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NATIONAL PARK SERVICE

REPORT ON
SAN MIGUEL ISLAND
OF THE
CHANNEL ISLANDS. CALIFORNIA

November 1, 1957

Prepared By

Region Four, National Park Service
Division of Recreation Resource Planning

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REPORT ON SAN MIGUEL ISLAND
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I. Summary Section

Under date of August 20, 1957, Acting Director Scoyen teletyped Regional Director Merriam informing him that the Department was understood to be preparing a report on HR-8935, a bill to establish a Naval Petroleum Reserve in California. The teletype explained that the Director had requested delay in the submission of the Department's report on the bill to allow the Service to gather essential data regarding San Miguel Island in support of its position as to the desirability of adding it to Channel Islands National Monument. It was urged that the Pacific Coast Seashore Survey give the highest priority to San Miguel so that data could be in the Director's hands by early October.

Prior to the receipt of the inquiry explained above a review of the file material on hand in the Region Four Office regarding San Miguel Island, and some discussions with people who have visited the island, had already been accomplished in the course of the seashore survey. This effort was intensified immediately upon receipt of the inquiry; but since this report is in response specifically to a request for consideration in the field of National Park System Planning of a possible addition to an existing National Park System area, the report is in the form required by Vol. 5, Part 510, Chapter 1 of the Administrative Manual, rather than as a part of the seashore survey.

Apparently the Service has never had a representative on San Miguel except on the occasion of the survey made there during the Spring of 1939 by Messrs. Sumner and Bond, as reported by Mr. Sumner under date of June 28, 1939, and during another visit by Sumner in 1957. The 1939 report covered Santa Barbara, Anacapa and San Miguel Islands; the 1957 observations are incorporated in the present report.

Service personnel from time to time have flown over San Miguel since 1939, including a flight on October 14, 1957 by Ben H. Thompson, George L. Collins, and Lowell Sumner. Such flights reveal only general conditions, and adequate knowledge of what is happening on the island must be gained chiefly from ground observations. However, the 1957 air inspection showed conclusively (as verified by subsequent ground check) that the serious erosion of earlier years had been checked and that an extensive healing process now is under way, due to the removal of grazing.

Conclusions

A. From evidence gained thus far it appears that there are about fifty ancient Indian village sites on the island. These contain a wealth of archeological information bearing upon human life there and on adjacent islands and the mainland during the past 5,000 years or more. The Santa Barbara Museum of Natural History reports deposits of fossil elephants on San Miguel, and the Scientific American (April 1956, page 68) carries an account of findings on nearby Santa Rosa Island which are significant of additional findings that may occur on San Miguel. These archeological and paleontological findings from the standpoint of the National Park Service would appear to warrant the Service's continued special concern. That the evidence would make an interesting and instructive public exhibit if adequately protected, can hardly be questioned.

B. Dr. John Hussey, Regional Historian, and Mr. Paul Schumacher, Archeologist, have reviewed the presently available written archeological and historical materials on San Miguel. Apparently the first contact of white men with the natives of the Channel Islands occurred in 1542, when Juan Rodriguez Cabrillo visited there. Whether or not Cabrillo actually is buried on the island, which seems to have been the popular conclusion, is a question raised by some authorities. It is Dr. Hussey's view at this time that the history of San Miguel supplements the knowledge of historical events in the Channel Islands generally, and on the adjacent mainland. It probably is not particularly unique in comparison with similar information on Santa Rosa, Santa Cruz and possibly other large islands of the Channel Islands group. However, there appears to be no likelihood of obtaining these other islands for the National Park System at any time in the foreseeable future, even if they were desired for that purpose, and San Miguel, which may be available, is important.

C. The geology of San Miguel is reported in the Santa Barbara Museum of Natural History Occasional Paper No. 2, by Carl St. J. Bremner, entitled: "Geology of San Miguel Island, Santa Barbara County, California." San Miguel is the most westerly in a chain of four of the Channel Islands which are the highest points in the range of mountains extending westerly from the Santa Monica Mountains of the mainland. The others are Santa Rosa, Santa Cruz, and Anacapa. Nothing particularly unique is claimed for the geology of San Miguel although it is interesting. The island is something of a curiosity in that with the tremendous amount of erosion that has occurred in recent times, due to grazing activities of the past, the entire surface has been affected so that it presents an unusually clear example of wind and water action on a denuded surface, followed by a period of diminished erosion and marked vegetative recovery commencing in 1950 when grazing was terminated. There are oil seeps in the Santa Barbara Channel, but nothing of that nature on the island or on Prince

Island has ever been reported. A thorough geological study, including test drilling, would be required to determine the presence of a commercially feasible oil drilling location on San Miguel, or on Prince Island or on any of the other points immediately off-shore.

D. The principal known values of San Miguel Island (in addition to archeological and possibly paleontological values not elsewhere represented in the National Park System) include an extensive region of unspoiled scenic ocean beaches, a unique and enthralling springtime display of wildflowers, now recovering from a history of past grazing, and a truly outstanding display of wildlife. The herds of elephant seals, sea lions of two species, sea otters, and the remarkably tame San Miguel foxes, are unique. These, together with the great rookeries of nesting sea birds, and the several pairs of nesting American eagles, are in need of absolute protection by a qualified governmental body. It is believed that the National Park Service would be justified in recommending the addition to Channel Islands National Monument of San Miguel Island and its immediate surroundings, including an area one nautical mile out from the mean tide level of the island.

E. The possibilities for cooperative field study, research, planning, development and administration looking toward the ultimate conservation of all resources of San Miguel Island, appear to be excellent and might well be discussed with the Office of Naval Research, U. S. Geological Survey, and several departments of certain educational and scientific institutions concerned with history, prehistory and other values which are exemplified at San Miguel.

Estimated Costs

Management and protection for the first fiscal year should include one ranger at GS-7, \$4,525. Costs in connection with travel and transportation between the island and other Channel Islands and the mainland would come to probably \$2,500. Supplies and equipment for the first year ought to include, among other items, those incident to establishing some sort of housing, and water supply improvement at one or more of the springs on the island in a total of, say \$5,000. After the first year and in five years' time (as per Vol. 5 of the Administrative Manual, Part 510, Chapter 1, page 19) costs would be perhaps \$20,000 per annum for physical improvement work of various kinds including investigations, planning and development of archeological, paleontological and biological exhibits, erosion control, water development, and personnel housing. In addition, after the first year, protection and administration might well be estimated on the basis of at least one ranger on the island constantly, together with scientific personnel from time to time to be engaged for at least several years in field research. Probably a Park Service boat would not actually be a necessity immediately, in view of the probable availability

of military or Coast Guard and commercial air and boat transportation from nearby mainland ports, unless the Channel Islands National Monument program as a whole, with the addition of San Miguel Island, would require a boat.

II. Report

Name of the Area

San Miguel Island.

Authorization and Purpose

The authorization for the investigations made in connection with this report is found in the Act of June 8, 1906 (34 Stat. 225) entitled An Act for the Preservation of American Antiquities; the Act of June 25, 1910 (36 Stat. 847) for the temporary withdrawal of Public Lands for various public purposes; the Act of August 25, 1916 (39 Stat. 535) entitled An Act to Establish a National Park Service, and for other Purposes; and the Act of June 23, 1936 (49 Stat. 1894) entitled An Act to Authorize a Study of the Park, Parkway and Recreational Area Programs in the United States, and for Other Purposes. Specifically, the order to engage in the investigation and preparation of this report came from the Office of the Director under date of August 20, 1957.

Investigation Activities

The Service's investigation activities have consisted principally of reviews of existing information, in Service files, in the libraries of educational and scientific institutions, and through discussions with various people who have either visited the island or otherwise have acquired substantial information. Mr. Robert Sharp, Biologist, and Mr. Robert Angle, Landscape Architect, both of the Pacific Coast Seashore Survey, have given San Miguel considerable attention along with other islands of the Channel Islands group. The Regional Naturalist, and Biologist Sumner, have provided suggestions and information. The latter made two on-the-ground investigations, one in 1939 and one in 1957. The Regional Chief of Recreation Resource Planning and Mr. Sumner, separately, have discussed San Miguel with authorities of the Santa Barbara Museum of Natural History, the California Academy of Sciences, and with Mr. Ed Durden, commercial aviator of Carpinteria, California, who knows the island, is highly conservation-minded and has made extensive photographic studies of the San Miguel wildlife.

Population

The population of the neighboring mainland, within two hundred miles of San Miguel Island, is roughly about eight and one-half million people according to the latest available figures. Currently, it is increasing at the rate of some 4,200 new people per week (San Francisco Chronicle, July 23, 1957, page 15). Among the Channel Islands themselves,

the only appreciable population is on Santa Catalina Island, which is approximately ninety-seven miles distant from San Miguel, and has a permanent population of several hundred and a summer population of several thousand.

Accessibility

The island lies about twenty-five miles south of Point Conception, and forty-five miles west of the City of Santa Barbara. It has at least one protected anchorage, known as Cuyler Harbor, although there are other places where anchorages and landings are possible.

The only means of reaching San Miguel Island are by boat and airplane. It is possible to land a light aircraft at a number of sites, which is being done with increasing frequency. On first thought it might not seem likely that very many people would visit the island even under favorable conditions, but as visitation increases -- and it is increasing, even to much more remote Santa Barbara Island -- the curiosity and interest of a tremendous nearby population, is leading to expanding visitation to all parts of California, not excepting San Miguel.

The mushrooming development of boating as a major form of recreation (recently the subject of a feature article in News Week) makes it certain that San Miguel will receive more and more attention from the public. Additional evidence of this interest is found in the magazine "Yachting" for April, 1950, Page 50 and again for September 1956, Page 55.

Apparently aircraft could be used effectively in connection with official planning, research and administration at San Miguel, and even for transportation of the public later on. Boat transportation to the island might be the most certain, however, in maintaining schedules and in providing services for numbers of people and quantities of goods.

Relationships to major travel routes and other park or recreational areas are relatively close as to distances. Previously because of the island's isolation and lack of facilities for the general public, San Miguel could be classed as a remote place. But developments in transportation that appear inevitable during the next ten or fifteen years remove the island from this classification. Already the sea elephant herds, which are vulnerable to unregulated sight-seeing, are receiving increasing visitation. The island is not now a stop on any scheduled steamship or airline route, the nearest regularly visited island area being Santa Catalina, ninety-seven miles distant to the southeast. Now completely devoid of human habitation, San Miguel is a place where the flora and fauna, unique and ordinary alike, are free to recover from the ravages of past human occupation and use.

