ALLAN HANCOCK PACIFIC EXPEDITIONS
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GENERAL ACCOUNT OF THE SCIENTIFIC WORK OF THE *VELERO III* IN THE EASTERN PACIFIC, 1931-41

PART II

Geographical and Biological Associations

(PLATES 17-128)

BY

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CONTENTS

GENERAL ACCOUNT OF THE SCIENTIFIC WORK OF THE *VELERO III* IN THE EASTERN PACIFIC

Geographical and Biological Associations

During the ten years in which the *Velero III* has been in the service of marine exploration in the Eastern Pacific, the ship has traversed a great stretch of coast line, much of it several times. This running description of the coast line, as it is associated with the collecting stations of the *Velero III,* is presented in the hope and expectation that it may be useful for reference to all those who are interested in the voyages of the *Velero III* and in the work of the Allan Hancock Foundation, but particularly to anyone who has been, is, or will be engaged in the detailed examination of any portion of the vast amount of biological material collected on the voyages, and preserved and stored in the Allan Hancock Foundation Building on the campus of The University of Southern California, Los Angeles. The account is intended as a setting for the record of collecting stations, as listed in a later part of this volume.

The principal sources of the information here supplied are the hydrographic survey charts, the three numbers of *Coast Pilot* that cover this part of the coast, photographs taken by photographers and other members of the Hancock Pacific Expeditions, in the possession of the Allan Hancock Foundation, direct observations of various members of these expeditions, and personal observations.

No apology is necessary for the greater detail in reference to the Gulf of California and the Galapagos Islands, since the collecting has been much more concentrated in these regions.

For many of the geographical names there is a lack of agreement in spelling. In cases of disagreement the *Coast Pilot* has been used as the authority, not that the *Coast Pilots* show any phenomenal degree of consistency, but because in them one can always find the name used, and the likelihood is that, as an authority, they are as reliable as, if not more reliable than, any other single authority.

The photographs, reproduced for illustration, have been selected, on the whole, from the extensive photograph library of the Foundation to give some pictorial idea of the nature of the coast described. Additional photographs supplied by the several scientists are so indicated in connection with the brief explanation of each illustration used in this account. One set of charts serves to indicate the routes taken in the longer expeditions, and the other set shows the trend of the whole coast line on a somewhat larger scale.

Distances are always given in geographical miles.

THE VOYAGES OF VELERO III

Since the launching of the *Velero III* in the summer of 1931, use has been made of her to explore the shore and coastal waters of the Pacific coast of the Americas, from the Golden Gate, San Francisco, California, 37° 49′ North, 122° 29′ West, to Port San Juan, Peru, 15° 20′ South, 75° 10′ West, a distance of over 4,500 miles; and, if the coast of the Gulf of California is included, as it must be, 1,500 miles should be added. Most of the continental islands have been visited, as well as the oceanic islands, the Revilla Gigedo group (Socorro and Clarion), Clipperton, Cocos, and the several islands of the Galapagos Archipelago.

Thrown in, as an extra that cannot readily be included in the Pacific Expeditions, was a cruise in 1939 through the Panama Canal, east along the coasts of Panama, Colombia, Venezuela, and the Guianas, to the Island of Trinidad and Tobago Island.

Although, particularly in the later expeditions, the main objective has been oceanographic and, especially, biological, abundant opportunity has been provided to collect material and data concerning terrestrial organisms and to observe the habits, customs, arts, and handicrafts of the natives that inhabit the countries bordering on these shores. This account, however, will be almost entirely restricted to the oceanographic work.

On the first expedition, December 3, 1931, to February 27, 1932, the first stop was made at Mazatlan, Mexico, from which the mainland coast line was traversed to Balboa, Canal Zone, hence to the Galapagos Islands and back to Balboa. The return trip was made by way of Cocos Island, up the west coast to the Gulf of California, along the west shore of the Gulf as far as Espiritu Santo Island, then back to port, after calling at Cedros Island on the way. (Expedition Chart 1)

The main object of this expedition was to obtain live animals—vertebrates—for the San Diego Zoological Gardens. There was no special equipment aboard for making any collections of marine invertebrates. Some such collecting was done in addition to collecting of terrestrial species. Insects on land and such shore forms as Crustacea and Mollusks served as a beginning of the collections that have since become so extensive, although this collecting was largely incidental.

The second expedition, December 29, 1932, to March 23, 1933, touched first at Tenacatita, Mexico, passed down the coast to Balboa by way of Malpelo Island to La Libertad, Ecuador, across to the Galapagos Islands by way of Cocos Island back to Balboa, then northwestward along the coast to the home port without entering the Gulf of California. (Expedition Chart 2)

The collecting of marine invertebrates on the first expedition was successful enough to indicate that the Eastern Tropical Pacific offered a fertile field for marine biological exploration, a field up to this time almost untouched. From such an unpretentious beginning, without placing any restraint on work on vertebrates, terrestrial invertebrates, or ethnology, marine biological exploration has come more and more to the fore until, on recent expeditions, this type of investigation, with other cognate oceanographic adherents, is of paramount importance.

Paralleling this development and, to some extent, accounting for it, there has been an increase in the amount and in the efficiency of the equipment carried on the *Velero III*. Suitable auxiliary boat equipment was provided as the ship was built, and this made it an easy matter to fit in any extra equipment necessary.

For the 1933 Expedition much equipment was added—a hand dredge, diving helmet, seines, dipnets, lobster traps, etc., suitable for shallow water as well as intertidal collecting. This brought in its train such an increase in marine invertebrate collecting, with such satisfactory results, that there could no longer be any doubt that the *Velero III* had found its proper niche in scientific endeavor.

The 1934 Expedition, December 30, 1933, to March 14, 1934, took quite a different route, although it covered little new area. The first stop was made at Socorro Island (Revilla Gigedo group), and the second at Clarion in the same group. From Clarion the course was set to Clipperton Atoll, and on to the Galapagos Islands. This was the only time that the archipelago was approached by way of Culpepper and Wenman islands, the most northwesterly islands of the group. Three weeks were spent in the Galapagos before proceeding to Guayaquil, Ecuador. The return voyage was made to Balboa, C.Z., and along the coast to the home port without entering the Gulf of California. (Expedition Chart 3)

The greatest improvement in equipment for this cruise was the fitting up of one of the whaleboats with a suitably geared power winch for dredging, a sorting table on the stern, movable shear legs for raising and emptying the dredge, and 250 fathoms of steel cable for hauling the dredge. This equipment made it possible to dredge satisfactorily in water to a depth of 100 fathoms or even more, although that depth was seldom exceeded.

Equipment to take water samples and bottom samples introduced physics and chemistry into the general plan of operations.

The success of this expedition engendered lasting confidence in the work of the expeditions. A sound basis for future work had been fairly and firmly established.

In June of this same year, 1934, a trip was made to the Revilla Gigedo Islands (Socorro and Clarion) to do some summer collecting.

The winter expedition of 1934-35, November 23, 1934, to April 12, 1935, was a long one. Sailing direct from Cedros Island to the Galapagos Islands, the members of the expedition spent over two weeks among the islands before leaving for Puná and Guayaquil, Ecuador, and on southward to Independencia Bay, Peru. On the return trip to port there was little wandering afield from the main coast line. (Expedition Chart 4)

The distinctive feature of this expedition was the visit to the Bird Islands and Bird Rocks along the Peruvian coast.

The route of the 1936 Expedition, February 14, 1936, to March 26, 1936, was largely confined to the Gulf of California. Certain stops were made along the west coast of Lower California; then the west coast of the Gulf of California was followed to Angel de la Guardia Island, across to Tiburon Island on the east side of the Gulf, down to San Pedro Nolasco Island, back again to the west coast of the Gulf to Cape San Lucas and back again to port. (Expedition Chart 5)

This was the first of three expeditions to do intensive as well as extensive collecting in the Gulf of California.

The 1937 Expedition, February 26, 1937, to April 8, 1937, covered somewhat the same general area as did that of 1936. The main attack was made in the Gulf of California. This time both sides of the Gulf were explored as far in as Consag Rock, not very far from the mouth of the Colorado River. On this occasion the east coast of the Gulf was followed as far south as Point Piaxtla before return was made to the west coast of the Gulf on the return journey. (Expedition Chart 6)

In July of this same year, 1937 (July 8 to 21), a trip was made to Cedros Island, Abreojos Point and Pond Lagoon, on the west coast of Lower California, the San Benito Islands, and Guadalupe Island, mainly, but not entirely, to obtain sea lions and elephant seals for the San Diego Zoological Gardens.

