VOLCANOES AND EARTHQUAKES.

The London *Saturday Review* contains the following interesting article, by way of a review of a recent French work on Volcanoes and Earthquakes:—

Nature has of late been calling attention, in her most emphatic accents, to the persistence and the intensity of her subterranean fires. What had come to be regarded as the exaggerations, if not the mythical inventions, of an age when science was yet unborn, have been forced upon us with a reality, and even a degree of dread, to which the most advanced science of our day has to lend an ear, half of curiosity, half of bewilderment. Those who are for ever agape for novelties and marvels, whether on the part of nature or of mankind, may find daily stimulants to sensation in so many villages overrun by the lava of Vesuvius, or so many scores of thousands swallowed up alive by the rending soil of Peru. Now we may expect the prophecy-monger to have it all his own way. What with earthquakes telegraphed every morning in divers places, and the palpable shaking of the stars of heaven witnessed to us in the reports of the November meteors, we ought surely to see Dr. Cumming bestir himself, if he would not have some junior aspirant to prophetic honors finally fix for him the date of the coming of the end. Meanwhile, people of less imagination, or less impatient for the drawing of the veil of the future world, will give studious and careful heed to the grand, and in many respects to the mysterious, phenomena which are just now manifest in nature. Numbers will be interested in the causes which science is prepared to assign for these unusually stupendous displays of physical force. Falling in opportunely with this state of interest and expectancy in the public mind, the little work which Mrs. Norman Lockyer has just given us has a claim to favorable consideration. "Volcans et Tremblements de Terre," by MM. Zurcher and Margollé, forms one volume of the well-chosen and agreeably-written series, the "Bibliothèque des Merveilles," whereby Messrs. Hachette are wont to cater with judgment and success for the growing appetite of the public for a knowledge of nature's more striking phenomena. The clear and graphic illustrations in wood, by M. Riou, have been employed in the embellishment of the English version. As a popular summary of the more prominent facts and theories connected with this sublime branch of terrestrial physics, we cannot readily point to a publication which embodies more systematically or expresses more clearly what readers beyond the pale of special or technical culture are likely to be desirous of knowing.

Without pretending to the depth or precision of a scientific treatise in the stricter sense, this little manual comprises a rapid historical survey of the principal recorded earthquakes and volcanic eruptions. The compilers have not indeed carried back their historical ken to the remote and often seemingly fabulous range of the Indian or Chinese chronicles. They have contented themselves with the nearer and safer ground of Greek and Roman antiquity. The frontispiece forms a vivid and speaking accompaniment to the well-known words in which the younger Pliny depicts the most memorable of all catastrophes of this kind. The list of eruptions from that fixed date is carried down almost to the margin of the striking series of outbreaks which just now keep scientific expectation on tenter-hooks. Upwards of a dozen eruptions of what may be termed the first class can be thus enumerated. Since that of A. D. 79, the most remarkable epochs were those of 204, 479, 512, 685, 993, 1036, 1136. After the violent one of 1136, Vesuvius remained inactive for nearly 500 years. At the opening of the seventeenth century the summit had the form of a large basin, which, according to the testimony of travellers, was covered with old oaks, chestnuts, and maple trees. In December, 1631, the volcano opened anew below the Atrio del Cavallo, the great depression which separates the crater from the Somme. A great portion of the mountain fell in, and the stream of lava, sweeping away houses and villages, ran into the sea near Portici. In 1685 and 1737 the cone underwent repeated changes of form. In 1797 the river of lava described by Sir W. Hamilton, 1500 feet wide and 14 feet deep, flowed three miles and a half, and extended into the sea 600 feet! Humboldt in 1822 has described the tremendous falling in of the cone, which rose to a height of 218 yards above the floor of the crater, when for days the air for miles round was darkened by clouds of ashes and *lapilli*, and people walked about with lanterns as at Quito during the eruptions of Pichincha. In 1850 large blocks of granite were borne down the mountain side by the torrent of lava. Not having the original at hand, we are at a loss whether to charge upon the authors or the translator the amazing exaggeration of making the plateau formed by this stream "a kind of cyclopean rampart raised more than *five miles* above the plain where the torrent stopped." The authors themselves have visited the mountain, and add their personal description to the scientific records persistently kept by Professor Palmieri for the greater part of the range of contemporary observation.

