spots the lands was still gradually rising or sinking, the sediments still falling on shores and sea-beds, and adding new strata to the ancient rocks, or being slowly lifted out of the waters, to form fresh fields and mountains. The order was not broken, it was only *continued elsewhere.*

And thus, too, we pass upwards, through that second world and that third world, to the present world, stage by stage, to find newer creations entombed in the newer beds; for, although the sands, clays, and limestones may *repeat* themselves in their peculiarities of structure, the the embedded species of animals and plants *never* do. *They* are always different in each succeeding stage, however like are the conditions of the rocks. So, too, as we pass upwards through periods of ages, ever and ever it is from the waste of older lands, from the wear and tear of preexisting materials that the newer soils are formed—only the older deposits were less elaborated by repeated regenerations, were more uniform in their characters over extended areas. All the limited notions of the popular belief respecting the age and antecedents of our planet are as totally crushed by the Evidences of the Rocks as they are by the testimony of their fossils. Coast-lines have altered, and lands which were are lands no more; sea-beds have been changed into verdant fields, and where the shell-fish crawled, now grows the yellow corn.

What fossils teach us of former worlds of life, the rocks teach us of former worlds of land and sea, until we seem almost to be telling the same tale and repeating ourselves.

(To be continued.)

FOREIGN CORRESPONDENCE.

By Dr. T. L. Phipson, of Paris.

Contents of three letters addressed to M. Elie de Beaumont—Lias formation of the Col d'Encombres (Alps)—Directions of the veins of lead and zinc ores in Prussia and in France—Geological investigations in Chili—Silver and copper in the waters of the ocean—Why there is no gold in them—Auriferous sand from the Isle of Bourbon—Effects of plutonic rocks on lignite, coal, anthracite, and graphite.

At one of the recent meetings of the Academy of Sciences, M. Elie de Beaumont noticed three letters which he had received that, from their geological interest, we will briefly refer to here.—The first, from the Piedmontese geologist, M. Sismonda, treats of the fossil beds of the Col

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d'Encombres, in Savoy. By their researches in the geology of this country the author, with his brother and M. Bellardi, confirms the conclusion they arrived at in the year 1848, that the anthraxiferous formation of the Alps belongs to the Liassic age. Perhaps no other stratigraphical group has given rise to so much discussion as the one of which we now speak. The presence of coal and anthracite in the limestone-formations of the Alps long ago attracted particular attention to these strata. What would our English geologists have thought, in 1830, had they observed a seam of anthracite or coal imbedded in the white chalk of Dover cliffs? Would it not have led to a strict examination of the stratigraphical relations of this chalk, and a more minute investigation of its fossils; more especially if these were broken, cemented together, and difficult to determine, as they are in the Col d'Encombres? That is precisely what has taken place regarding the Alpine strata; and since the year 1830, or thereabouts, up to the present time, they have been shifted about on geological tables and maps, from the white chalk to the coal-measures, from these to the white chalk again; from the latter they have travelled to the Jurassic formations, to be finally* fixed in the Lias. Studer, Brongniart, Brochant, and D'Omalius, have all striven to solve this problem; but for the elucidation of the discussed points we are mostly indebted to the admirable labours of M. Elie de Beaumont, who first got a glimpse of the real nature and position of the Lias strata of the Alps.

The list of fossils from the limestone of the Col d'Encombres shows in all 63 species, of which 35 only can be specifically classified by the examination of fossils already known. Of these 35 belong to the superior, inferior, and middle strata of the Lias, with the exception of four, which are attributed by M. Sismonda to the stratum known as the Inferior Oxfordian bed. A remarkable circumstance, which deserves especial notice is, that from Professor Sismonda's account, the fossils which modern palæontologists look upon as belonging to different strata, are, in the Lias of the Alps, all found in one bed. Thus, at Col d'Encombres, all those belonging to the three Lias beds are found in one single stratum.

* It is impossible to regard this vexed question as definitely settled, even after these late researches of MM. Sismonda and Bellardi; for we must not forget that M. Favre, and other equally talented and experienced Geologists, still consider that distinct Liassic beds are intermixed, by inversions, in some cases, with true Carboniferous beds, in these Alpine Anthraxiferous strata; although some refer the whole to the Jurassic series, and others place them all in the Carboniferous.—Ed. of Geologist.