Background Information

The only previous report by the National Park Service is contained in the Sumner report entitled, "An Investigation of Santa Barbara, Anacapa, and San Miguel Islands," dated June 28, 1939. The Santa Barbara Museum of Natural History has made some investigations from time to time, records of which have been published by that institution, and have been reviewed by the reporters. T. D. A. Cockerell's article, "San Miguel Island, California," (Scientific Monthly, 1938, Vol. 46, pp. 180-187) which contains a fairly good popular account of the island's interesting features, has been reviewed in connection with the present report. Otherwise the background information obtained thus far has come through miscellaneous news accounts and discussions with various individuals.

Major Characteristics

1. Scenic features

San Miguel averages about two miles wide, with a maximum width of four miles, and about eight miles in length. It is about 14,000 acres in size. Most of the island is from 400 to 500 feet in elevation. There are two rounded hills which dominate the terrain rising to 850 and 861 feet respectively. When first visited by Europeans the island was covered with a dense growth of brush, principally Lemonode Berry (*rhus integrifolia*). With the introduction of cattle and sheep on the island, about seventy-five years ago, a very large percentage of the surface subsequently was completely denuded of vegetation. However, the removal of grazing animals in 1950 has permitted a considerable recovery of vegetation, as proven by the 1957 inspection, similar to the recovery that began on Anacapa and Santa Barbara Islands upon removal of the sheep about 1935.

Thus the evidence clearly indicates that with adequate protection, and time, the growth would cover the island again. If necessary, native shrubs could be obtained from Prince Island for planting purposes, but it is certain that eventually the growth will naturally spread over the main island, if it is left alone.

With the phenomenon of erosion occurring at an accelerated rate due to stock raising, the strong prevailing winds of the northwest had, at the time of the 1939 report, been a contributing factor in the drifting of sand which covered a great deal of the island surface at that time. In those years it was feared the sand eventually might impair the anchorage; however, the extensive recovery of the island vegetation since 1950 now removes this fear.

It appears that a relatively reduced rate of sand-drift into the harbor

was a natural condition even when Cabrillo made his voyage of discovery into Channel Islands waters and wintered his boats at San Miguel in the year 1542. Thus, drifting sand dunes are considered a natural part of the scene except as they were exaggerated out of all proportion during the years of intense grazing.

The island shoreline consists of about twenty-four miles of unspoiled sandy beaches alternating with scenic cliffs, caves and promontories, and occasional sheltered coves. Grassy ravines, some of them green from moisture seeping close to the surface, reach inland to the open fields, which are green and flower-covered in the spring. The main body of the island offers, in addition to the extensive rolling fields, a fantastically eroded and dissected rocky plateau alternating with spreads of sand dunes. Much of this erosion, according to Dr. Phil C. Orr of the Santa Barbara Museum of Natural History, is of natural and ancient origin.

The flora and fauna of the island are detailed sufficiently for the purposes of Service information in the Sumner report of 1939, previously referred to, together with the 1957 observations reported herein.

Several springs are present which are in need of redevelopment and protection such as could be provided through the National Park Service Soil and Moisture Program. They were adequate during normal years for the support of considerable numbers of domestic animals. Two very old mules, left-overs from the sheep herding days, still use these springs. There was one dug well, from which the water was pumped through use of a windmill for stock watering purposes.

2. Historic or prehistoric features

Dr. Phil C. Orr, Curator of Geology and Anthropology at the Santa Barbara Museum of Natural History, in a letter of September 9, 1957, to Mr. Collins of the Regional Office, states that there are about fifty ancient Indian village sites on San Miguel Island, containing a wealth of archeological information covering the past 10,000 years and probably more. An article in Scientific American (April 1956, page 68) indicates that more recent research on adjacent Santa Rosa Island pushes this estimate back to 20,000 years, making this, speculatively at least, one of the oldest known inhabited regions in the New World. These prehistoric people presumably lived on woolly mammoths, whose bones, Dr. Orr indicated in conversation (with Sumner, October 15, 1957) still can be found in great numbers on the island despite the desultory digging of pot-hunters.

Dr. Orr also writes (article "On San Miguel Island" Museum Talk, 1950, Vol. 25, No. 2, pp. 13-18) "San Miguel has had a varied and interesting history ... Much later (than the mammoth era) the Indians came in

their planked canoes and for many centuries lived in and then abandoned some fifty villages before the historic period began with Cabrillo's visit in 1542."

Dr. Hussey in his search for information, confirmed that the first contact of white men with the natives of San Miguel probably occurred in 1542 when Cabrillo came there.

San Miguel, according to Cabrillo, was called "Ciquimynu" by the natives. He recorded the names of only two villages on that island, and so far as we can discover he left very little additional information about the natives or about the island in general. Apparently, the natives were moved to missions on the mainland during the early nineteenth century.

The Chumash Indians, who lived principally on the mainland coast, just opposite the Channel Islands, were the inhabitants of San Miguel. The Chumash were noted for their finely made shell ornaments, especially their decorative work in shell inland by means of asphaltum. As indicated, the natives constructed large sea-going canoes formed of planks lashed together with thongs. The seams were caulked with hot asphaltum. These boats were similar to those found in places in the South Seas, but they were entirely different from anything found elsewhere in the Americas.

During the 1870's and 1880's professional and amateur archeologists began explorations in the Channel Islands, and San Miguel began to be treated to some of the more or less sporadic and random explorations which have continued at intervals since those times. The earliest serious students of archeology in the Channel Islands found that many of the most important sites had already been devastated by excursionists and other souvenir collectors.

The first systematic survey of the island sites was made by the Santa Barbara Museum of Natural History during the 1920's. Dr. Orr of that institution was reassuring (in conversation with Sumner on October 15, 1957) that despite earlier depredations by souvenir collectors, a wealth of material remains buried beneath San Miguel's sand dunes. One such site, said by Mr. Ed Durden to be the largest on the island, is shown in an air photo included in this report. It also is marked on the map.

On November 23 of the year 1542, Juan Rodriguez Cabrillo took refuge in what almost certainly was the present Cuyler Harbor at San Miguel. There Cabrillo died in January of 1543 from the results of a fall. Some researchers believe that he is buried on the island. But his grave has never been discovered.

Dr. Orr, who is credited with being probably the most informed

among all of the current students of San Miguel, makes this statement (letter to Collins dated September 9, 1957): "Cuylers Harbor is usually regarded as the wintering place, and the place of death of Cabrillo in 1542. The Cabrillo Journal merely states that Cabrillo died -- not that he was buried on the island, as is commonly stated by modern writers. It seems more logical to me, that as a sailor, he no doubt was buried at sea."

The name San Miguel was not finally fixed on the island until the voyage of Captain George Vancouver in 1792 and 1793. Captain Vancouver's maps formed the basis of the British Admiralty charts which were in common use by navigators of all nations, and thus the present usage of the name San Miguel became common.

Apparently San Miguel Island was never granted by Spain or Mexico to a private individual, and when California was transferred to the United States in 1846, title is assumed to have passed to the United States Government. It has never been a non-Federal property in the records of the United States as far as can be determined.

A man named Bruce had some sheep on the island prior to 1850. In that year a George Nidever, a trapper and sea otter hunter, acquired from Bruce the right to use the island. Nidever brought to San Miguel 45 sheep, 17 cattle, 2 hogs, and 7 horses. By 1862, twelve years later, his herds had increased to 6,000 sheep, 200 cattle, 100 hogs, and 32 horses. During a drought of 1863-64, according to his own report, Nidever lost 5,000 sheep and most of the remainder of his livestock. In 1870, he sold his so-called rights to the island to the Mills brothers for \$10,000. His exploits, and some of the most authentic available information on conditions on San Miguel in those early days, appear in "The Life and Adventures of George Nidever (1802-1883)" University of California Press, 1937, edited by W. H. Ellison.

Sumner's 1939 report, Fig. 43, shows part of Capt. Nidever's historic adobe house. It is believed these remains may still be in existence.

Late in the last century, a Captain Waters squatted on the island and claimed it as his own. He claimed that since the island had not been mentioned in the Treaty of Guadalupe Hidalgo it did not belong to the Government and he had a right to it. It is said that a Presidential Order from President Cleveland was necessary in order to remove Waters from the island.

In 1916 a Mr. Robert L. Brooks of Carpinteria, California, leased all of San Miguel from the United States and stocked it with sheep. In 1944, when the island was under the jurisdiction of the Department of the Navy, Mr. Brooks' rental was \$50 per month. He established a headquarters on San Miguel consisting of a ranch house and a barn, a windmill, fences,

corral, etc., using principally materials salvaged from shipwrecks.

The schooner, Watson D. West, and the Pacific Mail Liner, Cuba, went aground on the west end of the island in September of 1923 and formed the major sources of materials for the ranch structures, which are still present though now in an abysmal state of disrepair.

In the headquarters courtyard there was a small white schoolhouse barely large enough for the teacher and two pupils. This was a structure of some special interest to visitors during the period of the twenties. It received considerable publicity as "the smallest schoolhouse in the world."

When World War II broke out, Mr. Brooks was given twenty-four hours to get off the island with his sheep. He was not able to get them all off on such short notice, according to Dr. Orr (conversation with Sumner), so, in 1950 when the Navy began to use San Miguel Island as a bombing target, Mr. Brooks was given permission to come back for thirty days to get the remainder.

In evacuating the island the second time, Mr. Brooks was assisted by personnel from the Santa Barbara Museum of Natural History, including Dr. Orr, who volunteered their services as sheepherders and laborers in order to have this last opportunity of making natural history observations (see Dr. Orr's published article previously mentioned). During the course of this experience, Dr. Orr reported finding three localities of fossil elephants, more than had been located during the thirty years Mr. Brooks leased the island. Apparently the mammoths became extinct, at least at this locality, about the close of the pleistocene period after the islands became separated from the mainland.

A cave was found in which Dr. Orr discovered ancient Indian burials. This, and two such caves on Santa Rosa Island nearby are the only instances of cave burials yet found on the island or the adjacent mainland. In his report on the experience during the removal of the sheep from San Miguel, Dr. Orr mentions that he and his group from the museum surveyed and mapped about sixty ancient Indian village sites. In some other correspondence he mentions fifty village sites. He spoke also of the huge dunes piled up high with the broken bones and shells which the Indians had carried from the oceans sometimes along a course of as much as several miles.