The destruction of life and property caused by Etna has never equalled that due to Vesuvius. Greater prudence, for one reason, has here been observed in pitching human habitations so near the mouth of danger. Considerable damage has, notwithstanding, been done to Catania and the neighboring villages by the frequent eruptions which local history has to record. From the time of fierce activity noted by Virgil, the mountain seems to have taken some centuries of rest. But during the last eight centuries eruptions have been both frequent and severe. Dislocations have been thereby occasioned to such an extent, that at the present time no fewer than 200 secondary beds can be counted on the sides of the mountain. The principal cone rises 3600 yards above the sea, its smoking summit enveloped in snow. The long and deep ravine on its eastern side reaching to the sea—the celebrated Val del Bove—is explained by Mr. Poulett Scrope as "a vast fissure enlarged into a crater by some paroxysmal eruption which blew out of the heart of the mountain, and since widened by the abrasive violence of aqueous *débâcles*, caused by the sudden melting of snows on the heights above by the fired lava and heated scoriæ." One such flood in March, 1755, is said by Recupero to have run down at the rate of a mile and a half a minute for a distance of twelve miles. Its track, two miles in breadth, is even now strewn visibly to the depth of thirty or forty feet with sand and fragments of rock. Similar *débâcles* had obviously for centuries taken the same course. At the opening of the valley to the sea, near Giorre, is to be seen a vast alluvial formation more than 150 feet deep, measuring ten miles by three in area, and resembling an upraised line of beach, 400 feet above the sea. The crater of Etna was well described by Elie de Beaumont and Leopold von Buch in 1834. Traces may still be found of the violent eruption of March, 1669, recorded in the *Philosophical Transactions* for that year from the testimony of eye-witnesses. A pillar of ashes went up into the sky, which, to their apprehension, "exceeded twice the bigness of Paul's steeple in London." The *sciarri*, or conglomerates of hard porous stone, like slag, were piled up to the top of the walls of Catania, 60 feet high, ten miles from the crater. There is still to be seen an arcade of lava curling over the same walls in places "like a wave on the beach." Turning fortunately aside from the city, and advancing towards the sea, the body of lava formed a perpendicular front, carrying before it huge blocks of granite, forming a vast causeway into the sea. In a few days, writes M. de Quatrefages, the lava had carried forward the line of the beach some 330 yards. The striking eruption of 1865 is well described in a letter from a French geologist, M. Fouqué, to M. Sainte-Claire Deville. The lava stream, which in two or three days had extended in length three miles, with a breadth of nearly half that extent, was parted by an ancient cone, one arm precipitating itself in a cascade of fire from a height of 50 yards. The incessant hammerings from the seven craters were vividly suggestive to the writer of the idea they gave the ancients—that of a forge in the centre of Etna, with the Cyclopes as workmen.

Our authors' survey of the active volcanoes carries them round the globe, and includes the latest and most distant records of these tremendous phenomena. Equally complete and vivid is the catalogue of remarkable earthquakes, which are made, by the progress of scientific observation, naturally to connect themselves with the agency of volcanic forces. The subjects of thermal springs, of mud islands or emissions, as well as of the singular oil or petroleum wells lately discovered in such wealth and extent, are discussed in their several bearings upon each other as well as upon the agency of subterranean fires in general. One of the most remarkable results of the combined and systematic observation brought to bear upon the phenomena of earthquakes relates to the extent and degree over which sonorous waves have been known to be propagated:—

