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FOREIGN CORRESPONDENCE.

By DR. T. L. PHIPSON, OF PARIS.

Sketch of the Geology of the Coast of Flanders—Discovery of a recently-formed Rock near this Coast—Fresh-water Limestone and Marine Tufa—New observations on the Metamorphism of Sedimentary Strata—Curious experiments by M. Ch. Deville—Artificial transformation of Chalk into Dolomite—Signification of the presence of Sulphates in Dolomites—Discovery of soluble Chlorides in these rocks—Experiments on Clays and Sandstone—Hydrophane: its artificial production and analysis by M. Langlois.

MANY curious facts render the coast of Flanders very interesting in a

geological point of view. Such, for instance, are—1st, the slow oscillation of this district, first noticed by Belpaire, and which still continues;* 2nd, the progressive movement of the sand-hills (dunes) towards the interior of the Belgian continent; 3rd, the existence along this coast of an immense bed of grey clay or marl, which spreads from the river Scheld to Calais, and which has been formed at a comparatively recent period, according to some geologists, since the time of Julius Caesar. To these and some other curious particulars we hope to refer again. At present we have to speak of a peculiar rock which we laid before the Academy of Sciences at Paris, a short time ago, and which appears to be daily forming on the coast of West Flanders.

The littoral portion of West Flanders presents three distinct stratifications, which have been classed by Omalius d'Halloy, in his "Terrains Modernes," and necessarily belong to some of the most recent geological formations. Beginning with the uppermost strata, we have—1st, the sand of the coast, and of the sand-hills or "dunes;" 2nd, a bed of grey clay or marl, generally known as the "Argile grise d'Ostende" (because it is very well developed in that neighbourhood), which attains, in some places, a thickness of from three to eight feet or more; 3rd, a bed of peat, which lies upon the sand known as "Sable de la Campine" (the whole of the province of la Campine being covered with it). These beds of clay and peat pass under the sand-hills of the coast, and extend to a considerable distance into the sea.

The recently-formed rock to which I allude in this paper appears to have been deposited, and continues in all probability to form daily, at or near the extremity of the stratum of peat, more than six miles from the coast.† When the weather is stormy, the sea throws up large blocks, enveloping fragments of peat, and the shells of mollusca which

* We have already noticed this in the pages of the GEOLOGIST (January, 1858).—T. L. P.

† About six miles out at sea, and stretching along the coast from Blankenberg to Ostend (a distance of about ten English miles), exists a bank or bar, called by fishermen "The Black Bank," which is the most dangerous on the coast. There are also many sand-banks, which shift their places according to the weather, the currents, &c. The bank we allude to here is, however, nothing less than the peat and clay beds mentioned in the text as stretching out into the sea underneath the sand of the coast. It consist principally of peat, of which large fragments, often pierced by innumerable *Pholas dactylus*, &c., are constantly thrown upon the coast in rough weather. The anchors of ships will not hold in it; and at low water it is covered with only three feet of water.—T. L. P.

live in the present sea. The most common of these shells is that of the cockle (*Cardium edule*), seen also, as a fossil, in the *argile grise*, on which the corn and potatoes grow so well in the neighbourhood of Ostend; but the rock contains an infinity of others, all common on the coast or in the neighbouring sea.

Upon submitting this rock to a careful examination, I found it to be a tufaceous limestone, of a grey colour, containing a considerable admixture of clay and sand, some few lamellæ of mica, vegetable débris of peat, and recent shells. Some fragments of it are light and fragile; others, harder and denser, consist of layers superposed in such a manner as to show that they have been formed successively, but which do not obliterate the compact appearance of the larger masses. This structure is frequent in tufaceous limestones.