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M. Elie de Beaumont, on presenting this letter to the Academy, observed that the persevering researches of Professor Sismonda cannot be too highly praised. Having lately visited the Col d'Encombres himself, he gave an interesting account of his recent excursion there, and explained the position and structure of the beds indicated by M. Sismonda. These vary from 7½ to 10 or 11 feet in thickness; they are covered by about 100 feet of calcareous strata, apparently devoid of fossil remains, and repose on a bed of grey crystalline limestone, presenting a few veins and blocks of black silica, which emits a bituminous odour when broken. *It is very difficult to extract the fossils from these deposits,* so firmly are they cemented together by the crystalline limestone. These beds of limestone have, however, completely escaped the metamorphic action which has so thoroughly modified the mineralogical characters of the surrounding strata. From this fact, and from the circumstance already mentioned of all the fossils of these three Liassic divisions being here distributed in one single bed, M. Elie de Beaumont is of opinion that the fossil beds of the Col d'Encombres will in future be regarded as one of the most classical and remarkable of the Liassic formations.

The second letter addressed to the learned Secretary of the Academy was from M. Rivière, who is studying, in Prussia, the direction of the veins of zinc and lead ores. A short paper enclosed in it, and entitled, "*On the general direction of the veins of Blende and Galena,*" contains the following results: On the right side of the Rhine, as the author has previously shown, the general direction of these veins (which are encased in the Grauwacke and Phyllades* of the country) is east 30° north, west 30° south. Towards the latter part of last year he found that the veins on the left side of the river not only show a similar nature and structure, but appear to have the same direction, as those on the right side; of which, in fact, they seem to be a prolongation. M. Rivière has also studied the same metallic veins in La Vendée, Auvergne, Forez, Ardêche, Cevennes, the Alps, &c., and now arrives at these conclusions: first, that there is a remarkable constancy in the mean direction taken by the veins of Blende and Galena throughout a great part of France; secondly, that these veins run generally north-west and south-east, inclining rather to the west and to the east, and seeming to appertain to M. Elie de Beaumont's *Système du Morbihan,* which he has defined by a line to the

* Clay-slate.—Ed.

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west 38° 15′ northward, and to the east 38° 15′ south; thirdly, that the veins in question are generally encased in the primitive rocks (granite, gneiss, mica-schist, talc-schist, &c.), never occurring higher than the Silurian strata, properly so called, and belonging, therefore, to a very ancient system of dislocation. Our readers will readily appreciate all the importance and utility attached to these investigations.

The author of the third letter, dated Copiapo, the 16th September, 1857, is from M. Pissis; it relates to a geological exploration of some parts of Chili. The writer informs us that he is, at present, studying the province of Atacama, of which he hopes to have a geological map completed before the end of 1858. The stratigraphical characters of the southern parts of Chili bear a great resemblance to those of the Brazils, and the upheaving of the strata seems to belong to the *Hundsruck system;* the direction of which, in Chili, is north-east and south-west, which is also that of the granite and talc-schist of the country. But, independently of this, there is a large band, from fourteen to eighteen leagues wide, of other formations running parallel to the coast, some of the strata of which are remarkable for the abundance and beautiful preservation of their fossils. The working of silver and copper mines is becoming every day more and more active there, not only in the inhabited districts, but even in the desert.

A short time ago, in the year 1856, an Englishman residing in South America, but whose name we cannot think of at this moment, discovered the presence of silver in the water of the Atlantic Ocean. He was surprised to find a small quantity of silver in the copper-sheeting of vessels which had navigated for some time. He analysed, first the new copper before it was placed on the ships, then the old copper taken from the bottom of ships that were undergoing repair. The results of his experiments were, that the copper taken from ships that had navigated during the longest period of time contained the most silver; those which had only made short voyages contained very little more silver than that which was originally found in the new copper-sheeting.* Similar experiments were lately made in France by MM. Durocher and Malaguti, whose conclusions coincide with those arrived at in South America. The existence of silver in sea-water cannot therefore be doubted. The presence of this precious metal in the waters of the ocean is without doubt due to the property possessed by common salt (chloride of sodium) of dissolving chloride of silver—

* Which almost always contains slight quantities of silver.