It was during this expedition that David Gray, a member of the party, found a perfect skull of the Southern Sea Otter, of the species found on San Miguel Island today.

Since the removal of the sheep and the termination of Mr. Brooks' permit by the Navy, it is understood that there has been no authorized

private activity on the island. Defense activities which required its use by the Navy personnel have passed. At this time no one is living on the island, and apparently use of it is not being claimed by anyone. Fishermen and yachtsmen land there fairly often, as do a growing number of photographers who have heard about the sea elephants. Sumner and Durden found two yachtsmen camping in the ranch house at the time of their visit, October 15, 1957.

3. Geological features

Probably the best reference in the matter of geology would be Carl St. J. Bremner's Occasional Paper No. 2, published by the Santa Barbara Museum of Natural History entitled: Geology of San Miguel Island, Santa Barbara County, California. This was published on June 1, 1933, and can be purchased at the Museum in Santa Barbara for seventy-five cents. However, our 1957 observations show that the air photograph (frontispiece) of that publication showing great areas of bare sand is now much out of date due to the recovery of the vegetation.

San Miguel is the western-most of the highlands protruding from the sea in the ridge which extends northwestward as a part of the Santa Monica mountains. This ridge forms the ^{South?} west wall of the Santa Barbara Channel. At one time in its geologic history this ridge probably was a great island separated from the mainland by only a narrow channel, as Bremner explains. Its forms of flora and fauna were not then as specialized locally as they became on San Miguel with the gradual inundation of the ridge when the last major ice recession occurred, leaving out of the sea only those highlands which we know as San Miguel and its three closest neighbors of the Channel Islands group -- Santa Rosa, Santa Cruz, and Anacapa. The geologic evolution of the ridge is the basic cause of all the other events in natural science and history that are exemplified on San Miguel. Therefore, while it may not be particularly unique the geology of the island -- all of the Channel Islands in fact -- is exceedingly important.

4. Biological features

The biology of San Miguel Island in many respects is unique. Biologist Lowell Sumner in his 1939 report covering his experiences on San Miguel Island provides what is probably the most comprehensive statement concerning the flora and fauna that has been made thus far in one report.

Mr. Sumner recorded twenty-one species of birds including colonies of nesting pelicans and other marine species. Three nests of the American eagle are known, and the increasingly rare Duck Hawk also has been recorded. Additionally, the San Miguel Song Sparrow is indigenous to this island.

About 175 species of native plants have been recorded, and about thirty-five introduced species. Thirty-one of the native species are known to be indigenous to the Channel Islands, although twelve of them do not occur on Santa Barbara or Anacapa which form the present Channel Islands National Monument. A very much overlooked feature of the National Monument is its enthralling springtime display of wildflowers, which rivals any of the celebrated displays of desert regions in scenic magnificence. Mr. Durden, who has enjoyed this display for many years, states that some of its former charm and beauty, of a bygone day before the advent of grazing, already seems to have returned. Sumner found, in October, 1957, that extensive recovery of flowering plants was unmistakable, paralleling that on Channel Islands National Monument (Anacapa and Santa Barbara) fifteen years ago.

Among the mammals are the San Miguel Island Fox, which is seen frequently and is very tame. This species of fox is found nowhere else in the world. Sumner watched one at close range on October 15, 1957. There is also a native species of mouse, though in recent years it has appeared to be scarce.

Still more spectacular is the sea elephant, or elephant seal, larger than a walrus but less aggressive, and without tusks. It was almost extinct a few years ago, although once abundant along the coast in the islands off Southern California and lower California. Slaughtered by the thousands for its oil in the early days, by 1892 it was reduced to about a dozen individuals all on Guadalupe Island, off the coast of Mexico.

The sea otter suffered similarly because of its world-famous fur. It has not yet built up its numbers as well as the sea elephants have, but individuals have been recorded around the island in recent years. Two species of sea lion, the California and the Stellar, are present (there is a predominance of the California species on Santa Barbara Island).

If protection can be continued, eventually the Guadalupe Fur Seal also may be brought back from virtual extinction and restored to its original place of importance on the island.

There is now a colony of about 300 elephant seals on San Miguel. They seem to prefer this island to any other because of the relative lack of disturbance, and the herd is most frequently seen here, though also on San Nicholas Island. Thus, San Miguel is noted at this time for the presence of elephant seals in certainly the largest colony we have. Their preservation appears to be assured if the island can be given protection from hunters and others who would thoughtlessly disturb them. Under adequate supervision, visitors to the elephant seal colony could have an

unforgettable and unique experience.

Mr. Durden works closely with the commercial fishermen in the Channel Islands region. Tuna, mackerel and sardines are the principal fishes taken in those waters. Mr. Durden is what is known as a tuna spotter. That is, he locates schools of fish from the air and by radio directs the fishermen to them. He stated to Mr. Collins on August 27, 1957, during a personal visit, and subsequently to Sumner in October, that in ten years of continuous work he has yet to see a school of commercially important fish in the vicinity of San Miguel Island. Mr. Durden stated, also, that the shoreline and the sea bottom in the vicinity of the island are quite rugged, the ocean is apt to be fairly rough, and it is not generally attractive in that vicinity to the fishermen. He saw no reason why the area should not be added to Channel Islands National Monument insofar as commercial fishermen are concerned and anticipated no objection by them.

When the fishing season closes each year, Mr. Durden becomes a wild animal photographer and trainer. Recently he made a television presentation of San Miguel using moving pictures he has obtained there during the past several years in a show called: "Deserted Island." He bemoans the activities of photographers who, he says, will go out to the island for the purpose of photographing the elephant seals. The seals are not active on land and usually in order to stir up some commotion which will show up well in a picture the photographers will attempt to frighten the animals, which may flounder toward the water with the result that they smash into and over each other. He has found up to thirty dead and injured young elephant seals as a result of this thoughtless photographic practice.

Mr. Durden has examined the island closely on the ground and from the air. He states that there are many pockets of native plants and shrubs which were sufficiently inaccessible during the grazing period on the island so that they were not ravaged or completely ruined. These, he thinks, could revegetate and re-cover the island in the course of time if given protection, and in this the authors of this report concur. It is their opinion that he is an especially well-qualified observer of San Miguel Island who should be consulted by any others who may be investigating there.

Under date of July 26, 1957, Biologist Sumner, in answer to an in-service inquiry, provided the Regional Director with a memorandum on the subject of a possible addition of San Miguel to Channel Islands National Monument. In this memorandum Mr. Sumner emphasized, as he did in 1939, that the scientific features of San Miguel are so outstanding biologically as to warrant every effort at preservation of the island. Mr. Ben H. Thompson and Mr. George L. Collins of the Service are of the opinion that San Miguel belongs in the National Park System.

Mr. Sumner's October 1957 inspection included a landing with Mr. Durden near the sea elephant colony, and, also, at the ranch area where Sumner centered his erosion observations in 1939. He was impressed by the recent recovery of native plants, which has been so extensive that it materially and favorably alters the entire outlook for future preservation of the island. Soil conservation measures now appear to be needed only on a comparatively limited scale, perhaps just on the basis of re-introducing certain shrubs, by seeds or cuttings, from Prince Island.

Mr. Egmont Z. Rett, Curator of Ornithology and Mammalogy at the Santa Barbara Museum of Natural History, has spent considerable time on San Miguel photographing the sea elephants, sea lions and other subjects. He is deeply impressed with the meaning of San Miguel as an observatory of wildlife for scientists and lay visitors.

On August 19, 1954, Mr. Al Allanson and his wife were camped at Cuyler Harbor. They saw, during the course of some explorations on that day, two sea otters. Mr. and Mrs. Allanson were particularly interested in locating and observing sea otters and went to San Miguel for that specific purpose after 5 otters had been reportedly observed there in 1953. Their account is published in Pacific Discovery for May-June of 1955.

The extensive kelp beds in the San Miguel vicinity are the natural habitat and place of refuge for the otters, so it is entirely probable that this marine mammal is present on the island now, as it certainly has been in the past. If this is true it needs to be adequately protected. The Allanson report appears in story form in the May-June 1955 issue of the California Academy of Sciences publication, Pacific Discovery.

5. Interpretive possibilities

Dr. Orr in his letter of September 9, 1957, mentions the possibilities of a public display of archeology involving excavation at one of the cemeteries.

Observatories (in the form of selected vantage points -- not necessarily towers or other structures) might without much cost or difficulty be established, also for the observation of wildlife including the rare elephant seal, the two species of sea lions and the marine bird colonies.

No particular interpretive device is necessary for observation of the San Miguel Fox, which may appear anywhere and which is very tame when not harrassed.

The story of erosion on the island could be shown graphically possibly by a model of the island, and by keyed-in real life photographic illustra-

tions and drawings.

One or more self-guiding nature trails, with appropriate printed guides, would provide identification of the unique flowering plants in the spring. Likewise the geology of the island could be shown in simple terms at some central point, and features of particular interest might be indicated in the field.

A marine observatory to provide views underwater might be constructed.

If the area were added to Channel Islands National Monument certainly a thorough study of its ultimate importance should be made.

While it may not appear at this time that large scale visitation by the general public would be very heavy to San Miguel in the immediate future the outlook may well be utterly different ten years or so from now. Perhaps interpretation for the present might emphasize research and academic work of various kinds, which would result eventually in thorough understanding of all of the cultural resources and values of the island. This information could be made available to students and others through publications, in readiness for the interpretive possibilities on a larger scale as the ultimate goal when the public visits the island in greater numbers -- a few years hence.

6. Other recreation possibilities

Aside from observations of scenery, wildlife and scientific resources of the island it appears that some twenty-four miles of clean, unspoiled beaches will have much to offer simply for rest and relaxation, provided adequate protection can be assured for the natural features of the island.

Need for Conservation

One obvious need for conservation at San Miguel Island is that for some seventy years it was so abused through grazing activities that many thought it was literally and hopelessly blowing away into the sea. Fortunately this has been checked, at least for the present (though it is understood that a half dozen sheep still remain on the island). The elephant seal clearly prefers San Miguel and San Nicolas to any of the other islands as its principal rookery location.

Much remains to be learned about the prehistoric human occupation of the island. Evidence has accumulated to show that native people probably lived there as much as 5,000 years ago, and possibly far longer. In fact, recent discoveries on Santa Rosa Island in the field of archeology

indicate that a great deal of important additional discovery is likely on San Miguel.

