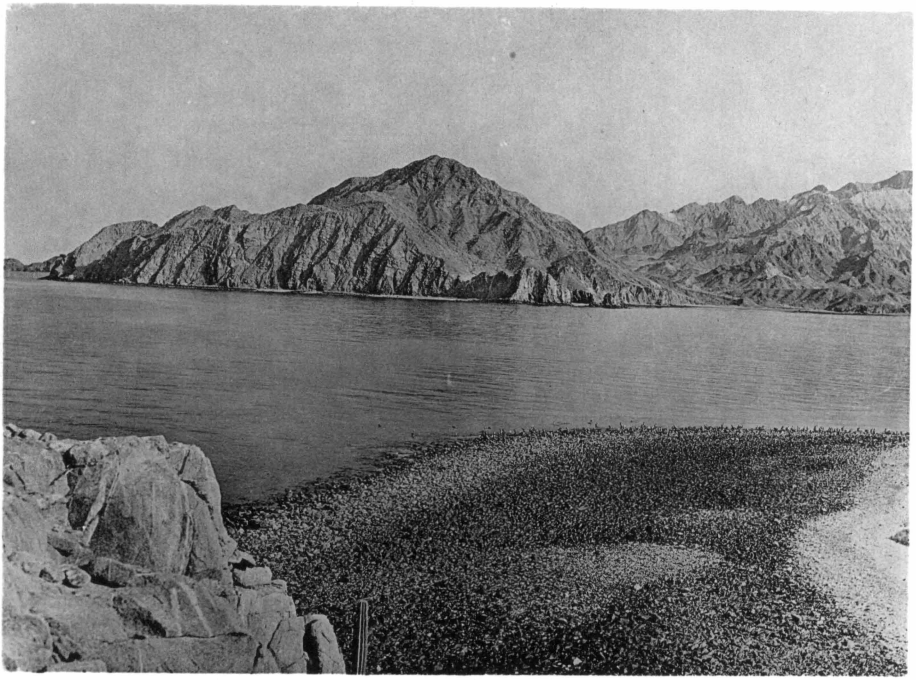


Fig. 110 Angel de la Guardia Island, from Granite Island

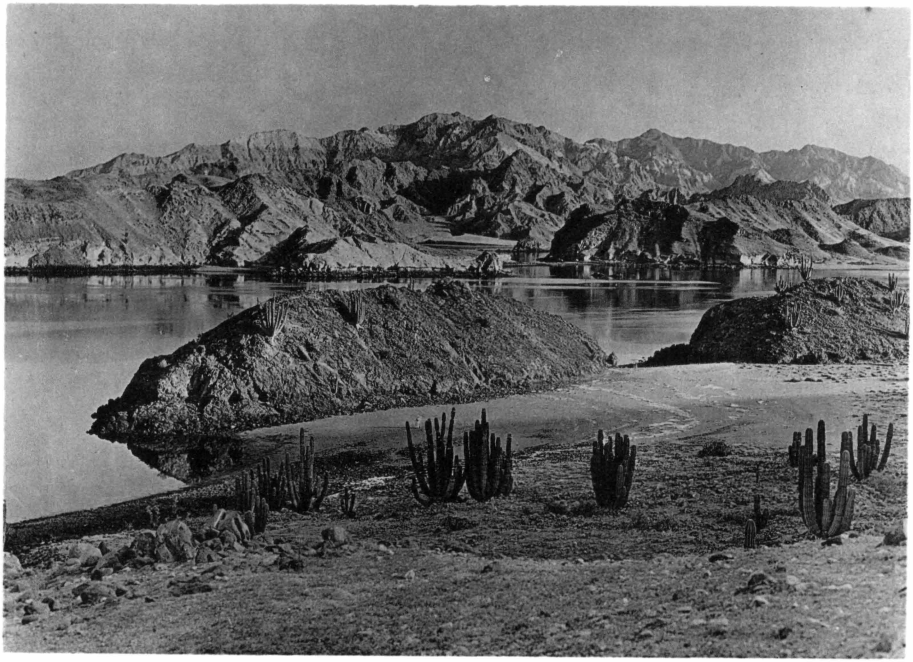


Fig. 111 Puerto Refugio, Angel de la Guardia Island

Fig. 112 Puerto Refugio, Angel de la Guardia Island, looking west

Fig. 113 Reef at Puerto Refugio, Angel de la Guardia Island

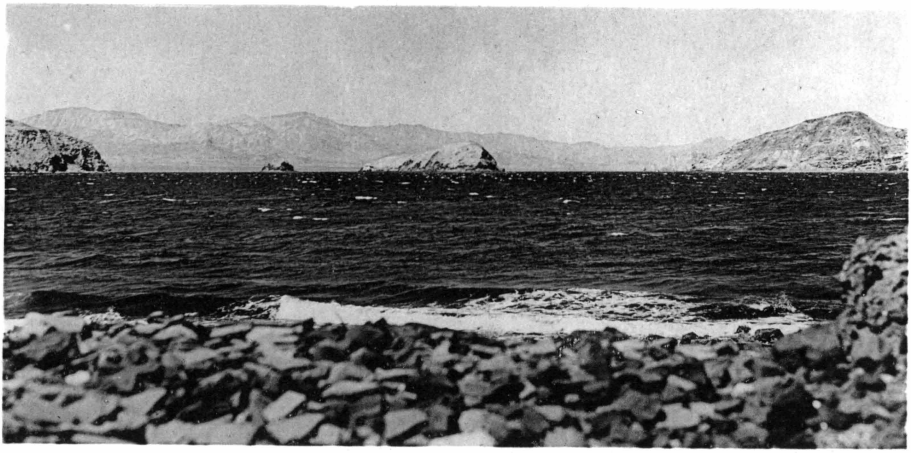


Fig. 114 Entrance Angeles Bay, Gulf of California

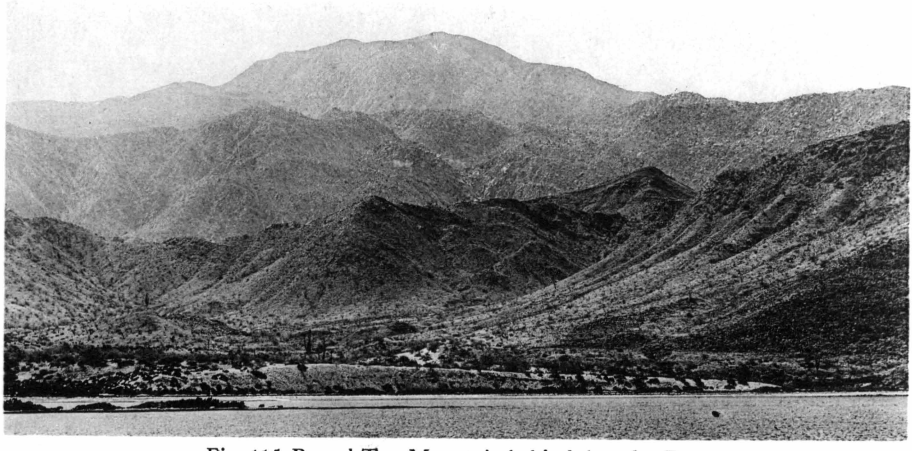


Fig. 115 Round Top Mountain behind Angeles Bay

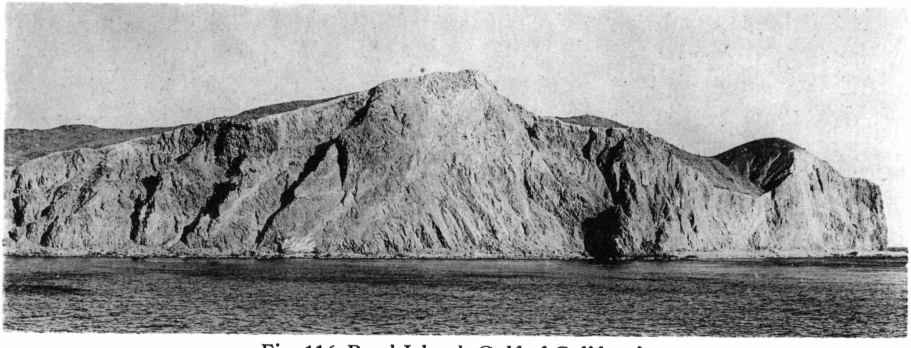


Fig. 116 Pond Island, Gulf of California

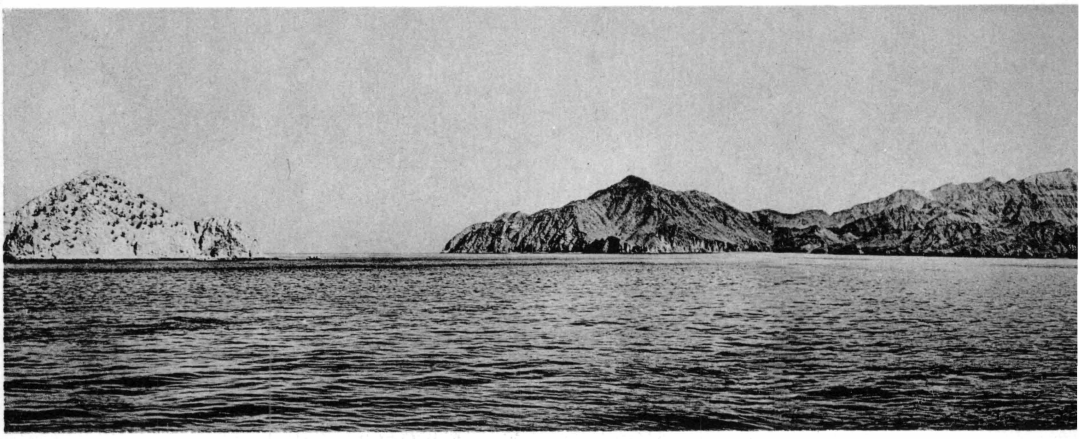


Fig. 117 Panorama, Angel de la Guardia Island, north end

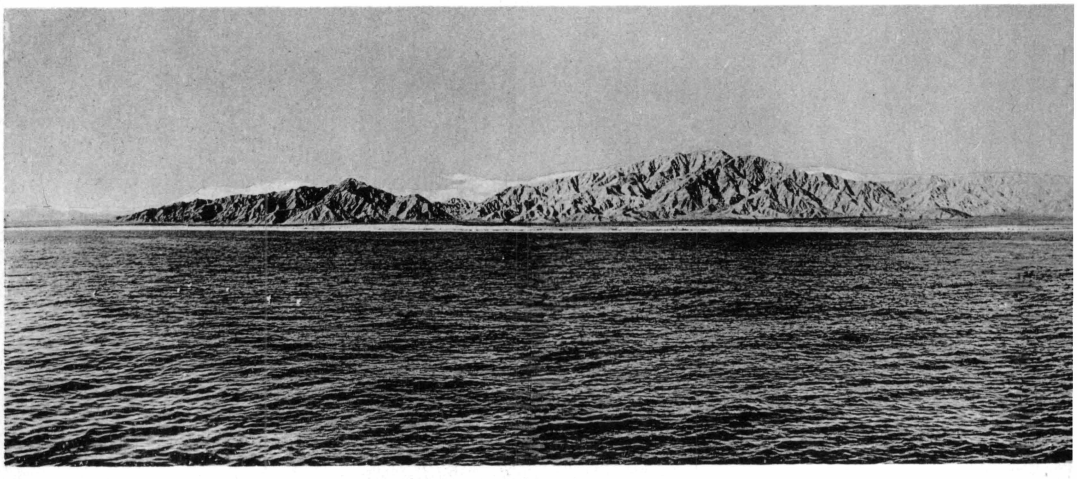
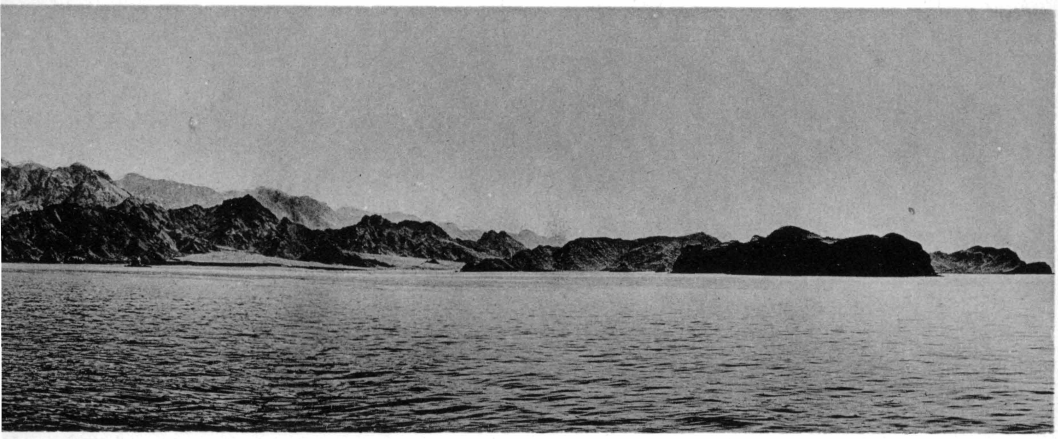
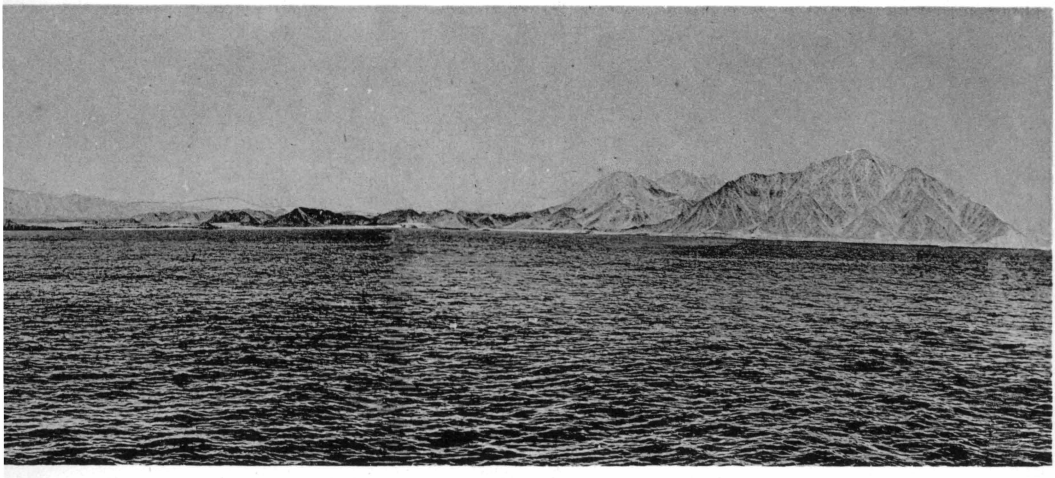


