman times ? For ages and ages it had been lying quiet, like any other hill. Beautiful cities were built at its foot, filled with people who were as handsome, and as comfortable, and (I am afraid) as wicked, as people ever were on earth. Fair gardens, vineyards, olive-yards, covered the mountain slopes. It was held to be one of the Paradises of the world. As for the mountain's being a burning mountain, who ever thought of that ? To be sure, on the top of it was a great round crater, or cup, a mile or more across, and a few hundred yards deep. But that was all overgrown with bushes and wild vines, full of boars and deer. What sign of fire was there in that ? To be sure, also, there was an ugly place below by the sea-

shore, called the Phlegræn fields, where smoke and brimstone came out of the ground, and a lake called Avernus, over which poisonous gases hung, and which (old stories told) was one of the mouths of the Nether Pit. But what of that? It had never harmed any one, and how could it harm them?

So they all lived on, merrily and happily enough, till, in the year A.D. 79 (that was eight years, you know, after the Emperor Titus destroyed Jerusalem), there was stationed in the Bay of Naples a Roman admiral, called Pliny, who was also a very studious and learned man, and author of a famous old book on natural history. He was staying on shore with his sister; and as he sat in his study she called him out to see a strange cloud which had been hanging for some time over the top of Mount Vesuvius. It was in shape just like a pine tree; not, of course, like one of our branching Scotch firs here, but like an Italian stone pine, with a long straight stem and a flat parasol-shaped top. Sometimes it was blackish, sometimes spotted; and the good Admiral Pliny, who was always curious about natural science, ordered his cutter and went away across the bay



to see what it could be. Earthquake shocks had been very common for the last few days; but I do not suppose that Pliny had any notion that the earthquakes and the cloud had aught to do with each other. However, he soon found out that they had, and to his cost. When he got near the opposite shore some of the sailors met him and entreated him to turn back. Cinders and pumice-stones were falling down from the sky, and flames breaking out of the mountain above. But Pliny would go on: he said that if people were in danger, it was his duty to help them; and that he must see this strange cloud, and note down the different shapes into which it changed. But the hot ashes fell faster and faster; the sea ebbed out suddenly, and left them nearly dry, and Pliny turned away to a place called Stabiæ, to the house of his friend Pomponianus, who was just going to escape in a boat. Brave Pliny told him not to be afraid, ordered his bath like a true Roman gentleman, and then went into dinner with a cheerful face. Flames came down from the mountain, nearer and nearer as the night drew on; but Pliny persuaded his friend that they were only fires in some villages from which the peasants had fled, and then went to bed and slept soundly. However, in the middle of the night they found the court-yard being fast filled with cinders, and, if they had not woke up the Admiral in time, he would never have been able to get out of the house. The earthquake shocks grew stronger and fiercer, till the house was ready to fall; and Pliny and his friend, and the sailors and the slaves, all fled into the open fields, amid a shower of stones and cinders,

tying pillows over their heads to prevent their being beaten down. The day had come by this time, but not the dawn—for it was still pitch dark as night. They went down to their boats upon the shore; but the sea raged so horribly that there was no getting on board of them. Then Pliny grew tired, and made his men spread a sail for him, and lay down on it; but there came down upon them a rush of flames, and a horrible smell of sulphur, and all ran for their lives. Some of the slaves tried to help the Admiral upon his legs; but he sank down again overpowered with the brimstone fumes, and so was left behind. When they came back again, there he lay dead, but with his clothes in order and his face as quiet as if he had been only sleeping. And that was the end of a brave and learned man—a martyr to duty and to the love of science.

But what was going on in the meantime? Under clouds of ashes, cinders, mud, lava, three of those happy cities were buried at once—Herculaneum, Pompeii, Stabiæ. They were buried just as the people had fled from them, leaving the furniture and the earthenware, often even jewels and gold, behind, and here and there among them a human being who had not had time to escape from the dreadful deluge of dust. The ruins of Herculaneum and Pompeii have been dug into since; and the paintings, especially in Pompeii, are found upon the walls still fresh. preserved from the air by the ashes which have covered them in. When you are older you perhaps will go to Naples, and see in its famous museum the curiosities which have been dug out of the ruined cities; and you will walk,

I suppose, along the streets of Pompeii and see the wheel-tracks in the pavement, along which carts and chariots rumbled 2000 years ago. Meanwhile, if you go nearer home, to the Crystal Palace and to the Pompeian Court, as it is called, you will see an exact model of one of those old buried houses, copied even to the very paintings on the walls, and judge for yourself, as far as a little boy can judge, what sort of life these thoughtless, luckless people lived 2000 years ago.

And what had become of Vesuvius, the treacherous mountain ? Half or more than half of the side of the old crater had been blown away, and what was left, which is now called the Monte Somma, stands in a half circle round the new cone and new crater which is burning at this very day. True, after that eruption which killed Pliny, Vesuvius fell asleep again, and did not awake for 134 years, and then again for 269 years : but it has been growing more and more restless as the ages have passed on, and now hardly a year passes without its sending out smoke and stones from its crater, and streams of lava from its sides.

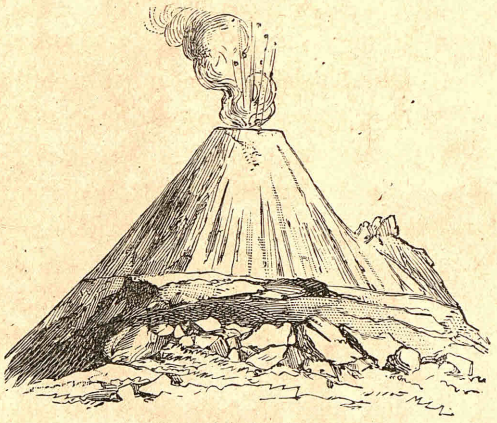
And now, I suppose, you will want to know what a volcano is like, and what a cone, and a crater, and lava are ?

What a volcano is like, it is easy enough to show you ; for they are the most simply and beautifully shaped of all mountains, and they are alike all over the world, whether they be large or small. Almost every volcano in the world, I believe, is, or has been once, of the shape which you see in

the drawing opposite ; even those volcanos in the Sandwich Islands, of which you have often heard, which are now great lakes of boiling fire upon flat downs, without any cone to them at all. They, I believe, are volcanos which have fallen in ages ago : just as in Java a whole burning mountain fell in on the night of the 11th of August, in the year 1772. Then, after a short and terrible earthquake, a bright cloud suddenly covered the whole mountain. The people who dwelt around it tried to escape ; but before the poor souls could get away the earth sunk beneath their feet, and the whole mountain fell in and was swallowed up with a noise as if great cannon were being fired. Forty villages and nearly 3000 people were destroyed, and where the mountain had been was only a plain of red-hot stones. In the same way, in the year 1698 the top of a mountain in Quito fell in in a single night, leaving only two immense peaks of rock behind, and pouring out great floods of mud mixed with dead fish ; for there are underground lakes among those volcanos which swarm with little fish which never see the light.

But most volcanos, as I say, are, or have been, the shape of the one which you see here. This is Cotopaxi, in Quito, more than 19,000 feet in height. All those sloping sides are made of cinders and ashes, braced together, I suppose, by bars of solid lava-stone inside, which prevent the whole from crumbling down. The upper part, you see, is white with snow, as far down as a line which is 15,000 feet above the sea ; for the mountain is in the tropics, close to the equator, and the snow will not lie in that hot climate any

lower down. But now and then the snow melts off and rushes down the mountain side in floods of water and of mud, and the cindery cone of Cotopaxi stands out black and dreadful against the clear blue sky, and then the people of that country know what is coming. The mountain is growing so hot inside that it melts off its snowy covering; and soon it will burst forth with smoke and steam, and red-hot stones and earthquakes, which will shake the ground, and roars that will be heard, it may be, hundreds of miles away.



And now for the words cone, crater, lava. If I can make you understand those words, you will see why volcanos must be in general of the shape of Cotopaxi.

Cone, crater, lava: those words make up the alphabet of volcano learning. The cone is the outside of a huge chimney; the crater is the mouth of it. The lava is the ore which is being melted in the furnace below, that it may flow out over the surface of the old land, and make new land instead.

And where is the furnace itself? Who can tell that? Under the roots of the mountains, under the depths of the

sea ; down " the path which no fowl knoweth, and which the vulture's eye hath not seen : the lion's whelp hath not trodden it, nor the fierce lion passed by it. There He putteth forth His hand upon the rock ; He overturneth the mountain by the roots ; He cutteth out rivers among the rocks ; and His eye seeth every precious thing "— while we, like little ants, run up and down outside the earth, scratching, like ants, a few feet down, and calling that a deep ravine ; or peeping a few feet down into the crater of a volcano, unable to guess what precious things may lie below—below even the fire which blazes and roars up through the thin crust of the earth. For of the inside of this earth we know nothing whatsoever : we only know that it is, on an average, several times as heavy as solid rock ; but how that can be, we know not.

So let us look at the chimney, and what comes out of it ; for we can see very little more.

Why is a volcano like a cone ?

For the same cause for which a molehill is like a cone, though a very rough one ; and that the little heaps which the burrowing beetles make on the moor, or which the ant-lions in France make in the sand, are all something in the shape of a cone, with a hole like a crater in the middle. What the beetle and the ant-lion do on a very little scale, the steam inside the earth does on a great scale. When once it has forced a vent into the outside air, it tears out the rocks underground, grinds them small against each other, often into the finest dust, and blasts them out of the hole which it has made. Some of them fall back into the

hole, and are shot out again: but most of them fall round the hole, most of them close to it, and fewer of them farther off, till they are piled up in a ring round it, just as the sand is filled up round a beetle's burrow. For days, and weeks, and months this goes on; even it may be for hundreds of years: till a great cone is formed round the steam vent, hundreds or thousands of feet in height, of dust and stones, and of cinders likewise. For recollect, that when the steam has blown away the cold earth and rock near the surface of the ground, it begins blowing out the hot rocks down below, red-hot, white-hot, and at last actually melted. But these, as they are hurled into the cool air above, become ashes, cinders, and blocks of stone again, making the hill on which they fall bigger and bigger continually. And thus does wise Madam How stand in no need of bricklayers, but makes her chimneys build themselves.

And why is the mouth of the chimney called a crater?

Crater, as you know, is Greek for a cup. And the mouths of these chimneys, when they have become choked and stopped working, are often just the shape of a cup, or (as the Germans call them) kessels, which means kettles, or caldrons. I have seen some of them as beautifully and exactly rounded as if a cunning engineer had planned them, and had them dug out with the spade. At first, of course, their sides and bottom are nothing but loose stones, cinders, slag, ashes, such as would be thrown out of a furnace. But Madam How, who, whenever she makes an ugly desolate place, always tries to cover over its ugliness,

and set something green to grow over it, and make it pretty once more, does so often and often by her worn-out craters. I have seen them covered with short sweet turf, like so many chalk downs. I have seen them, too, filled with bushes, which held woodcocks and wild boars. Once I came on a beautiful round crater on the top of a mountain, which was filled at the bottom with a splendid crop of potatoes. Though Madam How had not put them there herself, she had at least taught the honest Germans to put them there. And often Madam How turns her worn-out craters into beautiful lakes. There are many such crater-lakes in Italy, as you will see if ever you go there. Many such deep clear blue lakes have I seen in the Eifel, in Germany; and many a curious plant have I picked on their shores, where once the steam blasted, and the earthquake roared, and the ash-clouds rushed up high into the heaven, and buried all the land around in dust, which is now fertile soil. And long did I puzzle to find out why the water stood in some craters, while others, within a mile of them perhaps, were perfectly dry. That I never found out for myself. But learned men tell me that the ashes which fall back into the crater, if the bottom of it be wet from rain, will sometimes "set" (as it is called) into a hard cement; and so make the bottom of the great bowl waterproof, as if it were made of earthenware.