The 1938 Expedition, January 3, 1938, to March 13, 1938, was another long cruise, south along the coast to Guatemala, and then by way of Cocos Island to the Galapagos Islands, across to Peru as far south as San Juan Bay, Peru, to visit again the Bird Islands and Rocks. The return trip followed the mainland coast. (Expedition Chart 7)

Further equipment for dredging was used on this expedition for the first time. Facilities for using a much larger dredge directly from the deck of *Velero III* were provided, with 1,200 fathoms of cable, so that satis-

factory dredging could be done at a much greater depth than formerly if the bottom was suitable. The smaller dredge was not discarded, since it could be worked in shallower water and over a much rougher bottom than would be safe for the larger dredge.

In the summer of this year, 1938, the *Velero III* headed north for a change, for a visit to San Francisco. This provided the opportunity to do some collecting, mainly by dredging, in an area not previously entered.

In 1939, March 12 to May 14, Clarion and Socorro islands provided the first bases of operation. From these islands the course was set to Chacahua Bay, Mexico, and southeast along the mainland coast to Balboa, C.Z. (Expedition Chart 8)

Here came the only digression from the Pacific area in the ten years of operation. The Panama Canal was traversed to explore the Caribbean coastal areas of Panama, Colombia, Venezuela, and the Guianas, as far east as Trinidad and Tobago islands. On the return to Balboa, the *Velero III* was headed homeward along the mainland coast, collecting by the way as far north as Isabel Island, Mexico.

In 1940, January 17 to February 20, the Gulf of California was the center of attraction for the third time. On the way south stops were made at Turtle Bay, Santa Maria Bay, and Magdalena Bay, and on the way back at San Benito Islands. The Gulf itself was traversed pretty well from end to end, and many points on both sides of the Gulf, as well as the shores of many of the islands in the Gulf, provided collecting stations. (Expedition Chart 9)

In 1941 no long voyage south materialized. The longest trip (February 22 to March 2), although lasting but nine days, was quite successful. The route was to Wilson Cove, San Clemente Island, Johnsons Landing and White Cove, Santa Catalina Island, south and west of Point Loma, Todos Santos Bay, Ranger Bank, San Benito Islands, South Bay, Cedros Island, around Natividad Island, north through Dewey Channel, to the northeast point of Cedros Island and home. Its principal importance lay in the fact that the gaps in the Cedros Island region were filled up to some extent in an area that is much in the limelight in discussing distribution along the west coast of Lower California in relation to other areas farther north and south. (Expedition Chart 10)

During the intervals between the longer cruises, especially in the last three years, shorter collecting trips, lasting from one day to four or five days, have been made in the area between Point Conception and Point Loma. The shore has been explored, biologically, at most of the suitable locations on the mainland as well as on the islands of the Santa Barbara

and the Santa Catalina groups of the Channel Islands. Dredging has been done at various stations off all these shores, in shallow water from the dredge boat and, farther out, in deeper water, from the *Velero III*. The beam trawl and the tangles have been used to some extent. More recently the tangles have been used with the dredge regularly when the larger dredge is used. Water samples and bottom samples have been taken frequently and, more recently, bottom cores.

While, in a later part of this volume, a list of the collecting stations, with contributing data, will be given in chronological order, a brief description of each more general location, given in geographical order, will serve to give definition to these locations in larger sections of the coastal area. (See vol 1, no. 3, for station lists.)

An Account of Collecting Stations

California South of San Francisco

Plates 17, 26-28; Charts 19, 20, 25, 26

The most northerly location, represented by one dredging station, listed in the Pacific, is situated in the Gulf of the Farallones, 6 miles from the Middle Farallon and much the same distance from the North Farallon.

The Gulf of the Farallones serves as the approach to San Francisco Bay. It is bounded on the north by Point Reyes, on the south by Point San Pedro, and on the west by the Farallones. It is comparatively shallow, seldom exceeding 40 fathoms in depth, and most of it less than 30 fathoms. In general, the bottom is sandy.

The Farallones consist of three rocky islets, or groups of islets—the Southeast, the Middle, and the North Farallon islands—extending 7 miles in a northwest-southeast direction, approximately 25 miles from the Golden Gate.

Six miles south of Point San Pedro is Pillar Point, which serves to protect Halfmoon Bay from the northwest. This bay is shallow and has no protection from the southwest. There is one dredging station 1¼ miles south of Pillar Point, in 16 fathoms, coarse gravel.

Forty miles southeast of Halfmoon Bay is the much larger Monterey Bay, with a 20-mile face between Point Santa Cruz to the north and Point Pinos to the south. The shore consists largely of sand dunes, and the water is shallow for some distance out from the head of the bay with exception of a portion centrally placed where a deep canyon, Monterey Canyon, extends outward across the bay into the open ocean, with a depth, at the entrance of the bay, of 550 fathoms.

There is one station in quite shallow water at the head of the bay near the mouth of the Salinas River, in sand, and 3 stations in and outside the bay near Point Pinos, in 26-54 fathoms, shell and rock.

From Point Pinos the coast extends southwesterly 4 miles to Cypress Point and then turns abruptly eastward a couple of miles to Pescadero Point, which forms the northwestern boundary of Carmel Bay. Point Lobos appears at the southern extremity. Some dredging has been done in and around Carmel Bay in depths up to 40 fathoms.

From Carmel Bay there is a stretch of rugged coast southward 90 miles before the next station appears at Point San Luis, the point that bounds San Luis Obispo Bay to the westward. Around this rocky point,

off Port San Luis, lobster traps have been set and crabs *(Cancer)* obtained. A dredging station is located in San Luis Obispo Bay in 8-14 fathoms.

Thirty-six miles south of Point San Luis lies Point Arguello, with a dredging station a mile offshore in 15-30 fathoms.

At Point Conception, 12 miles farther on, the shore takes a sharp turn to run almost exactly east. Santa Barbara is located 40 miles from this point; and off the city, in 35 fathoms, there is a dredging station.

For 30 miles southeast of Santa Barbara there is a concavity in the coast line reaching to Point Hueneme, and then a nearly direct coast line, 23 miles, to Point Dume. Extending southward from Point Hueneme is the Hueneme Canyon. Two miles west of the mouth of this canyon is a dredging station; another is located 5 miles to the northwest of this; and still another, east of the canyon and quite close to it.

Seven miles along the coast from Point Hueneme is another canyon, Mugu Canyon, not so narrow or so definite as Hueneme Canyon. There are one dredging station near shore to the east of the canyon and two more about 4 miles offshore.

Northern Channel Islands

Plates 18-21; Charts 21-24

Separated from the eastern trend of the coast line from Point Conception by Santa Barbara Channel, and running east and west along the 34th parallel, is a series of four islands, Anacapa, Santa Cruz, Santa Rosa, and San Miguel, that makes up the Santa Barbara Islands, or the Northern Channel group.

The surface of each of these islands is irregular, and the shores are rocky, often precipitous. For much of the year there are strong winds and varying currents, from which the small open bays or coves give little shelter. There is scant precipitation, and permanent streams are scarce; hence, the vegetation, although varied, appears rather insignificant. San Miguel comes the nearest to absolute barrenness.

Anacapa Island, the most easterly, really consists of three islands—East, Middle, and West. It is 4 miles long, east to west, but in some places is quite narrow. The West Island is the highest, 930 feet.

The inshore water is rocky with kelp in places, the increase in depth is quite gradual, and the bottom soon becomes rocky or sandy, with shell.

The only shore stations are located at the east end of the West Island, or near the passage between the Middle and West islands. There are

numerous dredging stations all around the island, out to distances of 2½ to 3 miles, in depths of 50 fathoms or less. Those north of the West Island and west of this island in Anacapa Passage are among the richest in the southern California area.

Santa Cruz Island, separated from Anacapa Island by the 4-mile Anacapa Passage, is the largest island, 21 miles long and an average of 5 miles wide. It has several harbors, coves, and anchorages, but scarcely one of them is well protected in all weathers. On the north side there are Scorpion Anchorage, near the east end, and Chinese Harbor, Prisoners Harbor, and Pelican Bay, near the center—all in one large bight. To the east there are Smugglers Cove and to the south Willows Anchorage. The only island offshore, and it is small, is Gull Island, near the west end of the south side.

There are shore stations at Scorpion Anchorage and at Willows, where there are reefs and some turnable rocks, and at Prisoners Cove and Pelican Bay. There are dredging stations all around the island, but they are rather scarce along the east half of the south side and the west half of the north side. The latter area does not promise much, but the former gives indication of some good material. The dredging depths have ranged from 6 to 140 fathoms. The change in bottom with depth is much the same as with Anacapa.

Santa Rosa Island, 5 miles across Santa Cruz Channel from Santa Cruz Island, 15 miles long and 10 miles in greatest breadth, has almost as great an area as Santa Cruz Island. Water is more plentiful, and hence the vegetation is more conspicuous. The shore line is little indented, Bechers Bay, to the northeast, being the only inlet of any size. There are no islands off the coast, but offshore rocks are so numerous that few spots offer a good landing even in fair weather.