Fig. 118 Panorama, San Felipe Bay, Gulf of California





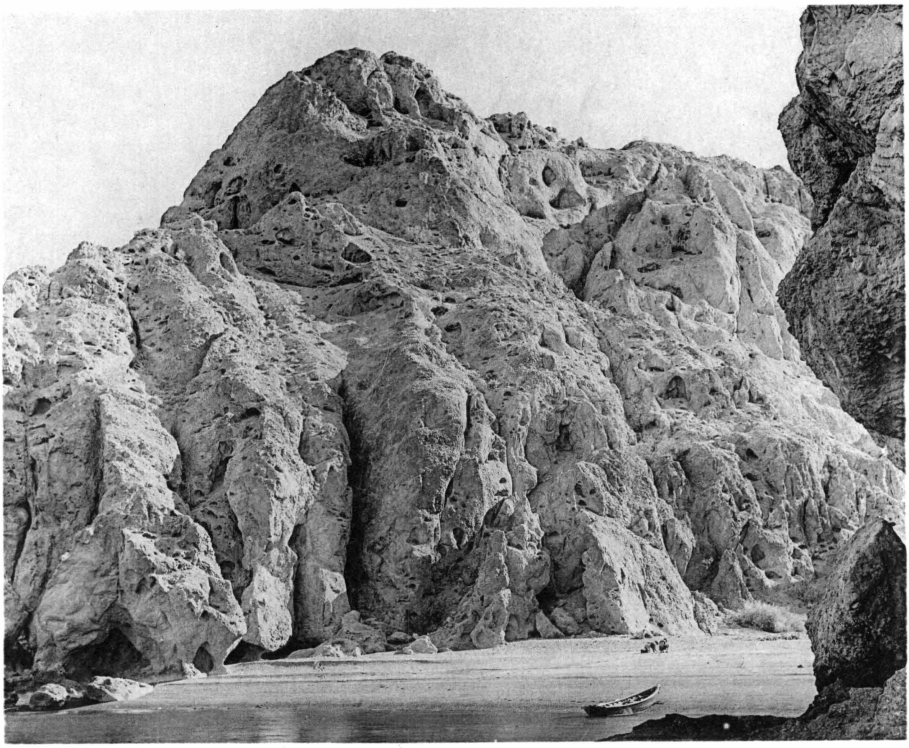


Fig. 119 Angel de la Guardia Island, mountain of pumice

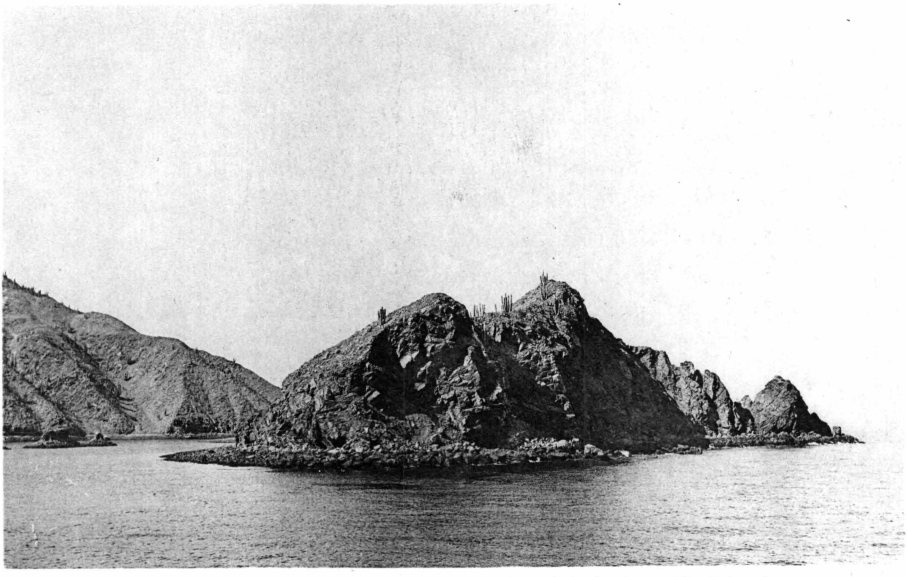


Fig. 120 Islet of Puerto Refugio Bay, Angel de la Guardia Island

Fig. 121 Gonzaga Bay, Gulf of California

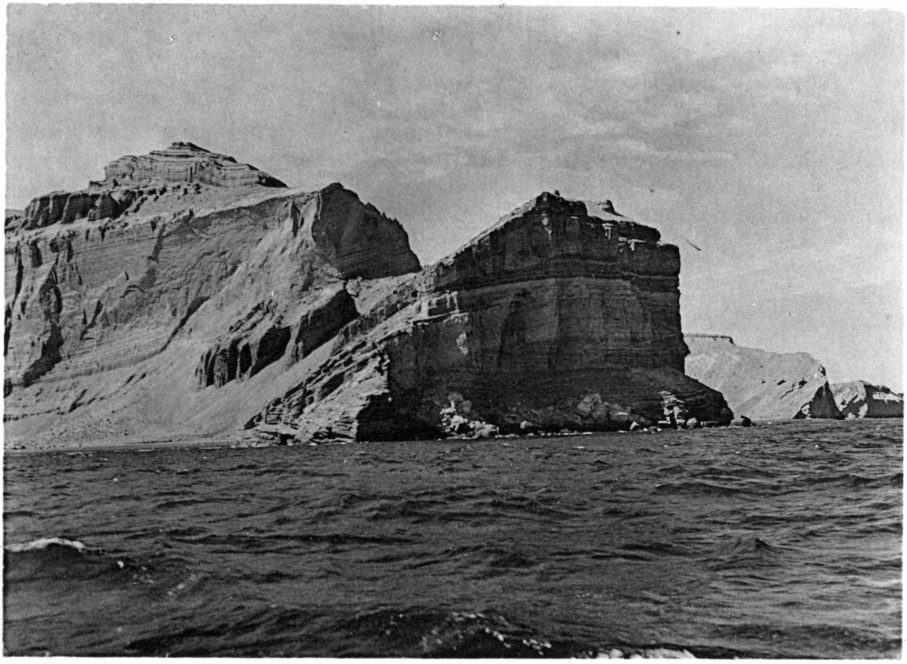


Fig. 122 San Luis Island, north of Gonzaga Bay

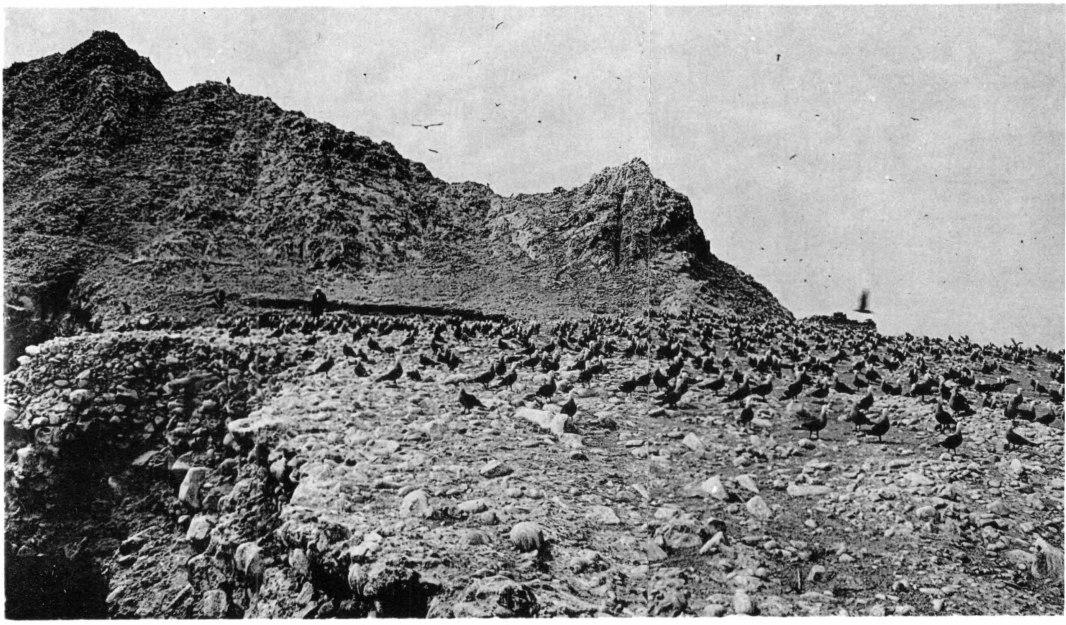


Fig. 123 Panorama of nesting colony Heerman Gulls, George's Island

Fig. 124 George's Island from NW

Fig. 125 (*right*) George's Island, sea stacks

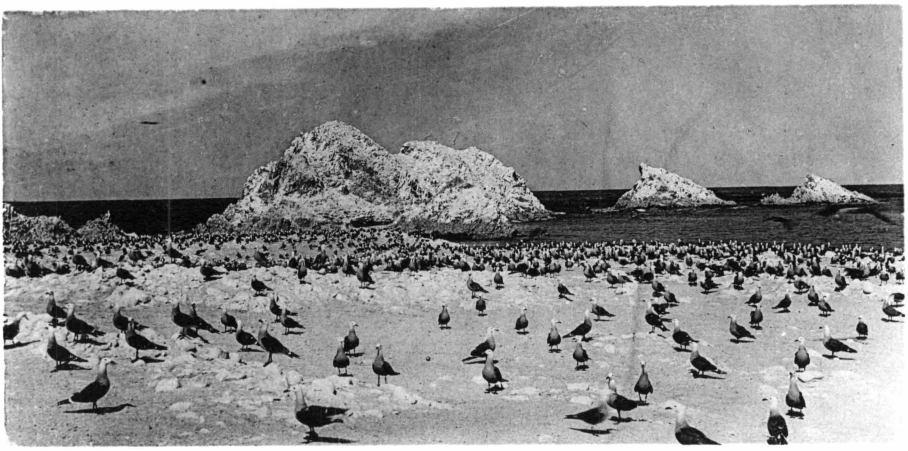


Fig. 126 Heerman gulls, George's Island

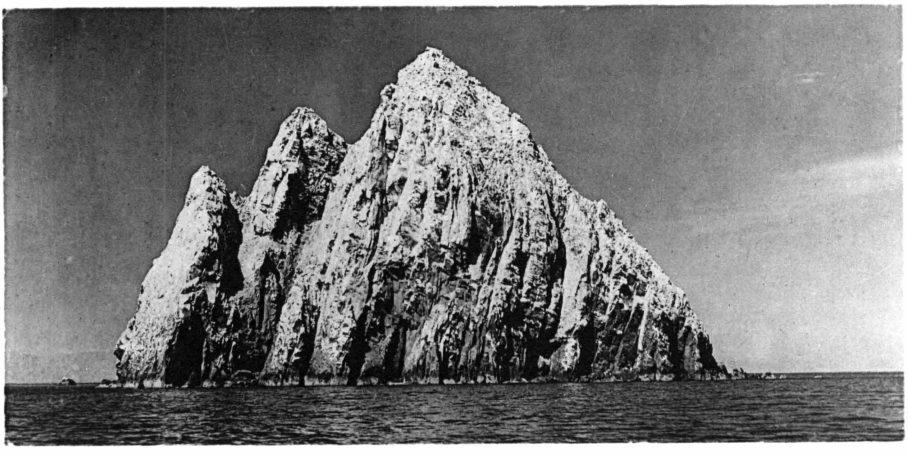


Fig. 127 Consag Rock, Gulf of California

Fig. 128 Rocky Point, Sonora, Mexico

PLATE 49

Fig. 105 Isla Raza, Gulf of California, looking north toward Isla Partida and Angel de la Guardia Island, which are shown in the left background. The pools in the foreground have been artificially built for the culture of oysters.

Fig. 106 Isla Partida, showing the western half of the island as viewed from the eastern half. The inlet at the right and a corresponding indentation to the left of the picture divide the island opposite the low isthmus shown in the foreground, so that from a little distance it resembles two islands. Chart 59, p. 400.

PLATE 50

Fig. 107 Unusual geologic formation at Isla Partida, Gulf of California. The columnar basalt shows cooling from a series of centers. The water in the foreground is deep, the illusion of shallowness being given by reflections of the rock mass.

Fig. 108 A number of planed terraces are seen in this photograph, taken at San Francisquito Bay, Gulf of California. The arm of the bay shown in the foreground is subject to extreme rise and fall of tidal level, since it is located opposite the narrow Sal Si Puedes Channel. Chart 58, p. 399.

Fig. 109 San Francisquito Bay, Gulf of California, is located just below San Francisquito Point, which in turn is located opposite San Lorenzo Island, across the famed Sal Si Puedes Channel, the swift current of which was much feared in the days of small sailing vessels.

PLATE 51

Fig. 110 View of Angel de la Guardia Island from Granite Island, located in Puerto Refugio. A flock of pelicans may be seen along the edges of the rocky spit which extends into the bay. Chart 59, p. 400.

Fig. 111 Puerto Refugio, Angel de la Guardia Island, has many arms extending among the low-lying foothills of the mountain chain arising in the background. The beach in the foreground shows clearly the 12-foot rise and fall of tide which continually alters the relative proportions of land and sea.

PLATE 52

Fig. 112 Puerto Refugio, Angel de la Guardia Island, seen from a hilltop located on the east side of the bay. The series of rocky spits extending into the bay are all part of the same bed of hard rock which underlies the softer deposits. The mainland of Lower California can be distinguished in the far distance.

Fig. 113 Reef at Puerto Refugio, Angel de la Guardia Island, a favorite collecting ground for the marine zoologists. It is the result of a tilted bed of hard rock which has withstood the weathering that has reduced the softer formation.

PLATE 53

Fig. 114 The entrance to Angeles Bay, Lower California, is guarded by several small islets, two of which are shown in the center of the picture. Much profitable dredging was accomplished by the small dredge boat in this vicinity. (See pls. 13, 14.)

Fig. 115 Round Top Mountain, elevation 3,423 feet, rises behind Angeles Bay, Lower California. An alluvial fan, cut by wave action, is shown in the foreground.

Fig. 116 Pond Island, Gulf of California, seen from the deck of *Velero III*. The island lies to the south of Angel de la Guardia Island and encloses a large lagoon in which rock oysters are found. Chart 59, p. 400.

PLATES 54, 55

Fig. 117 (A panorama.) A view of the north end of Angel de la Guardia Island, Gulf of California, showing Granite Island on the left, Mejia Island on the right, and the entire bay of Puerto Refugio between them.

Fig. 118 (A panorama.) San Felipe Bay, seen from the east. In the extreme distance rises the mountain range which forms the backbone of the Lower California peninsula and culminates in Mt. San Pedro Martir, elevation 10,000 feet, opposite San Felipe Bay. Chart 63, p. 402.

PLATE 56

Fig. 119 A mountain of pumice, located on the east side of Angel de la Guardia Island, Gulf of California. Pieces of this rock will float when placed in water.

Fig. 120 A nameless islet in Puerto Refugio Bay, Angel de la Guardia Island, Gulf of California.

PLATE 57

Fig. 121 A perfect spit separates the lagoon in the background from Gonzaga Bay (shown in the left foreground). In the right foreground is the narrow channel which lies between the tip of the sand spit and the rocky promontory from which the photograph was taken. The lagoon is a favorite stopping place for migratory birds.

Fig. 122 The island of San Luis, located north of Gonzaga Bay in the Gulf of California, is composed entirely of a soft gray sandstone which shows beautiful bedding.

PLATES 58, 59

Fig. 123 Nesting colony of Heerman gulls at George's Island, Gulf of California. The site chosen by the birds is an ancient alluvial fan. No eggs had yet been laid at the time the picture was taken.

Fig. 124 George's Island, seen from the northwest. *Velero III* may be seen in the distance directly above the remnants of an old alluvial fan. The reef in the foreground is awash at high tide.