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a salt which silver is very apt to form, and which is one of the most plentiful of the silver-ores. Small particles of it are constantly washed down by probably most rivers, and carried to the sea, where it is dissolved by the salt-water.

Copper has just been discovered in the water of the Mediterranean by M. Septimus Piesse, whose remarks have been published by our Parisian contemporary, *Cosmos*. To the sides of a steam-vessel going from Marseilles to Corsica, the author attached bags filled with nails and iron-filings. Iron having the power of displacing copper from its combinations, the iron nails and filings were found on examination to have extracted from the water a notable quantity of copper, which adhered to the nails and iron-filings. Certain soluble salts of copper, such as the sulphate for instance, which are not easily decomposed by natural agents, are probably carried down to the sea by rivers, together with insoluble particles, such as sulphide of copper, which, by long contact with sea-water, would transform itself into sulphate or chloride of copper, and be dissolved. M. Septimus Piesse has gone so far as to attribute the blue and green colours of certain parts of the ocean to salts of copper. But this was a rash step to take, and it would have been more reasonable had the author contented himself with stating simply the discovery of a small quantity of copper in sea-water—a discovery not devoid of interest—rather than attribute to this source the coloration of the waters of the ocean, which may be due to a thousand more likely causes.

In searching for copper by the above means, gold, if any were in solution in the sea, would certainly have been found. None of this most precious metal has ever been discovered in sea-water; and why? The reason is obvious—salts of gold are very easily decomposed; the least particle of organic matter decomposes the soluble ones, and precipitates their gold. Hence, when gold is met with in nature, it is always in the metallic state. It is impossible, therefore, that it can ever be found in sea-water, although no doubt exists as to a million or two sterling being washed down now and then by the various rivers, and swept into the sea in different parts of the world. If we wish to discover maritime gold we must look for it in the sand of the sea-beaten shores.

This reminds us that we have just received a sample of sand said to be auriferous, and recently imported by some speculators from the

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coast of the Isle of Bourbon. This sand is extremely interesting, first, by the great distance whence it has found its way into my laboratory in Paris; secondly, by its composition and aspect; and, last, perhaps not least, from its containing small quantities of gold. Three or four analyses made in Paris show that it contains $\frac{1}{50000}$th of its weight of gold: it is almost entirely black, of a very fine grain, and, from the slight examination I have as yet given it, appears to consist chiefly of nigrine (titanate of iron), mixed with grains of quartz, garnets, corundon, &c. The nigrine is easily separated from the rest by means of a magnet, for this mineral is extremely magnetic. There are a great number of other black grains, however, upon which the magnet has no action, and which appear to be either *debris* of basalt rocks or crichtonite.*

It would certainly be desirable and, perhaps, profitable, were some of our English ships touching at the Mauritius to bring back to England samples of sand taken from the coasts of the last-named island, whose geological structure is identical with that of the Isle of Bourbon,† and whose shores are doubtless strewn with a similar auriferous sand. Analysis and experiment would soon decide if the washing of this sand for its gold would prove a profitable undertaking, and whether we should thus be enabled to join to the organic produce of the Mauritius a mineral of quite as much importance. Besides the sand of which we speak, the ocean throws on to the coasts of the Isle of Bourbon (and I have reasons to suppose, on to the coasts of the Mauritius also), round blocks of what appears to me to be a species of trap-rock, which also contains a notable proportion of gold.

M. Delesse has lately made known‡ the results of his investigations on "The Metamorphism of Rocks."§ We extract what appears to us most interesting.

* Another species of *titanate of iron*, which is not magnetic.

† Both are volcanic islands: their soil is strewn with lava, basalt, &c. Bourbon has one volcano still active; those of Mauritius have long since ceased their eruptions.

‡ In a series of memoirs, of which extracts have been given in the "Comptes Rendus," from September to December, 1857.