But what gives the craters this cup-shape at first?

Think——While the steam and stones are being blown out, the crater is an open funnel, with more or less upright walls inside. As the steam grows weaker, fewer and fewer

stones fall outside, and more and more fall back again inside. At last they quite choke up the bottom of the great round hole. Perhaps, too, the lava or melted rock underneath cools and grows hard, and that chokes up the hole lower down. Then, down from the round edge of the crater the stones and cinders roll inward more and more. The rains wash them down, the wind blows them down. They roll to the middle, and meet each other, and stop. And so gradually the steep funnel becomes a round cup. You may prove for yourself that it must be so, if you will try. Do you not know that if you dig a round hole in the ground, and leave it to crumble in, it is sure to become cup-shaped at last, though at first its sides may have been quite upright, like those of a bucket? If you do not know, get a trowel and make your little experiment.

And now you ought to understand what "cone" and "crater" mean. And more, if you will think for yourself, you may guess what would come out of a volcano when it broke out "in an eruption," as it is usually called. First, clouds of steam and dust (what you would call smoke); then volleys of stones, some cool, some burning hot; and at the last, because it lies lowest of all, the melted rock itself, which is called lava.

And where would that come out? At the top of the chimney? At the top of the cone?

No. Madam How, as I told you, usually makes things make themselves. She has made the chimney of the furnace make itself; and next she will make the furnace-door make itself.

The melted lava rises in the crater—the funnel inside the cone—but it never gets to the top. It is so enormously heavy that the sides of the cone itself cannot bear its weight, and give way low down. And then, through ashes and cinders, the melted lava burrows out, twisting and twirling like an enormous fiery earthworm, till it gets to the air outside, and runs off down the mountain in a stream of fire. And so you may see (as are to be seen on Vesuvius now) two eruptions at once—one of burning stones above, and one of melted lava below.

And what is lava ?

That, I think, I must tell you another time. For when I speak of it I shall have to tell you more about Madam How, and her ways of making the ground on which you stand, than I can say just now.

CHAPTER IV.

THE TRANSFORMATIONS OF A GRAIN OF SOIL.

WHY, you ask, are there such terrible things as volcanos ? Of what use can they be ?

They are of use enough, my child ; and of many more uses, doubt not, than we know as yet, or ever shall know. But of one of their uses I can tell you. They make, or help to make, divers and sundry curious things, from gunpowder to your body and mine.

What ? I can understand their helping to make gun-

powder, because the sulphur in it is often found round volcanos; and I know the story of the brave Spaniard who, when his fellows wanted materials for gunpowder, had himself lowered in a basket down the crater of a South American volcano, and gathered sulphur for them off the burning cliffs: but how can volcanos help to make me? Am I made of lava? Or is there lava in me?

My child, I did not say that volcanos helped to make you. I said that they helped to make your body; which is a very different matter, as I beg you to remember, now and always. We will consider how a volcano, and the lava which flows from it, helps to make your body.

Now I know that the Scotch have a saying, "That you cannot make broth out of whinstones" (which is their name for lava). But, though they are very clever people, they are wrong there. I never saw any broth in Scotland, as far as I know, but what whinstones had gone to the making of it; nor a Scotch boy who had not eaten many a bit of whinstone, and been all the better for it.

Of course, if you simply put the whinstones into a kettle and boiled them, you would not get much out of them by such rough cookery as that. But Madam How is the best and most delicate of all cooks; and she knows how to pound, and soak, and stew whinstones so delicately, that she can make them sauce and seasoning for meat, vegetables, puddings, and almost everything that you eat; and can put into your veins things which were spouted up red-hot by volcanos, ages and ages since, perhaps at the bottom of ancient seas which are now firm dry land.

This is very strange—as all Madam How's doings are. And you would think it stranger still if you had ever seen the flowing of a lava stream.

Out of a cave of slag and cinders in the black hill side rushes a golden river, flowing like honey, and yet so tough that you cannot thrust a stick into it, and so heavy that great stones (if you threw them on it) float on the top, and are carried down like corks on water. It is so hot that you cannot stand near it more than a few seconds; hotter, perhaps, than any fire you ever saw: but as it flows, the outside of it cools in the cool air, and gets covered with slag and cinders, something like those which you may see thrown out of the furnaces in the Black Country of Staffordshire. Sometimes these cling together above the lava stream, and make a tunnel, through the cracks in which you may see the fiery river rushing and roaring down below. But mostly they are kept broken and apart, and roll and slide over each other on the top of the lava, crashing and clanging as they grind together with a horrid noise. Of course that stream, like all streams, runs towards the lower grounds. It slides down glens, and fills them up; down the beds of streams, driving off the water in hissing steam; and sometimes (as it did in Iceland a few years ago) falls over some cliff, turning what had been a water-fall into a fire-fall, and filling up the pool below with blocks of lava suddenly cooled, with a clang and roar like that of chains shaken or brazen vessels beaten, which is heard miles and miles away. Of course, woe to the crops and gardens which stand in its way. It crawls over them all

and eats them up. It shoves down houses ; it sets woods on fire, and sends the steam and gas out of the tree-trunks hissing into the air. And (curiously enough) it does this often without touching the trees themselves. It flows around the trunks (it did so in a wood in the Sandwich Islands a few years ago), and of course sets them on fire by its heat, till nothing is left of them but blackened posts. But the moisture which comes out of the poor tree in steam blows so hard against the lava round that it can never touch the tree, and a round hole is left in the middle of the lava where the tree was. Sometimes, too, the lava will spit out liquid fire among the branches of the trees, which hangs down afterwards from them in tassels of slag, and yet, by the very same means, the steam in the branches will prevent the liquid fire burning them off, or doing anything but just scorch the bark.

But I can tell you a more curious story still. The lava stream, you must know, is continually sending out little jets of gas and steam : some of it it may have brought up from the very inside of the earth ; most of it, I suspect, comes from the damp herbage and damp soil over which it runs. Be that as it may, a lava stream out of Mount Etna, in Sicily, came once down straight upon the town of Catania. Everybody thought that the town would be swallowed up ; and the poor people there (who knew no better) began to pray to St. Agatha—a famous saint, who, they say, was martyred there years ago—and who, they fancy, has power in heaven to save them from the lava stream. And really what happened was enough to make

ignorant people, such as they were, think that St. Agatha had saved them. The lava stream came straight down upon the town wall. Another foot, and it would have touched it, and have begun shoving it down with a force compared with which all battering rams that you ever read of in ancient histories would be child's toys. But lo and behold! when the lava stream got within a few inches of the wall it stopped, and began to rear itself upright and build itself into a wall beside the wall. It rose and rose, till I believe in one place it overtopped the wall, and began to curl over in a crest. All expected that it would fall over into the town at last: but no, there it stopped, and cooled, and hardened, and left the town unhurt. All the inhabitants said, of course, that St. Agatha had done it: but learned men found out that, as usual Madam How had done it, by making it do itself. The lava was so full of gas, which was continually blowing out in little jets, that when it reached the wall, it actually blew itself back from the wall; and as the wall was luckily strong enough not to be blown down, the lava kept blowing itself back till it had time to cool. And so, my dear child, there was no miracle at all in the matter; and the poor people of Catania had to thank not St. Agatha, and any interference of hers, but simply Him who can preserve, just as He can destroy, by those laws of nature which are the breath of His mouth and the servants of His will.

But in many a case the lava does not stop. It rolls on and on over the downs and through the valleys, till it reaches the sea-shore, as it did in Hawaii in the Sandwich

Islands. And then it cools, of course ; but often not before it has killed the fish by its sulphurous gases and heat, perhaps for miles around. And there is good reason to believe that the fossil fish which we so often find in rocks, perfect in every bone, lying sometimes in heaps, and twisted (as I have seen them) as if they died suddenly and violently, were killed in this very way, either by heat from lava streams, or else by the bursting up of gases poisoning the water, in earthquakes and eruptions in the bottom of the sea. I could tell you many stories of fish being killed in thousands by earthquakes and volcanos during the last few years. But we have not time to tell about everything.

And now you will ask me, with more astonishment than ever, what possible use can there be in these destroying streams of fire ? And certainly, if you had ever seen a lava stream even when cool, and looked down, as I have done, at the great river of rough black blocks streaming away far and wide over the land, you would think it the most hideous and the most useless thing you ever saw.

Now if you had seen, as I have seen, close round the edges of these lava streams, and sometimes actually upon them, or upon the great bed of dust and ashes which have been hurled far and wide out of ancient volcanos, happy homesteads, rich crops, hemp and flax, and wheat, tobacco, lucerne, roots, and vineyards laden with white and purple grapes, you would have begun to suspect that the lava streams were not, after all, such very bad neighbours. And when I tell you that volcanic soils (as they are called), that is, soil which has at first been lava or ashes, are gener-

ally the richest soils in the world—that, for instance (as some one told me the other day), there is soil in the beautiful island of Madeira so thin that you cannot dig more than two or three inches down without coming to the solid rock of lava, or what is harder even, obsidian (which is the black glass which volcanos sometimes make, and which the old Mexicans used to chip into swords and arrows, because they had no steel)—and that this soil, thin as it is, is yet so fertile, that in it used to be grown the grapes of which the famous Madeira wine was made—when you remember this, and when you remember, too, the Lothians of Scotland (about which I shall have to say a little to you just now), then you will perhaps agree with me, that Lady Why has not been so very wrong in setting Madam How to pour out lava and ashes upon the surface of the earth.

For see—down below, under the roots of the mountains, Madam How works continually like a chemist in his laboratory, melting together all the rocks, which are the bones and leavings of the old worlds. If they stayed down below there, they would be of no use; while they will be of use up here in the open air. For, year by year—by the washing of rain and rivers, and also, I am sorry to say, by the ignorant and foolish waste of mankind—thousands and millions of tons of good stuff are running into the sea every year, which would, if it could be kept on land, make food for men and animals, plants and trees. So, in order to supply the continual waste of this upper world. Madam How is continually melting up the under world, and pouring it out of the volcanos like manure, to

renew the face of the earth. In these lava rocks and ashes which she sends up there are certain substances, without which men cannot live—without which a stalk of corn or grass cannot grow. Without potash, without magnesia, both of which are in your veins and mine—without silicates (as they are called), which give flint to the stems of corn and of grass, and so make them stiff and hard, and able to stand upright—and very probably without the carbonic acid gas, which comes out of the volcanos, and is taken up by the leaves of plants, and turned by Madam How's cookery into solid wood—without all these things, and I suspect without a great many more things which come out of volcanos—I do not see how this beautiful green world could get on at all.