The same is true with respect to paleontology. At the same time, because of the paucity of information gained thus far due to relatively little field work having been accomplished no one can say now that outstanding discoveries might not be made in any of the fields of history and science. The authors believe a thorough examination of the island in this connection is called for and should be aggressively championed by the National Park Service.

Boundaries and Acreage

The map which is a part of this report shows the location of San Miguel in relation to the mainland and the other islands of the Channel Islands group. The island is an area of 14,000 acres. If added to Channel Islands National Monument, a reasonable line offshore all around the island should be established to insure the protection of the marine fauna, particularly those having amphibious habits. Prince Island which should be included would come inside such a line. The map shows a line one nautical mile offshore, which is believed suitable.

Possible Development

This is a subject which should await the results of detailed studies concerning the need for conservation of the island, and its interpretive possibilities. At this time it would not appear necessary to launch into any large or costly developments. Suitable self-guiding nature trails and observation locations certainly should be established. The water supply should be refurbished and made safe and potable, and any other basic essentials should be provided. San Miguel is not particularly hospitable for permanent residents. Good housing is essential for them. It would appear that anything in the nature of accommodations to serve the general public overnight that prove necessary at any time in the near future should be on a pioneering basis, without high initial investment. The splendid tent camp at Brooks River in Katmai National Monument is an example of the scale of public establishment the authors have in mind, if and when preliminary or experimental overnight accommodations prove necessary.

Practicability of Administration, Operation, Protection and Public Use

Assuming that the island is worth adding to Channel Islands National Monument, there can be no question of the practicability of instituting such measures as would be necessary to give the island the care it needs. For many years it has been neglected and ignored by the people and institutions

who might have preserved its resources.

The trouble with the Channel Islands National Monument today is, as Dr. Orr of the Santa Barbara Museum of Natural History puts it, that we have never given the Channel Islands any protection commensurate with their values, yet the very fact that we have national monument status is an open invitation to visitors who, without supervision, are apt to be destructive. Dr. Orr says in his letter of September 9, 1957, to Mr. Collins:

"I do believe it would be a mistake for the National Park Service to assume jurisdiction of San Miguel Island unless they were prepared to properly police the island, for the reason that as a National Monument there would be a high increase in visitors, resulting in vandalizing of the archeological sites by amateur diggers, and damage to the sea lion and elephant seal rookeries by hunters, or even well meaning people who pick up the baby sea lion.

"There is much to be desired under Navy supervision, but the threat of bombings formerly served to deter many visitors.

"I mention this lack of supervision because the National Park Service has never made any attempt to properly police the Channel Islands National Monument. Fortunately there are few landings and no water on these islands, and little that can be damaged.

"I should like to see San Miguel, particularly the elephant seals, the sea lion colony, and the island foxes preserved as a game refuge, or a primitive area, and I should like to stop the indiscriminate digging of artifacts and skeletons -- if this can be done by a thoroughly supervised National Monument, then I would be all in favor, but I am not in favor of merely designating it as a National Monument, as has been done with Anacapa and Santa Barbara Islands for the past 20 years."

Other Land Resources or Uses

The possibility of drilling for oil, on the island or in the vicinity thereof, or any activities in connection with explorations for oil, are obvious in the proposal for petroleum reserve No. 5, as per HR-8935. Other than the possibility of oil interests being concerned with the island, the Service has not found any other evidence of mineral interests. The agricultural resources of the island apparently have been exploited to death, literally. There are no feasible grazing areas left.

The only tree growth on the island as far as is known at this writing,

are two fig trees planted there years ago and reported by the Santa Barbara Museum in its issue of Museum Talk for the summer of 1950. Apparently there is no disposition on the part of anyone to attempt to utilize the island further for agricultural purposes.

Insofar as fishing is concerned, Mr. Durden, as previously stated in this report, has never seen a school of commercial fish in the immediate vicinity of San Miguel Island.

Hunting has no place on San Miguel since there is no game available which would be attractive to sportsmen. Water resources would not appear to offer any possibilities for power, or flood control, or irrigation.

Other uses which might be threats to the park and recreation values of the island could include sites for communications or other necessities connected with military activities, resumption of use of the island for military target, purposes, and failure to take steps in time to control erosion and re-establish ground cover.

Land Ownership or Status

Land status of the island is known to be Federal, in the custody of the Navy Department. Apparently there are no private rights whatever in the island.

Local Attitude

Mr. Ed Durden has stated that in his opinion the fishing industry would not object to the addition of San Miguel Island to Channel Islands National Monument; which is an exceedingly important consideration since the island is in one of the most intensely used salt water fishing areas of the Pacific. The Santa Barbara Museum of Natural History has indicated informally a favorable attitude provided the National Park Service would give the island adequate supervision if it were made a part of the national monument. Dr. Robert Miller, Director of the California Academy of Sciences, has indicated informally his approval in principle of the idea of giving San Miguel national monument status, as has Dr. Carl Hubbs, Professor of Biology at Scripps Institution of Oceanography.

Probable Availability

This is a point which would have to be determined with the Navy, probably at the Washington level. No representations as to possible National Park Service concern have been made to the Navy by Region Four officials. It is known that no use of the island is being made at this time by the Navy, all facilities there having been withdrawn sometime

ago. Superintendent Robinson of Cabrillo National Monument reported on August 8, 1957, his understanding that the Defense Department has requested the Navy to relinquish all land in its custody which is not necessary or vital to the Navy's part in the defense program.

Persons Interested

The persons seriously interested for the most part appear to be the scientists, or those who are interested from the standpoint of archeology, history, biology, geology, and botany. There is a growing number of recreation visitors who are attracted by the good anchorage at Cuyler Harbor, and the beaches and wildlife. There is a wilderness appeal that the amateur photographer and explorer enjoys. Comparatively few people know anything about San Miguel so far, however, and few other than fishermen and yachtsmen have ever been there. But this situation, the reporters believe, will not last for many more years. At the same time, it is likely that a good many people would support in principle the idea of preserving through national monument status the resources of public concern in the fauna, the flora, and the historic and prehistoric resources found there.

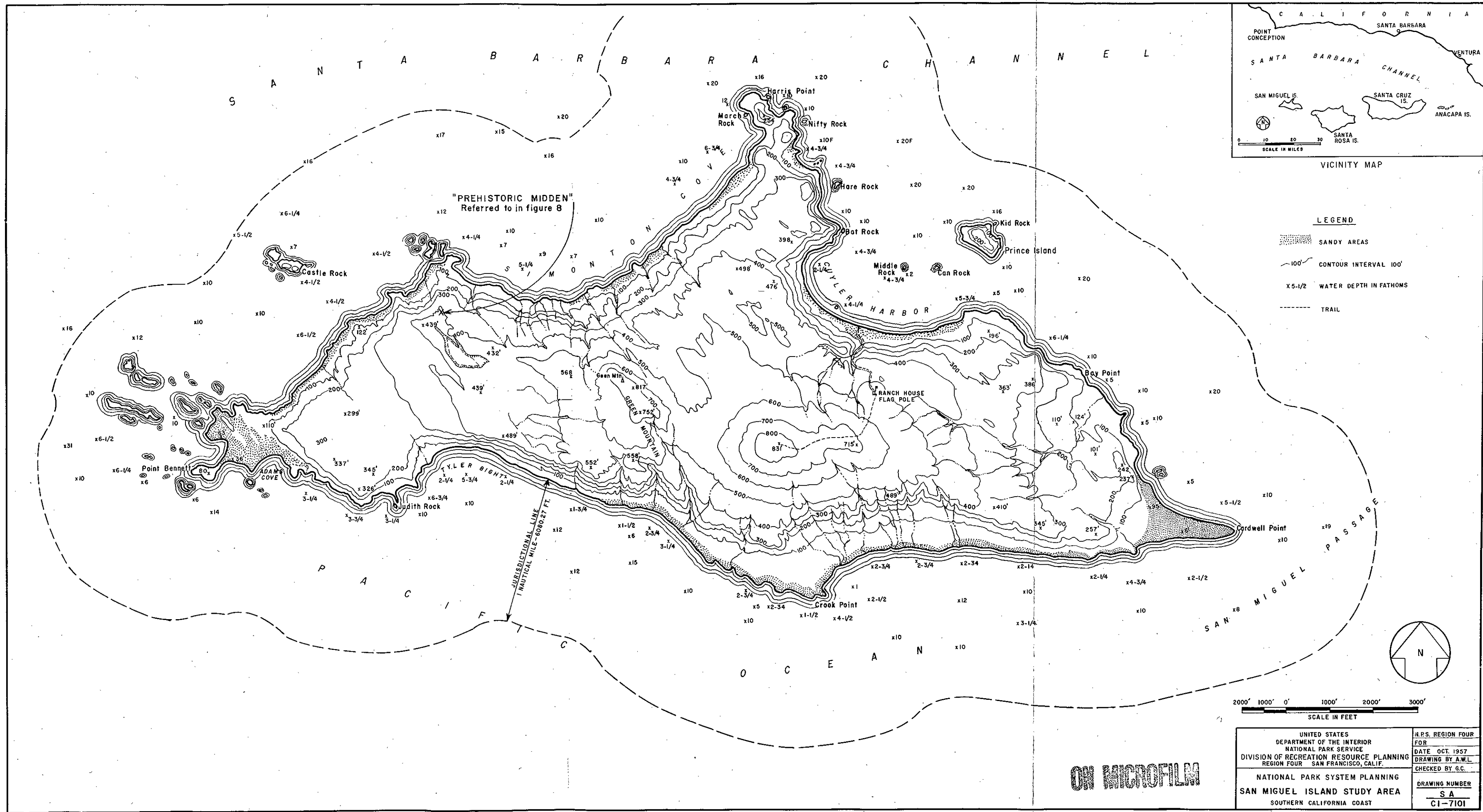




Fig. 1 San Miguel Island offers over 20 miles of unspoiled beaches. This comparatively isolated western end is a haven for several thousand sea lions and a smaller number of sea elephants. Earlier air photos of the island are becoming obsolete as the dark mantle of vegetation continues to spread over large areas of sand once laid bare by sheep grazing. For closer view of prehistoric Indian midden see Fig. 8.