Fig. 125 Marine biologists collecting on a reef which extends between two of the series of sea stacks which comprise George's Island, Gulf of California.

PLATE 60

Fig. 126 Heerman gulls nesting on the remnants of an ancient alluvial fan at George's Island, Gulf of California.

Fig. 127 Consag Rock, a conspicuous landmark for vessels setting a course to the mouth of the Colorado River. It is of basalt, the columns showing almost vertical jointing, and rises from the otherwise muddy floor of the upper Gulf to a height of 285 feet. Chart 63, p. 402.

Fig. 128 Rocky Point, Sonora, was the northernmost locality visited by *Velero III* on the east side of the Gulf of California. It is the terminus of an almost impassable road leading across the desert from southern Arizona. Chart 64, p. 402.

Gulf of California—East Coast

Plates 60-64; Charts 63-69

On the east coast of the Gulf of California, the *Velero III* has not proceeded farther north than Rocky Point. From this point to the mouth of the Colorado River the coast has been described by the *Coast Pilot* thus:

> Beyond Shoal Point, the eastern entrance point of the Colorado River, the coast, trending east-southeastward for a distance of 10 miles, is generally low, with here and there a sandhill of moderate height. Shoal water extends off shore to distances increasing from ½ mile, near Shoal Point, to 2 miles, at a position 10 miles farther east-southeastward.
>
> Adair Bay is a wide indentation that is entirely open to the southward, and is so filled with dangerous shifting shoals as to be impracticable for even the smallest coasters. Its western limit lies 10 miles east-southeastward of Shoal Point, and Rocky Bluff, the eastern limit, lies 35½ miles in the same direction from that point. The coast recedes 10 miles from a line drawn between these two points. The shore of the bay is low and sandy, with occasional rocky patches. Opening into the northern part is a lagoon, at the entrance to which there are several drying sandspits that project out 2 or 3 miles into the bay. Low plains with surface deposits of soda extend far into the interior. Spring tides rise about 22 feet.

From the bold Rocky Bluff the coast turns eastward for 5 miles to Rocky Point, the stretch between being Rocky Point Bay, with a sandy shore. There are dredging stations off Rocky Bluff and in Rocky Point Bay, 4-12 fathoms, sand and mud, at one of which basketstars were obtained.

From Rocky Point the coast turns almost directly eastward for 22 miles and then southward to form the wide open Georges Bay, about 26 miles from point to point, with low, sandy shore. Lying 7 miles offshore from the southern extremity of the bay is a high, barren rock, white with guano, Georges Island, with small outlying rocks. On portions of the shore there are large individual rocks, so that the shore might be described as a very coarse shingle. Here some collecting has been done, and there are dredging stations near the island.

From the southern extremity of Georges Bay the coastal trend is almost directly southward for more than 20 miles, when it gradually swings eastward past the mouth of the San Ignacio River, 32 miles from the southern extremity of Georges Bay, and then southward again to Cape Tepoca, 18 miles from the mouth of the river. The northern part of this coast is low and sandy, but the southern part is not so low. Cape Tepoca is high near the tip, but lower farther back. A low, rocky point

extends ½ mile southeastward to be continued as reef for some distance farther. The point and reef form the western limit of Tepoca Bay, 2½ miles across, the western portion of the shore being low and sandy, but the eastern with sand bluffs. Shore collecting has been done on the point and on the reef, and dredging in the bay.

From Cape Tepoca the coast turns eastward and then southward again to Cape Lobos, 23 miles distant. The sand cliffs extend for some distance, to be followed by a low, sandy shore. Cape Lobos is similar to Cape Tepoca, sheltering Libertad Anchorage in the same way that Cape Tepoca shelters Tepoca Bay. There are one shore station at Cape Lobos and two dredging stations offshore to the northwest.

From Libertad Anchorage, the coast continues in a southeasterly direction for 36½ miles to Cape Tepopa, with much the same type of coast, but with less of a sweep than in the two previous bays. Like the other two points, Cape Tepopa is a bold, rocky headland. Six and a half miles farther on in the same general direction is Sargents Point, also high and rocky, but it is connected with the mainland by a low, narrow neck of land that may be submerged at high tide. West of this point, 5½ miles, lies Patos Island, which, except for a conical hill in the northwest portion, is low. It, also, is white with guano. Collections of plants and insects have been made on this island.

From Sargents Point there is another sweep southeastward 20 miles to San Miguel Point, with a much similar coast line. From 2½ to 3½ miles off this part of the coast lies the northern half of the largest island in the Gulf of California, Tiburon Island, with the northern extremity 4 miles south of Sargents Point. It is high and rugged but not so barren as other islands in the Gulf, with a length north and south of 29 miles and an average width of 15 miles. It is nearly rectangular, but the east side is somewhat longer than the west. The north and much of the east coast are low and sandy, but the remainder is bolder and more rocky. Only the shore at the southeast corner is much broken.

The southeast point of the island, not named on the chart, is a high headland at the extremity of a peninsula that forms a bay, well protected from the southeast winds. To the westward of this point, 3 miles, separated from it by a narrow bay with a sand beach, is Monument Point, the most southerly point of the island. Off this bay are Turners Island, 1¼ miles by ½ mile, Seal Rocks, and several other rocks and reefs. Another small bay separates Monument Point from Red Bluff Point, 2½ miles westward. West of Red Bluff Point, the coast again becomes regular.

Only the vicinity of the southeastern extremity of the island has been explored, on both sides of the extreme southeastern point and around Turners Island, shore collecting on sand, rock, shingle, and reef, dipping, seining, and much dredging—almost wholly in shallow water.

Lying 7¾ miles south of Willards Point, the western extremity of Tiburon Island, is a barren, rocky island, 4 miles by 3 miles, Esteban Island, with plenty of coastal variety, rocks, reefs, gravel, shingle, and a sandspit (to the southwest). There have been shore collecting along the south shore and dredging to the east and southeast of the island.

From San Miguel Point southeastward to Point San Antonio, a distance of 90 miles, there are no significant coastal features. The coast is still low and sandy, and the water is shallow for a long distance from shore, but rocky bluffs, not very high ones, appear more often than farther north. The bluffs are continuous enough for 5 to 10 miles northwest of Point San Antonio to form a rugged coast for this short distance.

Directly west of Point San Antonio, 15 miles, and 8 miles from the nearest Sonora mainland is the barren, rocky, volcanic islet, San Pedro Nolasco Island, 2¼ miles long, ¾ mile wide. The coast is largely inaccessible. Off the southern end there are detached rocks, but elsewhere the water is deep close to shore. Some land plants have been collected on the island, and dredging has been done to the east and the northeast, in 45 to 110 fathoms.

The shore for some distance east of Point San Antonio becomes much higher and more rugged. The mountain peaks are nearer the coast, and the coast line is much more broken with numerous small indentations, projecting points, and small islands. East of Point San Antonio 2½ miles is Punta Doble, forming the western extremity of a large open bay, Ensenada San Francisco, the shore of which sweeps eastward and then southward to Cabo Arco, the southeastern extremity, 7 miles from Point Doble. There are several secondary inlets, of which Puerto San Carlos, nearer the northwestern end of the bay, affords the best shelter. Most of the collecting in Ensenada San Francisco has been done in or near Puerto San Carlos, shore collecting on rock and shingle, dipping, seining, beam trawling, and dredging.

From Cabo Arco the coast extends slightly south of east, in a series of three bights, to Cabo Haro, 4 miles away. Cabo Haro is the southern point of a peninsula that shuts off the inner harbor of Guaymas from the open Gulf and forms the western boundary of the outer harbor and the southern boundary of the middle harbor. The west face of this peninsula

extends irregularly 4 miles from Cabo Haro to Punta Baja. The most protected inlet is Bahia Catalina, 1½ miles from Cabo Haro, where shore collecting on shingle and dredging in and outside the bay have been carried on.

The outer harbor is shut off from the Gulf by the Isla de Pajaros and from La Laguna, an extensive body of water lying to the northward, by the long, narrow spit from the east shore, Playa de los Dolores. The outer harbor is wide open to the middle harbor, but the middle harbor is somewhat closed off from the inner harbor by islands and peninsulas, between which, however, there is a clear passage. The outer harbor is suitable for anchorage of large ships, but the middle harbor is shallower, and the inner harbor more so, only suitable for vessels of shallow draft.

The City of Guaymas is situated at the head of a small bay on the northwestern side of the inner harbor.

Some shore collecting on rock and shingle in the middle and inner harbor and one dredging station, in 2-3 fathoms, in the middle harbor cover the activities here.

The rugged hills and mountains, which are conspicuous near the shore in the Guaymas region, do not last for long, but the low-lying shore and immediate background hold sway again for a great distance. From Guaymas Harbor to Ahome Point, approximately 175 miles, through three long, sweeping curves, there is little else than sandy shores, sandy islands, sandy shoals, and sandy lagoons, making it difficult to approach the shore, and with such little variety that it offers little attraction to a marine collector. No collecting has been done anywhere near this part of the coast.

From Point Ahome, the same type of coast extends directly southward for 20 miles to San Ignacio Point, a point on a small island of the same name that lies off a large island, Santa Maria Island, 13½ miles long, one of the many elongated, low islands, separated by lagoons or shallow water areas from the low mainland. The trend of the coast here is eastward; so the long axis of the island lies east and west. Its southern shore forms the boundary of San Ignacio Bay. The east point of the island, Santa Maria Point, delimits, to the westward, Topolobampo Harbor and its northwestern extension, San Carlos Bay.

Lying 13 miles west-southwestward of Santa Maria Point is San Ignacio Farallon, a conspicuous, white, barren rock, 465 feet high.

Shore collecting has been done on the rocks at San Ignacio Farallon, and dredging in San Ignacio Bay, in 3 to 90 fathoms.

Southeast of Topolobampo Harbor the coast is of the same type found throughout the whole State of Sinaloa, so that no collecting has been done for another 175 miles, where there is one dredging station in 6-8 fathoms off Point Piaxtla, which, for a change, forms a rocky headland. Even at Mazatlan, 35 miles farther south, no marine collecting has been done. The *Velero III* called here in December, 1931, but the collecting at this time was all inland collecting.

Although Mazatlan is the largest city on the coast between San Diego and Panama, only the outer harbor is accessible to large vessels. The entrance is between Creston and Chivos islands.