On examining the *argile grise* which exists all along the coast of Flanders, I found that it is in reality an argillaceous marl, producing effervescence in acids, and containing a notable proportion of carbonate of lime (at least on the coast of Ostend); so that the tufaceous rock in question may owe its existence to a gradual absorption of carbonate of lime by this argillaceous stratum; but it is, no doubt, to the cretaceous rocks which are bathed by the waters of the English Channel (such as the chalk cliffs of Dover, &c.), that the carbonate of lime in our recent rock is owing.*

Fresh-water tufa, or travertine, as it is sometimes called, is very common in limestone countries, as all our readers are doubtless aware—there is hardly a stream in such districts but deposits carbonate of lime by the loss of the carbonic acid in the water which held it in solution. Marine tufa, however, has been looked upon, perhaps erroneously, as of much rarer occurrence. It has been observed in Sicily, at the Island of Ascension, in Australia, &c. Every one has heard of the famous rock discovered in the Antilles by M. Moreau de Jonès,† and which the negroes have christened *maconne-bon-Dieu*. It became celebrated from being found in Guadaloupe to contain human bones. Another such

* Since I found this marine tufa on the coast of Ostend, I have seen, in the geological collection of the *Jardine des Plantes*, at Paris, a rock called “Grès coquillier de Beauchamp (Seine et Oise),” containing both marine and fresh-water shells, and which appears to me to be identical with the tufa described in the text above.—T. L. P.

† *Hist. Physique des Antilles*; also Humboldt *Relation Historique*.—T. L. P.

formation was observed by de Saussure* in the Straights of Messina; and M. de Boblay† has described a similar rock which he found on the coast of Australia. Finally, deposits of marine tufa have been noticed in recent times at certain points of the English coast.

Whilst noticing rocks of modern formation, we should bear in mind the curious Oolitic limestone deposit which is being effected at the present time in the great lakes of Mexico, and the modern Oolite discovered by Leop. von Buch, in the Canary Islands.‡

M. Ch. Sainte Claire Deville, recently elected member of the Academy of Sciences, at Paris, has just read before that institution a long memoir on the action of the chlorides and sulphates of alkalies and earths in the metamorphism of sedimentary strata. Following in the path trodden by Sir James Hall, Dulong, Haidinger, Marignac, Daubr e, and others, the author has added one or two new features to the interesting series of investigations already made on metamorphism. Metamorphic phenomena have been so frequent on the surface of the globe, that although rocks may have been wonderfully changed by it in aspect and chemical composition, the processes by which these changes have been produced must nevertheless, thinks M. Ch. Deville, have been characterized by a certain simplicity; the chemical re-actions, of which we see the results, must have taken place between bodies which are abundant in the crust of the earth. By his researches on the gaseous emanations observed in volcanos, salzes, hot-springs, &c., the author has been led to conclude that the four elementary bodies, carbon, chlorine, sulphur, and fluorine, predominate in the chemical phenomena of the globe; and that they or their compounds must have played a great part in the metamorphism of rocks. From their action on sedimentary strata, says he, have arisen—1st, insoluble substances, as the minerals observed to have been formed in strata which have undergone metamorphism, and in which the carbon is seen to have been almost wholly fixed in the state of carbonates, the sulphur mostly as sulphates and sulphides, some traces of chlorine only, as chlorides, and nearly the whole of the fluorine, as fluor-spar, and certain fluo-salts; || 2nd, soluble salts, containing nearly the whole of the chlorine, a good deal

* *Voyage dans les Alpes*.—T. L. P.

† And likewise Perron (see Beudant, *Geologie*).—T. L. P.

‡ See the GEOLOGIST for February, 1858, p. 72 et seq.—T. L. P.

|| Topaz contains mica, &c.—T. L. P.

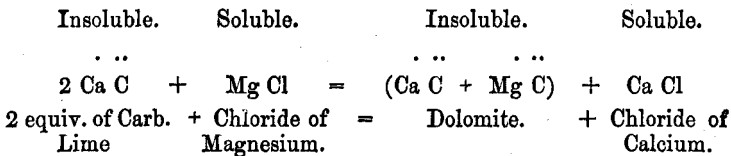
of the sulphur, and a small proportion of the carbon. This is exemplified in the composition of sea-water, for the salts it contains it has obtained whilst filtering through the strata of the earth.

It was the action of these soluble salts upon the three categories of sedimentary strata, that the author deemed it necessary to investigate.