Of course, when the lava first cools on the surface of the ground it is hard enough, and therefore barren enough. But Madam How sets to work upon it at once, with that delicate little water-spade of hers, which we call rain, and with that alone, century after century, and age after age, she digs the lava stream down, atom by atom, and silts it over the country round in rich manure. So that if Madam How has been a rough and hasty workwoman in pumping her treasures up out of her mine with her great steam-pumps, she shows herself delicate and tender and kindly enough in giving them away afterwards.

Nay, even the fine dust which is sometimes blown out of volcanos is useful to countries far away. So light it is, that it rises into the sky and is wafted by the wind across the seas. So, in the year 1783, ashes from the

Skapter Jokull, in Iceland, were carried over the north of Scotland, and even into Holland, hundred of miles to the south.

So, again, when in the year 1812 the volcano of St. Vincent, in the West India Islands, poured out torrents of lava, after mighty earthquakes which shook all that part of the world, a strange thing happened (about which I have often heard from those who saw it) in the island of Barbados, several hundred miles away. For when the sun rose in the morning (it was a Sunday morning), the sky remained more dark than any night, and all the poor negroes crowded terrified out of their houses into the streets, fancying the end of the world was come. But a learned man who was there, finding that, though the sun was risen, it was still pitchy dark, opened his window, and found that it was stuck fast by something on the ledge outside, and, when he thrust it open, found the ledge covered deep in soft red dust; and he instantly said, like a wise man as he was, "The volcano of St. Vincent must have broken out, and these are the ashes from it." Then he ran down stairs and quieted the poor negroes, telling them not to be afraid, for the end of the world was not coming just yet. But still the dust went on falling till the whole island, I am told, was covered an inch thick; and the same thing happened in the other islands round. People thought —and they had reason to think from what had often happened elsewhere—that though the dust might hurt the crops for that year, it would make them richer in years to come, because it would act as manure upon the soil;

and so it did after a few years; but it did terrible damage at the time, breaking off the boughs of trees and covering up the crops; and in St. Vincent itself whole estates were ruined. It was a frightful day, but I know well that behind that How there was a Why for its happening, and happening, too, about that very time, which all who know the history of negro slavery in the West Indies can guess for themselves, and confess, I hope, that in this case, as in all others, when Lady Why seems most severe she is often most just and kind.

Ah! my dear child, that I could go on talking to you of this for hours and days! But I have time now only to teach you the alphabet of these matters—and, indeed, I know little more than the alphabet myself; but if the very letters of Madam How's book, and the mere A, B, AB, of it, which I am trying to teach you, are so wonderful and so beautiful, what must its sentences be and its chapters? And what must the whole book be like? But that last none can read save He who wrote it before the worlds were made.

But now I see you want to ask a question. Let us have it out. I would sooner answer one question of yours than tell you ten things without your asking.

Are there potash and magnesia and silicates in the soil here? And if there are, where did they come from? For there are no volcanos in England.

Yes. There are such things in the soil; and little enough of them, as the farmers here know too well. For we here, in Windsor Forest, are on the very poorest and

almost the newest soil in England; and when Madam How had used up all her good materials in making the rest of the island, she carted away her dry rubbish and shot it down here for us to make the best of; and I do not think that we and our forefathers have done so very ill with it. But where the rich part, or staple, of our soils came from it would be very difficult to say, so often has Madam How made, and unmade, and re-made England, and sifted her materials afresh every time. But if you go to the Lowlands of Scotland, you may soon see where the staple of the soil came from there, and that I was right in saying that there were atoms of lava in every Scotch boy's broth. Not that there were ever (as far as I know) volcanos in Scotland or in England. Madam How has more than one string to her bow, or two strings either; so when she pours out her lavas, she does not always pour them out in the open air. Sometimes she pours them out at the bottom of the sea, as she did in the north of Ireland and the south-west of Scotland, when she made the Giant's Causeway, and Fingal's Cave in Staffa too, at the bottom of the old chalk ocean, ages and ages since. Sometimes she squirts them out between the layers of rock, or into cracks which the earthquakes have made, in what are called trap dykes, of which there are plenty to be seen in Scotland, and in Wales likewise. And then she lifts the earth up from the bottom of the sea, and sets the rain to wash away all the soft rocks, till the hard lava stands out in great hills upon the surface of the ground. Then the rain begins eating away those lava-hills likewise, and manuring the earth with them;

and whenever those lava-hills stand up, whether great or small, there is pretty sure to be rich land around them. If you look at the Geological Map of England and Ireland, and the red spots upon it, which will show you where those old lavas are, you will see how much of them there is in England, at the Lizard Point in Cornwall, and how much more in Scotland and the north of Ireland. In South Devon, in Shropshire—with its beautiful Wrekin, and Caradoc, and Lawley—in Wales, round Snowdon (where some of the soil is very rich), and, above all, in the Lowlands of Scotland, you see these red marks, showing the old lavas, which are always fertile, except the poor old granite, which is of little use save to cut into building stone, because it is too full of quartz—that is, flint.

Think of this the next time you go through Scotland in the railway, especially when you get near Edinburgh. As you run through the Lothians, with their noble crops of corn, and roots, and grasses—and their great homesteads, each with its engine chimney, which makes steam do the work of men—you will see rising out of the plain, hills of dark rock, sometimes in single knobs, like Berwick Law or Stirling Crag—sometimes in noble ranges, like Arthur's Seat, or the Sidlaws, or the Ochils. Think what these black bare lumps of whinstone are, and what they do. Remember they are mines—not gold mines, but something richer still—food mines, which Madam How thrust into the inside of the earth, ages and ages since, as molten lava rock, and then cooled them and lifted them up, and pared

them away with her ice-plough and her rain-spade, and spread the stuff of them over the wide carses round, to make in that bleak northern climate, which once carried nothing but fir-trees and heather, a soil fit to feed a great people; to cultivate in them industry, and science, and valiant self-dependence and self-help; and to gather round the Heart of Midlothian and the Castle Rock of Edinburgh the stoutest and the ablest little nation which Lady Why has made since she made the Greeks who fought at Salamis.

And now think what a wonderful fairy tale you might write for yourself—and every word of it true—of the adventures of one atom of Potash or some other Salt, no bigger than a needle's point, in such a lava stream as I have been telling of. How it has run round and round, and will run round age after age, in an endless chain of change. How it began by being molten fire underground, how then it became part of a hard cold rock, lifted up into a cliff, beaten upon by rain and storm, and washed down into the soil of the plain, till, perhaps, the little atom of mineral met with the rootlet of some great tree, and was taken up into its sap in spring, through tiny veins, and hardened the next year into a piece of solid wood. And then how that tree was cut down, and its logs, it may be, burnt upon the hearth, till the little atom of mineral lay among the wood-ashes, and was shovelled out and thrown upon the field and washed into the soil again, and taken up by the roots of a clover plant, and became an atom of vegetable matter once more. And then how, perhaps, a

rabbit came by, and ate the clover, and the grain of mineral became part of the rabbit; and then how a hawk killed that rabbit, and ate it, and so the grain became part of the hawk; and how the farmer shot the hawk, and it fell perchance into a stream, and was carried down into the sea; and when its body decayed, the little grain sank through the water, and was mingled with the mud at the bottom of the sea. But do its wanderings stop there? Not so, my child. Nothing upon the earth, as I told you once before, continues in one stay. That grain of mineral might stay at the bottom of the sea a thousand or ten thousand years, and yet the time would come when Madam How would set to work on it again. Slowly, perhaps, she would sink that mud so deep, and cover it up with so many fresh beds of mud, or sand, or lime, that under the heavy weight, and perhaps, too, under the heat of the inside of the earth, that Mud would slowly change to hard Slate Rock; and ages after, it may be, Madam How might melt that Slate Rock once more, and blast it out; and then through the mouth of a volcano the little grain of mineral might rise into the open air again to make fresh soil, as it had done thousands of years before. For Madam How can manufacture many different things out of the same materials. She may have so wrought with that grain of mineral, that she may have formed it into part of a precious stone, and men may dig it out of the rock, or pick it up in the river-bed, and polish it, and set it, and wear it. Think of that—that in the jewels which your mother or your sisters wear, or in your father's signet ring,

there may be atoms which were part of a live plant, or a live animal, millions of years ago, and may be parts of a live plant or a live animal millions of years hence.

Think over again, and learn by heart, the links of this endless chain of change: Fire turned into Stone—Stone into Soil—Soil into Plant—Plant into Animal—Animal into Soil—Soil into Stone—Stone into Fire again—and then Fire into Stone again, and the old thing run round once more.

CHAPTER V.

THE ICE-PLOUGH.

You want to know why I am so fond of that little bit of limestone, no bigger than my hand, which lies upon the shelf; why I ponder over it so often, and show it to all sensible people who come to see me?

I do so, not only for the sake of the person who gave it to me, but because there is written on it a letter out of Madam How's alphabet, which has taken wise men many a year to decipher. I could not decipher that letter when first I saw the stone. More shame for me, for I had seen it often before, and understood it well enough, in many another page of Madam How's great book. Take the stone, and see if you can find out anything strange about it.

Well, it is only a bit of marble as big as my hand, that

looks as if it had been, and really has been, broken off by a hammer. But when you look again, you see there is a smooth scraped part on one edge, that seems to have been rubbed against a stone.

Now look at that rubbed part, and tell me how it was done.



You have seen men often polish one stone on another, or scour floors with a Bath brick, and you will guess at first that this was polished so: but if it had been, then the rubbed place would have been flat: but if you put your fingers over it, you will find that it is not flat. It is rolled, fluted, channelled, so that the thing or things which rubbed it must have been somewhat round. And it is covered, too, with very fine and smooth scratches or grooves, all running over the whole in the same line. Now what could have done that?

Of course a man could have done it, if he had taken a large round stone in his hand, and worked the large channellings with that, and then had taken fine sand and gravel

upon the points of his fingers, and worked the small scratches with that. But this stone came from a place where man had, perhaps, never stood before—ay, which, perhaps, had never seen the light of day before since the world was made; and as I happen to know that no man made the marks upon that stone, we must set to work and think again for some tool of Madam How's which may have made them.

And now I think you must give up guessing, and I must tell you the answer to the riddle. Those marks were made by a hand which is strong and yet gentle, tough and yet yielding, like the hand of a man; a hand which handles and uses in a grip stronger than a giant's its own carving tools, from the great boulder stone as large as this whole room to the finest grain of sand. And that is ICE.

That piece of stone came from the side of the Rosenlaüi glacier in Switzerland, and it was polished by the glacier ice. The glacier melted and shrank this last hot summer farther back than it had done for many years, and left bare sheets of rock, which it had been scraping at for ages, with all the marks fresh upon them. And that bit was broken off and brought to me, who never saw a glacier myself, to show me how the marks which the ice makes in Switzerland are exactly the same as those which the ice has made in Snowdon and in the Highlands, and many another place where I have traced them, and written a little, too, about them in years gone by. And so I treasure this, as a sign that Madam How's ways do not change nor

her laws become broken; that Madam How is making and unmaking the surface of the earth now, by exactly the same means as she was making and unmaking ages and ages since; and that what is going on slowly and surely in the Alps in Switzerland was going on once here where we stand.