As Mazatlan is nearly directly east of Cape San Lucas, it may be considered to be the southeastern limit of the Gulf of California; but, commonly, Cape Corrientes, 175 miles farther south, is considered to be the limit.

For the first 70 miles from Mazatlan the trend of the coast line continues to the southeast and then turns more nearly southward. For about 100 miles from Mazatlan the coast is similar to that farther north, after which it becomes more bold and rugged and the sandy islands and the lagoons disappear.

Lying 17 miles offshore, 50 miles south of the boundary between Sinaloa and Jalisco and 90 miles north of Cape Corrientes, is Isabel Island, 1½ miles long, ½ mile wide, and 280 feet high, with several rocks or rocky islets offshore. The main island consists of three large crater cones, the half toward the water, in each case, having entirely disappeared. Two of them, in vertical section, have the appearance of lava formation, but the one facing south looks definitely like sandstone. Vegetation is sparse, but there is enough to show up distinctly on the northeastern slope, where it covers the surface quite fully. It is evidently a favorite resort and nesting place for myriads of frigate birds, terns, boobies, and tropic birds. Two of the outlying rocks, close to the northeast point of the island, are conspicuous. One of them is supposed to resemble a swan. The only sand beach is a small one near the southeastern end of the island.

This island has been visited on five occasions for specimens, on land, on sandy and rocky shore, on reefs, dipping near the surface, and on sand, coralline, and nullipore bottom in shallow water, 25 fathoms or less.

Approximately 40 miles to the southwest of Isabel Island are Las Tres Marias Islands. The northernmost island, San Juanito, is a small island, 2½ by 1¼ miles, and the three main islands, Maria Madre, Mag-

dalena, and Cleopha, follow in a series to the southeast. The islands are volcanic, with their western sides high, barren, inaccessible cliffs and the sea bottom dropping abruptly into deep water, but with the eastern sides low, sandy, and less barren. From the shores of all the islands there are extensive reefs and outlying rocks.

Maria Madre, 2 miles from San Juanito Island, is the largest, 12 miles long and 3 to 6 wide. A channel, 4 miles wide, separates it from Magdalena Island, the second largest, 8 miles long and 4½ wide, which, in turn, is separated from Cleopha, a nearly circular island, with a diameter of 3 miles, by a channel, 8½ miles wide. There are one shore station on the east coast of Magdalena Island and two dredging stations east of this island.

Port San Blas is situated where the low, sandy shore and low backcountry plains change over to the more rugged coast, where the mountains or high hills come much nearer the sea. Sandy beaches do not entirely disappear, but, when they do appear, there are usually rocky bluffs on each side and small islands offshore.

From Port San Blas, the coast turns eastward, then southward and southwestward to Punta Mita, 50 miles away, from which it turns abruptly eastward again to form the northern boundary of a 20-mile deep indentation, Banderas Bay, 15 miles across, with the southwestern limit at Cape Corrientes.

