



Fig. 185 Entrance to Port Utria, Colombia



Fig. 186 Port Utria, Colombia

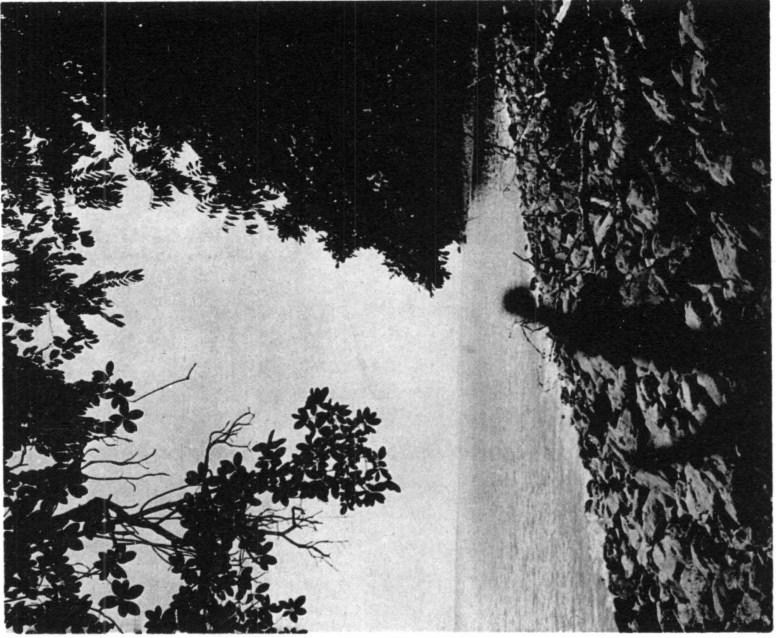


Fig. 188 Gorgona Island, Colombia

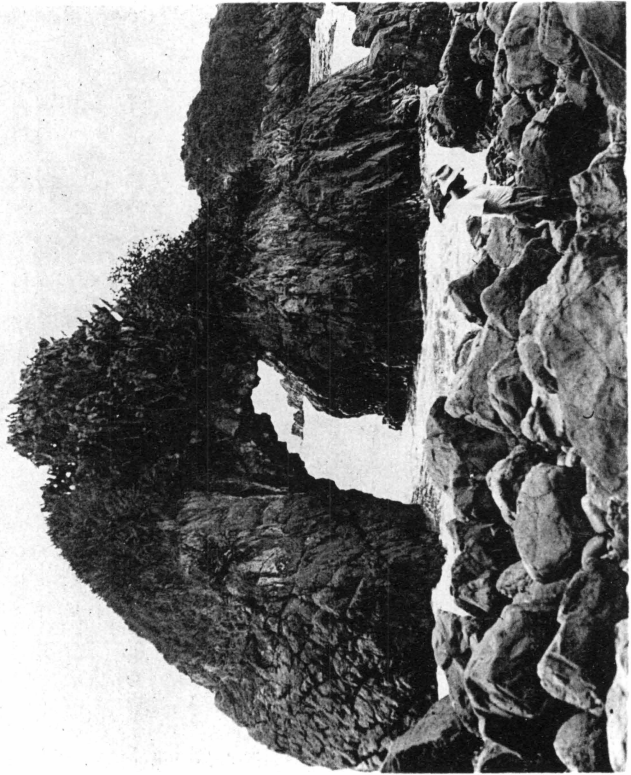


Fig. 187 Gorgona Island, Colombia



Fig. 189 Village, Cape San Francisco, Ecuador



Fig. 190 Lagoon, Cape San Francisco, Ecuador



Fig. 191 Panorama, Punta Brava, Santa Elena Peninsula, Ecuador



Fig. 192 La Plata Island, Ecuador

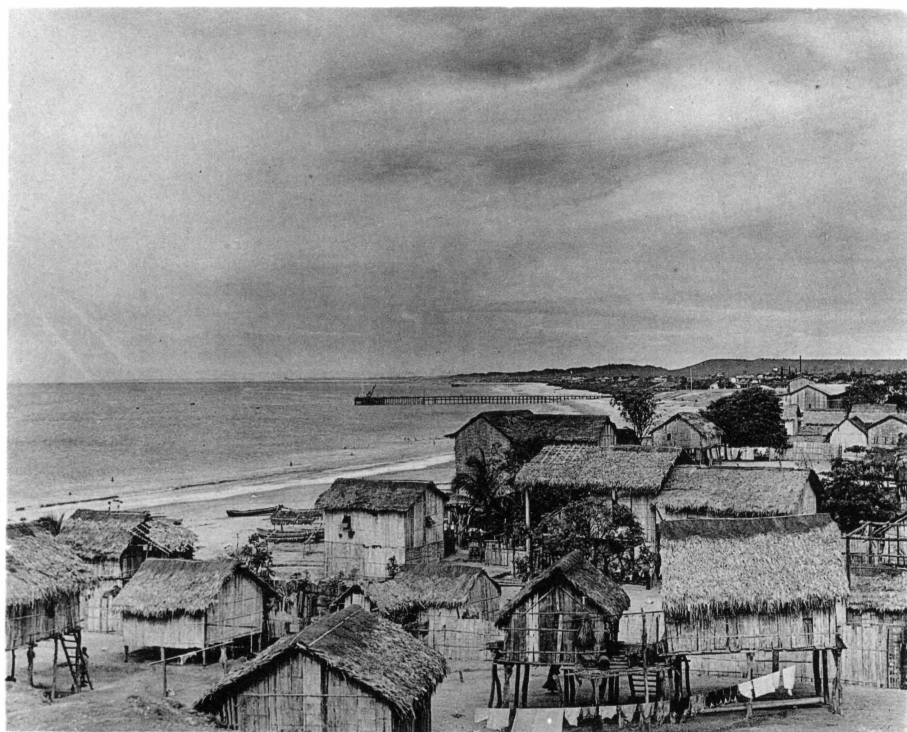


Fig. 193 La Libertad, Ecuador



Fig. 194 Manta, Ecuador



Fig. 195 Guayaquil, Ecuador

## PLATE 82

- Fig. 174 The spacious harbor of Bahía Honda, Panama, seen from a slight elevation on the mainland in the northeast portion of the bay. The village lies on an island to the left, and is not shown in the picture.
- Fig. 175 Native huts on the north shore of Bahía Honda, Panama, the homes of Panamanian fishermen. Collecting of marine invertebrates, particularly crustaceans, was accomplished in a small-rock shingle at the far end of the beach. Chart 80, p. 409.

## PLATE 83

- Fig. 176 Two views of the exposed reef which extends for a mile or more along a, b the shores of Jicarita Island, Panama, and probably represents an uplifted shore line. Jicarita Island is much smaller than, and is situated south of Jicarón Island. Chart 81, p. 409. (Photographs by Wm. R. Taylor.)
- Fig. 177 The village on Taboga Island, Panama, is not large, but it commands directly the Pacific approach to the Panama Canal. Dredging in the vicinity of Taboga Island was the only offshore operation carried on by the *Velero III* within the Bay of Panama. Chart 82, p. 410.

## PLATE 84

- Fig. 178 Water front at Panama City, Panama, taken from near the president's palace. The small boats in the foreground are fishing vessels and fruit boats which bring their produce to the market in the early morning hours. Chart 82, p. 410.
- Fig. 179 The *Velero III* alongside the dock in Balboa, Canal Zone. Vessels making the transit of the Canal pass up the channel directly astern. The clear spaces shown on the hills in the background represent recently burned-over areas. Chart 82, p. 410.

## PLATE 85

- Fig. 180 Gatun Lake in the Canal Zone seen from the head of the stairway leading to the Barro Colorado Island laboratories. The route of the canal crosses the picture from left to right about a mile beyond the small island in the center of the picture. (Photograph by W. L. Schmitt.)
- Fig. 181 The New York Zoological Society's Laboratory of Tropical Research is located on Barro Colorado Island in the Canal Zone. The laboratory is reached by crossing Gatun Lake from the Frijoles Railroad Station on the Trans-Isthmian Railroad. The principal laboratory building is shown at the head of the stairway. (Photograph by W. L. Schmitt.)

