XII.—*Note on the Bicarbonate of Ammonia of the Chinca Isles.*

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THE Chinca isles, which lie off the Coast of Peru, consist of three small rocks, the greater portion of their surface being covered with layers of guano, varying in thickness from ten to thirty yards. Here and there only the naked rock is laid bare. The quantity of guano lying in 1861–62 upon these little islands was estimated at 24,000,000 tons. Underneath the guano is found a comparatively thin layer of a white substance, forming beds several inches thick, and consisting chiefly of bicarbonate of ammonia. This salt has been met with also in Patagonia and Africa. The only mention I have found of this substance, as a natural production, is in Dana's excellent treatise on mineralogy, where he gives for its composition, NH_4O 32·91, CO_2 55·69, HO 11·40 = 100. But this applies only to the chemically pure bicarbonate, and appears to be simply a calculated result, as the natural substance is never quite pure. I am indebted to Captain Marcus Lowther, R.N., for a very fair specimen of this natural carbonate, which that gentleman procured whilst at the Chinca

isles. It is white, crystalline, compact, fragile, having an odour of ammonia, soluble in water, almost entirely volatilised by heat. Its composition, according to my analysis, is as follows:—

				Atomic ratio.	
Ammonia, NH ₄ O	.	.	29.76	1.144	1
Lime	.	.	6.02	0.215	
Magnesia	.	.	traces		
Water	.	.	11.00	1.222	1
Carbonic acid.	.	.	51.53	2.342	2
Sulphuric acid	}	.	traces		
Chlorine		.			
Phosphoric acid	.	.	0.60		
Uric acid	}	.	1.09		
Alkalies		.			
<hr/>				100.00	

This agrees nearly with the formula $\text{NH}_4\text{O}, 2\text{CO}_2, \text{HO}$ (which is that of the artificial bicarbonate of ammonia) for five equivalents of which there is in this specimen one equivalent of carbonate of lime. This natural substance differs from the scentless bicarbonate of the laboratory, by having a tolerably strong smell of ammonia, which proves that it contains a small quantity of free ammonia, or of sesquicarbonate, and accounts for the slight difference between the analytical result and the theoretical formula.

It appears quite evident that this bicarbonate of ammonia results from the decomposition of the guano which it underlies, whilst, on the other hand, guano gives birth to another substance, known in commerce as "West India Phosphate," &c., which possesses the colour and aspect of guano, but contains only about 0.5 *per cent.* of nitrogen, with abundance of phosphate and carbonate of lime. An analysis of this other product of the decomposition of guano has given me:—

Moisture	.	.	.	.	.	.	1.0
Organic matter containing 0.46 of azote	.	.	.	.	.	.	16.5
Phosphate of lime	.	.	.	.	.	.	35.5
Carbonate of lime	.	.	.	.	.	.	34.0
Sand	.	.	.	.	.	.	12.0
Sulphate of lime, &c.	.	.	.	.	.	.	1.0
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This substance has the aspect of guano ; it has no smell and contains no nodules.

It contains not a trace of uric acid, but a notable amount of xanthic oxide, which can be isolated by boiling the substance with a dilute solution of caustic soda, and passing a current of carbonic acid through the filtered liquid. In this manner, the xanthic oxide $C_5H_2N_2O_2$ is thrown down as a very fine yellowish-white powder, which can be collected on a filter, though it remains a long time suspended in the liquid. It presents all the characters of the xanthic oxide discovered by Dr. Marcet. Xanthic oxide appears to have been met with before in some kinds of guano, but it differs notably from the basic principle, guanine, discovered by M. Unger.

From the above it may be inferred that guano is capable of splitting up, by gradual decomposition, into a *mineral* portion containing phosphate and carbonate of lime, and an *organic* portion consisting entirely of bicarbonate of ammonia. But when we compare the quantity of carbonate of lime (34 per cent.) in the former product, with that contained in the rock, sombreroite* (5 per cent.), we cannot attribute the formation of the latter mineral to ancient deposits of guano ; moreover, sombreroite contains at least 17 per cent. of phosphate of alumina,—an ingredient never present in guano.