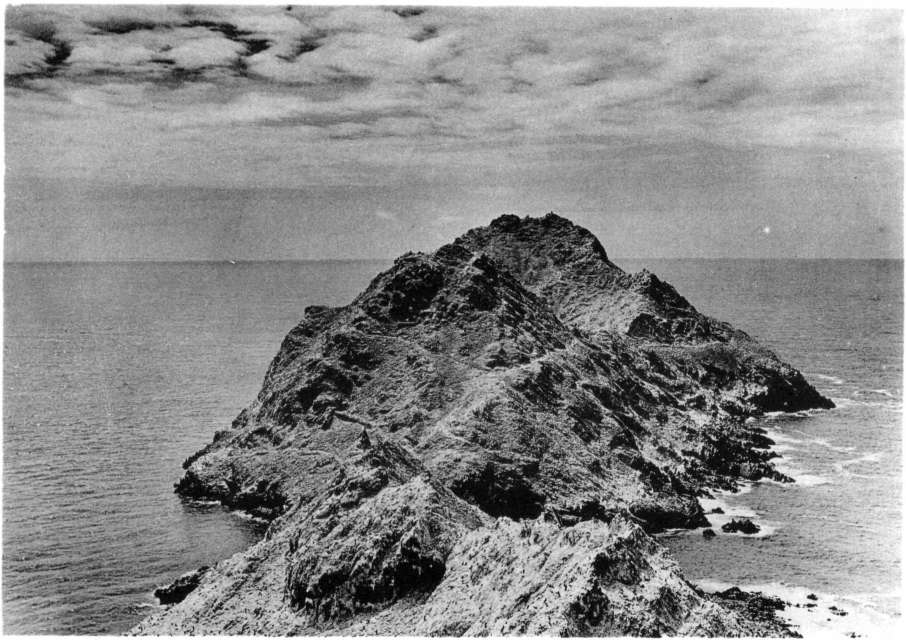


Fig. 129 George's Island, Gulf of California

Fig. 130 Tiburon Island, Gulf of California

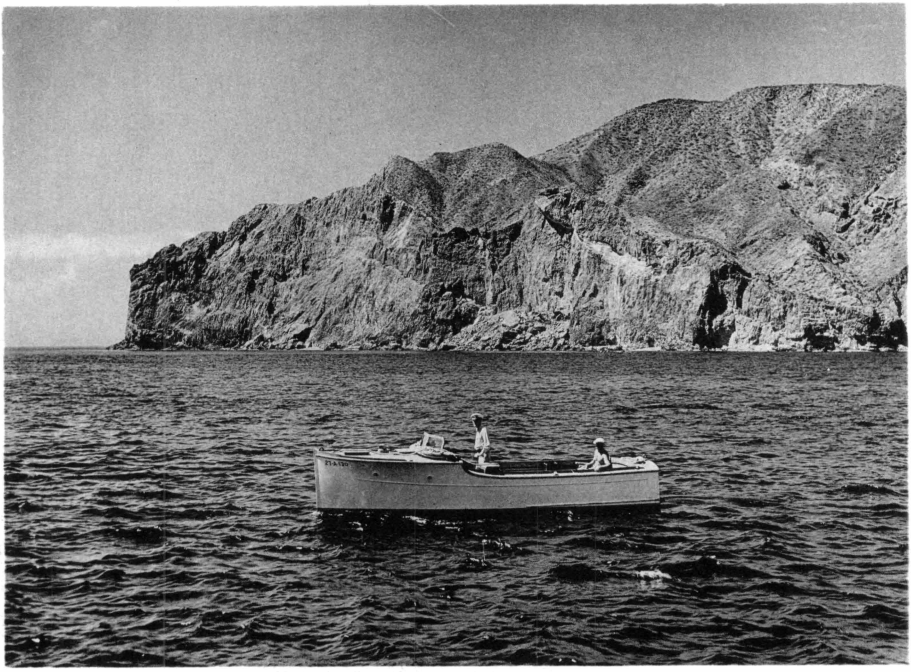


Fig. 131 San Esteban Island, south shore

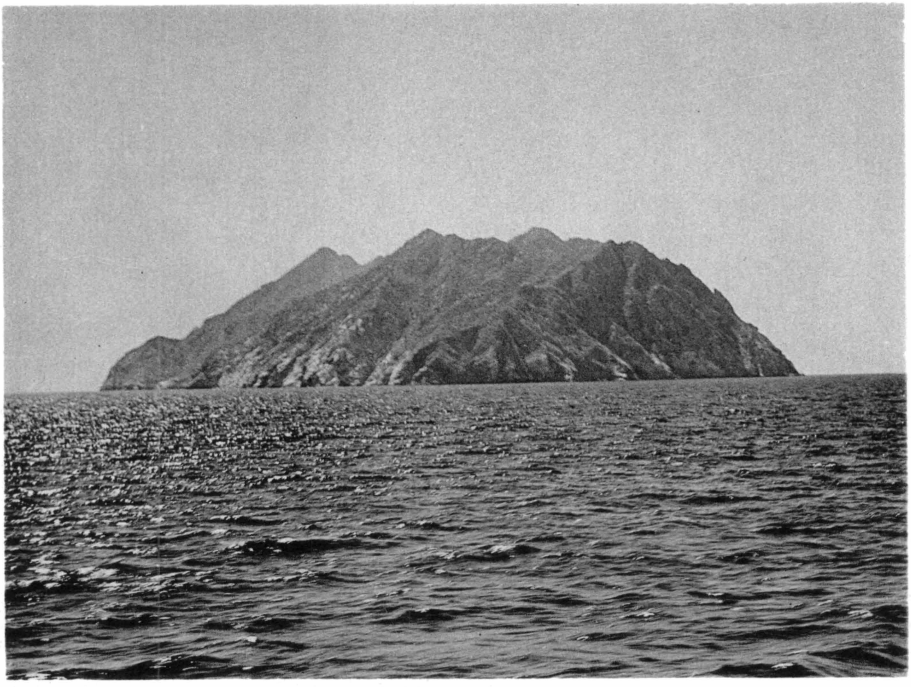


Fig. 132 San Pedro Nolasco Island

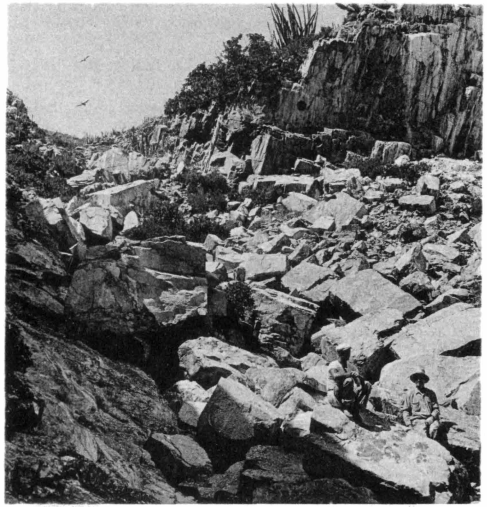
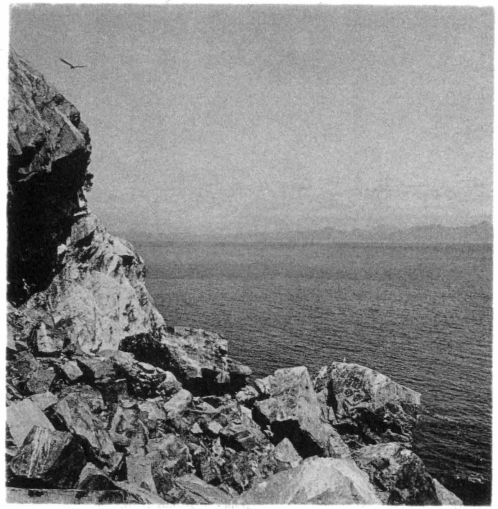
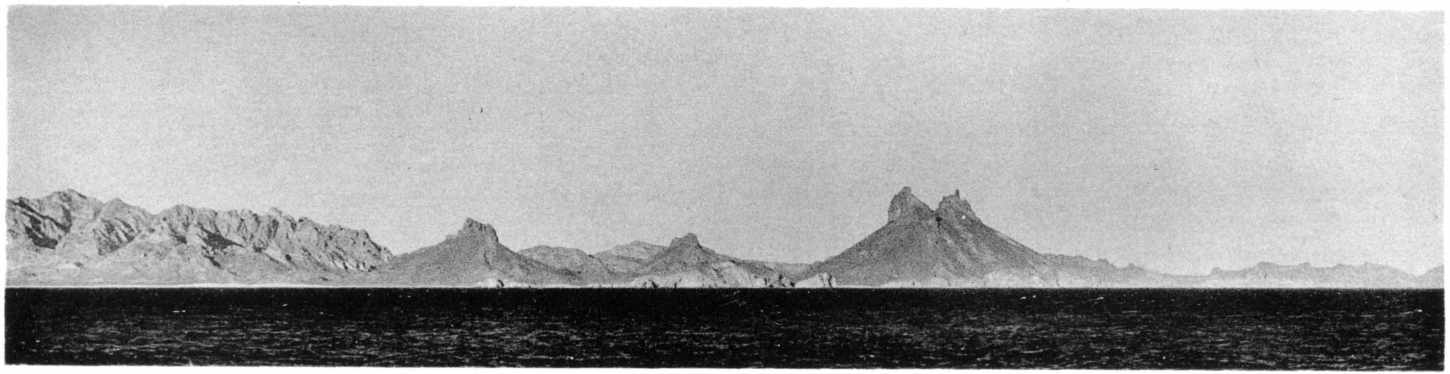