The nature of the noise also differs greatly; sometimes it is rolling, and occasionally like the clanking of chains; in the city of Quito it has sometimes been abrupt, like thunder close at hand, and sometimes clear and ringing, as if obsidian or other vitrified masses clashed, or were shattered in subterranean cavities. As solid bodies are excellent conductors of sound, which is propagated, for example, in burnt clay with a velocity ten or twelve times greater than in air, the subterranean noise may be heard at great distances from the place where it has originated. In the Caraccas, in the grassy plains of Calabozo, and on the banks of the Rio-Apure, which falls into the Orinoco, there was heard, over a district of 2300 square (German) miles, a loud noise resembling thunder, unaccompanied by any shaking of the ground; whilst at a distance of 632 miles to the northeast, the crater of the volcano of St. Vincent, one of the Small West Indian Islands, was pouring forth a prodigious stream of lava. In point of distance, this was as if an eruption of Vesuvius should be heard in the north of France. In 1744, at the great eruption of Cotopaxi, subterranean noises, as of cannon, were heard at Honde near the Magdalena river. Not only is the crater of Cotopaxi about 18,000 English feet higher than the Honda, but these two points are separated from each other by a distance of 436 miles, and by the colossal mountain masses of Quito, Pasto, and Popayan, as well as by countless valleys and ravines. The sound was clearly not propagated through the air, but through the earth, and at a great depth. During the violent earthquake in New Granada, in February, 1835, subterranean thunder was heard at Popayan, Bogota, Santa Martha, and Caracccas (when it lasted seven hours without any movement of the ground), and also in Hayti, in Jamaica, and near the lake of Nicaragua.

The evidences of volcanic action in the moon have since the time of Laplace had a lively interest for the minds of astronomers. There is, we need scarcely say, no longer any idea of the aerolites which from time to time fall upon our globe being projected from volcances in our satellite, or even of the luminous spots or bands visible upon the lunar surface being proofs of a chronic state of volcanic action. That changes to some extent, however, take place in the moon's substance seems placed beyond doubt by the subsidence of a marked crater within the last twelve months, as well as by the modifications which have made themselves evident in the lunar maps drawn up at definite intervals. The chapter on this subject forms one of the best in the volume before us. What distinguishes the lunar volcanoes in general from our own is their enormous size. The diameter of Clavius is not less than 140 miles. Eight other craters come between 69 and 113 miles, and no less than twelve have an average of 55 miles. In other respects a strong analogy can be traced between the aspect of these volcanic areas and extinct systems of the like kind in many parts of our globe. The mountains of Bohemia, as well as those of Auvergne, have been instanced as presenting a configuration closely analogous in plan to ranges of the lunar elevations. The luminous bands which distinguish the latter are ascribed by Maedler to gaseous streams, which have vitrified a portion of the surface, and disposed themselves in rays round many of the mountain peaks. Experiments have been made with the result of artificially producing much of the process by which nature may be conceived to have worked these singular effects:—

An English astronomer, Mr. Hooke, obtained an artificial imitation of the lunar cavities by heating calcareous mud until the steam, in the form of great bubbles, forced its way through the surface. In our terrestrial volcanoes, the upper stratum of matter in fusion sometimes rises by the elasticity of the subterraneous gases as far as the edges of the crater, but the dome sinks as soon as the gases have made a passage. It is known that there exist in America great extents of land which are hollow underneath, and which are in fact real bubbles. If we wish to compare the lunar surface with that of our globe, we must in imagination suppress the sedimentary earth and the seas which cover the latter. Many circles, now filled up, would then appear. In Auvergne there are some very large, which are still entirely sunken, although the granite which forms them is mixed up and disappears in a great number of points under thick beds of vegetable earth. The one in the island of Ceylon is forty-three miles in diameter. In Oceania several madreporic islands appear to be supported on similar circles. "We can then figure to ourselves," as remarked by Humboldt, "our satellite nearly like what our earth was in its primitive state, before it was covered with sedimentary beds rich in shells, gravel, and diluvium, due to the action of the tides and streams. Scarcely can we admit that there exist in the moon beds of conglomerates, and of detritus formed by friction."