## PLATE 86

- Fig. 182 Stream behind village at Piñas Bay, Panama, showing dense growth of tropical jungle. Chart 82, p. 410.
- Fig. 183 A glimpse of Panamanian shore line at Piñas Bay. The promontory which forms the southern boundary of the bay is shown beyond the figures of the native boys, who in turn are standing beside a large mortar used in grinding flour.
- Fig. 184 The island of Malpelo, Colombia, a solid mass of granite rising from the deep floor of the Bay of Panama. Here Hancock Expedition parties secured examples of the rare lizard, *Diploglossus hancocki*, and of the abundant land crab, *Gecarcinus malpелensis*.

It is desired to make a special acknowledgment to Dr. John S. Garth for his contribution of photographs used in the following figures: 82, 83, 87, 93, 97, 98, 104, 105, 106, 117, 120, 123, 124, 125, 133, 134, 139, 140, 141, 146, 147a, 149, 152, 157, 169, 171, 172, 173, 174, 182, 183, 187, 188, 195, 196, 197, 202, 204, 210, 214, 240, 242, 247, 248, 249, 257, 258.

## PLATE 87

- Fig. 185 The entrance to Port Utria, Colombia, is narrow, but deep. Hills are clothed with the luxuriant foliage of the tropical rain forest which extends to the water's edge. The few sand beaches are backed with groves of coconut palms beneath which are located native dwellings. Chart 85, p. 411.
- Fig. 186 Beneath the roots of the coconut palm trees at Port Utria, Colombia, were found giant burrowing land crabs, while the forest in the interior abounded with tropical birds and butterflies. Rainfall in this region is almost incessant. Chart 85, p. 411.

## PLATE 88

- Fig. 187 Sea arch located at the north end of Gorgona Island, Colombia. It is one of a series of sea stacks composed of basaltic lava. Chart 87, p. 412.
- Fig. 188 Rocky beach at Gorgona Island, Colombia, overgrown with dense tropical foliage. Chart 87, p. 412.

## PLATE 89

- Fig. 189 The village of Cape San Francisco, Ecuador, as little touched by civilization as any visited by the *Velero III*. Elevation of the bamboo and thatched houses to the second-story level is practiced in view of the abundant rainfall and consequent rapid runoff from the hillsides above in rainy periods.
- Fig. 190 The lagoon at Cape San Francisco communicates with the sea by a narrow estuary which is navigable to small craft at high tide. Ecuadorian fishermen sail their tiny fishing vessels into the lagoon and beach them during stormy weather. Chart 88, p. 412.

## PLATES 90, 91

- Fig. 191 (A panorama.) Punta Brava, most westerly promontory of the Santa Elena Peninsula, Ecuador. Several ancient shore lines are seen on the promontories in the background. The reef in the foreground was an exceedingly profitable collecting locality for the marine zoologists. (Photographs by W. L. Schmitt.)
- Fig. 192 Hancock Expedition members launching a native canoe through the surf at La Plata Island, Ecuador. Chart 90, p. 412.
- Fig. 193 La Libertad, Ecuador, seaport of the Santa Elena Peninsula, at which ocean-going tankers take on oil from refineries located across the peninsula at Ancon. Native dwellings are constructed of bamboo and thatch and are invariably elevated. Chart 89, p. 412.

## PLATE 92

- Fig. 194 Manta, Ecuador, a thriving seaport town of the province of Manabí. Houses are made for the most part of bamboo, which is known locally as Guayaquil cane. Cathedral spires dominate the landscape. Chart 90, p. 412.
- Fig. 195 The city of Guayaquil, located on the Guayas River about 40 miles from its mouth. It is the largest city in Ecuador, and from it a railroad leads to Quito, the capital, 300 miles inland and 9,000 feet high.



*Peru*

Plates 93-104; Charts 91-97

From Payana Point outward the south-southeastern shore forms the coast line of Peru. Fifteen or 16 miles from Payana Point the appearance of the coastal landscape changes very materially. The rich, green vegetation of the shores of the inner gulf and the north shore almost ceases. What there is, is low and scattered. It is 66 miles from Malpelo Point to Cape Blanco. There is one shore station 24 miles southwest of Malpelo Point and 9 miles from Zorritos Light.

South of Cape Blanco, 25 miles, is Parinas Point, the most westerly point of South America. The intervening coast is made up of two small bights, with Lobos Point between. Here and far south along the coast from here are numerous small bays that serve as anchorages for the many oil towns and villages on or near the coast.

From Parinas Point the coast stretches southwestward to Port Paita and westward again a short distance to Paita Point, 27 miles from Parinas Point. Paita Point is the northwest extremity of a 10-mile peninsula with Foca Point at the southwest extremity. Most of these points along this part of the coast form cliffs, often sandy, or bluffs higher than the coast and extending inland.

From Foca Point the trend of the coast for 30 miles is southeast to the entrance of a semicircular bay, Sechura Bay, 12 miles across the entrance to Pizura Point; or the whole indentation from Foca Point to Pizura Point may be called Sechura Bay. There are two dredging stations in the bay, both in 10 fathoms or less in sand and broken shell, the one 18 miles southeast of Foca Point and the other 10 miles northeast of Pizura Point.

Ten miles south of Pizura Point, where the oil fields are left behind, is Aguja Point, from which the coast line forms a regular convexity facing south for about 15 miles and then forms a regular, low-lying coast extending to the southeastward to Eten Head. Thirty-three miles southeast of Aguja Point and 9 miles offshore is Lobos de Tierra Island,  $5\frac{1}{2}$  miles long from north to south and  $\frac{1}{4}$  to 2 miles wide, with numerous islets and shoals offshore. The greatest height is 325 feet.

South and somewhat east of this, 28 miles, and 50 miles directly west of Eten Head are the Lobos de Afuera. There are two islands close together and several islets. They are barren, covered with guano, the most northerly of the "Bird Islands of Peru." Much of the shore is inaccessible, but there is anchorage in a bay to the northwest and in one to the

southeast. The birds here are the main attraction, but some shore collecting and dredging in shallow water and rock in both north and south bays have been done.

For more than 100 miles in a south-southeasterly trend, from Eten Head to Huañape Hill, the coast line might be described as wavy, as there are no prominent points and no deep recessions. The coast is low, mostly with a sand beach, but this is occasionally broken by sand cliffs.

Six miles west of south from the point that projects from Huañape Hill are the Huañape Islands, two of them, with some outlying islets and rocks. The islands are small but are high and rocky. Some collections have been made along the rocky shore by making use of a skiff.

With the exception of 30 miles of coast, 45 miles from Huañape Hill, where there are several definite indentations, separated by projecting points, the coast south of Huañape Hill, for 135 miles, to Salinas Promontory is much the same in nature and trend as that north of the Hill. Salinas Promontory projects directly westward. It is 6 miles wide at the face, between Bajas Point to the north and Salinas Point to the west. Eastward of Bajas Point is the fair-sized Salinas Bay. Huara Islands, a chain of small islets, lie 14 miles to the southwest.

From Salinas Point there is a 53-mile sweep of the coast, southwestward, southward, and finally westward to Callao Point, off which is the island, San Lorenzo, which forms the southwest boundary of Callao Bay, the entrance of which extends 11 miles from Cape San Lorenzo, the northern tip of the island, to Bernal Point on the mainland to the northeast.

Callao, the principal Peruvian port, 8 miles from Lima, the capital city, is situated at the head of the bay, facing the northwest.

Callao Point projects a mile or so from the mainland; it is narrow, and the connection with the mainland is but 200 yards wide. From the point a shoal, Camotal Bank, extends westward for  $1\frac{3}{4}$  miles, narrowing the real channel between the Bank and San Lorenzo Island, the Boquerón, to little more than half a mile. From the east shore of the bay, just north of Callao, at the mouth of the River Rimac, is another large bank, extending a mile seaward. Except for these banks the bay is free of dangers.