There are a fair number of dredging stations off Bechers Bay, on south through Santa Cruz Channel and to the southeast of the island, but the remainder has not been touched. This latter part is foul with rocks, reefs, and kelp in shallow water, but is better farther out. To explore it thoroughly, better sea and weather conditions than are commonly met with are necessary. The shelf south of the island, extending 18 miles from shore, should receive, and probably will receive, much more attention, as the dredging there, so far, has been very fruitful.

San Miguel Island, the most westerly of the group, is separated from Santa Rosa Island by the 3-mile San Miguel Passage. It is 7½ miles long, with an average width of 2 miles. The island is pretty well covered with

grasses, but there are no trees. There are more outlying rocks and reefs off the coast here than there are in the vicinity of the other islands, but there are some reasonably well-protected bays and harbors, although none of them is safe in all weathers. Cuyler Harbor on the north coast is the largest.

Shore collecting has been done only at the west end of the island, just north of Point Bennett. Dredging has been done in San Miguel Passage and at several points along the south coast, mostly in shallow water; but some deeper hauls have been made south of the west end of the island. On the north side the only dredging has been in and north of Cuyler Harbor.

Southern Channel Islands

Plates 22-25; Charts 27-31

The whole Santa Barbara Islands region, at least in waters 50 fathoms or less, offers greater inducements to carry on intensive work than does any other area of similar size that has been explored between Point Conception and the Mexican boundary. There are many places in which the fauna is rich and varied. In the deeper water farther out the bottom is nearly always fine sand or mud with very little to show as compared with the shallower water.

The eastern terminus of Santa Barbara Channel is Point Dume, 28 miles directly east of Anacapa Island. It also serves as the western or northwestern limit of Santa Monica Bay, which stretches 25 miles across to Cape Vicente. The shore of the bay forms a regular curve, and there is nowhere in it suitable protection in stormy weather. In general, the depth increases gradually from shore, but near Redondo there is a submarine valley with deep water almost to the shore, Redondo Canyon. At both extremities of the bay the shore is rocky and somewhat rugged, although in places the banks are clay; but the intervening portion, in the main, is a sandy beach, although it may be backed by rocky or clay cliffs.

Shore collecting has been done on an old pier at Playa del Rey and on the rocks at Bluff Cove, some distance south of Redondo Beach. Most of the dredging and beam trawl stations have been grouped in or near the Redondo submarine canyon, but there are two a short distance off Manhattan Beach.

At Point Vicente the coast line turns abruptly to run a little south of east for 7 miles to Point Fermin, the western limit of San Pedro Bay. The shore here is abrupt and rocky. Around Point Fermin and at Portu-

guese Bend, 2 miles east of Point Vicente, conditions are favorable for collecting at low spring tides, and some of it has been done at both places. There are dredging stations a short distance out from both of these points.

Point Fermin forms the western boundary of San Pedro Bay, which, with San Pedro Harbor, has become Los Angeles Harbor, with extensive sea walls or breakwaters to provide protection in all weathers. The outer breakwater, especially that part of it toward Point Fermin, has developed a rich fauna to be reached by low-tide collecting. In the harbor itself the hull of *Velero III* in dry dock at Craig's served as a collecting station. Anaheim Slough, near Seal Beach, was at one time a fine collecting area, but the changes that have been made in developing the area have destroyed much of the fauna. Dredging stations extend out from Seal Beach and Sunset Beach as far as the entrance of Los Angeles Harbor.

From Los Angeles Harbor the shore extends 70 miles in a gentle curve to Point La Jolla. It is low and sandy throughout, along the shore and for some distance out from shore, with few rocky projections and with no indentations that can be called bays, with the exception of the small, shallow Newport Harbor. The sandy bottom shore area is rather definitely marked off from the area farther from shore, and the increase in depth from this line is rapid.

Certain of the rocky projections at Corona del Mar, Laguna, and La Jolla have served for shore collecting. A series of dredging stations extend for 10 or 12 miles from Huntington Beach, Newport, and Laguna Beach. A bank that comes to about 60 fathoms from the surface midway between Dana Point and the eastern end of Santa Catalina Island has received considerable attention with both dredge and tangles.

From Point La Jolla the shore extends southward, 11 miles, to Point Loma, the western boundary of San Diego Bay. No collecting has been done in this stretch except for some shore work in Mission Bay, about midway between the two points. It is much in the nature of a large lagoon, and the fauna seems to be going the same way as it is in Anaheim Slough.

Lying some distance off the shore that extends from Point Vicente to Point Loma are the four islands that make up the Santa Catalina group, or the Southern Channel Islands. They do not form a linear series as the Santa Barbara Islands do, and no two of them are near each other. The main axis of each extends in a northwest-southeast direction. In general

appearance and in vegetation there is much general resemblance to the Santa Barbara Islands.

Santa Catalina is the largest of these islands, and it lies nearest the mainland, 18 miles across the San Pedro Channel from Point Fermin. It is 18½ miles long with a greatest width of 7 miles. Six miles from the northwest end it is almost divided into two parts by Catalina Harbor on the southwest coast and Isthmus Cove on the northeast; the low isthmus is only half a mile across. There are two inhabited areas both on the east coast, the one at Isthmus Cove and the other at Avalon (Dakin Cove), near the southeast end of the island, with smaller settlements at other points. The shore is rugged and even precipitous in places, with few beaches, and these small.

It affords so few satisfactory locations for shore collecting that very little has been done. The only shore collecting station is in Fourth of July Cove, on the north side of Isthmus Cove. The seaward slope is steep, so that there is little shallow water out from the coast. To the west and southwest there are strong currents and little shelter from the strong winds. It is but a short distance out to muddy bottom, and the stations in this bottom give little but polychaetes, brittle stars, and sea cucumbers.

All of the remainder of the way around the coast of the island dredging has been extensive, from close in shore to as much as 6 miles out. One bank, 6 miles east of Long Point with a loose rock bottom in 225-230 fathoms, is particularly rich in echinoderms. The favored locations have been off the northwest end of the island, off Emerald Cove, off Isthmus Cove, off Long Point and White Cove, off Avalon, and off the southeast end of the island.

In the deeper parts of San Pedro Channel, as well as in the other wide channels, except on certain small banks, the bottom is of green mud, but in shallower water this often gives way to sand, sometimes with shell or coralline, and then to rock, although there are rock patches well scattered over the whole area. Gravel patches or pebble beds seem to be conspicuous by their absence.

Lying 21 miles to the westward of the northwest end of Santa Catalina Island is Santa Barbara Island, the smallest of the four. It is only 1½ miles by 1 mile. There is a wider shallow-water area around this island, which area is rocky and heavily provided with kelp. Off the southwest end of the island the area is particularly foul with rocks and reefs. A rocky island—Sutil or Gull Island—lies 200 yards offshore, the channel foul and shallow. The islet is 300 feet high and is quite conspicuous. There is no very safe anchorage.

A small amount of shore collecting has been done around the north end of the island. Dredging stations appear all around the island and out to banks 15 miles to the northward and 6 miles to the southward (Osborn Bank). Beam trawling has been done all along the east side.

Twenty-four miles southwest of Santa Barbara Island is San Nicolas Island, 8 miles long, with an average width of 3 miles. There is more sandy beach on this island than on any of the others; but even off the beaches a short distance rocky patches appear, close or scattered, to give holdfast to a very abundant supply of kelp. At the west end this extends out from shore for as much as three miles.

A small amount of shore collecting has been done at Dutch Harbor on the south coast, the only place around the island that offers even a modicum of shelter. Scattered dredging stations appear north and northwest of the eastern end of the island and in a more concentrated area on the south coast, off Dutch Harbor.

San Clemente Island is the southernmost of the group, directly south of Santa Catalina Island, 19 miles away, and 60 miles from the mainland coast at La Jolla. It is almost as long as Santa Catalina Island, but it has an average width of only 2½ miles. The northwest half of the island has much more regular surface than is ordinarily found in these islands, but the remainder of the island is more corrugated. The northeast side is rocky and abrupt, but the southwest side is much less so, the sea slope here being correspondingly more gradual. There is much less kelp around the shores than around San Nicolas or Santa Barbara. There are three harbors near the north end—West Cove, Northwest Harbor, and Wilson Cove—and Pyramid Cove at the south end.

Shore collecting has been done at Northwest Harbor, Pyramid Cove, and Horse Cove (adjacent to Pyramid Cove). Dredging has been done west, north, and east of the north end of the island, in and near Wilson Cove, and in and off Pyramid Cove.

Lying southwest of San Clemente Island, the nearest one 30 miles away, are three large banks and other smaller ones, the surface of which comes much nearer to sea level than that of the surrounding areas. They all have their long axes in a southeast-northwest direction and are much longer than they are broad. They may be considered as South Channel Islands that do not quite reach the surface.