It is very difficult, I know, for a little boy like you to understand how ice, and much more how soft snow, should have such strength that it can grind this little stone, much more such strength as to grind whole mountains into plains. You have never seen ice and snow do harm. You cannot even recollect the Crimean Winter, as it was called then; and well for you you cannot, considering all the misery it brought at home and abroad. You cannot I say, recollect the Crimean Winter, when the Thames was frozen over above the bridges, and the ice piled in little bergs ten to fifteen feet high, which lay, some of them, stranded on the shores, about London itself, and did not melt, if I recollect, until the end of May. You never stood, as I stood, in the great winter of 1837-8 on Battersea Bridge, to see the ice break up with the tide, and saw the great slabs and blocks leaping and piling upon each other's backs, and felt the bridge tremble with their shocks, and listened to their horrible grind and roar, till one got some little picture in one's mind of what must be the breaking up of an ice-floe in the Arctic regions, and what must be the danger of a ship nipped in the ice and lifted up on high, like those in the pictures of Arctic voyages which you are so fond of looking through. You cannot recollect how that winter even in our little Blackwater Brook the alder

stems were all peeled white, and scarred, as if they had been gnawed by hares and deer, simply by the rushing and scraping of the ice,—a sight which gave me again a little picture of the destruction which the ice makes of quays, and stages, and houses along the shore upon the coasts of North America, when suddenly setting in with wind and tide, it jams and piles high inland. You recollect none of these things. Ice and snow are to you mere playthings; and you long for winter, that you may make snowballs and play hockey and skate upon the ponds, and eat ice like a foolish boy till you make your stomach ache. And I dare say you have said, like many another boy, on a bright cheery ringing frosty day, "Oh, that it would be always winter!" You little knew for what you asked. You little thought what the earth would soon be like, if it were always winter,—if one sheet of ice on the pond glued itself on to the bottom of the last sheet, till the whole pond was a solid mass,—if one snow-fall lay upon the top of another snow-fall till the moor was covered many feet deep and the snow began sliding slowly down the glen from Coombs's, burying the green fields, tearing the trees up by their roots, burying gradually house, church, and village, and making this place for a thousand years what it was many thousand years ago. Good-bye then, after a very few winters, to bees, and butterflies, and singing-birds, and flowers; and good-bye to all vegetables, and fruit, and bread; good-bye to cotton and woollen clothes. You would have, if you were left alive, to dress in skins, and eat fish and seals, if any came near enough to be caught.

You would have to live, in a word, if you could live at all, as Esquimaux live now in Arctic regions, and as people had to live in England ages since, in the times when it was always winter, and icebergs floated between here and Finchampstead. Oh no, my child: thank Heaven that it is not always winter; and remember that winter ice and snow, though it is a very good tool with which to make the land, must leave the land year by year if that land is to be fit to live in.

I said that if the snow piled high enough upon the moor, it would come down the glen in a few years through Coombs's Wood; and I said then you would have a small glacier here—such a glacier (to compare small things with great) as now comes down so many valleys in the Alps, or has come down all the valleys of Greenland and Spitzbergen till they reach the sea, and there end as cliffs of ice, from which great icebergs snap off continually, and fall and float away, wandering southward into the Atlantic for hundreds of miles. You may judge for yourself how you would like to live where it is always winter.

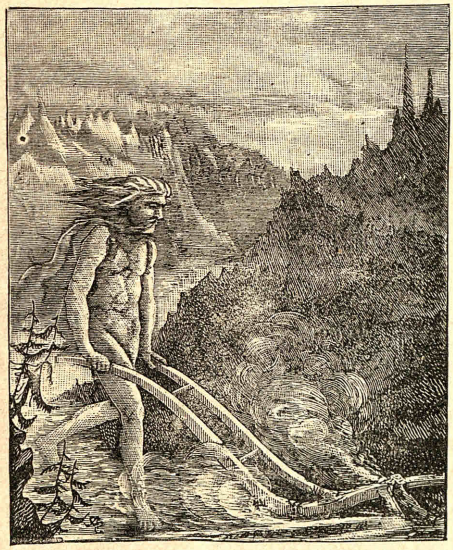
Now you must not ask me to tell you what a glacier is like, for I have never seen one; at least, those which I have seen were more than fifty miles away, looking like white clouds hanging on the gray mountain sides. And it would be an impertinence—that means a meddling with things which I have no business—to picture to you glaciers which have been pictured so well and often by gentlemen who escape every year from their hard work in town to find among the glaciers of the Alps health and refreshment,

and sound knowledge, and that most wholesome and strengthening of all medicines, toil.

When you see a glacier for yourself, you must bear in mind what a glacier means—that it is a river of ice, fed by a lake of snow. The lake from which it springs is the eternal snow-field which stretches for miles and miles along the mountain tops, fed continually by fresh snow-storms falling from the sky. That snow slides off into the valleys hour by hour, and as it rushes down is ground and pounded, and thawed and frozen again into a sticky paste of ice, which flows slowly but surely till it reaches the warm valley at the mountain foot, and there melts bit by bit. The long black lines which you see winding along the white and green ice of the glacier are the stones which have fallen from the cliffs above. They will be dropped at the end of the glacier, and mixed with silt and sand and other stones which have come down inside the glacier itself, and piled up in the field in great mounds, which are called moraines, such as you may see and walk on in Scotland many a time, though you might never guess what they are.

The river which runs out at the glacier foot is, you must remember, all foul and milky with the finest mud; and that mud is the grinding of the rocks over which the glacier has been crawling down, and scraping them as it scraped my bit of stone with pebbles and with sand. And this is the alphabet, which, if you learn by heart, you will learn to understand how Madam How uses her great ice-plough to plough down her old mountains, and spread the stuff of

them about the valleys to make rich straths of fertile soil. Nay, so immensely strong, because immensely heavy, is the share of this her great ice-plough, that some will tell you (and it is not for me to say that they are wrong) that with it she has ploughed out all the mountain lakes in Europe and in North America; that such lakes, for instance, as Ullswater or Windermere have been scooped clean out of the solid rock by ice which came down these glaciers in old times. And be sure of this, that next to Madam How's steam-pump and her rain-spade, her great ice-plough has had, and has still, the most to do with making the ground on which we live.



Do I mean that there were ever glaciers here? No, I do not. There have been glaciers in Scotland in plenty. And if any Scotch boy shall read this book, it will tell him presently how to find the marks of them far and wide over his native land. But as you, my child, care most about this country in which you live, I will show you in any gravel-pit, or hollow lane upon the moor, the marks, not of a glacier, which is an ice-river, but of a whole sea of ice.

Let us come up to the pit upon the top of the hill, and look carefully at what we see there. The lower part of the pit of course is a solid rock of sand. On the top of that is a cap of gravel, five, six, ten feet thick. Now the sand was laid down there by water at the bottom of an old sea ; and therefore the top of it would naturally be flat and smooth, as the sands at Hunstanton or at Bournemouth are ; and the gravel, if it was laid down by water, would naturally lie flat on it again : but it does not. See how the top of the sand is dug out into deep waves and pits, filled up with gravel. And see, too, how over some of the gravel you get sand again, and then gravel again, and then sand again, till you cannot tell where one fairly begins and the other ends. Why, here are little dots of gravel, six or eight feet down, in what looks the solid sand rock, yet the sand must have been opened somehow to put the gravel in.

You say you have seen that before. You have seen the same curious twisting of the gravel and the sand into each other on the top of Farley Hill, and in the new cutting on Minley Hill ; and, best of all, in the railway cutting between Ascot and Sunningdale, where upon the top the white sand and gravel is arranged in red and brown waves, and festoons, and curlicues, almost like Prince of Wales's feathers. Yes, that last is a beautiful section of ice-work ; so beautiful, that I hope to have it photographed some day.

Now, how did ice do this ?

Well, I was many a year before I found out that, and I

dare say I never should have found it out for myself. A gentleman named Trimmer, who, alas! is now dead, was, I believe, the first to find it out. He knew that along the coast of Labrador, and other cold parts of North America, and on the shores, too, of the great river St. Lawrence, the stranded icebergs, and the ice-foot, as it is called, which is continually forming along the freezing shores, grub and plough every tide into the mud and sand, and shove up before them like a ploughshare, heaps of dirt; and that, too, the ice itself is full of dirt, of sand and stones, which it may have brought from hundreds of miles away; and that, as this ploughshare of dirty ice grubs onward, the nose of the plough is continually being broken off, and left underneath the mud; and that, when summer comes, and the ice melts, the mud falls back into the place where the ice had been, and covers up the gravel which was in the ice. So, what between the grubbing of the ice-plough into the mud, and the dirt which it leaves behind when it melts, the stones, and sand, and mud upon the shore are jumbled up into curious curved and twisted layers, exactly like those which Mr. Trimmer saw in certain gravel-pits. And when I first read about that, I said, "And exactly like what I have been seeing in every gravel-pit round here, and trying to guess how they could have been made by waves or currents of water, and yet never could make any guess which would do." But after that it was all explained to me; and I said, "Honour to the man who has let Madam How teach him what she has been trying to teach me for fifteen years, while I was too stupid to learn

it. Now I am certain, as certain as I can be of any earthly thing, that the whole of these Windsor Forest Flats were ages ago ploughed and harrowed over and over again, by ice-floes and icebergs drifting and stranding in a shallow sea."

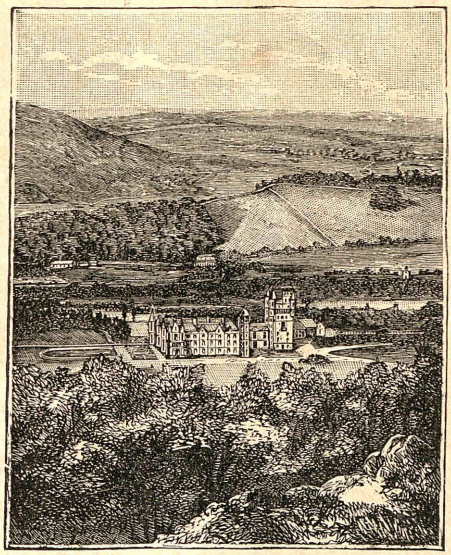
And if you say, my dear child, as some people will say, that it is like building a large house upon a single brick to be sure that there was an iceberg sea here, just because I see a few curlicues in the gravel and sand—then I must tell you that there are sometimes—not often, but sometimes—pages in Madam How's book in which one single letter tells you as much as a whole chapter; in which if you find one little fact, and know what it really means, it makes you certain that a thousand other great facts have happened. You may be astonished: but you cannot deny your own eyes, and your own common sense. You feel like Robinson Crusoe when, walking along the shore of his desert island, he saw for the first time the print of a man's foot in the sand. How it could have got there without a miracle he could not dream. But there it was. One footprint was as good as the footprints of a whole army would have been. A man had been there; and more men might come. And in fear of the savages—and if you have read Robinson Crusoe you know how just his fears were—he went home trembling, and loaded his muskets, and barricaded his cave, and passed sleepless nights watching for the savages who might come, and who came after all.