San Lorenzo Island,  $4\frac{1}{2}$  miles long, northwest to southeast, and 1 mile wide, with 1,220 feet as the greatest elevation, is separated from Callao Point by the Boquerón. There are several islands, islets, and rocks offshore, particularly off the south end. The largest of these is Fronton

Island,  $\frac{3}{4}$  mile long and slightly more than  $\frac{1}{4}$  mile wide. A bank from the main island extends around Fronton Island, as it does around some of the other small islands.

There is a shore station on the breakwater at Callao, but in this vicinity all the dredging has been done around Fronton Island and the adjacent portion of San Lorenzo Island.

West of Callao Bay, 37 miles from Bernal Point, is a small cluster of rocks, Hormigas de Afuera, guano covered and without vegetation. Here are two dredging stations, in 45 fathoms, mud and shell.

From Callao Point the coast line continues in the same general direction for 120 miles and then swings westward, 10 miles, to Paracas Point, with a southward indentation east of the point to form Paracas Bay, so that the Paracas Peninsula is cut nearly halfway through at the base. The peninsula is 7 miles wide at the face between Point Paracas and Point Huacas.

North of the peninsula, 10 miles, are the three small Chincha Islands, North, Middle, and South islands. The South Island is the smallest, and the Middle Island is but slightly smaller than the North Island. These islands are most definitely the "Bird Islands of Peru." So much guano has been exported that the height of the islands has materially decreased. Here again, the birds have been the big attraction, but there have been some shore collecting and considerable dredging. In shallow water, in sand, shell, and rock, fair results have been obtained, but in the deeper water, in mud, there is little but hosts of nematodes.

From Point Huacas the coast trends to the southeast and south, 20 miles, to Carretas Head, which extends southward to shut off the northern part of Independencia Bay. This large bay is 15 miles long, but is narrowed to 10 miles at the entrance between Carretas Head and Quemado Point. It is largely shut off from the open sea in its southern portion by the islands Viejas and Santa Rosa, but there is a wide channel, Trujillana Channel, between Viejas Island and Carretas Head. Here the water is much deeper than in most of the bay itself, where it is seldom more than 20 fathoms.

There are shore stations in rock and in sand on the mainland side of the bay south of Tungo Village and on the rocky shore on the east side of the island. Lobster traps have been set and dipping has been effective. There have been about 20 dredging stations off Tungo Village and south of this, east of Viejas Island, in the middle of the bay, in the central and southern portions, and in Trujillana Channel. In the shallow water in

sand, shell, and rock results have been good, but in the mud it is mainly nematodes again.

Seventy-two miles southeast of Quemado Point is Beware (Santa Ana) Point, at the northwestern entrance to Port San Nicolas, a bay 9 miles wide at the entrance, between Beware Point and San Nicolas (Harmless) Point. This latter point projects sufficiently to form a semi-circular bay, 2 miles wide, that forms the southeastern extension of the larger bay. There are one shore station on the rocks near Point San Nicolas and one dredging station about  $\frac{3}{4}$  mile east of this, near the south shore of the bay, in 10-25 fathoms, mud.

Southeast of San Nicolas Point is another indentation similar to that north of it, the southern extension, in particular, being similar. This is Port San Juan. The southwest point is San Juan Point, 8 miles southeast of Point San Nicolas. There are two shore stations on the rocks on the south shore of the bay, 2 dipping stations with electric light, and several dredging stations in the southern part of the bay and off Point San Juan, 10-45 fathoms, in sand, shell, rock, and mud.

Port San Juan is the southern limit of the *Velero III* exploration.

PLATE 93

- Fig. 196 (A panorama.) An extensive view of the seaward side of Lobos de Afuera Islands, Peru, showing the lighthouse at the extreme left and a cove in which landings may be made in calm weather only. The nesting birds are pelicans.
- Fig. 197 (A panorama.) Pelican rookery at Lobos de Afuera Islands, Peru. These are the northernmost of Peru's guano islands and are notable for the total absence of the white-breasted cormorant which occurs so abundantly on the more southerly islands. Chart 92, p. 413; Chart 93, p. 414.

PLATE 94

- Fig. 198 The landing place at Lobos de Afuera Islands, Peru, a deep and quiet cove in which live the lighthouse keeper and the guardian of the island, representatives of the Peruvian Guano Administration. Chart 92 p. 413.
- Fig. 199 The principal rookery at Lobos de Afuera contains about 200,000 of the Peruvian pelican. Most of the adult birds were at sea fishing at the time this picture was taken. Chart 92, p. 413.

PLATE 95

- Fig. 200 The island of Huañape, most productive guano island with possible exception of the Chinchas group. Over 3,000,000 guanayes, or cormorants, nest on the slopes of this island. Young guanayes just learning to swim may be seen in the lower right-hand corner.
- Fig. 201 Landing place at Huañape Island, Peru. The considerable rise and fall of the tide makes necessary the rope ladder and the extensible wooden stairway. A small army of several thousand workers descend upon the island every three years and shovel off the accumulated bird excrement.

PLATE 96

- Fig. 202 (A panorama.) A portion of a rookery of over 3,000,000 white-breasted cormorants nesting on the island of Huañape, Peru. Terraces have been built to afford a maximum of level nesting territory.
- Fig. 203 The seaward shore of Mazorca Island is precipitous and rocky. Every available nesting site is occupied by a pair of piqueros, or boobies, but because of the inaccessibility of the nesting sites their guano cannot be reclaimed.

PLATE 97

- Fig. 204 Mazorca Island, Peru, seen from the deck of the *Velero III*. Officials of the Guano Administration are about to greet the Expedition and invite its scientists ashore.
- Fig. 205 The Island of Mazorca, basaltic monolith surmounted by a lighthouse and radio station. The buildings in the foreground are occupied by workers of the Peruvian Guano Administration and are reached by means of the hanging ladders.

PLATE 98

- Fig. 206 The water front at Callao, Peru, showing small fishing vessels which can be propelled either by oar or by sail. Large ocean-going vessels tie up at Callao wharves, some of which may be seen at the left background.
- Fig. 207 The Peruvian coast line south of Callao, marked by sea stacks in various stages of disintegration as represented by the flattened islands at the left, the peninsula in the center, and the outlying rocks, Chart 94, p. 414.

## PLATE 99

- Fig. 208 The ruins at Pachacamac, visited by hundreds of tourists annually and included in the itinerary of a party from the *Velero III* at the time of 1938 cruise to Lima, Peru.
- Fig. 209 Expedition photographer surrounded by white-breasted cormorants at Chinchas Islands, Peru. Elevation of Middle Chinchas is said to have been lowered over 100 feet in the removing of its crown of solid guano.

## PLATE 100

- Fig. 210 (A panorama.) The north island of the Ballestas group, Peru, taken from near the summit of the south island. The *Velero III* may be dimly seen immediately above a large patch of nesting birds located over the sea cave which is a prominent feature of the middle island.
- Fig. 211 The Ballestas Islands, among the most eroded of the Peruvian guano islands. They support guanayes and piqueros in about equal numbers, the guanayes preferring the more level, the piqueros the more sloping, localities as shown on the promontory to the right. In the distance rises the cloud-enveloped summit of the island of San Gallan.

## PLATE 101

- Fig. 212 From the summit of Mazorca Island a magnificent panorama of ocean, rocky shore, and mist-filled valleys unfolds, the Peruvian Andes serving as a backdrop. The birds in the immediate foreground are piqueros, those on the lower slopes guanayes, or white-breasted cormorants.
- Fig. 213 View of Independencia Bay, Peru, taken from the east side of Vieja Island, looking south. The Humboldt penguin burrows into the recent conglomerate stratum of the beach in the foreground. In the left background is the Peruvian mainland. Chart 96, p. 415.