§ *Transformed or metamorphic* rocks are those in which the internal texture, the mode of stratification, and sometimes the chemical composition, have been changed either by contact with, proximity to, a plutonic or volcanic rock of eruption. (For details on this interesting subject see Humboldt's "Cosmos," vol. I, p. 248, *et seq.*)

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In one of his memoirs the author treats exclusively of the changes undergone by combustibles, such as lignite, coal, &c., under the modifying influence of some eruptive rock. In nature we find that fossil-wood modified by metamorphic action has become coal; coal, anthracite; and anthracite, graphite. Sometimes such transformations have taken place on a very large scale; an entire stratum of coal, for instance, has been transformed, by the action of some upheaved rock, into hard anthracite. M. Delesse calls this *normal metamorphism*. At other times, on the contrary, metamorphism is only observed to have occurred in that particular part of the combustible stratum which is immediately in contact with the eruptive rock. This is *metamorphism by contact*.

In normal metamorphism the combustible loses successively its bituminous matter, becomes comparatively richer in carbon, more compact, and augments in density. Last of all it become crystalline, passing to the state of graphite.

But in metamorphism by contact the changes are more complicated, and depend, in great measure, on the particular kind of eruptive rock that produces them. When lava, vomited by a volcano, flows over and envelopes pieces of wood, the wood becomes, in a greater or lesser degree, perfect coal. Some carbonized wood found in the ancient lava of Auvergne contained a certain quantity of carbonate of lime and oxide of iron, showing, perhaps, that in such cases the combustible matter may be impregnated with mineral substances. It is not often that we see granite and quartzose porphyry in contact with combustibles; but some few cases of such contact have been observed. For instance, the coal-measures of La Pléau, in France, spoken of by Beudant, which are in some parts imbedded in the porphyroid granite of this district, and the coal-strata of Altwasser, in Silesia, visited lately by M. Delesse, where the coal in contact with porphyry has been changed into prismatic anthracite, and furnishes, by combustion, 15 per cent. of ashes, principally formed of oxide of iron. In cases where combustibles are found encased in granite-rocks, they are observed to have lost their bituminous matter, and to have become anthracite or graphite. Up to the present time, according to M. Delesse, no *coke* has ever been found in contact with granite-rocks; it seems probable, however, that laminæ of graphite found in them have been produced by their metamorphic action on certain combustible or bituminous matters.

Trap-rocks, as basalt, dolerite, hyperite, euphotide, diorite, and

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trap properly so called, are often found in contact with lignite, coal, anthracite, and even graphite. In these cases metamorphism has sometimes been very feeble or null. In the Giant's Causeway a sheet of trap has overspread a bed of lignite without causing the slightest alteration in the structure or aspect of this substance. Such extraordinary examples as this are, however, very rare, and require elucidation.

Generally speaking, the contact of trap-rocks either renders the combustible more compact, or changes it into a species of coke. In the former case lignite becomes coal, anthracite, and sometimes graphite. When any combustible has been thus modified by the presence of trap-rock, it is observed to have taken a prismatic structure in those parts which are immediately in contact with the eruptive rock. M. Delesse has observed this curious fact in lignite, coal, anthracite, and also in graphite.

This prismatic structure is very difficult to explain, and is rendered the more so by the fact that samples presenting it shrink still more when they are artificially heated, evolving, at the same time, water and volatile bituminous matter, and becoming genuine coke.

We shall refer again to other observations on metamorphism made by M. Delesse. We have dwelt on the foregoing more particularly as they contain a few facts confirming ideas that we ourselves have cherished for many years, and which embrace some of the most interesting geological phenomena. We will endeavour to lay them before our readers at some future period, which we hope may not be far distant.

GEMS FROM PRIVATE COLLECTIONS.

(By the Editor and his Friends.)

I.—AMMONITES COMMUNIS; FROM THE LIAS OF WHITBY, YORKSHIRE.

In the Collection of J. S. Bowerbank, Esq., F.R.S., F.G.S., &c.

At the extremity of a pretty bay, on the coast of Yorkshire, stands the town of Whitby, known to every geologist for the numerous treasures of organic remains which the Lias beds, there outcropping on the shore, have furnished at various times.

Nor is Whitby wanting in historical associations. It was there, in Anglo-Saxon days, stood the far-famed monastery of Streones-healh, of

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