

December 1, 1845.—The President in the Chair.

William Johnson, Esq. was elected a Member of the Society.

The following communications were read :—

CLII. *An Account of various Substances found in the Guano Deposits and in their Vicinity.* By E. F. TESCHEMACHER, Esq.

REPORTS having been circulated that large quantities of saltpetre (nitrate of potash and nitrate of soda) were to be found of a very good quality in the neighbourhood of the guano deposits on the coast of Africa, numerous vessels were dispatched both from London and Liverpool in search of those valuable substances, particularly as it was considered they might be obtained upon the same terms as Ichaboe guano, namely, for nothing but the labour and expense of fetching.

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No favourable accounts however have as yet been received as to the success of these undertakings. The evidence of such deposits existing there at all was very unsatisfactory; the circumstance much relied upon was the existence of large beds of nitrate of soda in the neighbourhood of the coast of South America, and large deposits of guano similar in many respects to the deposits of guano on the African coast: there was certainly an abundance of animal matter and ammoniacal salts to furnish the nitric acid, and a temperature high enough to effect the decomposition, but the source from whence the alkaline bases of potash and soda were to be derived was not very evident. The principal source of saltpetre in the East Indies is from numerous districts of nitrous earth found on the surface of the soil, which being compounds of lime and magnesia with nitric acid, they are dissolved out, and the saltpetre subsequently formed by the decomposition of these nitrous compounds by potash salts. The nitrate of soda saltpetre beds in the Province of Tarapaca near Iquiqua on the coast of South America, are the only instances known of the occurrence of saltpetre ready-formed in extensive beds, but even this deposit contains the salt in a state of great impurity.

These explorations, however, on the African coast have brought to light various other substances which have been found there, the details of which are more particularly the object of this communication.

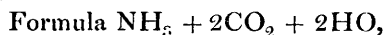
The substances which I shall now describe are found in the guano beds, or in their vicinity, either in a crystalline state, or in distinct masses. The first substance is a crystalline salt, perfectly transparent, with a cleavage and brilliant faces in one direction only; it gives a yellow precipitate with nitrate of silver; gives off ammonia upon application of caustic potash, and when heated to redness loses about 50 per cent. of water and ammonia; I consider it therefore to be *phosphate of ammonia*. The portion of salt I examined consisted only of a few grains, and was consequently too small a quantity to analyse with exactness.

The next substance was also a crystalline salt a little mixed with guano in its cavities; it possessed a cleavage with brilliant planes in two directions: upon examination with the reflecting goniometer, it gave 112° as the measurement of the angle formed by the meeting of the adjacent planes. Upon analysis I found it to consist of—

21.0	parts of Ammonia.
55.50	... Carbonic acid.
23.50	... Water.
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100.00	

found in the Guano Deposits and in their Vicinity. 15

being nearly equivalent to 1 atom of ammonia, 2 atoms of carbonic acid, and 2 atoms of water.

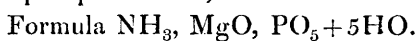


and is consequently a *bicarbonate of ammonia*.

The third substance was found at Saldanha Bay on the coast of Africa, imbedded in patches in the mass of guano. It is found in distinct crystals with numerous modifications, many of the planes possessing sufficient brilliancy to enable me to measure the angles by the reflecting goniometer. I have given the measurements of one crystal, from which it appears the primary form is the right rhombic prism of $57^\circ 30'$ and $122^\circ 30'$: it has a cleavage parallel to plane M*. Upon analysis I find this substance to be composed of—

14.30	parts of Ammonia.
17.00	... Magnesia.
30.40	... Phosphoric acid.
38.10	... Water.
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99.80	

which is nearly equivalent to 1 atom ammonia, 1 atom magnesia, 1 atom phosphoric acid, 5 atoms water.



It is therefore the *ammonio-magnesian phosphate*. The specific gravity is 1.65, hardness 2; it falls to powder before the blowpipe, giving off water and ammonia. It occurs white, translucent, sometimes coloured brown by the guano; it readily dissolves in weak acids.

This substance is clearly derived from the guano; but being insoluble in water, it must have been held in solution by some of the organic acids of the guano, and deposited therefrom in large crystals, as they are found, but disseminated in patches only of the guano, in various parts of the beds.

This substance not having been found before in a native state, but hitherto only been known as one of the artificial products of the laboratory, must be considered as a new mineral body; I therefore propose to give it the mineralogical name of *Guanite*, this name being derived from the circumstances and locality of its formation.

The source from which the first two substances, namely, the phosphate of ammonia and the bicarbonate of ammonia, are derived, is clearly the percolation of water through the guano beds dissolving out these salts, which running into lower

* See the angular measurements subjoined.

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situations may be detained in lagoons and hollows of rocks, where being subject to the high temperature of the climate they would be evaporated down, leaving these salts in the crystalline state described. As guano contains abundance of these two salts, it is possible there may exist considerable masses of them; should this be the case, it is evident that to the chemist in particular it would be of great interest as an additional source of these valuable salts.

The chance of finding any considerable quantity of guanite in the state of crystals is not great, but as it forms one of the ingredients of guano it is a substance of some importance. The application of it as a manure in combination with other ingredients is likely to be highly beneficial, it being a compound containing two important substances in an insoluble state, namely, ammonia and phosphoric acid; these may be taken up by plants only as they may be required, and not be liable to be dissolved out of the soil or evaporated like other ammoniacal salts.

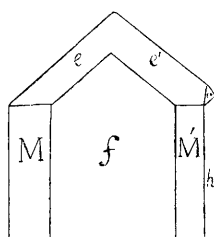
The last substance which I shall describe was also found imbedded in the guano from Saldanha Bay; it consists of small globular particles composed of concentric laminæ slightly adhering together, of a yellowish white colour, containing in places portions of a similar nature, which on fracture have appearances of an organic structure like bone, but on examination by the microscope proved to be portions of shells resembling Nummulites. On analysis I found the substance to be composed of—

37·50	parts	Carbonate of lime.
32·50	...	Carbonate of magnesia.
12·00	...	Phosphate of lime.
12·00	...	Water with a little ammonia and animal matter.
3·00	...	Sand.
2·50	...	Alkaline sulphates and chlorides.
99·50		

There does not appear to be any great quantity of this substance. How it has been formed it is difficult to imagine; the composition is so very different either from that of bones or shells, particularly in regard to the large quantity of carbonate of magnesia which it contains. It is however probable that both bones and shells form the base of this substance, and that partial decomposition having taken place, the magnesia may have subsequently entered into combination with the carbonate and phosphate of lime.

Measurements of Guanite.

M on M' .	57°·30
M on <i>f</i> .	118°·30
M' on <i>f</i> .	118°·30
M' on <i>h</i> .	151°·00
<i>f</i> on <i>h</i> .	89°·30
M on <i>e</i> .	142°·10



M' on <i>e'</i> .	142°·10
<i>h</i> on <i>c</i> . .	133°·20
<i>e</i> on <i>e'</i> . .	91°·50
<i>e</i> on <i>f</i> . .	112°·20
<i>e'</i> on <i>f'</i> .	112°·20
<i>e</i> on <i>c</i> . .	142°·10