## PLATES 102, 103

- Fig. 214 (A panorama.) A view of the peninsula which forms the southern boundary of San Juan Bay, Peru, southernmost locality visited by the *Velero III*. The Peruvian sea lion inhabits the rocky coves shown at the right of the picture, the Andean condor flying above the precipitous bluffs. Chart 97, p. 416.
- Fig. 215 Rugged coast encountered off San Juan Bay, Peru, showing rookeries of the Peruvian sea lion, and large beds of kelp. The rocks in the distance make navigation exceedingly hazardous.
- Fig. 216 San Juan Bay, Peru, most southerly point visited by the Allan Hancock Expeditions. The Expedition launch is about to land at a seal hunters' camp. A desolate portion of the Peru coast line is shown on the other side of the bay.

## PLATE 104

- Fig. 217 View of Viejas Island, Peru, looking across the southern channel of Independencia Bay from Santa Rosa Islands. The Santa Rosa Islands are a much eroded, uplifted plain, the summit of which affords nesting sites for thousands of white-breasted cormorants. Chart 96, p. 415.
- Fig. 218 The various islands of the Santa Rosa group are connected by suspension bridges which greatly facilitate the work of the guano harvesters. The islands are the remnants of an uplifted, wave-cut bench.
- Fig. 219 The Santa Rosa Islands, located at the southern end of Independencia Bay, Peru, and devoted exclusively to the culture of the guanaye or cormorant. Across the channel may be seen the southern end of Viejas Island, the summit of which is shrouded in mist.

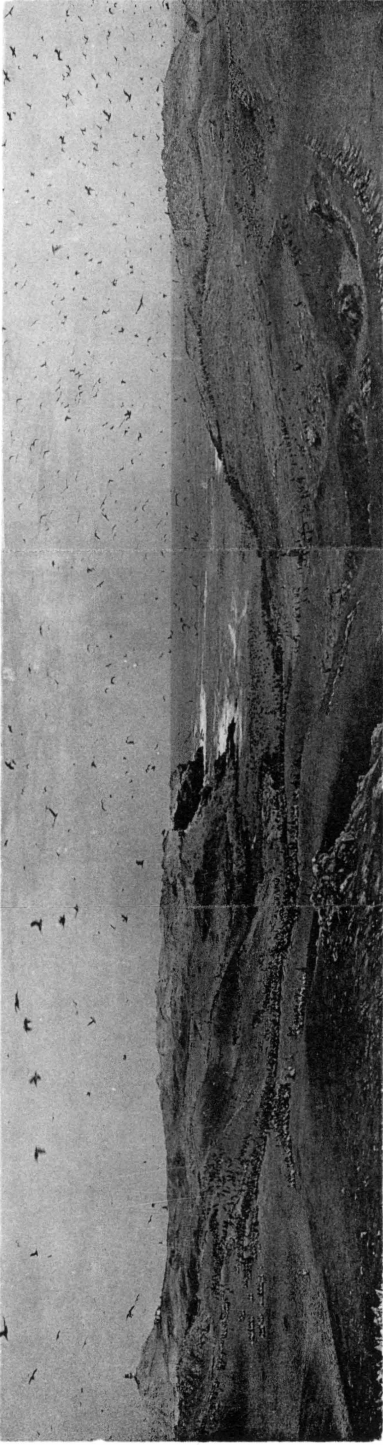


Fig. 196 Lobos de Afuera Islands,  
Peru

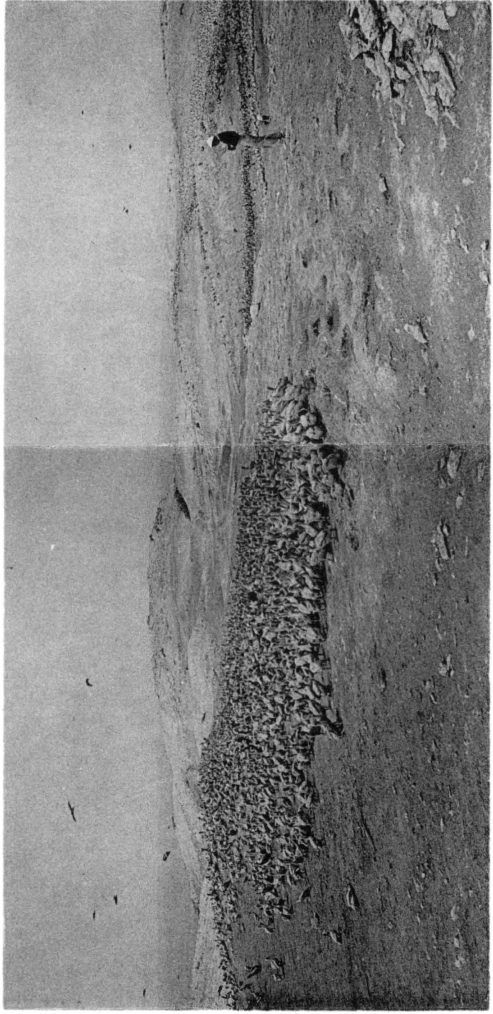
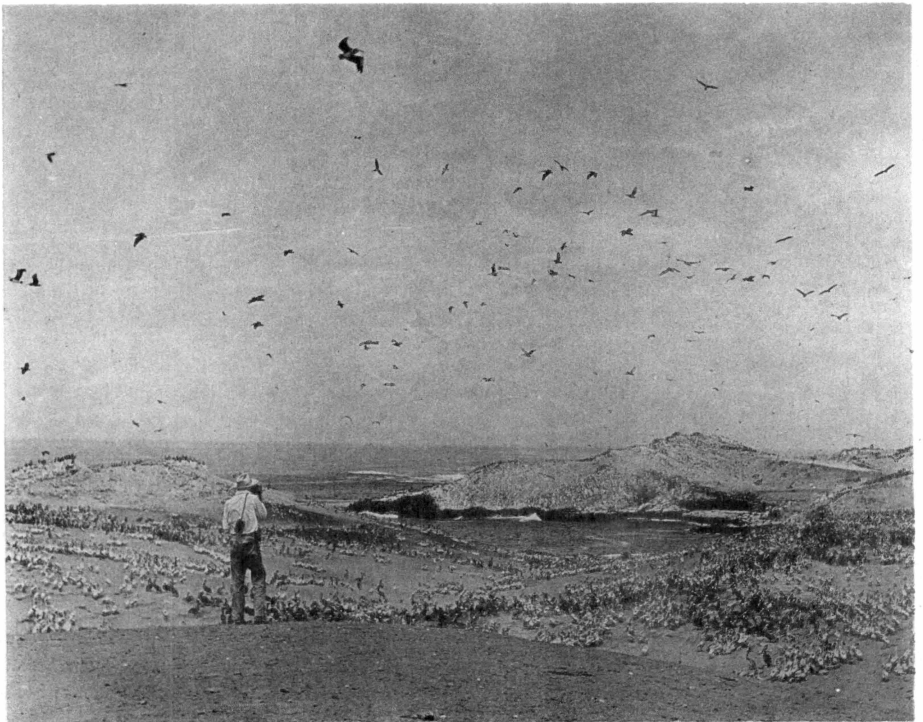
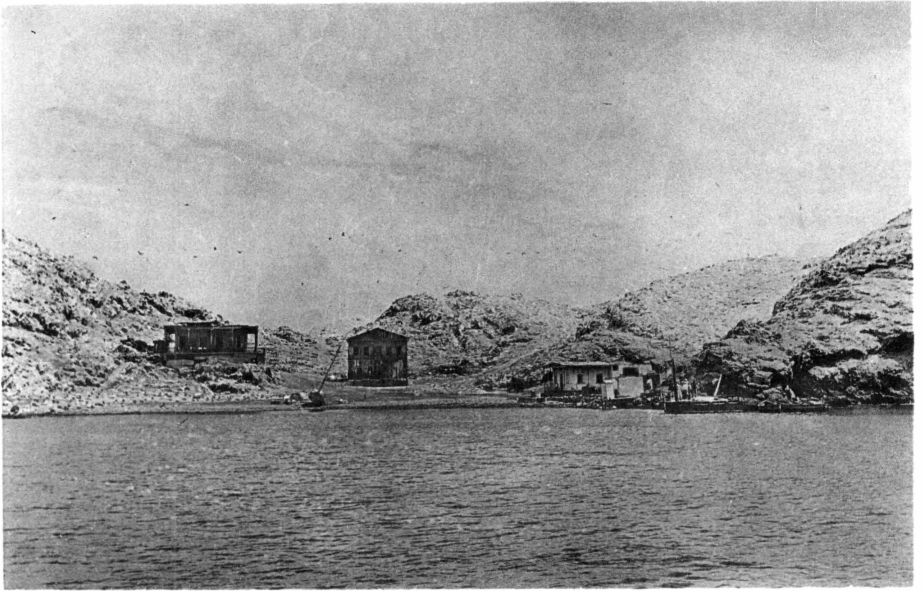