Fig. 2 Cuyler Harbor near the east end offers the best anchorage and landing facilities. From the beach it is but a short walk to the old ranch house. Prince Island is occupied by a large marine bird rookery and a nesting pair of American eagles. Santa Rosa Island in the background is separated from San Miguel by a shallow channel only 3 miles wide.



Fig. 3 The descent for a landing causes thousands of pelicans (white specks over sea in foreground) to rise from their siesta on Point Bennett. Basking sea lions and sea elephants are less easily disturbed and are visible in dense masses (clumps of black specks) along the beaches.



Fig. 4 Descending lower reveals approximately 1,000 sea lions in this cove alone (this is farthest off group in Fig. 3). In contrast to Anacapa and Santa Barbara Islands, San Miguel affords refuge for the Stellar Sea Lion of northern waters in addition to the California Sea Lion of the south.



Fig. 5 . . . having reached the safety of the breakers they turn and survey the visitor, barking with curiosity.



Fig. 6 Sea elephants are much less agile than the sea lions and are more easily approached. Young ones like this can actually be touched. However excessive molestation by photographers has at times seriously disturbed the animals and better protection will be needed.



Fig. 7 Though superb swimmers, sea elephants are virtually helpless on land, as well as inoffensive. When approached, the majority huddle together for protection like frightened sheep (background). If closely pressed a few of the boldest rear up in open-mouthed fright (foreground) but a feeble sigh is their only utterance and they do not offer to attack. On the right is a battle-scarred old bull; the rest are cows and young bulls. Their round brown eyes are about the size of silver dollars.

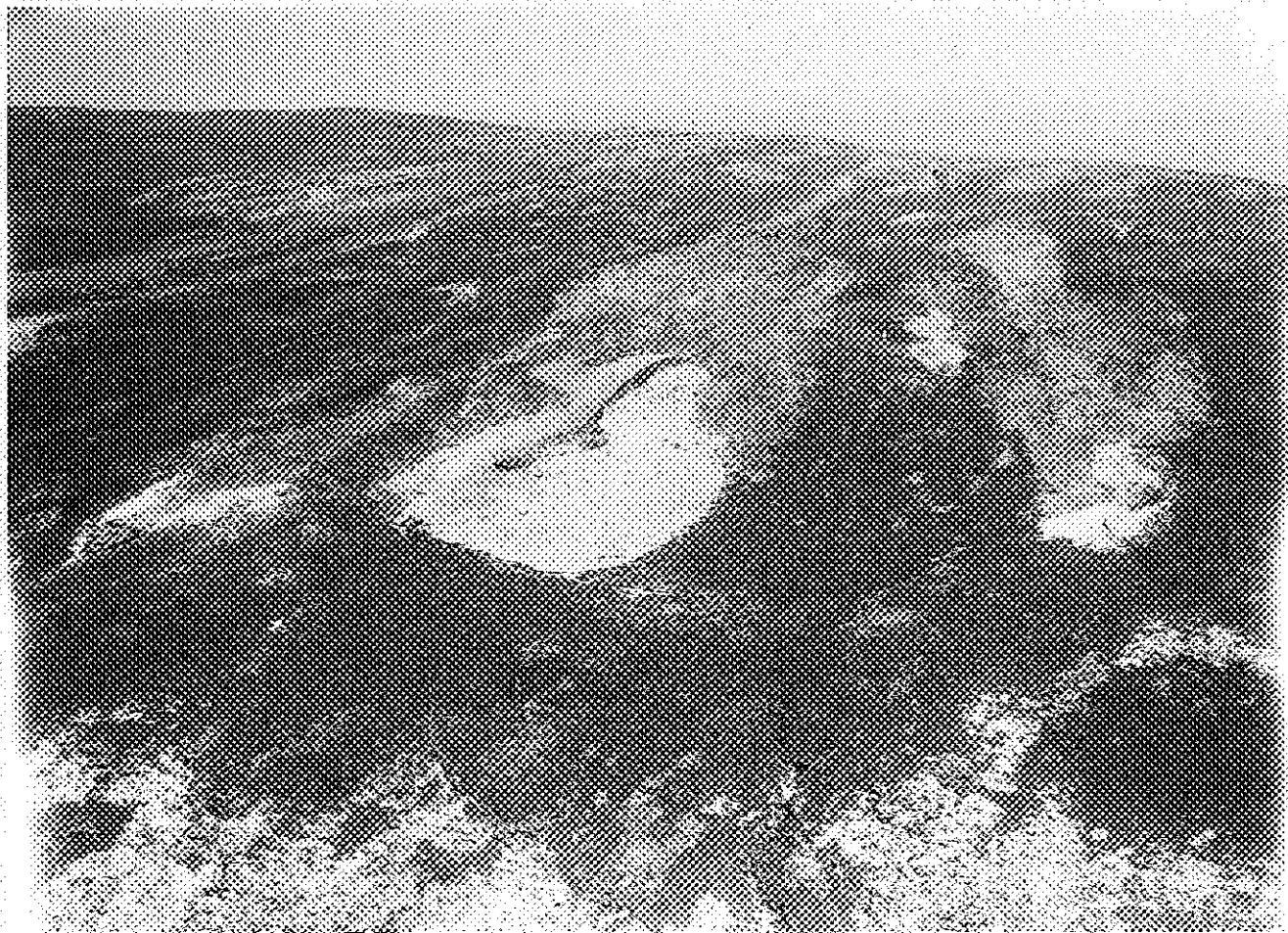


Fig. 8 Largest known prehistoric midden on San Miguel. Teeth of woolly mammoths dating back perhaps 20,000 years, according to some authorities, have been found on San Miguel Island which probably are in association with deposits such as those indicated in this picture. Recently it has been suggested that such sites may be among the oldest known place of human habitation in North America.

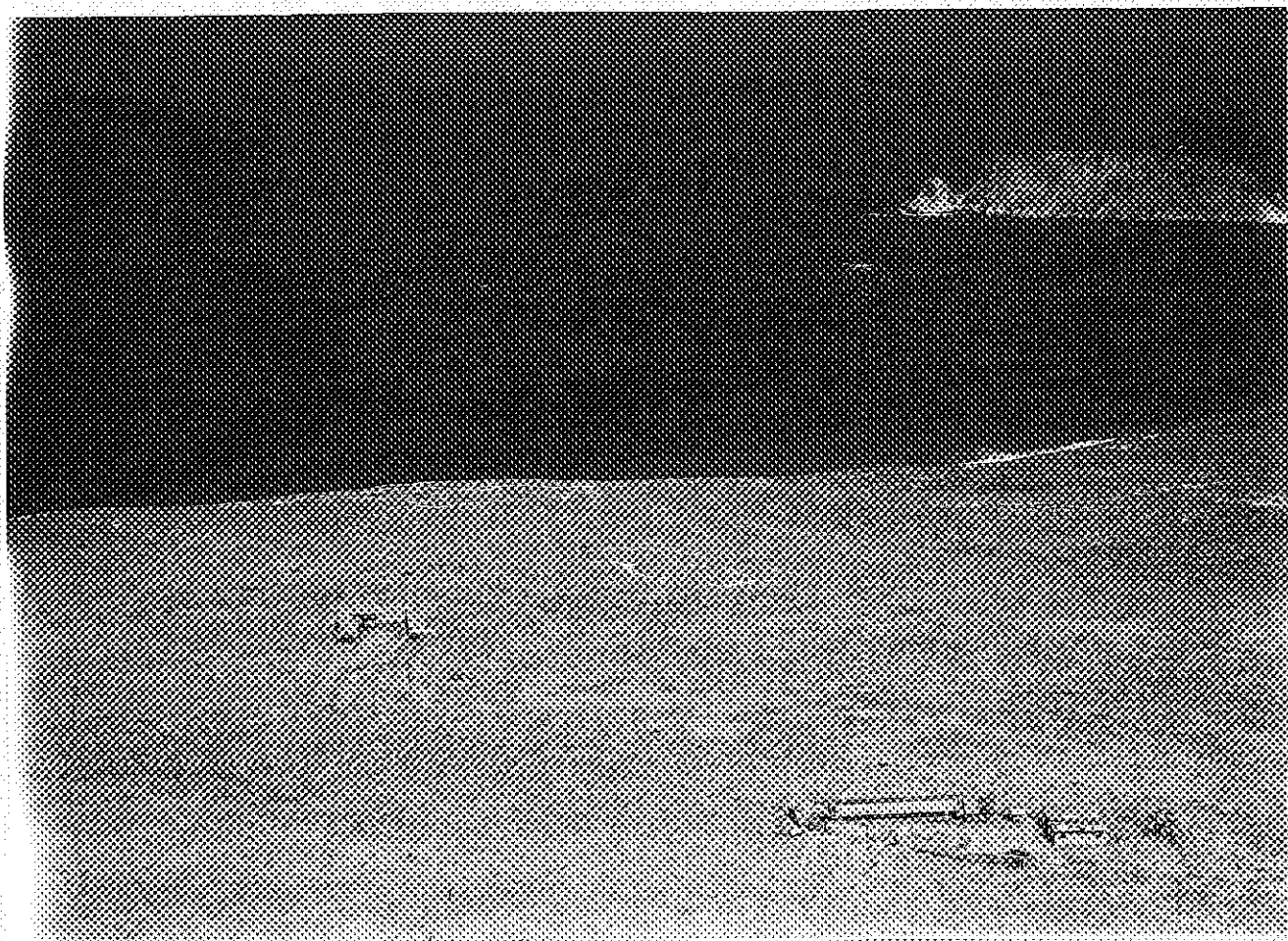


Fig. 9 Abandoned ranch house and barns, constructed some 40 years ago largely of timbers salvaged from wrecked sailing vessels of by-gone days. This plateau is covered with unique wildflower displays in the spring. Cuyler Harbor lies below the bluff and its beach is hidden from view.