And so there are certain footprints in geology which there is no mistaking; and the prints of the ice-plough are among them.

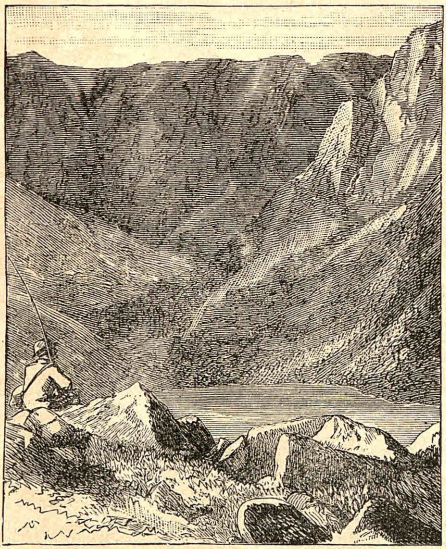
For instance:—When they were trenching the new plantation close to Wellington College station, the men turned up out of the ground a great many Sarsden stones; that is, pieces of hard sugary sand, such as Stonehenge is made of. And when I saw these I said, "I suspect these were brought here by icebergs:" but I was not sure, and waited. As the men dug on, they dug up a great many large flints, with bottle-green coats. "Now," I said, "I am sure. For I know where these flints must have come from." And for reasons which would be too long to tell you here, I said, "Some time or other, icebergs have been floating northward from the Hog's Back over Aldershot and Farnborough, and have been trying to get into the Vale of Thames by the slope at Wellington College station; and they have stranded, and dropped these flints." And I am so sure of that, that if I found myself out wrong after all I should be at my wit's end; for I should know that I was wrong about a hundred things besides.

Or again, if you ever go up Deeside in Scotland, towards Balmoral, and turn up Glen Muick, you will observe standing on your right hand, just above Birk Hall, three pretty rounded knolls, which they call the Coile Hills. You may easily know them by their being covered with beautiful green grass instead of heather. That is because they are made of serpentine or volcanic rock, which (as you have seen) often cuts into beautiful red and green marble; and which also carries a very rich soil because it is full of magnesia. If you go up those hills, you get a glorious

view—the mountains sweeping round you where you stand, up to the top of Lochnagar, with its bleak walls a thousand feet perpendicular, and gullies into which the sun never shines, and round to the dark fir forests of the Ballochbuie. That is the arc of the bow; and the cord of the bow is the silver Dee, more than a thousand feet below you; and in the centre of the cord, where the arrow would be fitted in, stands Balmoral, with its Castle, and its Gardens, and its Park, and pleasant cottages and homesteads all around. And when you have looked at the beautiful amphitheatre of forest at your feet, and looked too at the great mountains to the westward, and Benaun, and Benna-buird and Benna-muicdhui, with their bright patches of eternal snow, I should advise you to look at the rock on which you stand, and see what you see there. And you will see that on the side of the Coiles towards Lochnagar, and between the knolls of them, are scattered streams, as it were, of great round boulder stones —which are not serpentine, but granite from the top of



Lochnagar, five miles away. And you will see that the knolls of serpentine rock, or at least their backs and shoulders towards Lochnagar, are all smoothed and polished till they are as round as the backs of sheep; and then, if you understand what that means, you will say, as I said, "I am perfectly certain that this great basin between me and Lochnagar, which is now 3000 feet deep of empty air was once filled up with ice to the height of the hills on which I stand—about 1700 feet high—and that that ice ran over into Glen Muick, between these pretty knolls, and covered the ground where Birk Hall now stands."



And more:—When you see growing on those knolls of serpentine a few pretty little Alpine plants, which have no business down there so low, you will have a fair right to say, as I said, "The seeds of these plants were brought by the ice ages and ages since from off the mountain range of Lochnagar, and left here, nestling among the rocks, to found a fresh colony, far from their old mountain home."

If I could take you with me up to Scotland,—take you, for instance, along the Tay, up the pass of Dunkeld, or up Strathmore towards Aberdeen, or up the Dee towards Braemar,—I could show you signs, which cannot be mistaken, of the time when Scotland was, just like Spitzbergen or like Greenland now, covered in one vast sheet of snow and ice from year's end to year's end; when glaciers were ploughing out its valleys, icebergs were breaking off the icy cliffs and floating out to sea; when not a bird, perhaps, was to be seen save sea-fowl, not a plant upon the rocks but a few lichens, and Alpine saxifrages, and such like—desolation and cold and lifeless everywhere. That ice-time went on for ages and for ages; and yet it did not go on in vain. Through it Madam How was ploughing down the mountains of Scotland to make all those rich farms which stretch from the north side of the Frith of Forth into Sutherlandshire. I could show you everywhere the green banks and knolls of earth, which Scotch people call "kames" and "tomans"—perhaps brought down by ancient glaciers, or dropped by ancient icebergs—now so smooth and green through summer and through winter, among the wild heath and the rough peat-moss, that the old Scots fancied, and I dare say Scotch children fancy still, fairies dwelt inside. If you laid your ear against the mounds, you might hear the fairy music, sweet and faint, beneath the ground. If you watched the mound at night, you might see the fairies dancing the turf short and smooth, or riding out on fairy horses, with green silk clothes and jingling bells. But if you fell asleep

upon the mounds, the fairy queen came out and carried you for seven years into Fairyland, till you awoke again in the same place, to find all changed around you, and yourself grown thin and old.

These are all dreams and fancies—untrue, not because they are too strange and wonderful, but because they are not strange and wonderful enough: for more wonderful sure than any fairy tale it is, that Madam How should make a rich and pleasant land by the brute force of ice.

And were there any men and women in that old age of ice? That is a long story, and a dark one too; we will talk of it next time.

CHAPTER VI.

THE TRUE FAIRY TALE.

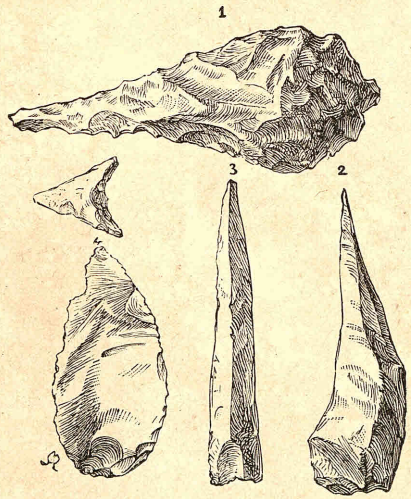
You asked if there were men in England when the country was covered with ice and snow. Look at this, and judge for yourself.

What is it? a piece of old mortar? Yes. But mortar which was made by Madam How herself, and not by any man. And what is in it? A piece of flint and some bits of bone. But look at that piece of flint. It is narrow, thin, sharp-edged: quite different in shape from any bit of flint which you or I ever saw among the hundreds of thousands of broken bits of gravel which we tread on here all day long; and here are some more bits like it, which

came from the same place—all very much the same shape, like rough knives or razor blades; and here is a core of flint, the remaining part of a large flint, from which, as you may see, blades like those have been split off. Those flakes of flint, my child, were split off by men; even your young eyes ought to be able to see that. And here are other pieces of flint—pear-shaped, but flattened, sharp at one end and left rounded at the other, which look like spear-heads, or arrow-heads, or pointed axes, or pointed hatchets—even your young eyes can see that these must have been made by man. And they are, I may tell you, just like the tools of flint, or of obsidian, which is volcanic glass, and which savages use still where they have not iron. There is a great obsidian knife, you know, in a house in this very parish, which came from Mexico; and your eye can tell you how like it is to these flint ones. But these flint tools are very old. If you crack a fresh flint, you will see that its surface is gray, and somewhat rough, so that it sticks to your tongue. These tools are smooth and shiny: and the edges of some of them are a little rubbed from being washed about in gravel; while the iron in the gravel has stained them reddish, which it would take hundreds and perhaps thousands of years to



do. There are little rough markings, too, upon some of them, which, if you look at through a magnifying glass, are iron, crystallised into the shape of little seaweeds and trees—another sign that they are very very old. And what is more, near the place where these flint flakes come from there are no flints in the ground for hundreds of miles; so that men must have brought them there ages and ages since. And to tell you plainly, these are scrapers, such as the Esquimaux in North America still use to scrape the flesh off bones, and to clean the insides of skins.



But did these people (savages perhaps) live when the country was icy cold? Look at the bits of bone. They have been split, you see, lengthways; that, I suppose, was to suck the marrow out of them, as savages do still. But to what animal do the bones belong? That is the question, and one which I could not have answered you, if wiser men than I am could not have told me.

They are the bones of the reindeer—such reindeer as are now found only in Lapland and the half-frozen parts of North America, close to the Arctic circle, where they

have six months day and six months night. You have read of Laplanders, and how they drive reindeer in their sledges, and live upon reindeer milk; and you have read of Esquimaux, who hunt seals and walrus, and live in houses of ice, lighted by lamps fed with the same blubber on which they feed themselves. I need not tell you about them.

Now comes the question—Whence did these flints and bones come? They came out of a cave in Dordogne, in the heart of sunny France,—far away to the south, where it is hotter every summer than it was here even this summer, from among woods of box and evergreen oak, and vineyards of rich red wine. In that warm land once lived savages, who hunted amid ice and snow the reindeer, and with the reindeer animals stranger still.

And now I will tell you a fairy tale: to make you understand it at all I must put it in the shape of a tale. I call it a fairy tale, because it is so strange; indeed I think I ought to call it the fairy tale of all fairy tales, for by the time we get to the end of it I think it will explain to you how our forefathers got to believe in fairies, and trolls, and elves, and scratlings, and all strange little people who were said to haunt the mountains and the caves.

Well, once upon a time, so long ago that no man can tell when, the land was so much higher, that between England and Ireland, and, what is more, between England and Norway, was firm dry land. The country then must have looked—at least we know it looked so in Norfolk—very like what our moors look like here. There were

forests of Scotch fir, and of spruce too, which is not wild in England now, though you may see plenty in every plantation. There were oaks and alders, yews and sloes, just as there are in our woods now. There was buck-bean in the bogs, as there is in Larmer's and Heath pond; and white and yellow water-lilies, horn-wort, and pond-weeds, just as there are now in our ponds. There were wild horses, wild deer, and wild oxen, those last of an enormous size. There were little yellow roe-deer, which will not surprise you, for there are hundreds and thousands in Scotland to this day; and, as you know, they will thrive well enough in our woods now. There were beavers too: but that must not surprise you, for there were beavers in South Wales long after the Norman Conquest, and there are beavers still in the mountain glens of the south-east of France. There were honest little water-rats too, who I dare say sat up on their hind legs like monkeys, nibbling the water-lily pods, thousands of years ago, as they do in our ponds now. Well, so far we have come to nothing strange: but now begins the fairy tale. Mixed with all these animals, there wandered about great herds of elephants and rhinoceroses; not smooth-skinned, mind, but covered with hair and wool, like those which are still found sticking out of the everlasting ice cliffs, at the mouth of the Lena and other Siberian rivers, with the flesh, and skin, and hair so fresh upon them, that the wild wolves tear it off, and snarl and growl over the carcase of monsters who were frozen up thousands of years ago. And with them, stranger still, were great hippopotamuses; who

came, perhaps, northward in summer time along the sea-shore and down the rivers, having spread hither all the way from Africa ; for in those days, you must understand, Sicily, and Italy, and Malta—look at your map—were joined to the coast of Africa : and so it may be was the rock of Gibraltar itself ; and over the sea where the Straits of Gibraltar now flow was firm dry land, over which hyænas and leopards, elephants and rhinoceroses ranged into Spain ; for their bones are found at this day in the Gibraltar caves. And this is the first chapter of my fairy tale.