The largest of these banks is Cortes Bank, which, measured within the 100-fathom line, is 25 miles long and 8 miles broad. Within the 50-fathom line it is 19 miles long, with a greatest width of 5 miles, and

within the 20-fathom line it is 3 miles long and 1½ miles wide. The pinnacle, Bishop Rock, is but 15 feet below the surface. Chart 32.

This bank lies 36 miles off San Clemente Island and is the most southerly bank of the group.

Tanner Bank, lying 5 miles northeast of the northern part of Cortes Bank, is not so large, 12½ miles long, 5½ miles wide. The pinnacle has 12 fathoms of water over it. Charts 32, 33.

Directly in line with Tanner Bank, 9 miles to the northwest of it, is the third large bank, yet unnamed, 9 miles long and 3 miles wide. It is 17 miles south of San Nicolas Island. No part of it comes nearer to the surface than 50 fathoms.

Dredging has been done on each of these banks with fair success. Much of the bottom is rocky, but there is also a large amount of sand and finely broken shell. In some spots there is coralline.

Point Loma is a narrow point of land extending directly southward to shut off San Diego Bay from the open ocean. The mainland shore extends in a regular, wide curve to the International Boundary, 10 miles from Point Loma. San Diego Bay itself, 7 miles long, is shut off further by a narrow spit that extends northwestward from the main shore, some distance south of the city of San Diego. This leaves a shallow bay, mostly with sandy bottom, outside the spit, extending southward from Point Loma to beyond the International Boundary. Chart 34.

The beam trawl and the small dredge have been used here in water less than 10 fathoms, while dredging from the *Velero III* has been done farther out, and in deeper water, about 80 fathoms, on a bank that lies 8 or 9 miles off Point Loma.

Lower California—West Coast

Plates 29-36; Charts 35-39, 41-45

When the coast line crosses the boundary, it is trending directly southward, and it continues much in this direction for 17 miles to Point Descanso. At first much of the shore is sandy, but later bluffs up to 80 feet in height appear, with characteristic flat-topped hills in the background, Table Mountain being very distinctive. The shallow water bench extends outward from shore from 8 to 12 miles, but from this to deep water the change is quite abrupt.

On this shallow water bench, 7 miles from shore and 5 miles south of the boundary, are the Coronado Islands, with a southeasterly axis. North Coronado is about one mile long, Middle Coronado consists of two small

islets, and South Coronado is 1¾ miles long. They are all precipitous and rugged, the north island 467 feet high and the south island 672 feet. For most of the year they appear very barren, but in the early spring (February and March) flowers may be quite abundant.

There is a dredging station in 14 fathoms between South Coronado and the main shore.

From Descanso Point to San Miguel Point, 26 miles, the shore takes two steps, first east and then south. There are several sandy beaches, but they are backed by abruptly rising bluffs or hills, and often the shore itself forms a bluff. There is little protection in any part of this coast. The depths increase rapidly offshore so that the shelf is narrow.

San Miguel Point forms the northern boundary of Todos Santos Bay, which provides the best protection along a great stretch of the northern part of the west coast of Lower California. The town of Ensenada is situated near the head of the bay. The bay, somewhat rectangular, is 9 miles wide at the entrance between San Miguel Point and Banda Point. Lying off the latter point 3 miles are the Todos Santos Islands, which offer some protection to the waters of the bay. A wind from the northwest is interrupted very little. The bay is all relatively shallow except for a small area north of Banda Point. An extensive lagoon lies behind a low sand beach on the south shore. Much of the bottom is sand or mud, but there are several rocky patches. Two dredging stations are located about 3 miles off San Miguel Point at the entrance to the bay.

From Point Banda to Cape San Quentin, a distance of 90 miles, the coast is quite regular, made up of three shallow bights, the northern one small, from Point Banda to Santo Tomas Point, the other two much more extensive—the first one from Santo Tomas Point to Cape Colnett and the second from this cape to Cape San Quentin. The coast is a succession of sandy beaches, rugged patches with outlying kelp, and more or less abrupt bluffs, with the background, hills, nearer the shore in the northern portion than in the southern. The most conspicuous feature is Cape Colnett, a semicircular headland that rises abruptly from the water in perpendicular cliffs to a plateau 300 or 400 feet high.

The shallow water shelf is much broader here, reaching a maximum width of 17 miles.

South of Cape San Quentin there is another bight extending to Point Baja, 26 miles, resembling those last mentioned except that Cape San Quentin extends southward to a long point to form the boundary of San

Quentin Bay, in which some dredging has been done in 25 fathoms or less.

From Point Baja to Point San Antonio, 12 miles, the San Quentin bight is repeated but on a smaller scale, with a bay, Rosario Bay, similarly placed to San Quentin Bay. There is an extensive sandy beach; and outside it, the bay, and the whole bight, for that matter, is well filled with kelp. A couple of miles off Point Baja there is a gap in the kelp, and here there is fair anchorage. Three dredging stations are located at the entrance to this gap.

From Point San Antonio to Point San Rosarito, a distance of approximately 110 miles, the coast line extends southeasterly. It consists of a series of shallow bights, varying much in breadth. In most cases the point between the bights extends in a southerly direction, to give slight protection to the northern extension of the bight, which in some cases is even called a bay. The last of these, Santa Rosalia, 7 miles across the entrance, deserves the name better than the others. The shore, in general, is of much the same type as that farther north. The depth of the water increases gradually, so that the 100-fathom line may be 30 miles or more offshore.

From Point San Rosarito, the coast line makes a long, gradual sweep southward, then southwestward, and finally westward to Cape San Eugenio. This large area, extending from Maria Point, 30 miles northwest of Point San Rosarito, to Cape San Eugenio and bounded on the west by Cedros Island, is Sebastian Viscaino Bay. It is 60 miles from Maria Point to Cape San Eugenio and 48 miles from Maria Point to the north end of Cedros Island. The whole bay is shallow, with no soundings greater than 70 fathoms recorded.

From Point San Rosarito almost to Cape San Eugenio the coastal area is low and much of the shore is sandy beach. Close to the shore and opening into the bay are three extensive lagoons, Manuela, Black Warrior, and Scammon. North of the entrance to Manuela Lagoon is a prominent headland, Lagoon Head (Morro de Santo Domingo), serving as a protection to Lagoon Head Anchorage.

Toward Cape San Eugenio the coast becomes more rugged again, particularly so in the vicinity of False Point, 12 miles northwest of Cape San Eugenio.

Apart from the collecting near Cedros Island, mentioned later, the only stations are in and off Lagoon Head Anchorage and in Manuela Lagoon.

Islands Off the West Coast of Lower California

Plates 29-32; Charts 39, 40

Off the west coast of Lower California, from Todos Santos Bay to Cape San Eugenio, there are several islands of special interest.

Guadalupe Island (North Point 29° 11′ North, 118° 17′ West), lying about 140 miles off the coast and 150 miles west and slightly north of the San Benito Islands, is 20 miles long, north and south, with a maximum width of 7 miles. Off the south end are two islets, the Inner Islet and the Outer Islet, the latter being 677 feet high. It is of volcanic origin and is mountainous (highest peak near North Point, 4,500 feet). The shores are so bold and rocky that landing is possible only in very limited areas. The south of the island is quite barren, but in the northern part there are fertile valleys, and there is some vegetation on the mountains. This vegetation has suffered badly from the numerous goats on the island. The depth of the water offshore increases rapidly, so that there is little or no shelf.

Guadalupe Island is of particular interest as the home of elephant seals and sea lions, and fur seals have also been reported. The island has been visited mainly to obtain live elephant seals for the San Diego Zoological Gardens, but some shore and inland collecting has been done.

The largest island off this part of the coast is Cedros (Cerros) Island, lying 12 miles to the northwest of Cape San Eugenio and forming the western boundary of Sebastian Viscaino Bay. It is 20½ miles long, from north to south, and from 2 to 9 miles wide, the widest portion being near the south end. The surface is very rugged, with high, abrupt peaks (the highest, Cedros Mountain, 3,950 feet), with deep, irregular valleys between. The southern end of the island is perhaps the most barren area along this whole barren coast. Toward the north end there are vegetation and even trees—cedars, pines, and some dwarf oaks.

The island arises from the continental shelf, so that there is shallow water for a considerable distance on all sides. Dredging and shore and inland collecting have been done on the east side near the north end and in or near a small village not far from the south end. In South Bay, to the south of the island, shore collecting has been done and dredging near the reef and kelp bed that extends outward from Cape San Agustin, the southwest point of the island.