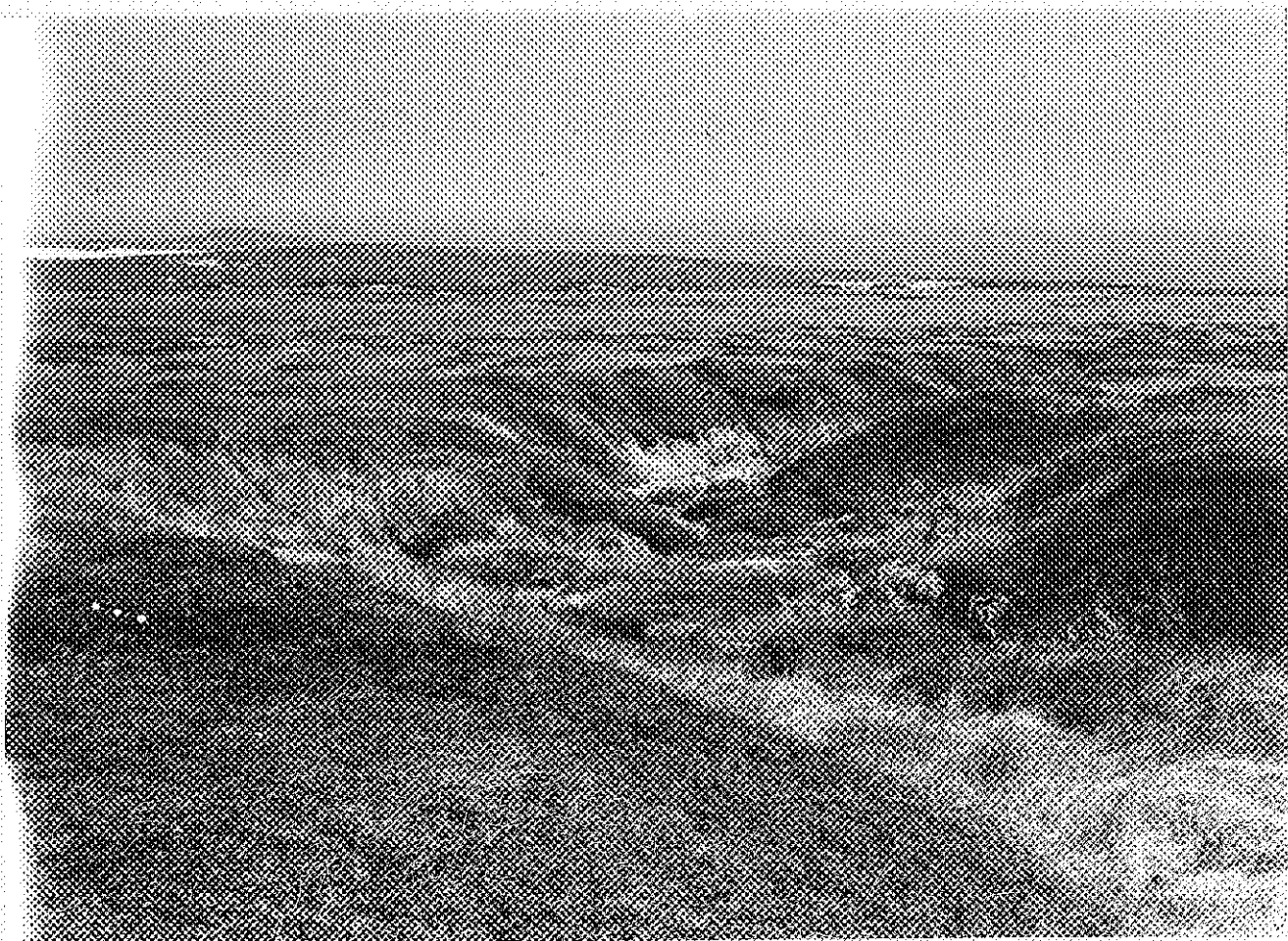


Fig. 10 Following the removal of the sheep in 1950 the island vegetation has made a striking recovery. Island-like patches of native species (left background) will enlarge until eventually they join together, as on Santa Barbara Island until the rabbit outbreak reversed the ecological story there. Island morning glory recovering in left foreground. A San Miguel Island fox was seen in this gully. Plate one, opposite the Table of Contents, in the enclosed copy of the Santa Barbara Museum of Natural History Occasional Paper No. 2, is from a picture of some years ago which gives no indication of the recovery being made now by the vegetation as shown in this scene.

APPENDIX

From "SCIENTIFIC AMERICAN" Magazine
APRIL - 1956

Roast Elephant, 27,000 B.C.

More than 29,000 years ago men were broiling dwarf mammoths on a little island off the California coast, according to George F. Carter, a geographer at The Johns Hopkins University. If true, this would place man in the area some 20,000 years earlier than archaeologists had previously estimated.

Carter has long argued for an early arrival of man in America. (His penchant for seeing hand-chipped stones where others see only naturally broken fragments, he says, has led his colleagues to name the doubtful items "Cartifacts.") He knew that during the last ice age dwarf mammoths roamed the island of Santa Rosa, which was then part of the mainland. If there were also men there at the time, he reasoned, they would have cooked and eaten these animals, which are the "original large economy-size package of protein." On an expedition to Santa Rosa last summer he found charred mammoth bones in several ancient fire sites. Radiocarbon dating put the age of the bones at 29,650 years.

UNIVERSITY OF CALIFORNIA

SCRIPPS INSTITUTION OF OCEANOGRAPHY
LA JOLLA, CALIFORNIA

22 October 1957

Mr. Robert H. Sharp
National Park Service
180 New Montgomery Street
San Francisco, Calif.

Dear Mr. Sharp:

I have at hand your letter of October 15, and, I am ashamed to say, an unanswered communication from you dated July 26. I have been pretty much snowed under recently.

First, in reply to your request of July 26, I am happy to make a statement regarding the need for protection and preservation of biological values on San Miguel Island. There is a very considerable number of significant biological values on this Island. This is the only place in Southern California where sea otters have been seen in recent years, and it is enormously important to insure the protection of the few individuals that are wandering down from the colonies in Central California. In addition, in the way of marine mammals, there is on San Miguel Island, specifically at the west end on Point Bennett, definitely the largest herd of elephant seals in California, and I believe the largest outside of the home grounds of Guadalupe Island, Baja California. I have reason to believe that there has been some poaching on this Island, or perhaps more likely, the colony on San Nicolas. In any event, maximum protection is called for, in order that this extremely interesting animal may begin to recover its former numbers. The ability of the species to recuperate under protection has been shown by our surveys on Guadalupe Island, where, from a population of only 9 near the turn of the century, as indicated by the numbers found around the shores of the island, the number has increased now to about 10,000.

As you know, there are a number of distinctive subspecies of land mammals and land birds on San Miguel. These certainly are unique and need protection. There is also a rather large number of endemic plants on the Channel Islands, and it would be of high value to preserve these and the natural conditions in which they live. The Island is extremely picturesque, and on that basis alone, I think deserves Park status.

In addition to the living plants and animals, there are on San Miguel Island abundant evidences of past life, both human and animal. There are numerous aboriginal sites on the Island, which have been very little explored, and which undoubtedly represent a number of distinct civilizations, perhaps similar to those that have been investigated somewhat more extensively on Santa Rosa Island. It is a custom of visitors on these Islands to pick up the choicest artifacts, so that much of the surface material in the way of bowls, points, etc., has been picked up. I believe this is more true of the other Islands than San Miguel. In any event, there is great need for the protection of these archeological remains. In addition, there are some very interesting Pleistocene deposits

on the Island, and I have no doubt other geological features.

I have not been on the Island during the bird breeding season, but marine birds do abound around the Island, and no doubt many of them nest there or on the offshore rocks. These also should be protected.

All in all, I can say that I rejoice greatly at hearing of the possibility of San Miguel being brought back into the administration of the National Park Service, and I hope very much that this will be consummated, and that at least one custodian with a boat can be located on the Island permanently.

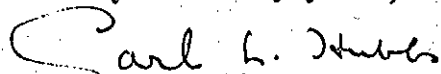
In connection with the seashore preserve program, the northern Channel Islands certainly could play a prominent part. One of the reasons, besides the relative isolation of these Islands, is the circumstance that as one proceeds from Point Bennett at the extreme west end of San Miguel Island, to the south side of Santa Cruz, and probably to the south side of Anacapa, one gets pretty much the range of temperature that is registered from the cold waters of Central California to the warm waters near San Diego. As a consequence, a very high percentage of the total fauna and flora of the seashore for the whole California coast is represented along the northern Channel Islands. If Santa Cruz Island could be included in the Channel Islands National Monument, there certainly would be assured the protection of a very large and rich biota.

You are, of course, at liberty to use any of this information or opinion in any way that will be helpful.

It would be a great pleasure to visit the Islands with you and others who are interested in preservation. I expressed such a desire to Don Robinson when we had a talk recently, and this conversation was the basis of his discussion with you. I am sorry, however, if we gave the impression that we were making any series of regular trips to the Channel Islands. We have paid quite a number of visits to these Islands, but on no regular schedule. We have no trip immediately lined up, but I told Don Robinson that if a specific occasion arose when transportation would be needed and a trip seemed feasible, I would be glad to see if it might be possible to get one of our ships lined up. I indicated that I would very much like to be along on the trip, and there are many studies that we would like to continue around the Islands.

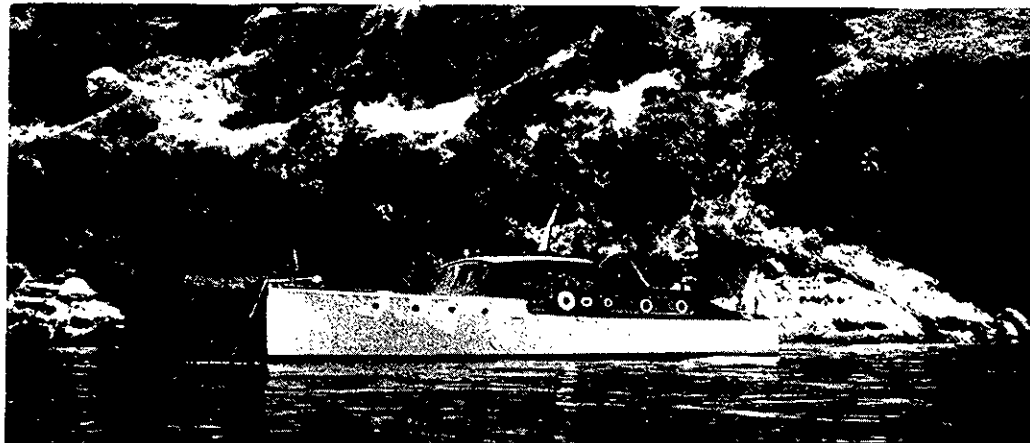
I am just about to take off for a trip to Guadalupe Island, and have another one scheduled for Dec. 12-20. The present one is for Oct. 24-31. I have no other sea trips scheduled, but of course have many other obligations. If you could give me some idea as to the general season when you would wish to make a trip to San Miguel and perhaps some of the other Islands, I would be glad to look into the matter of chances for getting one of our ships. It happens that we are running into some financial difficulty in our ship program, so that some of our marine work may be curtailed, but this does not mean that a trip to the Islands cannot be considered.