Now while all this was going on, and perhaps before this began, the climate was getting colder year by year—we do not know how ; and, what is more, the land was sinking ; and it sank so deep that at last nothing was left out of the water but the tops of the mountains in Ireland, and Scotland, and Wales. It sank so deep that it left beds of shell belonging to the Arctic regions nearly two thousand feet high upon the mountain side. And so

> "It grew wondrous cold,
> And ice mast-high came floating by,
> As green as emerald."

But there were no masts then to measure the icebergs by, nor any ship nor human being there. All we know is that the icebergs brought with them vast quantities of mud, which sank to the bottom, and covered up that pleasant old forest-land in what is called boulder-clay ; clay full of bits of broken rock, and of blocks of stone so enormous, that nothing but an iceberg could have carried

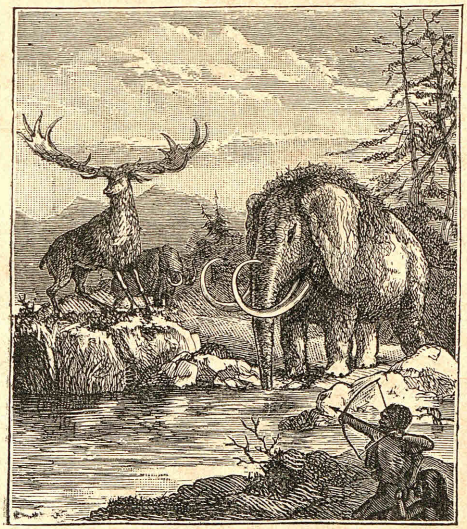
ISLAM HIGH SCHOOL

them. So all the animals were drowned or driven away, and nothing was left alive perhaps, except a few little hardy plants which clung about cracks and gullies in the mountain tops; and whose descendants live there still. That was a dreadful time; the worst, perhaps, of all the age of Ice; and so ends the second chapter of my fairy tale.

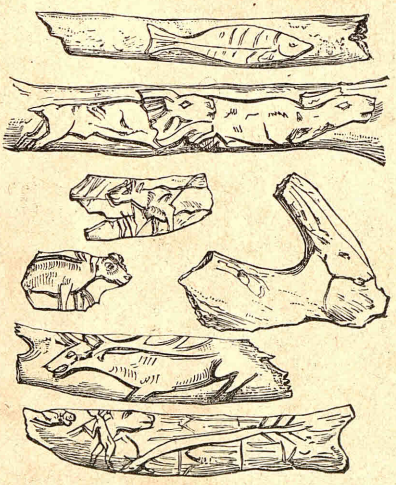
Now for my third chapter. "When things come to the worst," says the proverb, "they commonly mend;" and so did this poor frozen and drowned land of England and France and Germany, though it mended very slowly. The land began to rise out of the sea once more, and rose till it was perhaps as high as it had been at first, and hundreds of feet higher than it is now: but still it was very cold, covered, in Scotland at least, with one great sea of ice and glaciers descending down into the sea, as I have said when I spoke to you about the Ice-Plough. But as the land rose, and grew warmer too, while it rose, the wild beasts who had been driven out by the great drowning came gradually back again. As the bottom of the old icy sea turned into dry land, and got covered with grasses, and weeds, and shrubs once more, elephants, rhinoceroses, hippopotamuses, oxen—sometimes the same species, sometimes slightly different ones—returned to France, and then to England (for there was no British Channel then to stop them); and with them came other strange animals, especially the great Irish elk, as he is called, as large as the largest horse, with horns sometimes ten feet across. A pair of those horns with the skull you

have seen yourself, and can judge what a noble animal he must have been. Enormous bears came too, and hyænas, and a tiger or lion (I cannot say which), as large as the largest Bengal tiger now to be seen in India.

And in those days—we cannot, of course, exactly say when—there came—first I suppose into the south and east of France, and then gradually onward into England and Scotland and Ireland — creatures without any hair to keep them warm, or scales to defend them, without horns or tusks to fight with, or teeth to worry and bite ; the weakest you would have thought of the beasts, and yet stronger than all the animals, because they were Men, with reasonable souls. Whence they came we cannot tell, nor why ; perhaps from mere hunting after food, and love of wandering and being independent and alone. Perhaps they came into that icy land for fear of stronger and cleverer people than themselves ; for we have no proof, my child, none at all, that they were the first men that trod this earth. But be that as it may, they came ; and so cunning were these

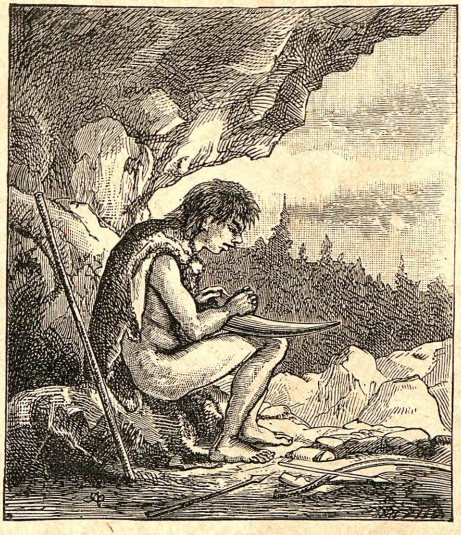


savage men, and so brave likewise, though they had no iron among them; only flint and sharpened bones, yet they contrived to kill and eat the mammoths, and the giant oxen, and the wild horses, and the reindeer, and to hold their own against the hyænas, and tigers, and bears, simply because they had wits, and the dumb animals had none. And that is the strangest part to me of all my fairy tale. For what a man's wits are, and why he has them, and therefore is able to invent and to improve, while even the cleverest ape has none, and therefore can invent and improve nothing, and therefore cannot better himself, but must remain from father to son, and father to son again, a stupid, pitiful, ridiculous ape, while men can go on civilising themselves, and growing richer and more comfortable, wiser and happier, year by year—how that comes to pass, I say, is to me a wonder and a prodigy and a miracle, stranger than all the most fantastic marvels you ever read in fairy tales.



You may find the flint weapons which these old savages used buried in many a gravel-pit up and down France and the south of England; but you will find none here, for the

gravel here was made (I am told) at the beginning of the ice-time, before the north of England sunk into the sea, and therefore long, long before men came into this land. But most of their remains are found in caves which water has eaten out of the limestone rocks, like that famous cave of Kent's Hole at Torquay. In it, and in many another cave, lie the bones of animals which the savages ate, and cracked to get the marrow out of them, mixed up with their flint-weapons and bone harpoons, and sometimes with burnt ashes and with round stones, used perhaps to heat water, as savages do now, all baked together into a hard paste or breccia by the lime. These are in the water, and are often covered with a floor of stalagmite which has dripped from the roof above and hardened into stone. Of these caves and their beautiful wonders I must tell you another day. We must keep now to our fairy tale. But in these caves, no doubt, the savages lived ; for not only have weapons been found in them, but actually drawings scratched (I suppose with flint) on bone



or mammoth ivory—drawings of elk, and bull, and horse, and ibex—and one, which was found in France, of the great mammoth himself, the woolly elephant, with a mane on his shoulders like a lion's mane. So you see that one of the earliest fancies of this strange creature, called man, was to draw, as you and your schoolfellows love to draw, and copy what you see, you know not why. Remember that. You like to draw; but why you like it neither you nor any man can tell. It is one of the mysteries of human nature; and that poor savage clothed in skins, dirty it may be, and more ignorant than you (happily) can conceive, when he sat scratching on ivory in the cave the figures of the animals he hunted, was proving thereby that he had the same wonderful and mysterious human nature as you—that he was the kinsman of every painter and sculptor who ever felt it a delight and duty to copy the beautiful works of God.

Sometimes again, especially in Denmark, these savages have left behind upon the shore mounds of dirt, which are called there "kjökken-möddings"—"kitchen-middens" as they would say in Scotland, "kitchen-dirtheaps" as we should say here down South—and a very good name for them that is; for they are made up of the shells of oysters, cockles, mussels, and periwinkles, and other shore-shells besides, on which those poor creatures fed; and mingled with them are broken bones of beasts, and fishes, and birds, and flint knives, and axes, and sling stones; and here and there hearths, on which they have cooked their meals in some rough way. And that is nearly

all we know about them ; but this we know from the size of certain of the shells, and from other reasons which you would not understand, that these mounds were made an enormous time ago, when the water of the Baltic Sea was far more salt than it is now.

But what has all this to do with my fairy tale ? This :—

Suppose that these people, after all, had been fairies ?

I am in earnest. Of course, I do not mean that these folk could make themselves invisible, or that they had any supernatural powers—any more, at least, than you and I have—or that they were anything but savages ; but this I do think, that out of old stories of these savages grew up the stories of fairies, elves, and trolls, and scratlings, and cluricaunes, and ogres, of which you have read so many.

When stronger and bolder people, like the Irish, and the Highlanders of Scotland, and the Gauls of France, came northward with their bronze and iron weapons ; and still more, when our own forefathers, the Germans and the Norsemen, came, these poor little savages, with their flint arrows and axes, were no match for them, and had to run away northward, or to be all killed out ; for the people were fierce and cruel in those old times, and looked on every one of a different race from themselves as a natural enemy. They had not learnt—alas ! too many have not learned it yet—that all men are brothers. So these poor savages were driven out, till none were left, save the little Lapps up in the north of Norway, where they live to this day.

But stories of them, and of how they dwelt in caves,

and had strange customs, and used poisoned weapons, and how the elf-bolts (as their flint arrow-heads are still called) belonged to them, lingered on, and were told round the fire on winter nights and added to, and played with half in fun, till a hundred legends sprang up about them, which used once to be believed by grown-up folk, but which now only amuse children. And because some of these savages were very short, as the Lapps and Esquimaux are now, the story grew of their being so small that they could make themselves invisible; and because others of them were (but probably only a few) very tall and terrible, the story grew that there were giants in that old world, like that famous Gogmagog, whom Brutus and his Britons met (so old fables tell), when they landed first at Plymouth, and fought him, and threw him over the cliff. Ogres, too —of whom you read in fairy tales—I am afraid that there were such people once, even here in Europe; strong and terrible savages, who ate human beings. Of course, the legends and tales about them became ridiculous and exaggerated as they passed from mouth to mouth over the Christmas fire, in the days when no one could read or write. But that the tales began by being true any one may well believe who knows how many cannibal savages there are in the world even now. I think that, if ever there was an ogre in the world, he must have been very like a certain person who lived, or was buried, in a cave in the Neanderthal, between Elberfeld and Dusseldorf, on the Lower Rhine. The skull and bones which were found there (and which are very famous now among scientific men)

belonged to a personage whom I should have been very sorry to meet, and still more to let you meet, in the wild forest; to a savage of enormous strength of limb (and I suppose of jaw) likewise

"like an ape,
With forehead villainous low;"

who could have eaten you if he would; and (I fear) also would have eaten you if he could. Such savages may have lingered (I believe, from the old ballads and romances, that they did linger) for a long time in lonely forests and mountain caves, till they were all killed out by warriors who wore mail-armour and carried steel sword, and battle-axe, and lance.