Fig. 133 (*left*) San Pedro Nolasco Island

Fig. 134 (*right*) Sonoran mainland from San Pedro Nolasco Island

Fig. 135 (*below*) Sonoran coast line, north of Guaymas





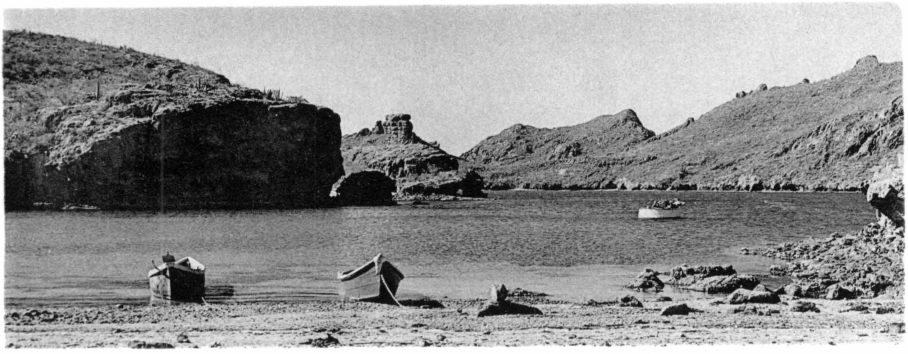


Fig. 136 Puerto San Carlos

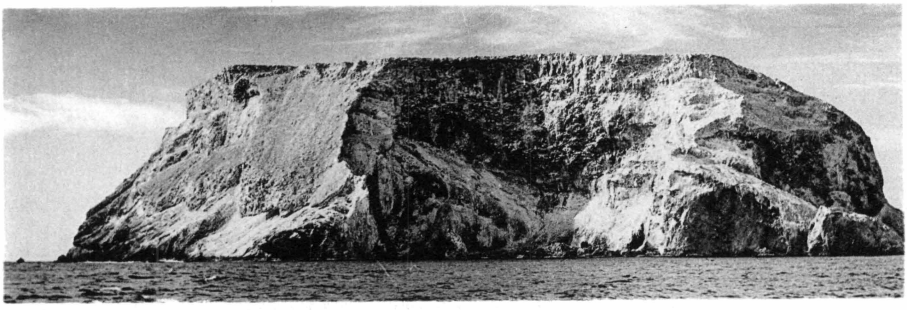


Fig. 137 San Ignacio Farallon

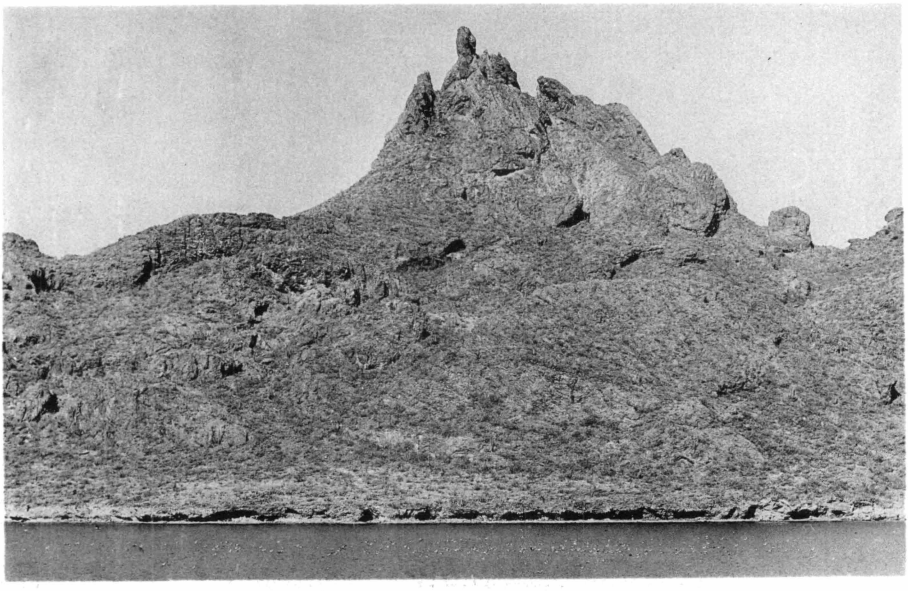


Fig. 138 Puerto San Carlos, *las tetas de cabra*

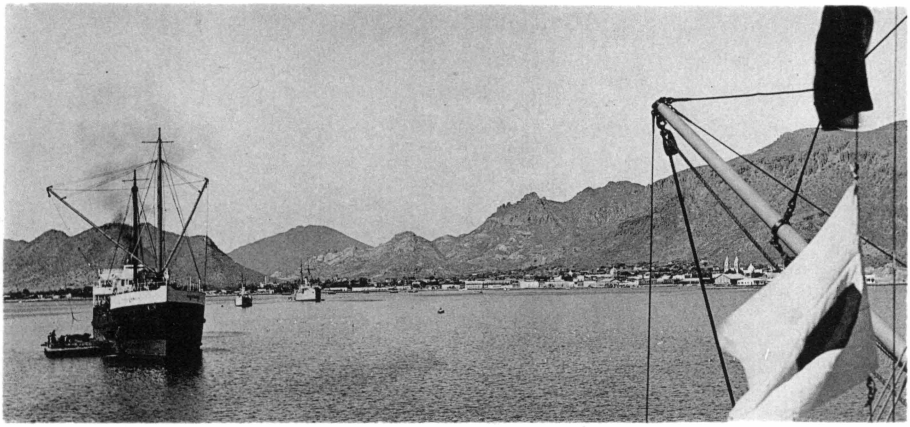


Fig. 139 Guaymas Harbor, Mexico

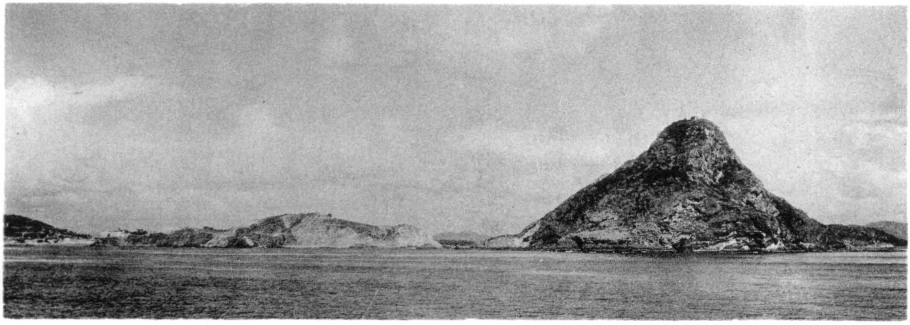


Fig. 140 Mazatlan, Mexico

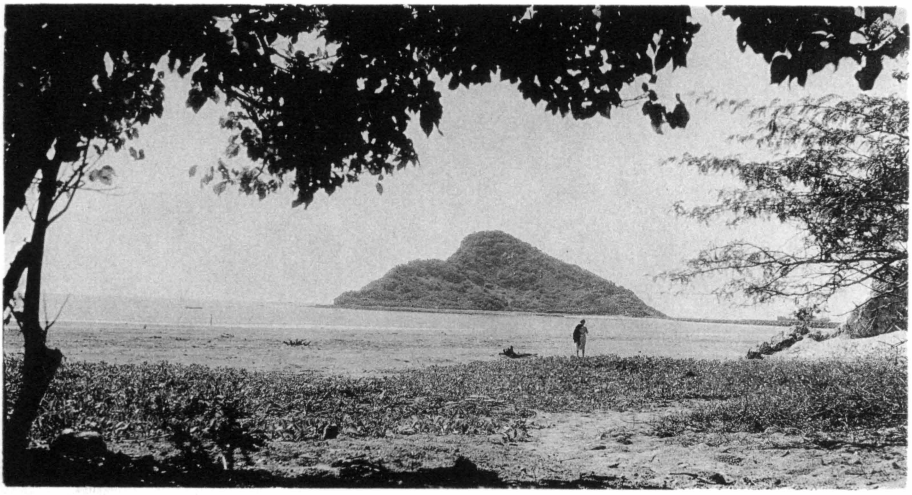


Fig. 141 Mazatlan, Mexico, beach south

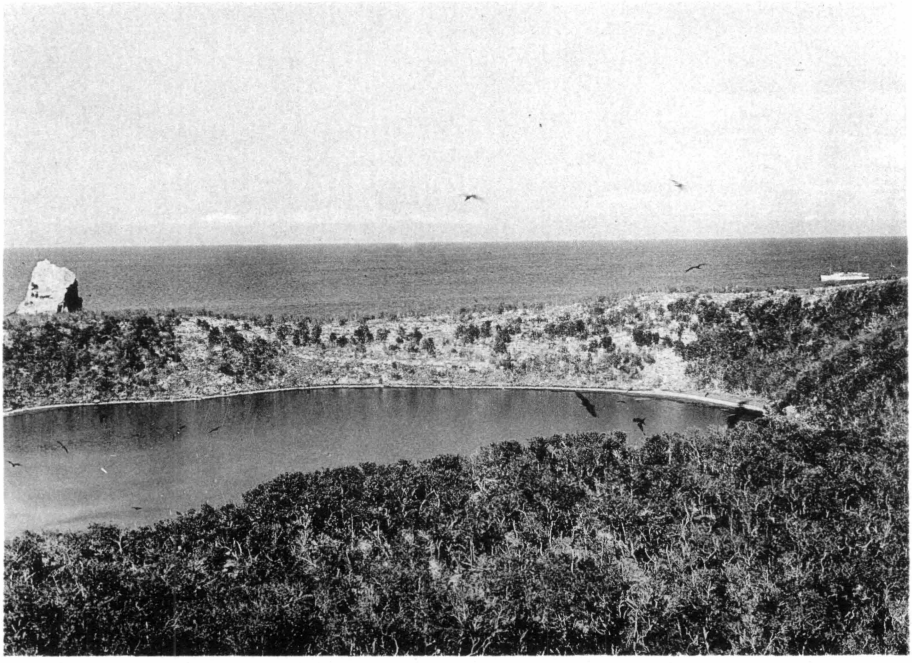


Fig. 142 Crater Lake, Isabel Island, Mexico

Fig. 143 Isabel Island, Mexico, reef

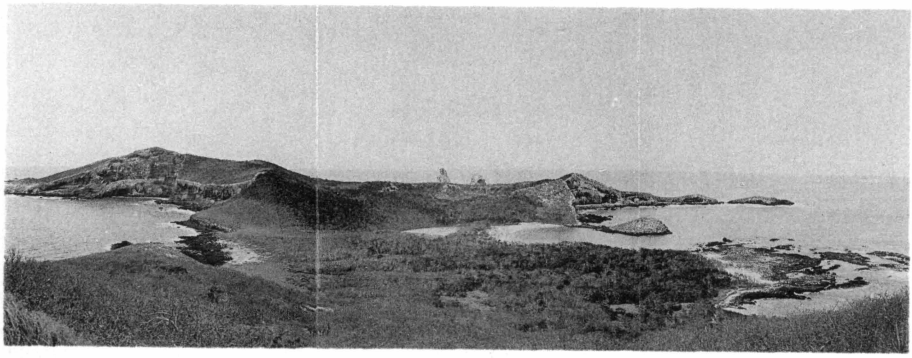


Fig. 144 Panorama, Isabel Island

Fig. 145 Reef, Isabel Island

Fig. 146 Isabel Island, beach

Fig. 147a Tenacatita Bay, Mexico

Fig. 147b Navidad Head from Tenacatita Bay

PLATE 61

Fig. 129 George's Island, Gulf of California, is the nesting site of thousands of Brewster's boobies and lesser numbers of red-billed tropic birds. Chart 64, p. 402.

Fig. 130 A quiet inlet on the southeast shore of Tiburon Island, Gulf of California, home of the nomadic tribe of Seri Indians. A dwarf species of deer is said to occur on the island, which is exceedingly barren, mountainous, and with no apparent sources of fresh water. Chart 66, p. 403.

PLATE 62

Fig. 131 The south shore of San Esteban Island shows a type of undercutting by wave action which is characteristic of the unprotected shores of the Gulf of California. The ship's launch is shown in the foreground. Chart 66, p. 403.

Fig. 132 San Pedro Nolasco Island is located in the Gulf of California north and west of Guaymas. There are few landing places on its steep granite slopes. It is inhabited largely by pelicans, boobies, and rock iguanas. Chart 67, p. 403.

PLATE 63

Fig. 133 One of the several boulder-strewn canyons which rise precipitously from the eastern shore of San Pedro Nolasco Island, Gulf of California.

Fig. 134 Mainland of Sonora, Mexico, seen from the shores of San Pedro Nolasco Island, Gulf of California.

Fig. 135 The Sonora coast line north of Guaymas is exceedingly irregular. Perhaps no landmark in the entire Gulf is more distinctive than *las tetas de cabra* shown above the ship's telegraphic control.

PLATE 64

Fig. 136 Puerto San Carlos, a small landlocked bay in the vicinity of Guaymas, Sonora, affords ideal protection to small vessels. *Velero III* anchored outside in the larger Ensenada de San Francisco.

Fig. 137 San Ignacio Farallon is located in the southern portion of the Gulf of California about 18 miles from Topalobampo Harbor. (Like Consag Rock, it seems to bear no relation to its surroundings, the mainland territory being low and sandy.) Expedition members scaled the summit and found thousands of nesting sea birds, including tropic birds and Brewster's boobies. Chart 68, p. 403.

Fig. 138 The *las tetas de cabra* is a particularly eroded pinnacle located within sight of Guaymas, Sonora. Hancock Expedition scientists scaled all but the topmost pinnacle on two separate occasions. Chart 13, p. 371.

PLATE 65

Fig. 139 Panoramic view of the harbor at Guaymas, Sonora, showing cargo vessels in the foreground and the city in the middle distance. The boat landing is to the left of the cathedral spires shown above the lowest of the signal flags. Chart 13, p. 371.

Fig. 140 Beach at Mazatlan, Mexico, just west of the harbor, showing breakwater extending to Chivos Island in the center, in back and to the right of which a freighter may be seen. Chart 13, p. 371.

Fig. 141 Entrance to the harbor at Mazatlan, Mexico. The lighthouse is perched upon Creston Island at the right, fully 500 feet above the surface of the sea.

PLATE 66

Fig. 142 Crater Lake at Isabel Island, Mexico, showing one of the sea stacks at the left and *Velero III* at the right. The forest of low trees in the foreground is occupied by nesting man-o'-war birds. Chart 69, p. 404.