Fig. 197 (*right*) Lobos de Afuera  
Islands, Peru, pelican rookery



Figs. 198, 199 Lobos de Afuera Islands, Peru, landing and rookery





Fig. 200 Huañape Island, Peru



Fig. 201 Huañape Island, Peru, landing



Fig. 202 Panorama, Huañape Island, Peru



Fig. 203 Mazorca Island, Peru, rookery and piqueros



Fig. 204 Mazorca Island, Peru



Fig. 205 Mazorca Island, Peru



Fig. 206 Callao, Peru, waterfront

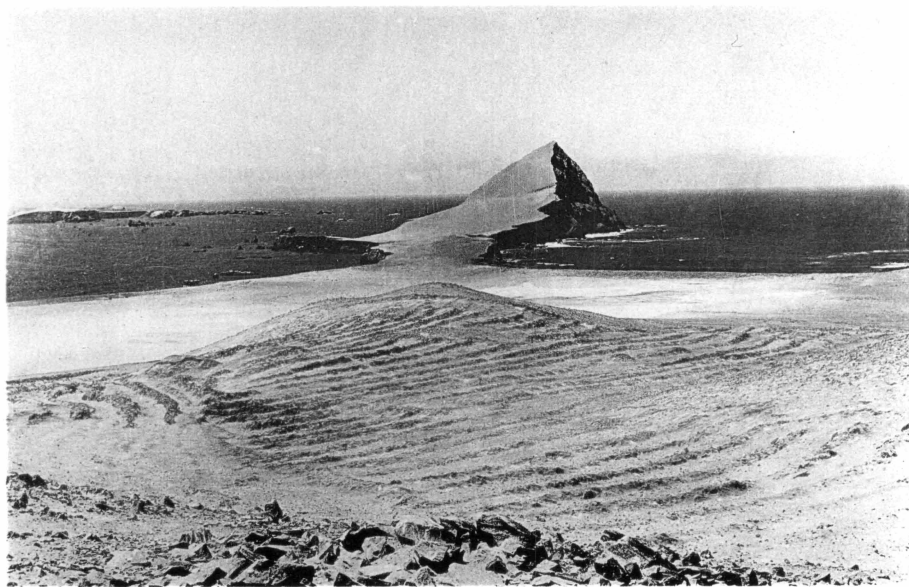


Fig. 207 Peruvian coastline south of Callao

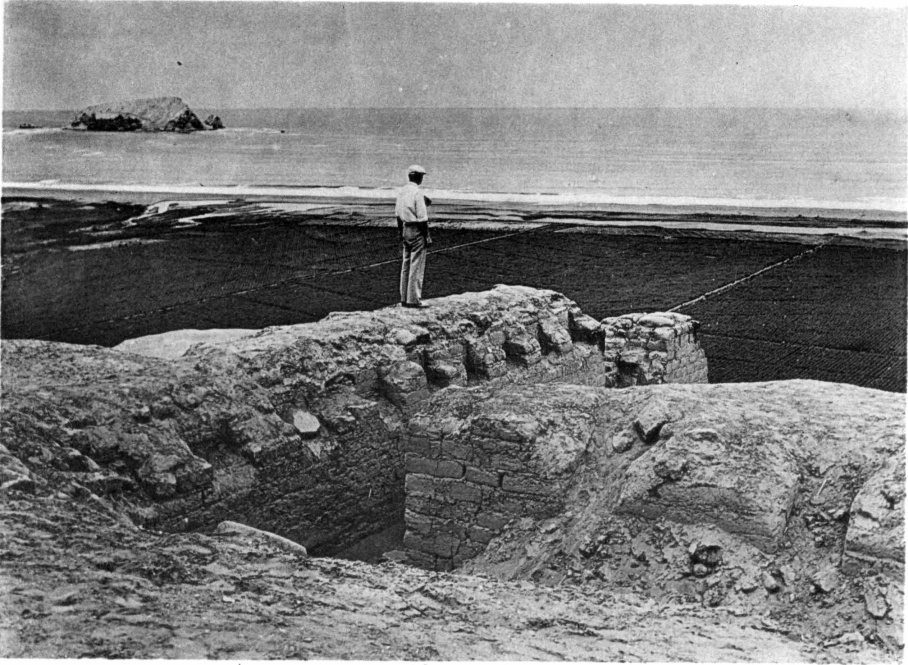


Fig. 208 Pachacamac, Peru, ruins



Fig. 209 Chinchas Islands, Peru

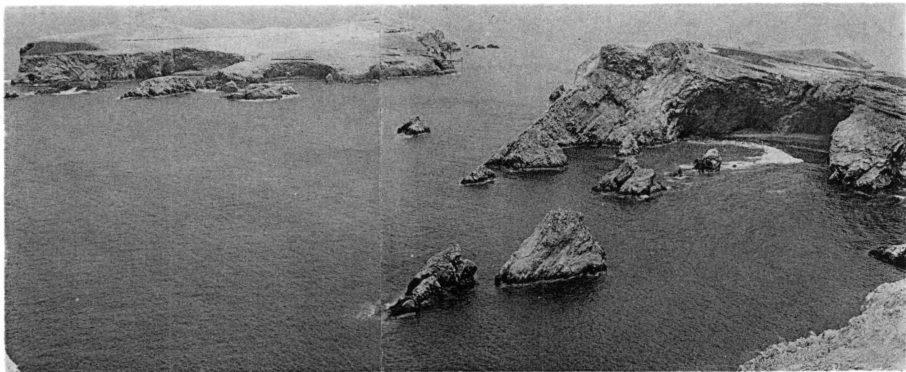


Fig. 210 Ballestas, Peru, north island



Fig. 211 Ballestas Islands, Peru

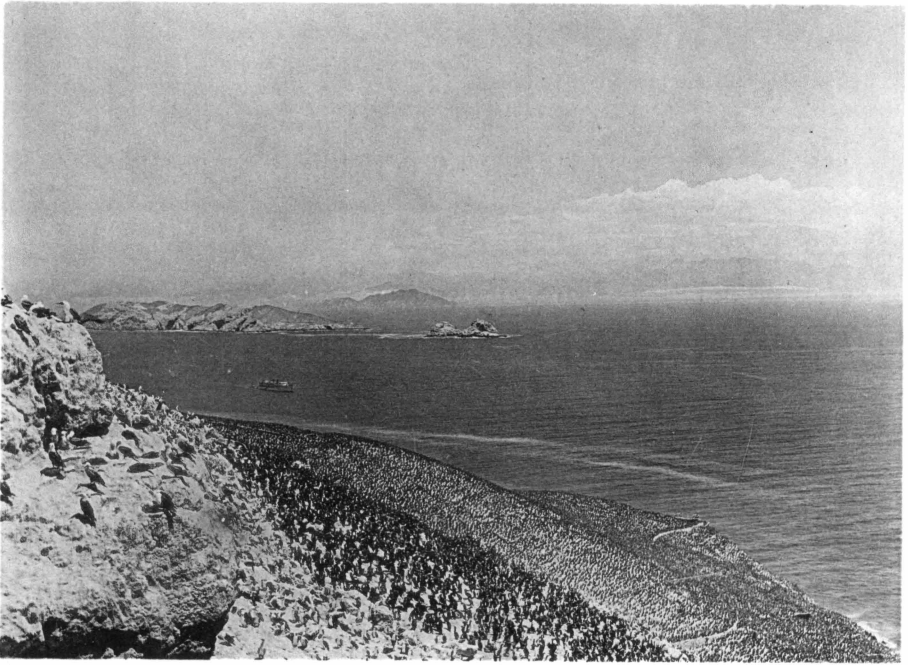


Fig. 212 Rookery, Bird Islands, Peru



Fig. 213 Independencia Bay, Peru



Fig. 214 Panorama, San Juan Bay, Peru



Fig. 215 San Juan Bay, Peru, sea lion rookery



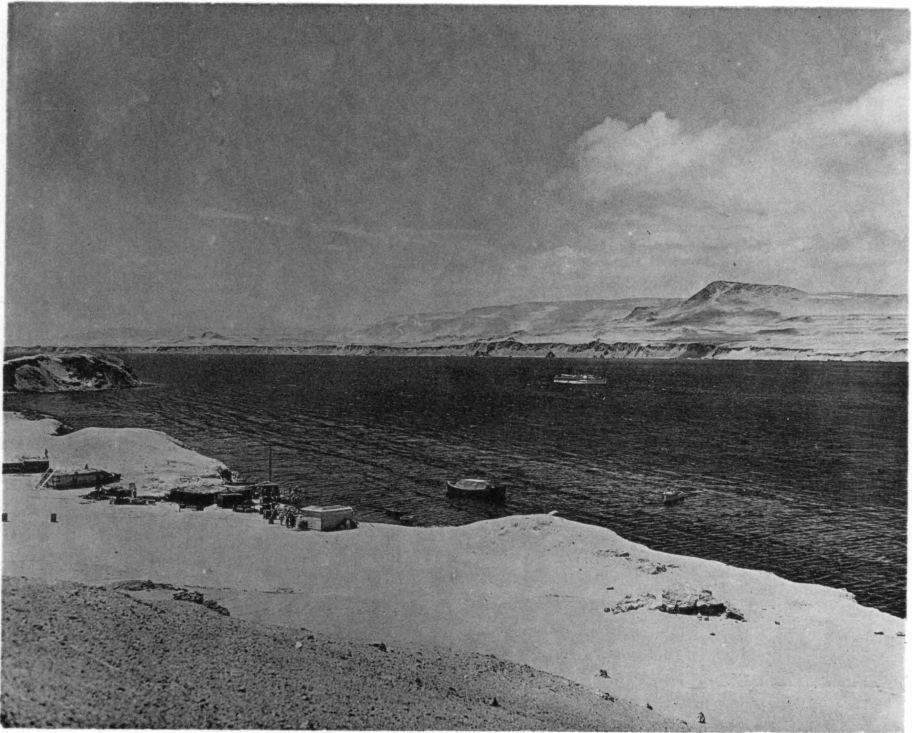
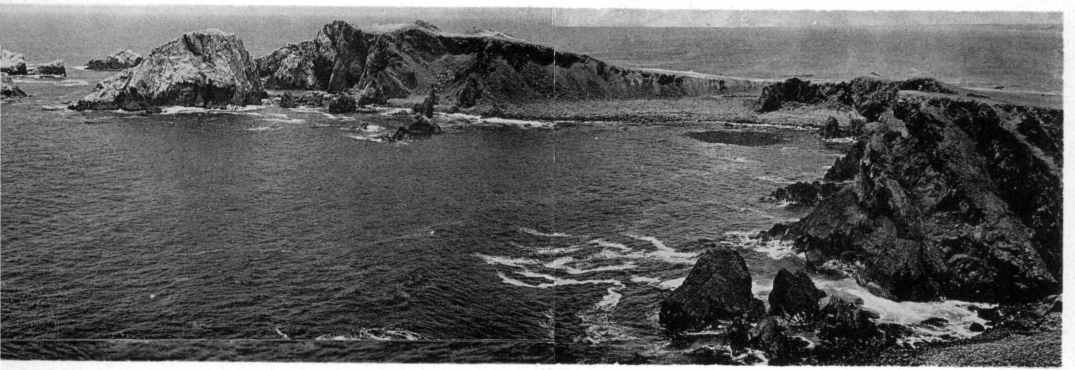
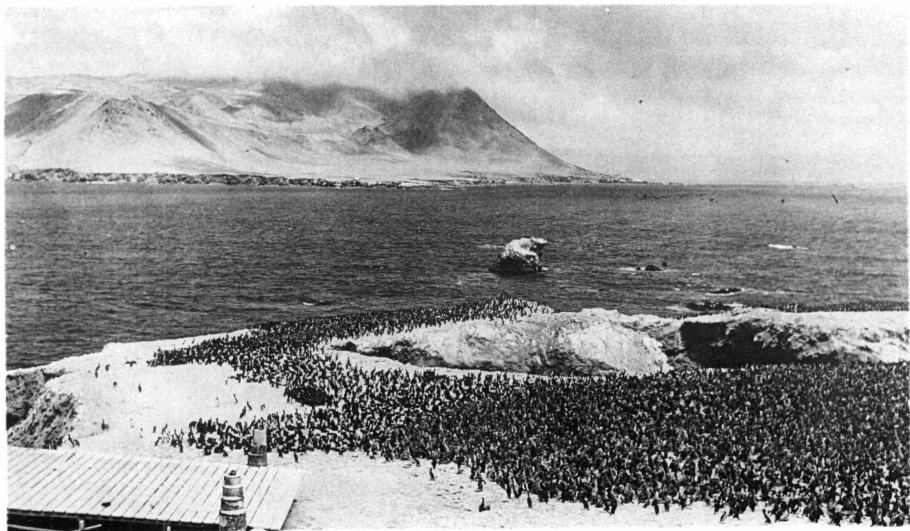


Fig. 216 San Juan Bay, Peru, sea lion hunters' camp



Figs. 217, 218 Santa Rosa Islands; 219 Vieja Island from Santa Rosa Islands, Peru

*The Galapagos Islands*

Plates 105-128; Charts 98-115

Apart from Culpepper and Wenman islands, which are outliers to the northwest, the Galapagos Islands form quite a compact archipelago, 600 miles from the coast of Ecuador, lying between  $0^{\circ} 40'$  North and  $1^{\circ} 30'$  South, and between  $89^{\circ} 15'$  West and  $91^{\circ} 45'$  West. Nearly all the large islands have Spanish as well as English names; one of them has two Spanish names and one English.