It is not often that we find justice done in foreign works of science to the labors of our own countrymen, and the book before us is by no means an exception to the rule. Nothing is indeed gained by this ignorance or neglect of British science. In no part of the world is the theory of volcanic action in a more advanced or positive position than in this country. For a general view of the subject, no foreign work can be consulted in preference to Sir Charles Lyell's recent chapters. Of the two main hypotheses, the "chemical" one first broached by Davy has been worked with much industry and skill by Dr. Daubeny; while what may be called the "mechanical" owes its chief development and proof to Mr. Mallet. There is of course no need for these theories being taken as absolutely excluding one another. The laws of the mechanical forces, due immediately to the agency of heat, are in fact but subsidiary in turn to those ulterior considerations which relate to that chemical action of the elements in nature's laboratory which results in fusion and volcanic force. The writers before us have abstained from going deeply into the theoretic portion of this inquiry, though they intimate a general acquiescence in the chemical hypothesis as it has been developed of late in the able hands of M. Sainte-Claire Deville. Their work, as we have said, is not one which aims at supplying the world of science with new or advanced ideas. Still, as a manual for popular use, it contains much that readers of the ordinary class will find both novel and interesting.

NATIONAL FINANCES.

Senator Morton's Able Reply to Horace Greeley—Opinions on Specie Payment.

In a letter just issued from Washington, Senator Morton replies to Horace Greeley, in the following vein, on the financial question of the day:—

In your letter addressed to me, in the *Tribune* of the 21st instant, you undertake to answer several positions taken by me in my late speech in the Senate on the currency, but devote yourself chiefly to the establishment of the proposition that the Government can and should at once resume specie payments, with only $70,000,000 of gold in the Treasury, and that the declaration of resumption would have the effect to bring the greenback currency to par. And, to rebut the idea that more than seventy millions would be required with which to begin resumption, you say:—

"You assume that if we resume the Government must 'redeem the greenback currency.' I think not. Our banks have repeatedly resumed after months and even years of suspension, and have never been required thereon to redeem their outstanding issues. On the contrary, the fact of their resumption has uniformly precluded all desire of disposition to exact such redemption. Yet their notes were not a legal tender, had not the Federal Government behind them, but were the mere promises—the long falsified promises—of private corporations. Yet we all went on receiving them and paying them out, without asking for specie to the extent of one dollar in twenty of the notes thus suddenly made redeemable in coin. If you think the people, who have so often shown faith in and forbearance towards private moneyed corporations, would not now evince at least equal faith in the Government—that is, in themselves—you have given me no reasons for sharing your distrust."

You then enter into an argument of some length to show the superior convenience of the greenback currency over coin. You show very clearly how business would be impeded by a mere metallic currency; that the business of the country can be better developed and extended by a redeemable or convertible paper currency, and that the people could not do without the greenback currency long enough to have it run into the Treasury for redemption in gold.

Your argument is excellent to prove that after the greenback currency has been brought to par it would be preferable to gold, and but little of it would be brought to the Government for redemption; but as long as the greenback currency is three cents under par, that margin would make it profitable to brokers to run it into the Treasury from every part of the United States.

Your first argument was that greenbacks were so much more convenient and desirable than gold that they would not be presented for redemption. But here you state that we cannot safely resume even with $200,000,000 of gold in the Treasury, and that the one thing needful for resumption is to provide a new bond, which the holders of greenbacks would prefer to coin, which will sell at a premium above specie par, and that when we have got such a bond we can safely resume with ten millions of gold in the Treasury. Here you would seem to make resumption impossible by requiring in advance a national security which will largely sell at some rate above specie par, which the holders of greenbacks will prefer to coin, and which you have before said should bear interest at the rate of four or five per cent. Such a bond could not be sold even at par until after resumption is firmly established, much less in advance, as a means of bringing it about.

With such a bond, which the holders of greenbacks would prefer to coin, the greenbacks would be funded, and it would result in large and sudden contraction, which would be in hostility to your first proposition that the people need the greenbacks and will keep them. Your policy, like that of the Secretary of the Treasury, resolves itself finally into contraction, and if to the evils of immediate resumption you add the calamities of large contraction, you will make short work of the business of the country.