Very sincerely yours,


Carl L. Hubbs
Professor of Biology

CLH:dk

cc: Don Robinson



"Cazadora," in which the author cruised the islands, is a sturdy 48-footer

Inside the caves of Valdez, with the cavern walls towering a hundred feet above



EXPLORING THE CHANNEL ISLANDS

An Introduction to the Little-Known Islands of the California Coast

By CARL M. BIGSBY

From Magazine "YACHTING" April, 1950

THE EXPLORER Cabrillo is credited with the discovery of what are now known, loosely, as the "Channel Islands," situated a few miles off the coast of southern California. Of the eight Channel Islands (not including the Coronados and Todos Santos in Mexican waters) one, Santa Catalina, whose principal harbor is Avalon, has become world famous. Thousands of vacationers flock there every year. On another, San Miguel, Cabrillo is believed to be buried. Only commercial fishing boats and archaeological explorers ever drop anchor at San Miguel. That leaves six islands, all of them less than 100 nautical miles from Los Angeles, the farthest only 53 miles offshore. But outside of military men and fishermen, I am sure that not more than one in a thousand residents of Los Angeles County could even name them. And from my experience, I judge that not one in ten thousand has ever cruised to more than three of them!

Thus Juan Rodriguez Cabrillo achieved the unique distinction of discovering a part of the continental United States, barely offshore from its third largest city, which became undiscovered almost as soon as it was discovered—a part of California which, though it is surveyed as belonging to Los Angeles, Ventura, and Santa Barbara Counties, was referred to in an official navy publication in 1944 as "probably the least known of any parcels of land within the (forty-eight) states of the American Union."

For information about these islands, the venturesome yachtsman will ask at his yacht club in vain. If he consults the more seasoned of his cruising friends he will be warned about the dangers of the Anacapa Passage. If he finally locates someone who has been to Santa Cruz Island, he will

be told of the anchorages at Smuggler's Cove and Pelican Bay, but never a word about the caves, the canyons, or the coves that are the real attraction.

With this background of local indifference, a natural theater of operations for the intrepid modern explorer has existed for many years, easily accessible to the coastline of southern California. Its components consist of the islands of Santa Barbara, Santa Cruz, Santa Rosa, Anacapa, San Clemente, San Miguel, and San Nicholas. A two weeks' cruise of the first four, which are discussed in this article, will make any yachtsman feel like a modern Cabrillo.

Cazadora, aboard which the writer has made three cruises to these islands, is a 48-foot cabin cruiser, powered by two 110-horsepower Superior diesels. She was built by Lowman in 1941, broad-beamed forward, roomy and sturdy, cruising at 10 knots. Fuel capacity is ample for 450 miles, fresh water storage is sufficient for several weeks afloat. In her two double staterooms and fo'cs'le she sleeps eight. Our cruises were made in July, August and September, the two former months providing the best weather.

In my opinion, yachtsmen from the Los Angeles-Newport Harbor area of southern California will have the most pleasant cruise by dropping anchor the first day out at Emerald Bay, the farthest westerly of the harbors on Catalina which affords the shortest sail to Santa Cruz. A course starting from here affords quartering seas that are much more pleasant than those encountered on a course originating from Point Firmin off San Pedro. Even from Emerald Bay an early start is recommended, to avoid the usual afternoon trades in the passage between Santa Cruz and Anacapa Islands. With an early start, a cruiser doing ten knots would arrive at Pelican Bay, on the north side of Santa Cruz, around two o'clock in the afternoon.

En route, as one enters the treacherous channel between Santa Cruz and Anacapa Islands, there is an inclination, if the seas are moderate, to investigate Anacapa, which is in fact a group of three islands. On one of these islands is maintained one of the few offshore lighthouses along southern California's coast. The Anacapas have been designated a national monument, probably because, as "Science Magazine" states, "They are preserving for nature lovers more than eight endemic flowering plants, some 30 endemic mammals and birds and 16 mollusks." For the yachtsman, their weather-beaten, crumbling walls have little attraction, and they are passed to starboard only with the hope that their only small boat harbor—East Fish Camp, with bottom at five to seven fathoms—may never have to be used. To port lie the enchanting islands of Santa Cruz and Santa Rosa.



The silhouetted walls of Cueva Valdez frame a view of the bright which is picturesque and protected

One of the reasons that Santa Cruz and Santa Rosa Islands are so little known is that both are privately owned. Visitors ashore are said to be unwelcome, though at only two points on the vast periphery of Santa Cruz, and at no places on Santa Rosa, are to be seen "No Landing" signs. In fact, in 1949 two parties of Santa Rosa Islanders came aboard for cocktails during our stay. Both islands are utilized for sheep and cattle grazing. Each island is owned by two separate interests. Long before the turn of the century, a colony of 60 inhabitants was well established on Santa Cruz Island, the precipitous slopes of its two giant gorges being planted to grapes. Wine of exceptional quality from Santa Cruz Island was of world renown, and the colony was said to have been completely self-sustaining. Whether or not the wine-making activities of this island still persist is unknown.

Fortunately, the Channel Islands, even the islands of Santa Cruz and Santa Rosa, are regions of contrast in climate. I venture that, between the bight in which stands the wharf in Becher's Bay, and the bold anchorage called Smuggler's Cove, a differential of 30° in temperature regularly prevails. The undaunted skipper who is not discouraged by the biting breeze that whistles through the passage, will find to his delight that he has suddenly, upon changing his course to westward after rounding Cavern Point on Santa Cruz Island, entered a realm where mild, pleasant summer weather prevails from July through September. And the abundance of secluded, snug little harbors qualify the island without reservation as a yachtsman's paradise. Its coves are by far the most placid, the most intriguing, the most explorable of the California Coast. And on these two islands the most delightful anchorages, for a craft up to 100 feet in length, drawing up to 10 feet, are, for the most part, the harbors that are not even dignified by mention in the "Coast Pilot," or identified by name on the large scale chart of the U. S. Coast and Geodetic Survey.

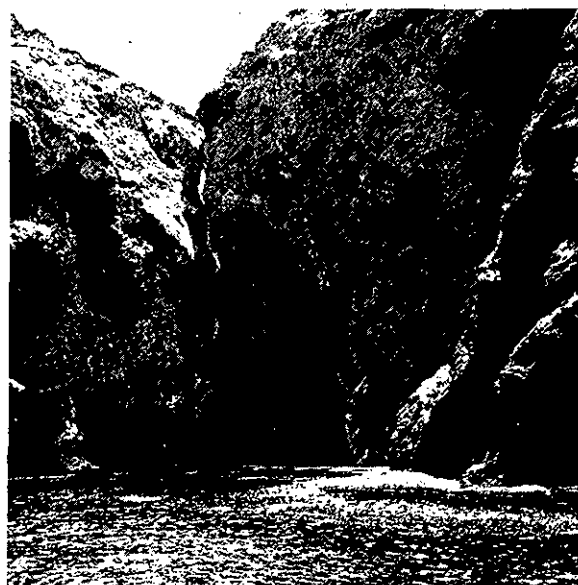
On the northern shore of Santa Cruz Island (landlubbers would think of it as the eastern shore) are more than a dozen spots to "drop the hook." Most frequented is Pelican Bay. Close to the north shore of this bay one will find ample protection from the prevailing summer winds, with enjoyable hiking on shore—if he ignores the "No Landing" signs. But if one wants more certain seclusion he will cruise on to some of the other smaller harbors further westward.

For no one, it seems, ever thought of staying in the eastern one of the Twin Harbors, or in the shadow of the majestic wooded cliffs of the harbor just west of Fry's, where the clear, quiet waters lap one of the island's many caves, and the camera couldn't open its eye at a wide enough angle to catch the grandeur of the cliffs which terminate in only

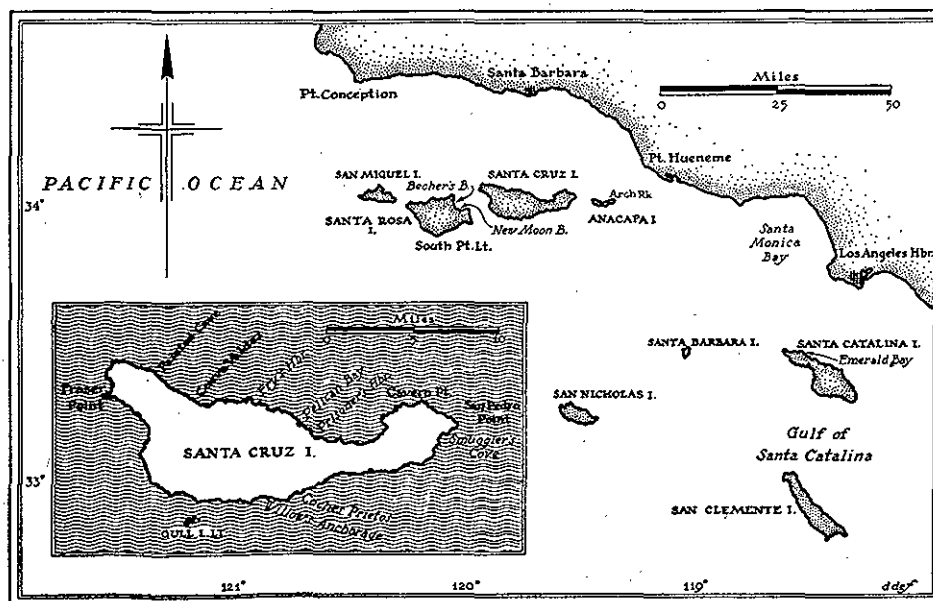
six fathoms of sandy bottom. Nor in the adequate bight west of Cuevo Valdez, which I named "Rooster Cove," because of the inescapable limestone image that showed itself in the red volcanic walls of this shelter. Nor in the square opening (which the chart-makers leave unnamed) in the shore line west of Arch Rock, into which two stream beds drop precipitously from the 1000-foot elevation. These, and others yet unnamed, or any of the dozen-odd named harbors of the north shore of the island (except Pelican Bay and Fry's) are, usually, all yours.