The main islands are arranged in three crescents lying in the same general direction. There is a northern crescent, with which Culpepper and Wenman may be included, consisting of Abingdon (Pinta), Bindloe (Marchena), and Tower; a central crescent, including the part of Albemarle (Isabela) north of Perry Isthmus, James (San Salvador), Indefatigable (Santa Cruz), Barrington (Santa Fe), and Chatham (San Cristobal); and a southern crescent, consisting of Narborough (Fernandina), the southern portion of Albemarle, Charles (Floreana or Santa Maria), and Hood (Española). The several small islands are usually adjacent to the larger ones.

All the islands are volcanic in origin, and some of them still show signs of activity or have been active recently. All the larger islands have the same general appearance. Each has one or more volcanic cones, the highest of them up to 5,000 feet. The coastal areas and lower portions of the slopes are dry and barren, the naked lava flows showing, or with more or less complete covering of cactus and prickly or spiny shrubbery, with leaves small or absent, practically devoid of green coloration. Farther up the slopes there may be some moisture or even an occasional spring, while the mountain tops themselves are often beclouded or be-fogged, and so get a share of moisture. In these higher areas the vegetation gets a better chance, and sugar cane, vegetables, and certain fruits, such as bananas and papayas, do very well. The soil formed from the eroded lava is evidently fertile when water is available.

Several of the islands have been inhabited at various times, and some of them are inhabited at present. In ordinary years conditions for a comfortable life in certain locations are quite favorable, but in an unusually dry year existence may become precarious.