Lying to the westward of the northern portion of Cedros Island, 14½ miles, are the three San Benito Islands, East, Middle, and West. They are all rocky and barren, and there are outlying rocks and masses of kelp

in almost every direction. The West Island is the largest and highest (661 feet), the East Island is the second, and the Middle Island is a small, low, flat island. The passage between the East and Middle islands is safe for navigation, but the other passage is not.

A spur of the continental shelf extends northward from the area west of Cape San Agustin, Cedros Island, to surround the San Benito, but there is a tongue of deeper water coming in from the north that separates these islands from the northern portion of Cedros Island.

At present the San Benito Islands serve as the home of many sea lions and elephant seals. At one time, the elephant seals were slaughtered so extensively that, as far as the San Benito were concerned, they seemed to be exterminated, but a few remained on Guadalupe Island; and, when they were totally protected for some time, the numbers materially increased, and now they are back on San Benito Islands again in goodly numbers.

Some collecting has been done on all the islands, and considerable dredging to the south of them.

Lying 6 miles to the northward of East San Benito Island, Ranger Bank extends on northward for 11 miles, with a breadth of 1¼ to 3½ miles. It is at quite a uniform depth of 67 to 75 fathoms, except at the margins where the depth is slightly greater, and is surrounded by water of much greater depth. The bottom consists of rock in place, loose rock, pebbles, and shell, with an abundance of a tall, much-branching coral. Dredging here has given very satisfactory results.

Natividad Island lies 3¾ miles west of Cape San Eugenio, separated from it by Dewey Channel. It lies in a northwest-southeast direction, 3¾ miles long, ½ to 1½ miles wide. It is barren and hilly and is surrounded by reefs, rocks, and kelp patches that extend into Dewey Channel, but there is a safe passage through, near the mainland shore.

Dredging has been done in Dewey Channel and in various directions from Natividad Island, in depths of 20-65 fathoms.

The whole area west and south of Cedros Island, from Ranger Bank, past the San Benito Islands, to and around Natividad Island, on the continental shelf, has been explored to some extent, with very satisfactory results. Much of the bottom is shell, coral, nullipores, and sponges, on a rocky or sandy base, and the fauna is rich in practically all groups of marine invertebrates. It is of special interest because this area appears to be the northern portion of a zone that extends southward to Santa Maria Bay, or Magdalena Bay, where there is much distributional overlapping between the Panamic and Californian faunas.

For 10 miles southward from Cape San Eugenio, the coast is somewhat abrupt, but little indented, backed by rapidly rising hills. For the next 5 or 6 miles to Kelp Point it forms a shallow bight with a low-lying shore, but Kelp Point itself is more conspicuous. It forms the boundary for Port San Bartholomé, with a southern extension to form Turtle Bay, which provides the best harbor between the International Boundary and Magdalena Bay. It is 1 mile wide at the entrance and has a depth of 2½ miles. Most of the shore is formed by gravel, shingle, or sand beaches. Cape Tortolo forms the southwestern limit of the bay. From this cape, for over 2 miles to Thurloe Head there is a continuous, conspicuous cliff, 25 to 100 feet high. A reef extends from Thurloe Head in a southerly direction for 400 yards, around and adjacent to which is the most southerly mass of kelp, similar in nature and size to the kelp beds farther north. South of this point, these large kelps gradually disappear, until no more of them are in evidence.

East of Thurloe Head is Thurloe Bay, with a sand or shingle beach backed by sand hills.

Shore collecting and dredging have been done in the vicinity of Port San Bartholomé, Thurloe Head, and Thurloe Bay. Dredging near the kelp on the reef off Thurloe Head gave excellent results.

From Thurloe Head to Abreojos Point, a distance of nearly 100 miles, the coastal area is quite inconspicuous. The coast line itself forms a number of wide, shallow bights. In the northern portion bluffs appear along the coast, but these soon disappear, and the shore is mostly low lying, sandy, with several extensive lagoons just behind it. The 100-fathom line may be as much as 20 miles offshore. The only stop that has been made in all this distance was off Asunción Island, near the center of the coast.

From Abreojos Point the coast makes a wide sweep, first southeastward and then almost directly southward to Cape San Lazaro, 135 miles away, in a straight line, with only two significant indentations, Ballenas Bay, behind Point Abreojos, and San Juanico Bay, over a third of the way southward. From the sea this coastal area is not interesting. Most of it is low, with sandy shores and extensive lagoons, with sand dunes or low benches, sometimes cut with arroyos, forming the immediate background. Hills or mountains can commonly be seen, but they are far in the distance. The seaward slope is just as gradual; the 100-fathom line may be 40 miles offshore. The bottom is sand, mud, and broken shell.

The only collecting stations along this part of the coast are in San Juanico Bay, but in one stormy passage southward several specimens were

picked up on deck, about 50 miles offshore, slightly south of San Juanico Bay.

From Cape San Lazaro the coast trends southeastward for 3½ miles to Hughes Point, the northwest boundary of Santa Maria Bay, with an entrance width of 7½ miles, to Cape Corso, its southwest boundary. From this entrance, the bay extends 4½ miles to the northeastward. A narrow strip of sand beach serves as its east coast and separates the bay from Magdalena Bay.

Cape Corso is the northern extremity of a narrow peninsula that extends to the southeast 9 miles to Entrada Point, to separate all but the southern portion of Magdalena Bay from the open ocean. Its open coast consists of a series of rocky points separated by sandy beaches. The southern portion of this bay and its southern extension through Marcy Channel, Almejas Bay, are separated from the open sea by the large island, Santa Margarita, 21 miles long and as much as 4½ miles wide. It is bold and rocky at each end but low and sandy in the central portion. The northwestern tip is Redondo Point, and the southeastern is Point Tosco.

Although the entrance to Magdalena Bay, from Entrada Point to Redondo Point, is only 3 miles wide, the bay is large, 17 miles by 12 miles. Most of the coast is low and sandy, with numerous lagoons, shoals, and sandbars. This is true of Almejas Bay as well.

Considerable dredging and shore collecting have been done in and off Santa Maria Bay, particularly in the vicinity of Hughes Point. There are one dredging station 8 miles off the entrance to Magdalena Bay in 81 fathoms and two off Point Tosco in 15 and in 45 fathoms.

From Point Tosco to Cabo Falso, the southern extremity of Lower California, approximately 130 miles, the coast line is regular with no significant indentations. Most of the minute dents appear where the arroyos meet the sea. For the first hundred miles the coast and the immediate background are low, rather frequently cut with arroyos. At Lobos Point, near-by low hills begin to appear and the sand beaches are broken by rocky or sandy bluffs; this condition is continued to Cabo Falso. In this area also there are distinctive arroyos. The shelf out to the 100-fathom line continues wide until within 50 miles from the extremity of the peninsula and then abruptly contracts to 1 to 3 miles.

There has been little collecting in all of this vast area, but directly west of Cabo Falso, 14 miles, rising from the deeper water to a minimum depth of 50 fathoms and consisting of 3 patches, is the area known as San Jaime Bank, which has been explored to some extent.

From this account it is evident that the Pacific Coast of Lower California, with the exception of the Cedros Island region, has been explored very inadequately as yet, although it is an area of promise above the average. It is quite a different story with the east coast of the peninsula and the whole of the Gulf of California.

Before giving consideration to this large and important area, some reference may be made to some of the outlying islands.

The Revilla Gigedo Islands

Plates 74, 75; Charts 46, 47

South of Cabo Falso 260 miles and slightly west of it is Socorro Island, the largest island of the Revilla Gigedo group. This island consists of a large volcanic cone, Mount Evermann, 3,707 feet high, with several smaller cones, some of them quite small, on its flanks. It is 10 miles in length and over 8 in breadth. The slopes to the north and west are quite steep, to the south and east much less so. The whole island is volcanic, and the general appearance, due to exposed lava and a general lack of green vegetation, is anything but inviting. There is said to be fresh water on the island throughout the year, but there is not much general evidence of it. At times the island has been inhabited. Chart 46.

Some of the ash or cinder cones stand out prominently; the one to the westward of Braithwaite Bay is a characteristic feature of the island. In many cases the lava flows are entirely exposed. Near the shore this is generally true, but in the gullies or draws, or even on the regular slopes, the cactus and low shrubbery may be plentiful, often so thickly matted that passage through is not readily possible.

The island is nearly rectangular, the northern portion terminating in Cape Middleton, the eastern in Cape Pearce, the southern in Cape Rule, and the western in two points, two miles apart, Rugged Point and Cape Henslow. A short distance off this latter cape is a conspicuous, rocky islet, Oneal Rock. The shore, in general, is abrupt and rugged, with plenty of outlying rocks, but with deep water close offshore; hence, there are few spots that offer a good landing. Much of the southwest coast consists of a narrow bight, Cornwallis Bay; and on the south shore, some distance east of Cape Rule, is the only real bay on the whole coast, Braithwaite Bay, with the cinder cone, mentioned above, forming much of its western boundary. At the head of the bay is a beach, well supplied with isolated rocks, so that it may be described as bouldery rather than shingly.