The following results have been obtained :—

Limestones.—Many experimentalists,* acting upon ideas enunciated by Leop. von Buch, that dolomite resulted from the substitution of one equivalent of magnesia for one equivalent of lime, in limestones, have obtained a mixture containing magnesia and lime, in the proportion of dolomite, by heating to 200° (centigrade), and at a pressure of 15 atmospheres, carbonate of lime with sulphate of magnesia or chloride of magnesium. M. Ch. Deville has shown that the same re-action can take place at 100° (centigrade)—boiling-water point—and at the ordinary pressure of the atmosphere. He steeped a fragment of chalk in a solution of chloride of magnesium, until it had absorbed as much as possible of the liquid, and then heated it to 100° in a crucible. He observed what Dulong, when studying the action of soluble salts upon insoluble ones, had remarked before, namely, that the re-action takes place, but is very limited. Thus, by one operation, six or seven per cent. of lime only is replaced by magnesia. But, if the piece of chalk be washed so as to eliminate the chloride of calcium formed, steeped again into the chloride of magnesium, and a second operation effected, more lime is replaced by magnesia; and, after the eighth experiment, the two bases are in the proportion 1 : 2 or 1 : 1.5, that is, as they are found in dolomite.

What takes place in these experiments may be clearly seen by the following formula :—



Fragments of coral, &c., were treated in the same manner, and transformed into dolomite (after a succession of imbibitions with chloride of magnesium and calcination to 100° C), without losing their organic structure or their external appearance. These experiments call to mind

* Haidinger, de Morlot, Maignac, Durocher, &c.—T. L. P.

the influence of long persistent chemical actions in nature, which we have already noticed before. If the anticipations of Leopold Von Buch are exact, says M. Ch. Deville—if really dolomite has been formed in nature by the substitution of one equivalent of magnesia for one equivalent of lime, in limestone—the magnesia having been brought in one form or another from the interior, one ought to find in the transformed rock traces of the substances that have occasioned the transformation. In the memoir referred to this is proved to be the case. A great number of dolomites, as is well known, are found in nature associated with anhydrite or gypsum, and these are sometimes intimately mixed, as we find, for instance, in the dolomite of l'Ariège, in France. M. Hugard has recently shown that sulphate of baryta is mixed up with the dolomites in the Valley of Binn, and that this salt appears to be nothing less than the traces of the sulphuretted agents which have determined the formation of these dolomites.

M. Ch. Deville has proved satisfactorily to himself that *chlorides*, notwithstanding their solubility in water, which accounts for their being rarer in rocks, more frequent in the waters of the ocean and rivers than sulphates, *are, nevertheless, to be found in dolomites*, in such quantity (more than the 1-1000th part of the rock) as may be determined by careful chemical analysis. The author assures us that he has found chlorides in dolomites from the Valley of Fassa,* especially in those from Rosengarten, and, again, in the dolomites of Seefeld, in the Tyrol, in those of the variegated marls of Fribourg, in dolomites from the carboniferous strata in the province of Liège (Belgium), and, finally, in the Tertiary dolomite of Beyne. When treated with pure water, at boiling point, these rocks yield chlorides of calcium and magnesium. Others, such as the dolomite of St. Gothard, have never shown traces of either sulphates or chlorides, which singular fact tends to prove that, in the manufacture of dolomites, nature has evidently employed more than one process.

Clays.—The author's experiments on clays are similar to those described above. Taking a fragment of pure kaolin,† he soaks it in a

* We should remember that a well-known English *savant*, Dr. Percy, formerly suggested that the circumstance of the production of the *Gehlenite*, at a high temperature, in an iron furnace, may possibly be available by geologists in explaining the formation of the rocks in which the natural mineral occurs, as in the Valley of Fassa (or Fassathal) in the Tyrol, mentioned here.—T. L. P.

† Silicate of Alumina.—T. L. P.

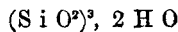
solution of common salt (chloride of sodium) and, after having slightly dried it, heats it to a good red heat in a platinum crucible. Soon vapours of hydro-chloride acid are given off (showing that the salt is decomposed) and silicate of soda is found to have formed in the kaolin. This experiment is repeated three, four, or five times, until the kaolin no longer decomposes the salt, when the earth is seen to have become a granular mass of crystals, easily fusible, and so hard as to scratch glass with facility. The same experiment was tried with chloride of calcium and chloride of magnesium instead of salt, and with similar results. Chloride of magnesium and proto-chloride of iron act with far greater ease than common salt. But, as a remarkable exception, chloride of potassium gives no result at all. This becomes an extremely interesting fact, since M. Delesse has shown formerly that those feldspars, which seem to have been produced by metamorphism, are never found to contain potassa.