At various times horses, donkeys, cattle, and goats have been taken to the islands, and there are still many of them which have gone wild. On some of the islands the goats, in particular, seem to have thrived to the detriment of other stock and indigenous animals that require the same

type of food. The abundance of fish in the near-by seas is possibly the greatest attraction nowadays.

Culpepper Island,  $1^{\circ} 39'$  North,  $91^{\circ} 49'$  West, marks the northwestern limit of the Galapagos Archipelago. It is a small island, 2 miles long, with the greatest elevation 550 feet. It is reported to be quite inaccessible. The *Velero III* has not visited the island, but passed it, in plain sight, about 10 miles to the westward.

Wenman Island is 20 miles south and east of Culpepper, almost equidistant, 75 miles, from Albemarle and Abingdon islands. It is really a group of three islands, but appears as one even at no great distance. The main island is precipitous, 830 feet high, with a flat top. Although volcanic, the main island appearing to be about half the cone of a large volcano, the rock appears to be laid down in uniform layers, probably formed from successive flows. Although the gaps between the separate islands give some degree of shelter, there is no suitable anchorage.

A shore station on the ledges of rock provided much good material, and birds, marine iguanas, lizards, etc., are plentiful. Dredging opposite the channel between the large island and the smaller island to the north of it, in 100-150 fathoms, in nullipores and worm-tubes, gave good results, although the dead material was large as compared with the living material.

Abingdon Island, the northwestern island of the three main islands of the northern crescent, is  $6\frac{1}{2}$  miles long, north and south, 5 miles wide, 1,950 feet high. The shores are precipitous, but in some places there is a sea-level ledge at the foot of the precipice. There are numerous rocks or rocky islets lying offshore. The only reasonable anchorage is  $1\frac{1}{2}$  miles north of Cape Chalmers (the southwestern extremity) on the west side of the island. There is a shore station near this anchorage.

Bindloe Island is of much the same type as Abingdon, 8 miles long, northwest to southeast, and 5 miles wide, but with greatest height only 500 feet. It lies  $13\frac{1}{2}$  miles to the southeast of Abingdon Island. Here also the best protection is to the southwest of the island. There are one shore station on the rocks and two dredging stations in shallow water, in sand and rock, and a greater number of tangle stations in water up to 20 fathoms, rock.

Tower Island, 27 miles east of Bindloe, is a smaller island, 4 miles long, east and west, and 3 miles wide, not much like the other two. It is low (100 feet) and is far from being as rugged. Its most characteristic feature is Darwin Bay, a break in the south shore near the east end of

the island,  $\frac{1}{2}$  mile wide at the entrance, but  $1\frac{1}{4}$  miles wide farther in and nearly circular, with the water deepening rapidly from all the shore and becoming very deep. Most of the shore is rocky, but there is a beach on the north side of the bay. There are a small pond near the beach and a much larger one, apparently filling, or partly filling, an old crater, about a mile north of the north shore of the bay.

There are shore stations on the rocks, in the sand, at the shore lagoon and the crater lagoon, several for collecting coral masses, for diving, and for dipping under the electric light; and there are dredging stations in sand, rock, and coral, from 5 to 70 fathoms.

In 1933 the *Velero III* rediscovered the Galapagos Fur Seal at Tower Island. Sea lions are common here as well as at many of the other islands.

Narborough Island really belongs to the southern crescent; but, as it faces the concavity of Albemarle and is but 3 miles from it in the northern portion, it may well be taken here. It is almost the same in length and breadth, 16 or 17 miles, and it has but one large volcanic cone, 4,320 feet, not far from the center of the island. The slopes are quite steep in the upper portion, but more gradual in the portion toward the sea, so that a large part of the island is comparatively low. There has been violent activity on this island more recently than on any of the others, as recently as 1926. The lava flows to the east, southeast, and south of the main cone seem so fresh that they might have just cooled.

There are numerous indentations along the northeast shore of the island, almost, or entirely, shut off to form salt-water lagoons, some of which are much filled with mangroves. Sea lions and turtles are partial to these lagoons. The marine iguanas are numerous along this shore. The shore and land birds are plentiful but are not different from those on the other islands. One shore station is made to include collecting along the ragged rocks, in the tide pools, in the lagoons, and among the mangroves.

Albemarle Island is the largest in the archipelago, and in some respects the most interesting. It is shaped somewhat like a sock, with the foot a little broader than the leg. While the greatest length from north to south is about 75 miles, the leg, measured from the top to the heel, northwest to southeast, is 65 miles; and the foot, from the heel to the toe, northeast to southwest, is 45 miles. The greatest width of the leg is 18 miles, and of the foot 22 miles. Where the leg joins the foot, there is a strong constriction, Perry Isthmus, to a width of 5 miles, from Elizabeth Bay on the west coast to Cartago Bay on the east coast.

Perhaps no other area in the world, at least within easy reach, equals Albemarle Island as a demonstration of the various phases of volcanism. The other islands give some good illustrations, but, in this respect, Albemarle stands supreme. It consists, in the main, of five large volcanoes, or volcanic cones: three in the leg, 4,000, 4,000, and 3,780 feet; and two in the foot, 4,230 and 5,000 feet. Perry Isthmus is of low altitude, but the other valleys are much higher. Some of these cones are still active, but not violently so.

In many places the lava flows are still exposed from the crater rims down to the sea. On all slopes of the large cones there are innumerable cones and craters of all sizes. They are most pronounced on the northwestern slope of the northern volcano and on the western slope of the most southwesterly one. Adjacent to the sea, on the northwestern part of the island, many of the craters are incomplete, the seaward portion missing. Probably by some catastrophic action after the cones were formed, great portions, sometimes as much as half the cone, were split off, leaving a vertical section exposed. When the section is directly through the blow-hole, it may give a perfect demonstration of the way in which the cone was built up, layer after layer in such noticeable stratification that it appears to be diagrammatic. When a large crater is exposed, it may show secondary or even tertiary cones within the crater.

The northeastern slope is much more gradual, down to Albemarle Point, the northeastern point of the island. This is true also of the southeastern slope.

The western slope of the southwestern cone, extending down to Cape Christopher, has so many cones, crowded and interspersed, that the appearance is fantastic in the extreme. It would be impossible to count these cones except from the air, and even then there are so many secondary and tertiary cones, some of them rather small, that it would be a difficult matter. Apparently most of the cones have been formed from the fluid or semifluid lava, as there appear to be few, if any, ash or cinder cones.

Because of all this seismic activity it is quite impossible to give in a few words any general description of the shores of such a large island. A large proportion of it is raggedly rugged, but it may be high or low. It is so rugged and so much of it is exposed so directly to the heavy surf, the Cape Christopher area, for example, that it is unsafe to try to make shore under any circumstances. There are numerous reefs and rocky ledges, but few sandy beaches. There is one small one south of Albemarle Point, at the northeast corner of the island, and some small ones in Cartago Bay, but here the mangrove has spread out so much that there is little of them

exposed. There is a bay at each end of Perry Isthmus, Elizabeth Bay to the west and Cartago Bay to the east, and a bay on the west coast, Banks Bay, just south of Cape Berkeley, the northwest point of the island. There is no very safe anchorage in any of these; but there is one in Tagus Cove—a small, funnel-shaped inlet, shut off from the open sea by the north end of Narborough Island.

There are several small islands near the coast, the most noticeable being Redondo Rock, 14 miles off the north shore; White Rock, white with guano, off the entrance to Cartago Bay; and Crossman Islets and Tortuga Island, off the southeast convexity of the island. Near the head of Tagus Cove there is a saline lake in an old crater.