There is plenty of evidence that Socorro is a tropical island. Frigate birds, goonies, and boobies fly about, mantas and sharks are abundant in

the waters, the brilliant red Sally Lightfoot crab scuttles about among the boulders on the beach, and coral masses appear at or near the surface.

With the exception of some shore collecting at Grayson Cove, in the northwestern part of Cornwallis Bay, all the stations are in the vicinity of Braithwaite Bay and Cape Rule. The bouldery shore provides much good material, and the coral masses protect an interesting association of species. Dredging in depths to 75 fathoms, mostly in nullipore bottom, has been profitable but not startlingly so.

Clarion, the only other sizable island in the group (San Benedicto Island, very small, and Roca Partida, a rocky islet, have not been visited), lies 214 miles to the westward of Socorro Island, but separated from it by water of a depth of over 2,000 fathoms. It, also, is volcanic, and in many of its physical features it resembles Socorro. Instead of a single large cone, there are three, 1,100, 933, and 959 feet high. The island is 5¼ miles long, east and west, and 2 miles wide, rectangular or trapezoidal in shape. It is abrupt to the north, west, and east, but slopes much more gradually to the south from a high ridge running east and west. The slope flattens more toward the sea, with the area approaching the two southern beaches (the only beaches on the island) not so far from being level. There is a large dry lagoon near Sulphur Bay. Chart 47.

Instead of having distinct points at the four corners, as Socorro has, there is one rocky point to the southwest; but at or near the other corners there are conspicuous outlying rocks or rocky islets—Monument Rock to the northwest, Shag Rock, somewhat moved southward, to the northeast, and Pyramid Rock to the southeast. The only bay, and it is not very prominent, is Sulphur Bay, on the south shore, 1½ miles east of Rocky Point.

The surface has much the same general appearance as Socorro, but there is more vegetation, even if the most of it is cactus. The fauna is similar in type to that of Socorro. The island is an important breeding place for birds.

Much shore collecting and inland collecting have been done at Sulphur Bay and around the lagoon back of it, much dredging in and off this bay, with conditions much similar to those at Braithwaite Bay; and there are four stations located north of the west end of the island.

Clipperton Island

Plate 75

Away to the southeast of the Revilla Gigedo group, 515 miles from Socorro Island, lies the isolated Clipperton Island (10° 17′ North, 109°

13′ West). It is 600 miles from the nearest mainland, near Cape Corrientes, Mexico, and 1,400 miles almost due west of Port Culebra, Costa Rica. Apparently, Clipperton is the only sizable atoll in the Eastern Pacific. The lagoon is a couple of miles in breadth, with a depth varying from a few inches to 55 fathoms. The low coral ring that forms the island varies in width from a few yards to a quarter of a mile, and in height, from 5 to 14 feet.

On the west side of the island there is a clump of cocoanut palms, and on the east side are some scattered palms and a conspicuous rock, Clipperton Rock, 62 feet high, which, from certain directions, looks like a sail. The island is fringed by a coral reef and coral rocks, over which there is always a surf breaking. Outside the reef the water deepens rapidly.

On the occasion of the only visit to this island, the surf was too heavy to attempt landing. Dredging was attempted to the east of the atoll, but the slope was so steep and the bottom so rocky that the attempt met with little success.

PLATE 17

Fig. 31 The Golden Gate Bridge as seen from the flying bridge of the *Velero III,* which visited San Francisco Bay in August of 1938. The bay region is the northernmost coastal area explored by Allan Hancock Pacific Expeditions.

Fig. 32 Rolling hills covered with live oak trees rise behind Port Luis Obispo near Avila, where *Velero III* often anchored while side trips were being made to Captain Hancock's Santa Maria properties.

PLATE 18

Fig. 33 View of Cuyler Harbor, San Miguel Island, looking northeast. A steady wind which blows from the west has lifted sand from the windward side of the promontory and deposited it on the lee side as shown in the picture. (Photograph, L. A. Museum—Channel Islands Biol. Survey.)

Fig. 34 View of Cuyler Harbor looking northeast from the main island of San Miguel toward Prince's Island. The *Velero III* rides at anchor at the right of the smaller islet. Chart 24, p. 379.

Fig. 35 A rookery of California sea lions off Point Bennett, at the extreme western tip of San Miguel Island. Dangerous submerged reefs extend for several miles to the west and north.

PLATE 19

Fig. 36 View of Santa Rosa Island looking northwest along the shore from the summit of Skunk Point. (Photographs, figs. 36-40, by Arthur Woodward.)

Fig. 37 Sand dunes at the east end of Santa Rosa Island. Chart 23, p. 379.

Fig. 38 Mouth of Elderberry Canyon near the wharf at Becher's Bay, Santa Rosa Island.

Fig. 39 Skunk Point, Santa Rosa Island, site of an old Indian village.

Fig. 40 View of Santa Rosa Island looking northwest across Becher's Bay. An old Indian village site is located on the point in the middle foreground.

Fig. 41 View along the beach at Santa Rosa Island showing the way in which the sand has been piled in dunes by the incessant wind. (Photograph, L. A. Museum—Channel Islands Biol. Survey.)

PLATE 20

Fig. 42 Pelican Harbor, on the northern or protected shore of Santa Cruz Island, which is sparsely covered with oak and Bishop pine. A few inhabited dwellings may be seen on the promontory in the center of the picture.

Fig. 43 Willow's Anchorage, on the south shore of Santa Cruz Island. The Tertiary sediments of Anacapa and Santa Cruz islands represent a western extension of the Santa Monica Mountains. Chart 22, p. 378.

Fig. 44 Prisoner's Harbor, Santa Cruz Island, showing the protected landing place in which small vessels may anchor to serve the farmhouse a short distance inshore. The perpendicular cliffed shore line is similar to that of Anacapa Island, which lies but a few miles across Anacapa Passage.

PLATE 21

Fig. 45 East Anacapa Island, with west island visible in the middle distance and Santa Cruz Island beyond. Wave action has resulted in a remarkable series of sea stacks, seen at the base of the lighthouse. Chart 21, p. 378.

Fig. 46 The results of wave action are clearly seen on Gull Island, a series of low rocks lying off the southwest corner of Santa Cruz Island and marked by a flashing light. Much dredging was done in the vicinity of Gull Island and in the adjacent Santa Rosa Channel.

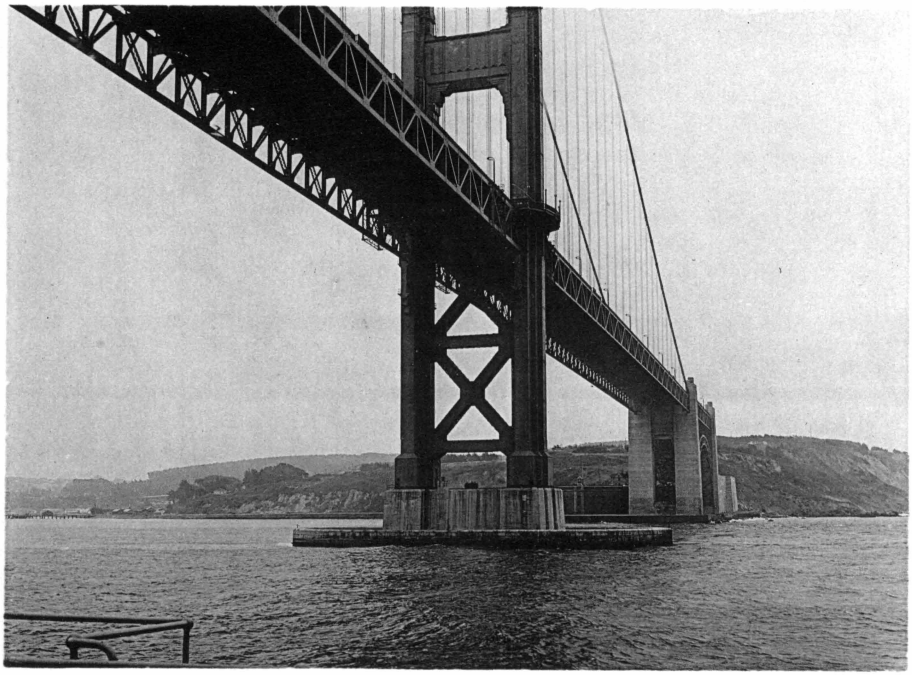
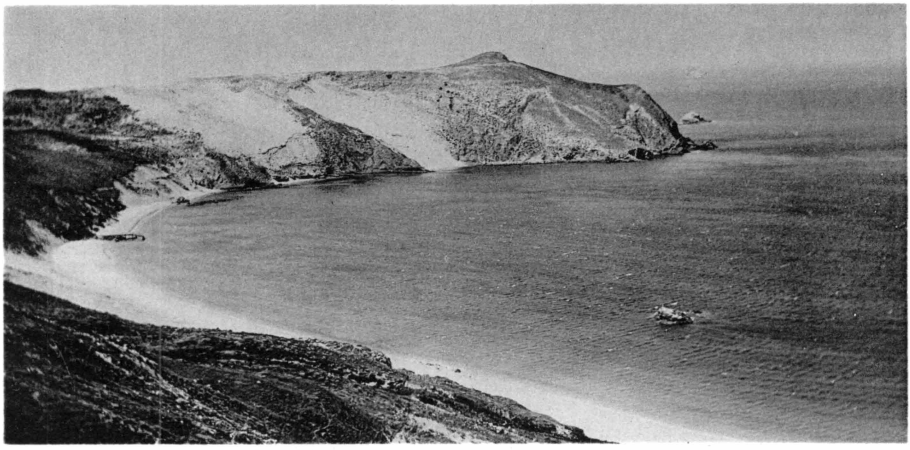
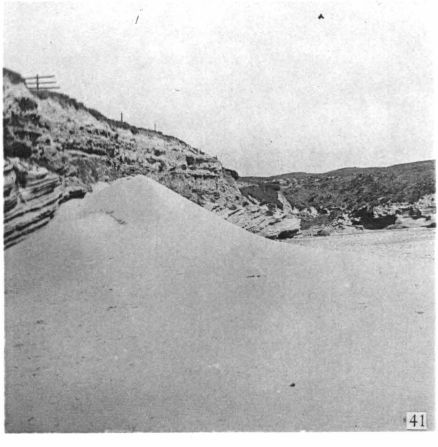