Sandstones.—One experiment is alone recorded :—The author took a piece of sandstone, essentially quartzose, and containing little or no admixture whatever—it was the *grès d'Orsay*, with which the streets of Paris are paved. He soaked it alternately with a solution of chloride of magnesium and a solution of chloride of calcium, and then submitted it to a red heat. After a certain number of successive imbibitions and calcinations, the sandstone was observed to become spongy; it absorbed, without difficulty, a considerable quantity of liquid, and was easily pulverized in an agate-mortar. Thus pulverized, it was heated in a crucible to a white heat, when it melted, and was transformed into a milky mass, composed of numerous long crystalline needles. It had a specific gravity of 3.00, was insoluble in acids, and did not contain a trace of chlorine. When analyzed, it gave the composition of amphibolite or pyroxene, of which it showed the specific gravity.

Hydrophane is opal (hydrated silica), which has the remarkable property of becoming transparent or translucent when placed in water, and losing its transparence again when taken out of the liquid. M. Langlois* has just produced artificial hydrophane in the following

* We remember having read in the *Comptes Rendus*, of the Paris Academy of Sciences, a memoir published many years ago by Ebelman, late chemist of the porcelain manufactory of Sèvres, where he describes a process by which he produced hyalite; and, if we are not mistaken, hydrophane also. We will turn again to this memoir at the first opportunity.—T. L. P.

manner:—A current of chloride of silicium is brought through a tube, terminating by a glass funnel, the wide opening of which just touches the surface of water. The chloride of silicium is decomposed in presence of water, even before it comes in contact with the liquid, in the damp air contained in the funnel, and hydrophane is deposited upon the sides of the latter. It is translucent when wet, opaque when dry, and becomes translucent again whenever it is placed in contact with water. Analyzed, it gave a formation similar to that of resinite:—



or, water 11·68; silicic acid, 88·32.

NOTES AND QUERIES.

POTATO DISEASE.—“The early re-appearance, this season, of the potato disease in the Midland Counties, induces me to call the attention of practical geologists to the subject; for perhaps I may not err in supposing that soil exercises great influence in the development of the disease. In the year 1855, when travelling from this place to Penman Mawr, I was forcibly struck by the fact, that whilst all the potato-fields in the district occupied by the varieties of the New Red Sandstone, through which my course lay, exhibited unmistakable signs of this disease, no sooner were the older strata, whether carboniferous or Silurian, entered upon, than all the potato crops presented a perfectly healthy appearance. Again, in the autumn of last year, all the potato crops in this region suffered in a greater or less degree; whilst, as I was informed by an eye-witness, in the carboniferous and other strata of Northumberland and Cumberland, the potato crops were wholly free from this disease, although the weather in that part of England was so wet and ungenial at the time, that the crops of corn suffered greatly from excess of moisture. It has occurred to me as by no means improbable, that, by a proper admixture of soil, this serious evil might, in a great measure, be suppressed, if not wholly eradicated; and, if agricultural geologists would, through the medium of the GEOLOGIST, furnish reports of the districts in which the disease is particularly prevalent, and of those where the crops are healthy, it might lead to very beneficial results.—R. M. ZOERNLIN, Kenilworth, August, 1858.”

CLASSIFICATION OF THE PURBECK BEDS.—“SIR,—As a student of geology, I have been much puzzled with the classification of the Purbeck beds; some authors representing them as belonging to the Wealden, others to the Oolite, and some again as being a distinct formation. Can you inform me, through your invaluable Journal, which is most correct. Also, of the origin of the popular belief in the existence of coal beneath Blackheath, near London.—Yours obediently, N. Z. FOSSIL.”—The Purbeck and Wealden deposits are probably contemporaneous with certain lower Cretaceous marine beds, which are to be found existing in France and Switzerland, and were, therefore, anterior in age to our greensand and chalk, though to some extent our lower greensand intercalates with the Upper Wealden beds. The rivers of the Oolitic, Wealden, and early Cretaceous period evidently ran from the same lands, though these were progressively modified in extent, and washed by seas, holding, as ages advanced, successively modified faunas. In geological language, therefore, the Purbeck and Wealden indicate a transitional period between the Jurassic and the Cretaceous periods, partaking in the animal and vegetable characters of each.