Fig. 143 Wave-worn coast of Isabel Island, Mexico, showing the *Velero III* and one of her launches in the left middle distance and a portion of the Mexican mainland beneath the cloud bank on the right horizon.

PLATE 67

Fig. 144 Panorama of Isabel Island, Mexico, showing on the left the highest portion of the eastern half of the island, in the center the two stacks, crater lake, and reef-enclosed landing place, and on the right the semi-detached headland behind which may be seen the *Velero III* and the cloud-banked mainland of Sinaloa.

Fig. 145 Reef on which much shore collecting was accomplished at Isabel Island, Mexico. Landings were made in the shallow cove to the right, which was reached through the narrow passage seen above the first headland.

PLATE 68

Fig. 146 Rocky beach at Isabel Island, Mexico, showing nesting blue-footed boobies in the lower left-hand corner and a much-eroded sea stack in the right background.

Fig. 147a Beach at Tenacatita Bay, Mexico, showing thatched huts occupied seasonally by palm nut harvesters in the middle distance. Chart 70, p. 404.

Fig. 147b The southeast shore of Tenacatita Bay, Mexico, from Tenacatita Head on the left to Navidad Head, the cluster of islets on the right, has an average elevation of from 400 to 500 feet. A grove of coquita nut palms may be seen beyond the beach.

Mexico from Cape Corrientes to Guatemalan Boundary

Plates 65-76; Charts 70-73

Cape Corrientes, of itself, is not a particularly noticeable landmark, but it is situated at the tip of a prominent convexity in the coast line, south of which the trend changes definitely from south or slightly southeast to but little south of east. Off the Cape, in consequence, there are strong currents and tide rips such as are usually found in such situations. It is a bold headland, 506 feet high, and the wooded country back of it rises rapidly to mountain heights.

There is little variety in the coast line from Cape Corrientes to the Guatemalan boundary. It consists, in the main, of a series of sand beaches separated by rocky points. The sand beaches vary much in length, and the rocky points may be small and low, or in the nature of high bluffs, or even headlands of considerable width. There are very few indentations significant enough to be called bays, but along the whole coast there are anchorages, safe enough in the dry season, from December to May. Where there are bays, there are commonly outlying rocks and islands. As a background to the shore, the surface of the land rises rapidly and far to the high mountain heights, so that some of the highest mountains in Mexico can be seen in clear weather from a few miles offshore. The lower portion of the rise is often quite barren looking, but, higher up, the mountain sides may be heavily wooded.

South of Cape Corrientes the first location explored is Tenacatita Bay, some 80 miles from the Cape, still in the large convexity of the coast. It lies between Brothers Point to the west and Navidad Head to the southeast and is 5 miles across the entrance. Brothers Point is a high, bluff headland, connected to the mainland by a low, sandy isthmus. Lying offshore are some rocks and rocky islets. The north shore and the head of the bay are sandy. Along this shore a lagoon running parallel to the shore empties into the bay. The land at the head of the bay is wooded in part, and there are large nutpalm groves. The southeast shore is higher and more rugged, becoming more so as it extends outward to form Navidad Head, which separates Tenacatita Bay from Navidad Bay. Extending southward from Navidad Head is a chain of rocky islands. There is deep enough water for anchorage in most of the bay, but, when the northwest wind blows, the bay is much exposed.

The bay has been visited several times. Some interesting material has been obtained at the entrance to the lagoon and along the rocky shore, especially at Navidad Head. Dredging toward the head of the bay was

not very effective, but the rich fauna off Navidad Head more than makes up for any deficiency elsewhere. It is doubtful if any other location explored has so much to offer.