If sudden resumption will involve the great decline in prices which you say it will, it would be a vast calamity to the majority of the people of the United States. It would certainly bankrupt or suspend three-fourths of the business men of the country at once. It would produce a suffering and desolation of which we have no record in this or any other country. Hundreds of thousands now living in comfort would be reduced to poverty. Business would be destroyed; the poor left without employment; the people unable to pay their taxes, and the Government itself threatened with bankruptcy and dishonor, and yet you say you want to make the plunge at once. If the private indebtedness of the people to each other on the 1st of February, 1869, amount to $8 000 000,000, the capacity of the debtors to pay, by your lowest estimate, would be diminished to the extent of $2,000,000,000. *You* may be ready to make the plunge, but the great body of the people are not. Your plan would suit admirably that class of people who are not in debt and have plenty of capital, or who have fixed incomes which would be greatly improved in value by the large decline in prices of every other kind of property. Your plan would enrich the creditors by the destruction of the debtors; for, as you say, the sheriff and constable would be after "many of us;" our property would be sold for a song, and a large balance of debt be left against our future earnings. And all this suffering and destitution I put according to your own statement of what would be the effect of immediate resumption.

Now, sir, in contrast to your plan, which would be so merciless, if it were possible, I will present you with another:—

First. That Congress shall by law fix a time—say 1st of July, 1871—to begin the redemption of the greenback notes. By fixing a time so far in the future people would be advised of the change, adjust their business, and make their contracts accordingly. Before that time nearly all the existing indebtedness among the people will have been paid. By an estimate which has been approved by some who are well versed in the business of the country, three-fourths of the existing indebtedness among the people will be discharged within twelve months from 1st of January, 1869; three-fourths of the remaining one-fourth will be discharged within the next twelve months, and that by the 1st July, 1871, there will not be in existence and unpaid to exceed four per cent. of the existing indebtedness, and thus the debtor class will almost entirely escape from the oppression and disasters with which your plan would overwhelm them, arising from the sudden decline in the prices of all kinds of property.

Second. By fixing a definite period when the greenback note will be redeemed, a fixed value will be given to it, which will constantly appreciate as the period fixed for redemption approaches, and it will be at par at or before that time, provided the Government is making the necessary preparations for its redemption. It will be much better for the business of the country for it to reach par by gradual appreciation, than to come up to it by a sudden jerk as you propose. The whole process should be gradual, so that the transition which the country must make from one condition to the other shall be made with as little disturbance as possible.

Third. By fixing a time for redemption so far in the future, Government can, without sudden strain and without great sacrifice, get ready for it. To bring about the gradual appreciation of the greenback notes the gold must visibly accumulate in the Treasury as the time goes on. The Hon. John J. Cisco said in a letter some two years ago that the presence in the Treasury of a gold surplus of seventy or eighty millions gave strength to the currency, although not set apart by law for its redemption, from the probability that it might be so appropriated in the future. Should Congress refuse to reserve the present surplus gold in the Treasury, and that which is to accrue for the redemption of the currency, but empower the Secretary of the Treasury, before the time arrives for redemption to obtain the necessary gold by the sale of our bonds, it would probably bring up the notes to par at that time, if he was known to have made the preparation, but their appreciation would not be so gradual or so certain as if the gold was visibly accumulating while the intermediate time was passing.

That it would be necessary to have in the Treasury an amount equal to the greenback currency, to begin redemption, I do not believe. Redemption could safely begin with two hundred millions of gold in the Treasury under the provisions of my bill, but certainly not with seventy millions. In this work confidence is everything, and is a plant of slow growth, and can only be produced by the obvious employment of the necessary measures of preparation. If the people are satisfied that the Treasury has gold enough to redeem all the notes that will probably be presented, but few will be presented; but if not, then there will be a rush for the gold to sell it in the market again at a profit, and this is the precise principle upon which specie-paying banks have been sustained.

Fixing resumption at a reasonable time in the future, which the Government and the people may work to, and the making of needful preparations, to be known and understood by all, are indispensable to any plan of resumption which would avoid the hardships which you admit would attend the adoption of yours. By the method I have suggested, there will be an actual inflation of the currency at the time of resumption to the extent that the whole amount of gold and silver in the country that would enter into the circulation would exceed the amount of greenbacks that would be presented for redemption, and this would do much to prevent the hardships that might otherwise occur.