The exhausted guano then becomes phosphatic in distinction to being nitrogenous and ammoniacal ("leached"), and the subjacent limestone undergoes a metamorphosis by a double decomposition, into phosphate of lime. If the absorbing limestone is pure, the phosphate of lime formed thereby will be correspondingly pure; and on the other hand, if the calcareous base is intermixed with clay or sand or ferruginous material, the newly formed product will contain alumina, silica, oxide of iron, etc., in like proportions.

Such has been the undoubted origin of the deposits of Aruba Rock phosphate, samples of which are on the table, and which are typical of this kind of metamorphosis and will serve to illustrate many similarly formed deposits, notably those of Curaçao, Sombrera, Navassa and Redondo (in which latter case the subsoil must have been aluminous, since the mineral is a phosphate of alumina).

In some cases the phosphatic principle may have been derived from animal *debris*, such as bones.

The composition of animal bones varies somewhat, according to the animal furnishing them, and even with the particular part of the same animal, but the following analysis, expressed in 100 parts, may be taken as an average :—

| | Green Bones. | Bone Ash. |
|---|---|---|
| Moisture<br>Organic matter | 33. (gelatine) | |
| Phosphate of lime | 56 | 70·75% |
| Phosphate of Magnesia | 3 | |
| Carbonate of Calcium | 3 | |
| Alkaline Salts | 4 | |
| Silica | | |

The bones of birds are even richer in phosphoric acid than those of animals, but bones of amphibia and fish contain less than those of birds and animals.

Amongst other animal organisms rich in phosphoric acid or phosphate of lime may be mentioned certain shell fish, or rather their shell remains, notably the shells of *Lingula* and *Orbicula*, which consist for the greater part of phosphate of lime, and are found in accumulated beds in the Lower Silurian rocks, being thus described by Sir Wm. Logan (Geology of Canada, 1863) :