Fig. 31 *Velero III* beneath Golden Gate Bridge

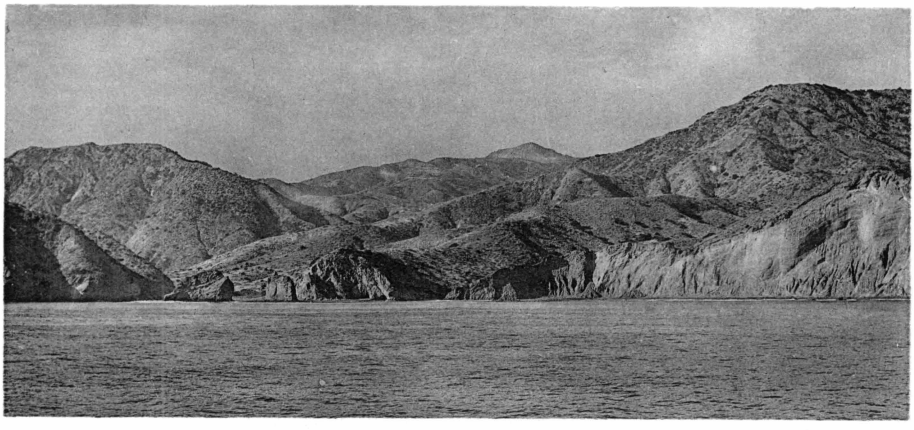
Fig. 32 Port San Luis Obispo near Avila

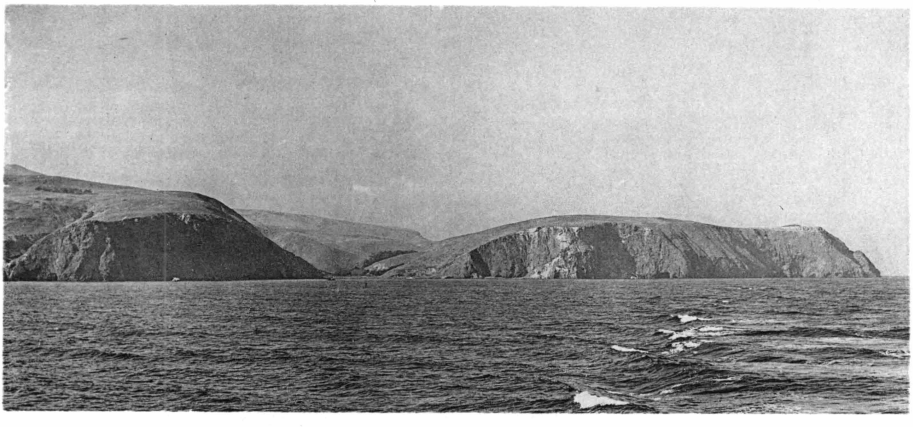


Figs. 33, 34 Cuyler Harbor; 35 Point Bennett, San Miguel Island



Figs. 36-41 Santa Rosa Island





Figs. 42-44 Santa Cruz Island

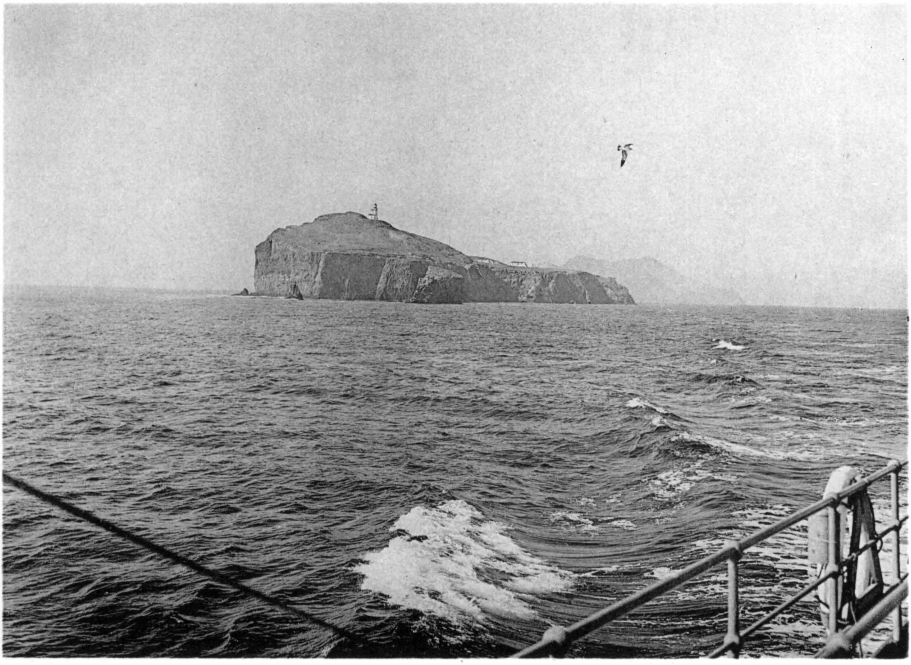


Fig. 45 East Anacapa Island

Fig. 46 Gull Island off SW corner of Santa Cruz Island

Fig. 47 Santa Barbara Island, northwest side

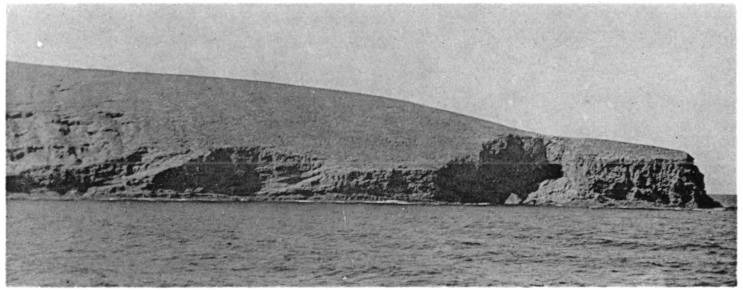


Fig. 48 Santa Barbara Island

Fig. 49 Santa Barbara Island Landing

Fig. 50 San Nicolas Island, Dutch Harbor

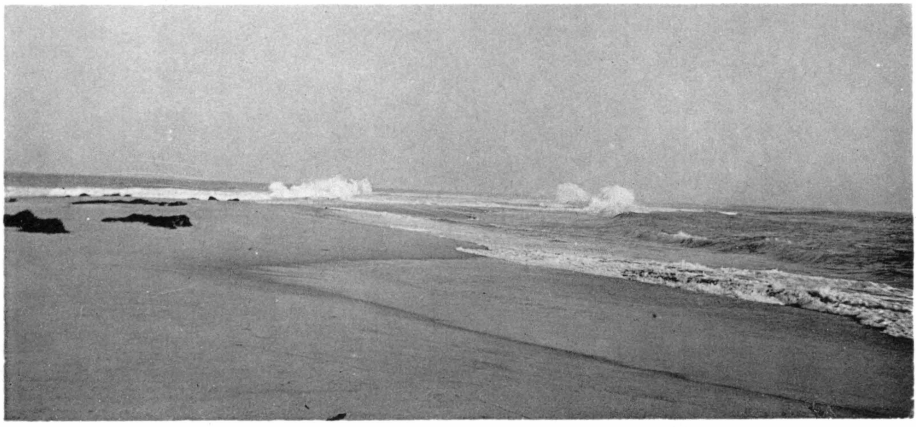


Fig. 51 San Nicolas Island, east sand spit

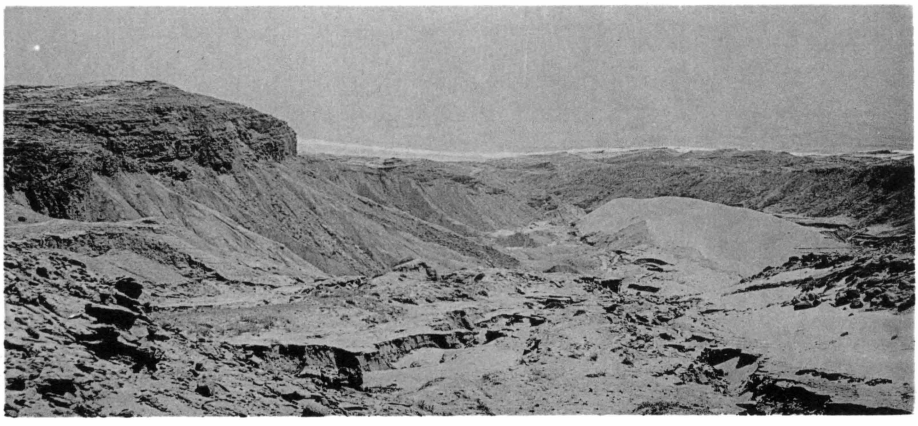


Fig. 52 San Nicolas Island looking southward

Fig. 53 China Point SE end of San Clemente Island

Fig. 54 Pyramid Cove, San Clemente Island