Leaving Tenacatita Bay to follow the coast with a trend somewhat south of eastward, there is nothing to record for over 200 miles, until Petatlan Bay is reached. The landward view is much like it has been, except that perhaps the high mountains come a little nearer the coast, and higher individual peaks come into view. The two Colima peaks, the western sentinels of a long volcanic chain, are situated in the Tenacatita Bay hinterland. In many cases the immediate foreground is low, and there are many lagoons similar to the one near shore in Tenacatita Bay, running parallel to the coast. Manzanillo, the port of entry for the State of Colima, is situated on the east shore of Manzanillo Bay, 30 miles from Tenacatita Bay.

Petatlan Bay, 7 miles across at the entrance, forms an indentation in the coast line 2½ to 3 miles deep, between a somewhat inconspicuous, rocky bluff to the northwest and Punta Gorda, the tip of a bold headland, 640 feet high, Morro de Petatlan, to the southeast. This headland is connected with the mainland by a low, wooded isthmus. On the bay side of the isthmus the shore is shingle or rock, but on the southeast side there is a long, sandy beach. On the seaward side of the headland the cliffs are abrupt, perpendicular in places, but they leave a low, narrow ledge between them and the water's edge at low spring tide. The east and north shores form a sandy beach.

Lying 1 to 1½ miles westward of Punta Gorda are the White Friars (Potoci), a group of 12 rocks, of which 4 are large enough to be dignified by the name of islands or islets. They serve as nesting places for a variety of marine birds and are covered by guano to such an extent that, since they stand out clearly from the shore, they can be recognized for a long distance, particularly in approach from the southward.

Lying a mile off the northwest entrance to the bay is the conspicuous Black Rock, 46 feet high, and steep on all sides. To the westward of the bluff at the northwest limit of the bay and of Black Rock is the small but safe and well-protected bay, Sihuatenejo Bay, in which the *Velero III* anchored December 11 and 12, 1931.

White Friars have provided ornithological material and photographs. The shore on the bay side of Morro de Petatlan is rather barren, but the small strip at the base of the cliffs on the seaward side is much more interesting. Dredging in the bay has given only fair results. Near the White

Friars it is much better, especially on the south side, i.e., between White Friars and Morro de Petatlan. Two hauls were made in deep water, 5 miles out from White Friars, in the mud, with not very encouraging results. The depths were 60 and 100-140 fathoms. From the deeper haul, a larval spiny lobster created some surprise.

East-southeastward from Morro de Petatlan, 115 miles, is Acapulco Harbor. The entrance lies between the Acapulco heads. In the entrance and farther in the bay there are several islands, islets, and individual rocks, but there are safe passages into what "is considered the finest (harbor) on the west coast of Mexico." From the main bay there are secondary bays, upon the shore of one of which, Santa Lucia Bay, is situated the city of Acapulco, the port of entry for the State of Guerrero. All around the harbor are high mountains that provide shelter. The *Velero III* anchored here, southbound, December 14-15, 1931, and northbound, February 12-13, 1932.

There is one dredging station 16 miles southeast of Acapulco Harbor, 2 miles offshore, in 11 fathoms, fine sand.

From Acapulco Harbor, with the trend of the coast in the same general direction, it is 115 miles to Chacahua Bay. From Acapulco eastward, the high hills in the foreground and the high mountains in the background gradually disappear, and for 50 or 60 miles they are little in evidence. They begin to show again before Chacahua Bay is reached, so that they take on much the same appearance as they do west of Acapulco. The entrance to Chacahua Bay, 6 miles across, lies between two high, rocky headlands, Punta Galera to the west and Morro Hermoso to the east, which, like so many of the headlands along the Mexican coast, are each connected with the mainland by a low isthmus. There are rocks and reefs off Punta Galera, but few of them off Morro Hermoso. At the head of the bay a sandbar separates the bay from Chacahua Lagoon. There are a shore station at the margin of the lagoon and one at the rocks at the entrance, where *Heliasters* are abundant. There are dredging stations in the shallow water in the bay in sand, and outside the bay in 45-50 fathoms, mud.

East of Chacahua Bay the coast line continues eastward and then swings to form a southward convexity before turning north of east again to Tangola Tangola Bay, 95 miles from Chacahua Bay.

Tangola Tangola Bay, the last of three shallow indentations of the coast, with sandy beaches and rocky points between, is preceded by Santa Cruz Bay and Guatulco Bay. It is only 6 miles across the mouth of the

three of them. At a short distance offshore the three beaches appear to be continuous. From 10 miles out to sea these bays are difficult to locate or distinguish. In Tangola Tangola Bay there is a small island, Tangola Tangola Island. The bottom is sandy out to a depth of 25 fathoms, after which the sand is replaced by mud. A shore station on the rocky point and 3 dredging stations are located here.

West of Tangola Tangola Bay, 23 miles, situated on a small bay, is Port Angeles, the port of entry for the State of Oaxaca.

Beginning between Port Angeles and Tangola Tangola Bay, there is a long sweep of coast, northeastward, eastward, and southeastward, to form the Gulf of Tehuantepec. The distance across the mouth of the gulf, from Port Angeles to Suchiate Bar, where Mexico adjoins Guatemala, is about 250 miles. From such a line across the entrance to the head of the gulf it is 65 miles. This head is 120 miles southward of the southern shore of the Gulf of Mexico. From Salina Cruz the shore is a continuous, sandy beach, often backed by lagoons. Although throughout the whole of the Gulf there are few dangerous rocks, shoals, or obstructions, and although the sea bottom is even, deepening very gradually offshore, the effect of the strong winds coming across the trans-Mexican gap, which forms the Isthmus of Tehuantepec, which are felt for great distances out to sea, and the disturbance that these set up in the ocean currents in this region make the reputation of the Gulf of Tehuantepec anything but savory. In the days of sailing vessels passage across the Gulf was often hazardous, and even now, in the days of large steamships, it may be an unpleasant experience.

Salina Cruz, 55 miles east of Tangola Tangola Bay, the terminus of the Tehuantepec Railroad, was a busy port at one time, but after the completion of the Panama Canal it deteriorated badly. Apparently it is now coming into its own again.

The only collecting station in the whole Gulf is a dredging station, 20 miles offshore, State of Chiapas, 15° 41′ North, 94° 08′ West, in 35 fathoms, mud, where a catch of shrimps was the chief feature of the haul.

Central American Coast

Guatemala

Plates 77-80; Chart 74

The coast of Guatemala extends from Suchiate Bar, southeasterly and then easterly for 140 miles. The sandy coast is regular, with no indentations of importance, although there are several roadsteads, the most important of which are Champerico and San José. At both of these there are ports of entry, connected by rail with the interior. Champerico is 30 miles from the Mexican border, and San José 40 miles from the boundary of El Salvador. The landward slope from the shore is rather gradual, but it extends to a continuous range of high mountains in the interior, some of which are actively volcanic. The two most notable of these volcanoes, directly north of San José, are Agua, 12,334 feet, and Fuego, 12,603 feet, connected by a high ridge. When the atmosphere is clear, in the morning or early forenoon, these are readily visible far out to sea. Later in the day they are likely to be obscured by heavy smoke.

No shore collecting has been done off the coast of Guatemala, but there are several dredging stations, all in sand, in the vicinity of San José, in 3-5 fathoms inshore to 56 fathoms 30 miles out.

El Salvador

The coast of El Salvador extends slightly south of east from the Guatemalan boundary, approximately 140 miles, to the Gulf of Fonseca. The coast and its background are similar to that of Guatemala. The mountains are closer to the sea, but the highest of them are far from being as high as those in Guatemala. There is one irregular bay, Jiquilisco Bay, 30 miles west of the Gulf of Fonseca, but it is largely filled up with low islands. There are two ports of entry, Acajutla, 20 miles from the western boundary, and La Libertad, 30 miles east of Acajutla. No collecting has been done along the coast of El Salvador.

The Gulf of Fonseca is a large inlet, 19 miles wide at the entrance and practically that width for 12 miles, after which it diverges to a width of more than 40 miles, giving off a number of secondary inlets, the farthest point from the entrance being 25 miles. The landward portion consists largely of mud flats, and there are numerous islands, large and small, in various parts of the gulf.

Three countries share the coast line of the Gulf—El Salvador, the western shore, for 16 miles; Honduras, the northern and most of the western shore, for 38 miles; and Nicaragua, the remainder, 17 miles to

Monypenny Point and then 12 miles to the open sea at Punta Chiquirin. El Salvador has a port of entry, its most important port, at La Unión; Honduras has one at Amapala; but Nicaragua has none.

There is no collecting station in or near the Gulf of Fonseca.

Nicaragua

Plate 76

Around the Gulf of Fonseca and along the Nicaraguan coast, which extends southeasterly 160 miles, to Salinas Bay, the immediate background is low, and the mountains farther back are not so high. There is a distinct chain of these extending from the Gulf of Fonseca to Lake Managua, close to the shore at first, but gradually receding to the eastward. The chain contains many active volcanoes, of which Mount Viejo, 5,670 feet, inland from Corinto, and Monotombo, 3,910 feet, on the shore of Lake Managua, are probably the most prominent, as seen from the sea in clear weather.

The coast line is still regular, and there is no conspicuous inlet anywhere. The nearest approach to one is Corinto Harbor, 40 miles from the Gulf of Fonseca, on which is situated the Port of Corinto, the only port of entrance of importance. The *Velero III* anchored here February 6-9, 1932. There is one dredging station, 11 miles northwest of the port, in 1-3 fathoms, in sand and dead leaves.

Costa Rica—Cocos Island

Plates 76-81; Charts 75-78

In crossing the boundary between Nicaragua and Costa Rica, beginning with Salinas Bay, the nature of the coast becomes different. Instead of the regular coast line, inlets and peninsulas, with or without pointed headlands, follow in succession, so that the point-to-point measurement from Salinas Bay to Punta Burica of roughly 300 miles gives but a slight idea of the amount of actual coast line. Enough variety is introduced to kindle real enthusiasm in a marine zoologist.

The coast line, in general, is bolder, rising abruptly to form cliffs or bluffs, or more gradually to rolling hills that are never of great height. One misses the high mountains in the distant background, as they are too far inland to be seen from the sea. Sandy beaches are relatively scarce. The open coast often shows evidence of aridity, with but little except cactus in sight, but the shores of the bays may be quite well wooded.

Salinas Bay is a secondary extension of the larger inlet, the Gulf of Papagayo, which extends from San Juan del Sur in Nicaragua to Cape