But had these people any religion?

My dear child, we cannot know, and need not know. These poor folks were, I doubt not, happy enough in their way; and we are bound to believe (for we have no proof against it), that most of them were honest and harmless enough likewise. Of course, ogres and cannibals, and cruel and brutal persons (if there were any among them), deserved punishment—and punishment, I do not doubt, they got. But, of course, again, none of them knew things which you know; but for that very reason they were not bound to do many things which you are bound to do. For those to whom little is given, of them shall little be required. What their religion was like, or whether they had any religion at all, we cannot tell. But this we can tell, that known unto God are all His works from the creation of the world; and that His mercy is over all His

works, and He hateth nothing that He has made. These men and women, whatever they were, were God's work; and therefore we may comfort ourselves with the certainty that, whether or not they knew God, God knew them.

And so ends my fairy tale.

CHAPTER VII.

THE CHALK-CARTS.

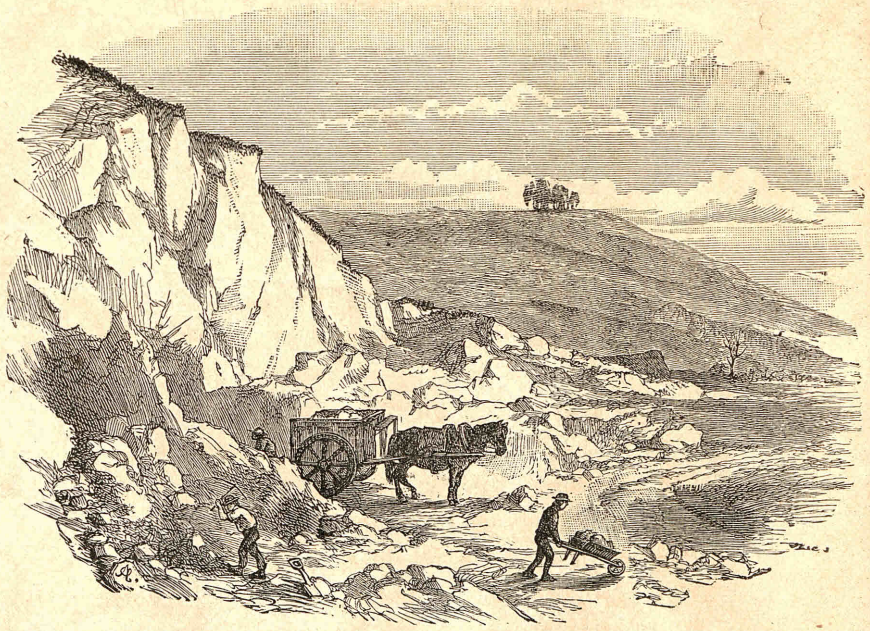
WHAT do you want to know about next? More about the caves in which the old savages lived,—how they were made, and how the curious things inside them got there, and so forth.

Well, we will talk about that in good time: but now—What is that coming down the hill?

Oh, only some chalk-carts.

Only some chalk-carts? It seems to me that these chalk-carts are the very things we want; that if we follow them far enough—I do not mean with our feet along the public road, but with our thoughts along a road which, I am sorry to say, the public do not yet know much about—we shall come to a cave, and understand how a cave is made. Meanwhile, do not be in a hurry to say, "Only a chalk-cart," or only a mouse, or only a dead leaf. Chalk-carts, like mice, and dead leaves, and most other matters in the universe are very curious and odd things in the eyes

of wise and reasonable people. Whenever I hear young men saying "only" this and "only" that, I begin to suspect them of belonging, not to the noble army of sages —much less to the most noble army of martyrs,—but to



the ignoble army of noodles, who think nothing interesting or important but dinners, and balls, and races, and back-biting their neighbours; and I should be sorry to see you enlisting in that regiment when you grow up. But think —are not chalk-carts very odd and curious things? I think they are. To my mind, it is a curious question how

men ever thought of inventing wheels; and, again, when they first thought of it. It is a curious question too, how men ever found out that they could make horses work for them, and so began to tame them, instead of eating them, and a curious question (which I think we shall never get answered) when the first horse-tamer lived, and in what country. And a very curious, and, to me, a beautiful sight it is, to see those two noble horses obeying that little boy, whom they could kill with a single kick.

But, beside all this, there is a question which ought to be a curious one to you (for I suspect you cannot answer it)—Why does the farmer take the trouble to send his cart and horses eight miles and more, to draw in chalk from Odiham chalk-pit?

Oh, he is going to put it on the land, of course. They are chalking the bit at the top of the next field, where the copse was grubbed.

But what good will he do by putting chalk on it? Chalk is not rich and fertile, like manure, it is altogether poor, barren stuff: you know that, or ought to know it. Recollect the chalk cuttings and banks on the railways between Basingstoke and Winchester—how utterly barren they are. Though they have been open these thirty years, not a blade of grass, hardly a bit of moss, has grown on them, or will grow, perhaps, for centuries.

Come, let us find out something about the chalk before we talk about the caves. The chalk is here, and the caves are not; and "Learn from the thing that lies nearest

you " is as good a rule as " Do the duty which lies nearest you." Let us come into the grubbed bit, and ask the farmer—there he is in his gig.

Well, old friend, and how are you ? Here is a little boy who wants to know why you are putting chalk on your field.

Does he then ? If he ever tries to farm round here, he will have to learn for his first rule—No chalk, no wheat.

But why ?

Why, is more than I can tell, young squire. But if you want to see how it comes about, look here at this freshly-grubbed land—how sour it is. You can see that by the colour of it—some black, some red, some green, some yellow, all full of sour iron, which will let nothing grow. After the chalk has been on it a year or two, those colours will have all gone out of it ; and it will turn to a nice wholesome brown, like the rest of the field ; and then you will know that the land is sweet, and fit for any crop. Now do you mind what I tell you, and then I'll tell you something more. We put on the chalk because, beside sweetening the land, it will hold water. You see, the land about here, though it is often very wet from springs, is sandy and hungry ; and when we drain the bottom water out of it, the top water (that is, the rain) is apt to run through it too fast : and then it dries and burns up ; and we get no plant of wheat, nor of turnips either. So we put on chalk to hold water, and keep the ground moist.

But how can these lumps of chalk hold water? They are not made like cups.

No: but they are made like sponges, which serves our turn better still. Just take up that lump, young squire, and you'll see water enough in it, or rather looking out of it, and staring you in the face.

Why! one side of the lump is all over thick ice.

So it is. All that water was inside the chalk last night, till it froze. And then it came squeezing out of the holes in the chalk in strings, as you may see it if you break the ice across. Now you may judge for yourself how much water a load of chalk will hold, even on a dry summer's day. And now, if you'll excuse me, sir, I must be off to market.

Was it all true that the farmer said?

Quite true, I believe. He is not a scientific man—that is, he does not know the chemical causes of all these things; but his knowledge is sound and useful, because it comes from long experience. He and his forefathers, perhaps for a thousand years and more, have been farming this country, reading Madam How's books with very keen eyes, experimenting and watching, very carefully and rationally; making mistakes often, and failing and losing their crops and their money; but learning from their mistakes, till their empiric knowledge, as it is called, helps them to grow sometimes quite as good crops as if they had learned agricultural chemistry.

What he meant by the chalk sweetening the land you would not understand yet, and I can hardly tell you; for

chemists are not yet agreed how it happens. But he was right; and right, too, what he told you about the water inside the chalk, which is more important to us just now; for, if we follow it out, we shall surely come to a cave at last.

So now for the water in the chalk. You can see now why the chalk-downs at Winchester are always green, even in the hottest summer: because Madam How has put under them her great chalk sponge. The winter rains soak into it; and the summer heat draws that rain out of it again as invisible steam, coming up from below, to keep the roots of the turf cool and moist under the blazing sun.

You love that short turf well. You love to run and race over the Downs with your butterfly-net and hunt "chalk-hill blues," and "marbled whites," and "spotted burnets," till you are hot and tired; and then to sit down and look at the quiet little old city below, with the long cathedral roof, and the tower of St. Cross, and the gray old walls and buildings shrouded by noble trees, all embosomed among the soft rounded lines of the chalk-hills; and then you begin to feel very thirsty, and cry, "Oh, if there were but springs and brooks in the Downs, as there are at home!" But all the hollows are as dry as the hill tops. There is not a brook, or the mark of a watercourse, in one of them. You are like the Ancient Mariner in the poem, with

> "Water, water, every where,
> Nor any drop to drink."

To get that you must go down and down, hundreds of feet, to the green meadows through which silver Itchen glides towards the sea. There you stand upon the bridge, and watch the trout in water so crystal-clear that you see every weed and pebble as if you looked through air. If ever there was pure water, you think, that is pure. Is it so? Drink some. Wash your hands in it and try. You feel that the water is rough, hard (as they call it), quite different from the water at home, which feels as soft as velvet. What makes it so hard?

Because it is full of invisible chalk. In every gallon of that water there are, perhaps, fifteen grains of solid chalk, which was once inside the heart of the hills above. Day and night, year after year, the chalk goes down to the sea; and if there were such creatures as water-fairies—if it were true, as the old Greeks and Romans thought, that rivers were living things, with a Nymph who dwelt in each of them, and was its goddess or its queen—then, if your ears were opened to hear her, the Nymph of Itchen might say to you—

So child, you think that I do nothing but, as your sister says when she sings Mr Tennyson's beautiful song,

> "I chatter over stony ways,
> In little sharps and trebles,
> I bubble into eddying bays,
> I babble on the pebbles."

Yes. I do that: and I love, as the Nymphs loved of old, men who have eyes to see my beauty, and ears

to discern my song and to fit their own song to it, and tell how

"'I wind about, and in and out,
With here a blossom sailing,
And here and there a lusty trout,
And here and there a grayling,

"'And here and there a foamy flake
Upon me, as I travel
With many a silvery waterbreak
Above the golden gravel,

"'And draw them all along, and flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.'"