Fig. 55 San Clemente, south side looking NW from China Point

Fig. 56 Santa Catalina Island, SE end

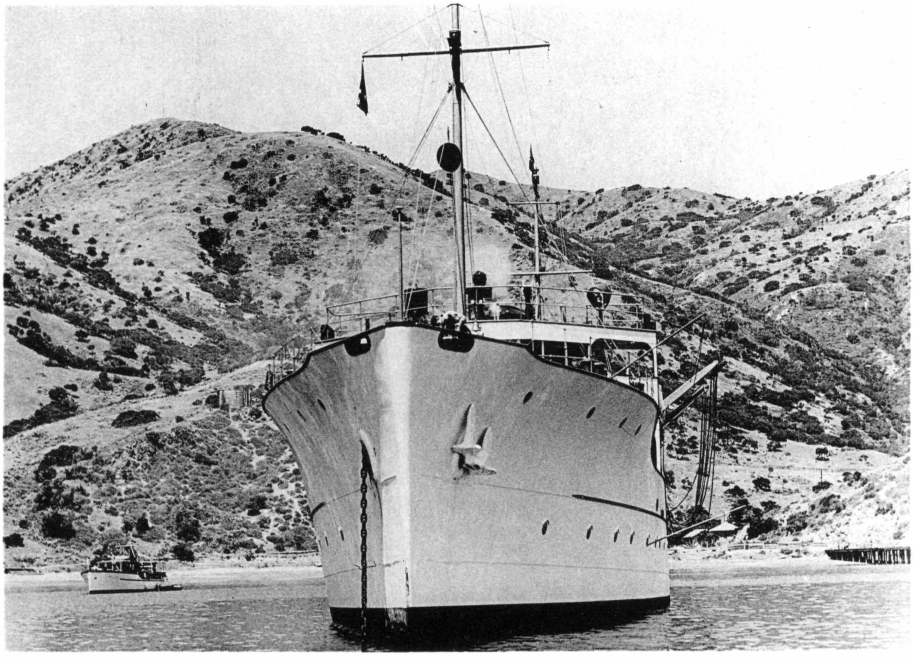


Fig. 57 Santa Catalina Island, *Velero III* in White Cove

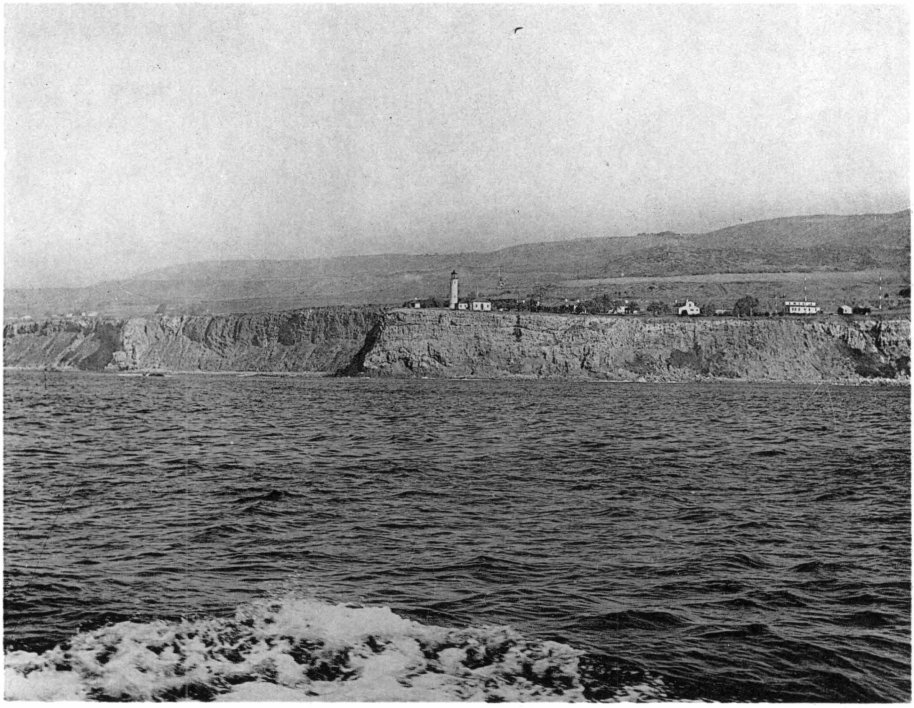


Fig. 58 Point San Vicente light, Palos Verdes hills

Fig. 59 Point Fermin, San Pedro

Fig. 60 Corona del Mar, California, looking southward

Fig. 61 Corona del Mar, California

Fig. 62 Laguna, California, looking northward

Fig. 63 Laguna, California, looking northward

Fig. 64 Guadalupe Island, north end

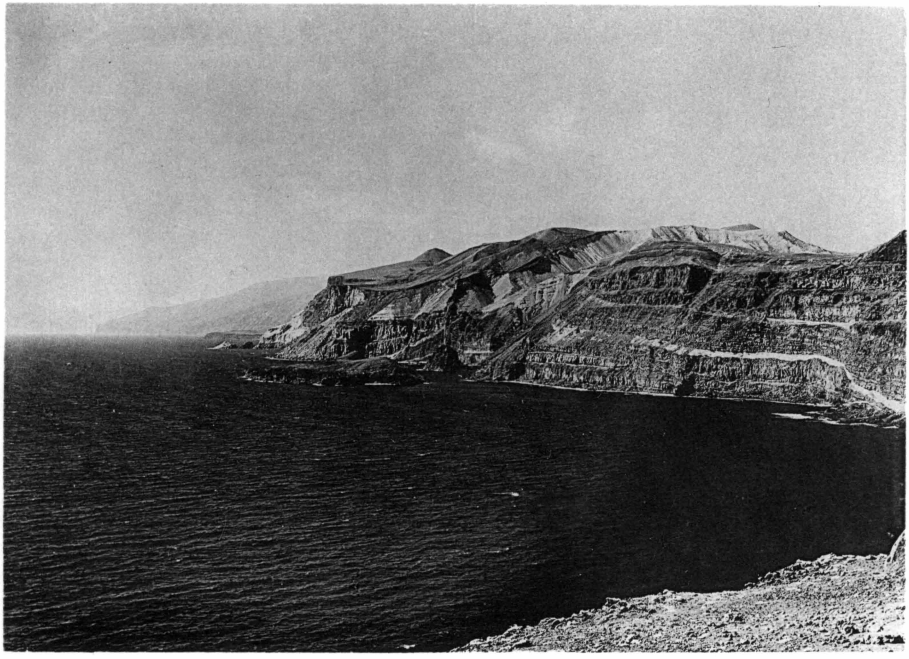


Fig. 65 Guadalupe Island, south end

Fig. 66 Guadalupe Island, Elephant Seal Beach

Fig. 67 East San Benito Island

Fig. 68 West San Benito Island

Fig. 69 Village east side of Cedros Island

Fig. 70 Algae, Cedros Island, South Bay

Fig. 71 Cedros Island, South Bay