There are many collecting stations on or near Albemarle Island. Near the northeast point of the island, Albemarle Point, there has been collecting along the rough, rocky shore, in the tide pools, and among the mangroves in the small lagoon. There are an abundance of birds, some marine iguanas, and sea lions. One attempt at dredging in the shallow water was not much of a success. South of Cape Berkeley, at the northern entrance to Banks Bay, the rocky shore has been explored, and again at Black Bight at the southern entrance of this bay. Here also there has been dredging in 12 fathoms, rock. A short distance north of the northern entrance to Tagus Cove, there is a reef near the shore, with the surface exposed only at low spring tide. This has provided some good collecting. Tagus Cove has been a favored location; there have been 26 stations in or near it. The shore stations are on the rocks on both sides of the cove. On the west shore there are some interesting aggregations of solitary corals, forming almost as dense masses as the colonial corals do. There is one station on the shore of the near-by saline lake. At anchorage the electric light reveals a most interesting marine world. The plankton is plentiful and varied; many of the specimens are large enough to be seen readily. The large, graceful flying fish provide much of the visible motion to the picture, which may be quite a peaceful one until the ubiquitous shark intrudes.

The dredging stations from near the head of the cove to well out in the channel between Albemarle and Narborough provide a gradation from sandy bottom, in 10 fathoms or less, near the head, where such sand-loving species as *Amphioxus* are found, out through a coralline and nullipore bottom in 10-50 fathoms to the channel depths of 75 fathoms in rock.

There is one shore station 2 miles south of Tagus Cove, and there are no more until Cape Christopher. Here the shore is so rocky and broken and the surf is so violent that the collection is a scanty one.

On the east coast Cartago Bay provides all of the stations. Most of the shore stations are near where the rock and sand meet, near the northern entrance of the bay, but there is one station on the south side near the head. There is so much mangrove growing out from the shore in much of the bay that it is a difficult matter to make even a near approach to the shore. Much of the main part of the bay is shallow, with sandy bottom liberally sprinkled with patches of rock, and is not very satisfactory for dredging. At the entrance to the bay, and farther out, there is a nullipore bottom, and farther out still, near White Rock, there is mud. The electric light has been used several times at anchorage, but the plankton is not so interesting or so varied as it is at Tagus Cove.

James Island, 10 miles east of Albemarle and 10 miles south of the equator, is nearly rectangular, with greatest length from east to west, 20 miles, north to south, 12 miles. It has one high peak, 2,700 feet, near the center of the island; but other cones of considerable size make it quite rugged, particularly on the western slope, but not so much so as some sections of Albemarle. In the northeast the slope is more gradual, and there is a rather large area of low altitude near shore. The western slope, in general, is green and well wooded, the trees larger than on the other islands. On the western slope of the main peak, at a height of about 1,000 feet, there is a crater that contains a saline lake, from which salt has been obtained. The northern and eastern slopes are much more arid. The basal rock is a rough lava of the "aa" type, but over this, in places, there have been what appears to be three distinct, liquid lava flows: one, possibly the oldest, is reddish brown, somewhat like the basal lava in appearance; another is light gray; and the third is almost black. These give a distinctive appearance to that side of the island.

There are two sizable bays extending into the shore of the island, James Bay on the west side and Sullivan Bay at the north end of the east side. Off the northern portion of the west side is Albany Island, separated from James by a deep channel,  $\frac{1}{4}$  mile wide; and off the northeast corner of the island is a somewhat larger island than Albany, Bartholomew Island, the channel between, at its narrowest, being less than 300 yards wide. As it extends to the northeast, it forms part of the boundary of Sullivan Bay.

Bartholomew is a picturesque little island. It consists of two main portions, east and west, joined by a neck of land, bordered by a sand beach on each side, the south beach backed by sand dunes. Most of the central portion of this neck is occupied by a mangrove lagoon. The larger, eastern



portion reaches a height of 340 feet, as a volcanic cone, much of the base of which, toward the sea, has disappeared. The numerous small cones and craters give it the appearance of the southwestern portion of Albe-marle in miniature. Many of the smaller craters broaden as they go down and have fine volcanic ash in them, as though they had recently been used as fireplaces. They may be as small as 10 feet high and 4 or 5 feet across the mouth of the crater.

The western portion is lower; but toward the Sullivan Bay side a single, huge rock, 50 or 60 feet high, narrowed almost to a point above, but otherwise precipitous with almost perpendicular sides, is broken off sheer from the remainder and makes a very distinct and picturesque landmark. It forms the central figure of a picture which, seen from out in Sullivan Bay, is possibly the most attractive in the Galapagos.

Except for the small sand beaches on Bartholomew Island and one on the shore of James Bay, the shore is wholly rocky and rugged. Just back of the beach at James Bay there is a lagoon, where a flock of flamingoes make their home.

In the James Bay region there are shore stations south of the southwest entrance of the bay on rocky ledges, on rock in the southern portion of the bay, on the beach near the lagoon, and on the shore of the lagoon itself. One is situated on the shore of the salt lake in the interior. There are three dredging stations off the north entrance of the bay between the main shore and Albany Island, from 30 to 75 fathoms, the deeper water being well in the channel, where there are rock and shell. The results have been satisfactory.

All other stations are in the Sullivan Bay area. Shore stations near the rock column on Bartholomew Island, on the shores of the narrow part of the channel, and along the main shore of James Island near the entrance to the channel, where large coral masses were obtained on the ragged, rocky shore, provided good collecting; but the beach on the south side of the neck of land and the lagoon were not so good. There is good dredging in Sullivan Bay in the shallower water, in rock bottom, when the rock is not too rough, as it is liable to be farther out in deeper water off the entrance.

Jervis (Rabida) Island is a small, rugged, barren island, 4 miles south of James Island, with very little vegetation. Although it is only  $1\frac{3}{4}$  miles long, it has a height of 1,050 feet. It is not readily accessible, but in fair weather a landing may be made on the northwestern side of the island. The island has not been visited. Dredging in 145 fathoms was attempted without success at a point 4 miles east of the northern part of the island.

Indefatigable Island is the central island of the archipelago, 10 miles from James, 10 miles from Barrington, 15 miles from Albemarle, and 27 miles from Charles. It is the second largest island in the group, somewhat rectangular, 23 miles from east to west, 18 miles from north to south, with an additional narrow projection extending northward 5 miles toward South Seymour Island. It has but one important elevation, near the center, 2,296 feet. The smaller cones are not very numerous. The slope in the upper part is more rapid, but there is a flattening in all directions toward the coast. The lower portions are arid, of the regular Galapagos type; but on the steeper parts of the slopes, although it does not reach the summit, there is much greener vegetation.

There is little sandy beach, or beach of any kind; almost all of the shore is rugged and rocky. There are two bays, Conway Bay to the northwest and Academy Bay near the center of the south shore. Of the islands lying off the coast, the largest is Duncan (Pinzon), 6 miles to the westward. It is somewhat ellipsoidal, 3 miles by 2 miles, with a height of 1,300 feet, with dense, almost impenetrable vegetation. It has been a prominent feature in several expeditions, largely because of the extensive and intensive galápagos hunting that has taken place. Now the Duncan Island species is almost, if not entirely, extinct. Some inland collecting has been done here and some coral masses have been obtained.

North Seymour and South Seymour islands with the *Daphne* group will be considered later.

Eden Island lies at the southwestern entrance to Conway Bay, and Gordon Rocks lie  $1\frac{1}{2}$  miles east of the eastern point of the island.

In the Conway Bay region there are shore stations on the mud flats of Eden Island, on the rocks of the main island shore near by, and near the northern entrance to the bay; a dipping station at the anchorage; and one dredging station in 8 fathoms, sand, near the center of the bay. There are several stations in the vicinity of Academy Bay, some shore stations on the north shore of the bay, at the landing and east of it; electric light stations at the anchorage; dredging stations, well inshore in 8 to 12 fathoms and farther out in 15 to 25 fathoms (where algae are unusually abundant for the Galapagos). There are a coral mass station at the shore at Gordon Rocks and three dredging stations not far away, in 20-45 fathoms, rock. There is one deep station, 15 miles east of Gordon Rocks, in 392 fathoms, sand.

Mention has been made of the slender northward extension of Indefatigable Island. This projection reaches out past the boundary of the