Yes. That is all true: but if that were all, I should not be let to flow on for ever, in a world where Lady Why rules, and Madam How obeys. I only exist (like everything else, from the sun in heaven to the gnat which dances in his beam) on condition of working, whether we wish it or not, whether we know it or not. I am not an idle stream, only fit to chatter to those who bathe or fish in my waters, or even to give poets beautiful fancies about me. You little guess the work I do. For I am one of the daughters of Madam How, and, like her, work night and day, we know not why, though Lady Why must know. So day by day, and night by night, while you are sleeping (for I never sleep), I carry, delicate and soft as I am, a burden which giants could not bear: and yet I am never

tired. Every drop of rain which the south-west wind brings from the West Indian seas gives me fresh life and strength to bear my burden; and it has need to do so; for every drop of rain lays a fresh burden on me. Every root and weed which grows in every field; every dead leaf which falls in the highwoods of many a parish,—ay, every atom of manure which the farmers put on the land—foul enough then, but pure enough before it touches me—each of these, giving off a tiny atom of what men call carbonic acid, melts a tiny grain of chalk, and helps to send it down through the solid hill by one of the million pores and veins which at once feed and burden my springs. Ages on ages I have worked on thus, carrying the chalk into the sea. And ages on ages, it may be, I shall work on yet; till I have done my work at last, and levelled the high downs into a flat sea-shore, with beds of flint gravel rattling in the shallow waves.

She might tell you that; and when she had told you, you would surely think of the clumsy chalk-cart rumbling down the hill, and then of the graceful stream, bearing silently its invisible load of chalk; and see how much more delicate and beautiful, as well as vast and wonderful, Madam How's work is than that of man.

But if you asked the nymph why she worked on for ever, she could not tell you. For like the Nymphs of old, and the Hamadryads who lived in trees, and Undine, and the little Sea-maiden, she would have no soul; no reason; no power to say why.

It is for you, who are a reasonable being, to guess why:

or at least listen to me if I guess for you, and say, perhaps —I can only say perhaps—that chalk may be going to make layers of rich marl in the sea between England and France ; and those marl-beds may be upheaved and grow into dry land, and be ploughed, and sowed, and reaped by a wiser race of men, in a better-ordered world than this : or the chalk may have even a nobler destiny before it. That may happen to it, which has happened already to many a grain of lime. It may be carried thousands of miles away to help in building up a coral reef (what that is I must tell you afterwards). That coral reef may harden into limestone beds. Those beds may be covered up, pressed, and, it may be, heated, till they crystallise into white marble : and out of it fairer statues be carved, and grander temples built, than the world has ever yet seen.

And if that is not the reason why the chalk is being sent into the sea, then there is another reason, and probably a far better one. For, as I told you at first, Lady Why's intentions are far wiser and better than our fancies ; and she—like Him whom she obeys—is able to do exceeding abundantly, beyond all that we can ask or think.

But you will say now that we have followed the chalk-cart a long way, without coming to the cave.

You are wrong. We have come to the very mouth of the cave. All we have to do is to say—not " Open Sesame," like Ali Baba in the tale of the Forty Thieves—but some word or two which Madam Why will teach us, and forthwith a hill will open, and we shall walk in, and behold

rivers and cascades underground, stalactite pillars and stalagmite statues, and all the wonders of the grottoes of Adelsberg, Antiparos, or Kentucky.

Am I joking? Yes, and yet no; for you know that when I joke I am usually most in earnest. At least, I am now.



But there are no caves in chalk?

No, not that I ever heard of. There are though, in limestone, which is only a harder kind of chalk. Madam How could turn this chalk into hard limestone, I believe even now; and in more ways than one: but in ways which would not be very comfortable or profitable for us Southern folk who live on it. I am afraid that—what between squeezing and heating—she would flatten us all out into phosphatic fossils, about an inch thick; and turn Winchester city into a "breccia" which would puzzle geologists a hundred thousand years hence. So we will hope that she will leave our chalk downs for the Itchen to wash gently away, while we talk about caves, and how Madam

How scoops them out by water underground, just in the same way, only more roughly, as she melts the chalk.

Suppose, then, that these hills, instead of being soft, spongy chalk, were all hard limestone marble, like that of which the font in the church is made. Then the rain-water, instead of sinking through the chalk as now, would run over the ground down-hill, and if it came to a crack (a fault, as it is called) it would run down between the rock; and as it ran it would eat that hole wider and wider year by year, and make a swallow-hole—such as you may see in plenty if you ever go up Whernside, or any of the high hills in Yorkshire—unfathomable pits in the green turf, in which you may hear the water tinkling and trickling far far underground.

But how is the swallow-hole sure to end in a cave?

Because it cannot help making a cave for itself if it has time.

Think: and you will see that it must be so. For that water must run somewhere; and so it eats its way out between the beds of the rock, making underground galleries, and at last caves and lofty halls. For it always eats, remember, at the bottom of its channel, leaving the roof alone. So it eats, and eats, more in some places and less in others, according as the stone is harder or softer, and according to the different directions of the rock-beds (what we call their dip and strike); till at last it makes one of those wonderful caverns about which you are so fond of reading,—such a cave as there actually is in the rocks of the mountain of Whernside, fed by the swallow-holes

around the mountain-top ; a cave hundreds of yards long with halls, and lakes, and waterfalls, and curtains and festoons of stalactite which have dripped from the roof, and pillars of stalagmite which have been built up on the floor below. These stalactites (those tell me who have seen them) are among the most beautiful of all Madam How's work ; sometimes like branches of roses or of grapes ; sometimes like statues ; sometimes like delicate curtains, and I know not what other beautiful shapes. I have never seen them, I am sorry to say, and therefore I cannot describe them. But they are all made in the same way ; just in the same way as those little straight stalactites which you may have seen hanging, like icicles, in vaulted cellars, or under the arches of a bridge. The water melts more lime than it can carry, and drops some of it again, making fresh limestone grain by grain as it drips from the roof above ; and fresh limestone again where it splashes on the floor below : till, if it dripped long enough the stalactite hanging from above would meet the stalagmite rising from below, and join in one straight round white graceful shaft, which would seem (but only seem) to support the roof of the cave. And out of that cave—though not always out of the mouth of it—will run a stream of water, which seems to you clear as crystal, though it is actually, like the Itchen at Winchester, full of lime.

Now if you can imagine for yourself (though I suppose a little boy cannot) the amount of lime which one of these subterranean rivers would carry away, gnawing underground centuries after centuries, day and night, summer

and winter, then you will not be surprised at the enormous size of caverns which may be seen in different parts of the world—but always, I believe, in limestone rock. You would not be surprised (though you would admire them) at the caverns of Adelsberg, in Carniola (in the south of Austria, near the top of the Adriatic), which runs, I believe, for miles in length ; and in the lakes of which, in darkness from its birth until its death, lives that strange beast, the Proteus, a sort of long newt which never comes to perfection —I suppose for want of the genial sunshine which makes all things grow. But he is blind ; and more, he keeps all his life the same feathery gills which newts have when they are babies, and which we have so often looked at through the microscope, to see the blood-globules run round and round inside.

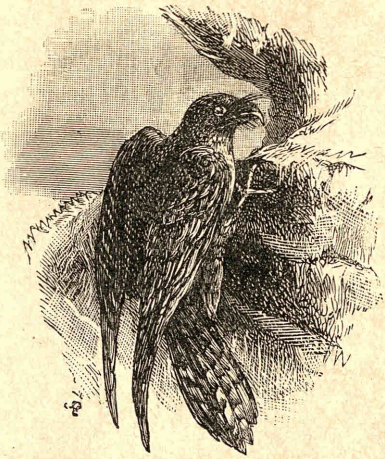
Neither would you be surprised (if you recollect that Madam How is a very old lady indeed, and that some of her work is very old likewise) at that Mammoth Cave in Kentucky, the largest cave in the known world, through which you may walk nearly ten miles on end, and in which a hundred miles of gallery have been explored already, and yet no end found to the cave. In it (the guides will tell you) there are " 226 avenues, 47 domes, 8 cataracts, 23 pits, and several rivers ; " and if that fact is not very interesting to you (as it certainly is not to me) I will tell you something which ought to interest you : that this cave is so immensely old that various kinds of little animals who have settled themselves in the outer parts of it, have had time to change their shape, and to become quite

blind; so that blind fathers and mothers have blind children, generation after generation.

There are blind rats there, with large shining eyes which cannot see—blind landcrabs, who have the foot-stalks of their eyes (you may see them in any crab) still left; but the eyes which should be on the top of them are gone. There are blind fish, too, in the cave, and blind insects; for, if they have no use for their eyes in the dark, why should Madam How take the trouble to finish them off?

One more cave I must tell you of, to show you how old some caves must be, and then I must stop; and that is the cave of Caripé, in Venezuela, which is the most northerly part of South America. There, in the face of a limestone cliff, crested with enormous flowering trees, and festooned with those lovely creepers of which you have seen a few small ones in hothouses, there opens an arch as big as the west front of Winchester Cathedral, and runs straight in like a cathedral nave for more than 1400 feet. Out of it runs a stream; and along the banks of that stream, as far as the sunlight strikes in, grow wild bananas, and palms, and lords and ladies (as you call them), which are not, like ours, one foot, but many feet high. Beyond that the cave goes on, with subterranean streams, cascades, and halls, no man yet knows how far. A friend of mine last year went in further, I believe, than any one yet has gone; but, instead of taking Indian torches made of Spanish wax, such as a brave bishop of those parts used once when he went in further than any one before him, he took with him some of the beautiful magnesium light which you have

seen often here at home. And in one place, when he lighted up the magnesium, he found himself in a hall full 300 feet high—higher far, that is, than the dome of St. Paul's—and a very solemn thought it was to him, he said, that he had seen what no other human being ever had seen; and that no ray of light had ever struck on that stupendous roof in all the ages since the making of the world. But if he found out something which he did not expect, he was disappointed in something which he did expect. For the Indians warned him of a hole in the floor which (they told him) was an unfathomable abyss. And lo and behold, the said abyss was just about eight feet deep. But it is no wonder that the poor Indians with their little smoky torches should make such mistakes; no wonder, too, that they should be afraid to enter far into those gloomy vaults; that they should believe that the souls of their ancestors live in that dark cave; and that they should say that when they die they will go to the Guacharos, as they call the birds that fly with doleful screams out of the cave to feed at night, and in again at daylight, to roost and sleep.



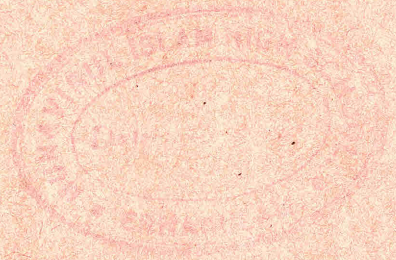
Now, it is these very Guacharo birds which are to me

the most wonderful part of the story. The Indians kill and eat them for their fat, although they believe they have to do with evil spirits. But scientific men who have studied these birds will tell you that they are more wonderful than if all the Indians' fancies about them were true. They are great birds, more than three feet across the wings, somewhat like owls, somewhat like cuckoos, somewhat like goatsuckers; but, on the whole, unlike anything in the world but themselves; and instead of feeding on moths or mice, they feed upon hard dry fruits, which they pick off the trees after the set of sun. And wise men will tell you, that in making such a bird as that, and giving it that peculiar way of life, and settling it in that cavern, and a few more caverns in that part of the world, and therefore in making the caverns ready for them to live in, Madam How must have taken ages and ages, more than you can imagine or count.

But that is among the harder lessons which come in the latter part of Madam How's book. Children need not learn them yet; and they can never learn them, unless they master her alphabet, and her short and easy lessons for beginners, some of which I am trying to teach you now.

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