THE GUANO DEPOSIT OF THE WESTERN ISLANDS (HSISATAO) OR PARACEL REEFS

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WITH ONE PLATE

INTRODUCTION

The western Islands (Hsisatao) or the Paracel Reefs form the southern-most Chinese territory in the China sea. They are situated between latitudes 15°30′ N., and 17°30′ N. and longitudes E 111-113°. Accordingly with this position in the tropical zone, the climate is hot throughout the year.

In recent years, guano deposits on the islands have been found and produced for the purpose of fertilization. The reefs being far from the continent, and deprived of communication, a detailed study of the deposits has not yet been made. In May of the year 1928, under the auspices of the Political Council of Canton, a group of officers, selected from different departments, was sent especially for the purpose making an investigation of the guano deposits. The author had the opportunity to join them on this expedition. The islands visited at this time were four in number; namely, *Woody Island*, *Rocky Island*, *Duncan Island*, and *Palm Island*. The remaining islands, more than ten in number, were left out on account of the difficulty of anchorage.

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GENERAL TOPOGRAPHY AND GEOLOGY

The four islands which have been surveyed are all small in area and of different shapes. *Woody Island* (林島) has an area of 1,500,100 square meters. It has an oval shape with its longer axis in an east and

west direction. *Rocky Island* (石島) is much smaller, covering an area of 68,750 square meters only. It is rather round in shape with an irregular outline. These two Islands are very near together, and are surrounded by the same coral reef. *Duncan Island* has an area of 432,500 square meters. It has a simi-circular shape with the convex side towards the north-east, and the concave side on the south-west. *Palm Island* is also very small in area, having only 76,250 square meters. It has nearly the same shape as *Duncan Island*. The latter two Islands are also situated very close to each other and are surrounded by the same reef.

The elevations of these islands above sea level are very small. *Rocky Island* which is the highest, has an elevation of fifteen meters. The others are not more than ten meters in height.

As mentioned above, the islands are surrounded by coral reefs which rise to within a few feet of the surface of the water. On the beach of each island, there are accumulated plenty of the broken corals, shells, etc. But on the island, the corals have made a circular rim which is usually a little higher than the middle part. On some islands a small lake is present at the center.

Geologically, the islands are principally made up of corals and shells. The shells are those of Lamellibranchiata, Scaphopoda, Gastropoda, Cephalopoda. The testis of Echinodermata such as Echinoidea and Crinoidea, are also mingled with the shells and with the corals. Bones of fishes also form a part of the material of the islands. These corals, shells and bones, are cemented by percolating waters carrying lime in solution into hard rock showing stratification as may be seen on *Rocky Island*. In addition to the shells, etc there are the guano deposits. These are the excrements of sea birds and are of two types, one in the form of brown powder, the other in whitish nodules. Small flakes of calcareous matter are present, although no proper soil is formed.

GUANO DEPOSITS

The Guano deposits are found on all the four islands, and are especially abundant on *Woody Island*, where they form a bed 25 centimeters in thickness, and more an powder than in the form of nodules. The latter vary in size, weighing from less than one pound to more than forty pounds each.

On *Rocky Island*, the brown coloured powder of guano is also found, but it varies much in quantity throughout the area. In some parts a little guano is also present in the consolidated rocky mass of shells.

On *Duncan* and *Palm Islands*, guano is present on a small scale in the interstices of the corals and shells.

Guano is said to be found also on *Money Island*, which is not very far from *Duncan Island*. But the detailed conditions are not known because it was impossible to find an anchoring place.

The origin of the guano deposit appears to be from different sources, but the excrements of birds are certainly of first importance. The author was told by Professor Otto Jaekel that Professor Schauinsland, a Zoologist of Bremen, Germany, has given an excellent description of the life of such birds in *Laysan Island* in the north of the Hawaiian archipelago. It is generally said that these birds come from a great distance to deposit their eggs on the ground. Others make their nests in trees at different heights. Therefore, in the same part of the island, the Guano deposits are formed of excrement of different birds, especially those of gulls.

The quality of guano also varies in different places. The samples collected by Mr. Chu Wei Sheng and the author from *Woody Island* have been analysed by the Chemical Department of Sun Yatsen University in Canton:

No.	Moisture (Heated at 100°-105°)	Ash	P_2O_5
1	4.99%	64.44%	8.19%
2	2.77"	64.57"	2.41"
3	7.52"	66.21"	12.51"
4	6.72"	59.26"	10.27"
5	4.19"	69.17"	6.48"
6	2.64"	59.71"	1.24"
7	6.51"	74.28"	14.56"
8	5.83"	68.17"	10.80"
9	5.79"	65.38"	13.50"
10	9.73"	74.81"	14.31"
11	5.88"	74.25"	16.26"
12	2.66"	79.12"	5.55"
13	3.83"	78.87"	14.40"
14	9.86"	71.52"	12.24"
15	8.94"	70.65"	14.49"
16	4.27"	77.95"	16.88"
Average	5.20%	69.89%	10.88%

The deposit of guano on *Woody Island* is of special importance. According to the map surveyed at this time the area covered by guano deposits is 1,291,600 square meters. Taking twenty five centimeters as an average

thickness, the volume of guano would amount to 322,900 cubic meters. From this volume, the space occupied by the roots of the trees should be deducted. The latter may be estimated at one tenth of the total volume. Therefore, some 290,000 cubic meters constitute the aproximate volume of the guano. A car of 0.65 cubic meters takes half a ton of the guano. Thus the total quantity of guano is about 223, 500 tons. But the guano already taken away covers an area of 280,000 square meters. By the same method of calculation, we derive a quantity of 48,500 tons. Deducting the latter, the quantity remaining will be 175, 000 tons.

T. O Chu: Plan and sections of Paracel Reefs.