Principal objectives for exploration along the northern shore of Santa Cruz are the Caves of Valdez (incorrectly but euphoniously referred to on the chart as "Valdaze") and the Painted Cave. From a sheer love of combining the idiosyncrasies of nature with its rewards, one would return again and again to Cueva Valdez. In 1910, Holder reported that this cave had one entrance on the sea, and one from the shore. Almost four decades later, I found that the gnawing tongues of the sea have eroded another marine entrance; but the placid opening that he photographed in 1910 still provides a tepid, sandy-bottomed pool that Hollywood would delight to bathe in.

Up the canyon from the Caves of Valdez is to be found a stream which catapults over the rocks, hurtling from pool



The entrance to the Painted Caves of Santa Cruz Island is, at a distance, almost concealed



to pool, gurgling over diminutive water falls, etching its geological course through emerald brakes and wispy ferns, even in 1948—one of California's driest years.

But for the intrepid mariner, Santa Cruz' Painted Cave presents, by all odds, the most vital challenge. In the main library in Los Angeles are only two published works dealing with these islands—a large volume published by Charles Frederick Holder in 1910, and a 12-page bound article published in March, 1944, "U. S.



Naval Institute Proceedings." Holder is most enthusiastic in his report of his conquest of the Painted Cave:

"It is well called the Painted Cave, as the salts have dyed or colored it in a fantastic manner, in brilliant yellows, soft browns, reds, greens, and vivid white. The first room opening from the sea may be 60 or 70 feet high, the walls beautifully colored or painted. From this room we pushed the boat in until we came to a dark door or opening somewhat but not much larger than the boat. As we approached, a wave came rolling in, sobbing, hissing, groaning in a strange uncanny manner, and I noticed that as it swept in, it almost closed the entrance. It was not an alluring prospect, and I did not wonder that the men displayed so little curiosity. There was but one thing to do. We pushed our boat as near the hole as possible and waited for the next roller, and as it filled the entrance we pushed in immediately after it and got through before its successor came along, a proceeding easily accomplished. At once we were in almost absolute darkness, a small vivid eye of light representing the entrance. . . .

"We had made a flambeau of waste, and tying this to a stick endeavored to see the roof or ceiling; we also attempted to sound the cave, but all to no purpose. I should imagine it was 100 feet across. I found on the side a ledge, and beyond, and under this, were other caves or passages through which the water went roaring, hissing, and reverberating in a series of sounds which I could easily understand would demoralize anyone with weak nerves"

That was Painted Cave at the turn of the century, and the only published information the writer has been able to find. It is hard to explain why so few yachtsmen of southern California have ever followed Holder's oars into this intriguing, yet so foreboding cavern. The author found the entrance to Painted Cave much less fearsome than Holder describes, and believes that either Holder may have been describing his entrance into another of the island's caves, or that in the intervening 38 years the sea may have changed the contours of the caves. I believe it is one of the most challenging spots.

The entrance to the Painted Cave is from the north shore of Santa Cruz Island, which is whipped, in the mildest weather, by chops of whitecap proportions. To negotiate the entrance, therefore, requires a relatively calm sea. A bold outcropping at the mouth of the cave resists the direct action of the waves, in the lee of which a boat of up to 50 feet, at least, can, in fair weather, nudge gingerly inward and enter the cave without crashing its almost vertical shores. Once within the arched overhanging walls, my skipper turned off the engines, weighing the disadvantage of doing so against the possibility of creating fumes that would be hazardous, or echoes that would bring down accumulated erosions of the cavern walls. An almost total absence of current in the cave made it possible for him to fend our cruiser off from the underwater walls.

Because of the vicious waves just outside the cave, we had dropped the dinghy alongside as we left our previous night's anchorage in Lady's Harbor. As an elongated painter, we had attached a 200-foot line, which the skipper paid out



*The placid and almost landlocked harbor of Coches Prietos (left).
The foliage on the rolling hills of Santa Cruz is luxuriant*

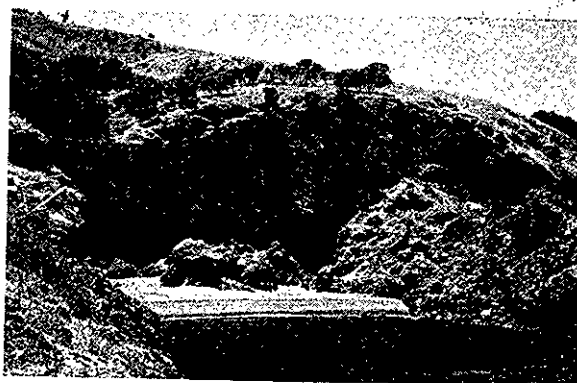
as I rowed, stern-first, into the cave. As evidence of the calmness of the waters inside the cave is the fact that, when the 200 feet was paid out, and I continued rowing, I found that I had towed my 21-ton cruiser an additional 100 feet into the cave!

Three hundred feet into a cave, before this trip, I would have regarded as nothing! But as I entered the main amphitheater of this now dimly lit chamber, I was by no means wholly at ease. As each flash bulb went off, the sound of angry sea lions protesting this intrusion into their lair echoed and re-echoed. At what moment, I wondered, would one of them come up under my dinghy, to catapult me out in the semi-darkness to join them? Much resembling a cathedral, the dome above me appeared at least 60 feet in height, and the rotunda itself of about the same diameter. Off from the walls of the central chamber were clearly visible two marine channels, reminding me of some of the narrower canals of Venice, Italy. No doubt the more intrepid explorer would have cast off the line from his mother ship, and probed these inner reaches, but I resolved I should return at a later date better equipped, for this further investigation.

Soundings in the cave are reported in considerable depths. The entrance appears to be over 70 feet high. The walls inside the cave continue almost vertically below the surface of the water and the bottom is nowhere visible.

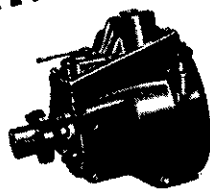
From Painted Cave, the vacationist-explorer would do well to interrupt his stay on Santa Cruz with an excursion to Santa Rosa Island. Santa Rosa lies west of Santa Cruz, across the five-mile wide Santa Cruz Channel, down which

(Continued on page 96)

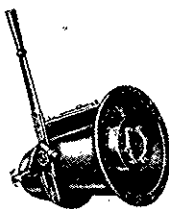


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MIDSHIPMAN SKIPPERS AND CREWS

(Continued from page 42)

Academy supporters, however, the highlight of the race was *Highland Light's* chase of *Baruna* into and up the Bay. From plane and lighthouse reports it appeared, at several times, that the *Light*, under Lt. Frank Siatkowski, USN (Ret.), was well within her time allowance of approximately one hour and eight minutes. But the final result saw *Baruna* finish first in the fleet with the *Light* crossing the line just 22 seconds after her time allowance on *Baruna* had elapsed. However, they had to yield best corrected honors to *Burma* in Class A and to *Alar* in the fleet.

It is planned to enter *Vamarie*, *Highland Light*, *Royono* and two of the Luders yawls, *Intrepid* and *Restless* in the Bermuda Race this year. In addition, the *Freedom*, although too large to be eligible for the race, may sail the course to give another midshipman crew an opportunity to test their prowess over an ocean course.

If you ask the midshipmen themselves where they have the best fun and ruggedest competition (as well as some of the loudest laughs) they will invariably reply "During the two annual trophy races." In these, entries are confined to Academy midshipmen sailors, with no officer-instructors or others aboard.

Tops in the trophy field is the Admiral Dubose Trophy Race, for yawls. Each year the sailing team that works its way through the preliminary to the final yawl race obtains 200 points in the color-company competition, and the winning skipper has his name engraved on the trophy presented by Admiral Dubose.

At the opposite end of the spectrum are the knockabout races. Any midshipman with the urge to sail may enter. Because such crews are likely to be far less experienced than those sailing the yawls almost anything can, and usually does, happen. As its name implies, the knockabout can take a lot of punishment, and affords a grand chance to take a few risks without causing any real damage. But the Thompson Trophy Race, as the knockabout competition is called, sometimes sees some expert sailing, with vociferous crowds along the shoreline to cheer on others who help to keep alive the "Age of Sail" in Annapolis, Mother of the Fleet.

EXPLORING THE CHANNEL ISLANDS

(Continued from page 52)

whip the winds and the seas; as they swirl off treacherous Point Conception. A compass course of 225° will quarter these seas across the channel, and will bring one out approximately at Corral Point, north of the wide indentation shown on the chart at Becher's Bay. The entire eastern shore of Santa Rosa is surrounded by dense kelp, which is not nearly as formidable as the biting wind which becomes colder with each mile westward.

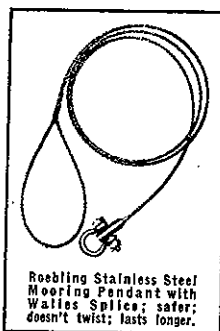
Within Becher's Bay lies Northwest Anchorage where a wharf, with 16 feet at its outer end, provides facilities for embarking the cattle from Santa Rosa Island for the mainland. The yachtsman will search in vain for a comfortable berth in Northwest Anchorage, though from the chart this would appear to be a natural harbor. Cold winds incessantly sweep the bay, kelp is everywhere, and an uncomfortable swell comes close in shore. A skipper easily discouraged would quickly be turned about, but should he do so he would have missed what I believe is the finest small boat anchorage on the entire western sea coast of California.

For less than three miles south of Northwest Anchorage, unmarked on the chart, except by its natural contour, lies the harbor of any yachtsman's dream. At the southern end of Becher's Bay a peak rises on the island; cliffs drop precipitously to the shore; the sailor skirts a headland, and lo! before him lies a clear placid harbor, whose marine colors blend from turquoise to deep blue, whose beach is of virgin



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white sands, and whose land barrier warms the breezes as it protects the harbor from them.

A new moon came up the night I first made anchorage in this dream spot. I noted a resemblance in the shape of the beach. It now has a name on my chart: "New Moon Bay." In five days there, two fishing vessels passed, well out in the channel, a motor-sailer barged ruthlessly by, but none intruded within a mile of this haven. On shore, one can bathe in mild waters, as friendly seals meander by; or he can stretch out on hour-glass sands, following the course of the sun on the beach. At night, he will see an elk silhouetted against the skyline. As he reluctantly leaves he may cruise in the channel alongside of a giant basking shark, or see a school of whales playing. If he is a fisherman, he may match wits with the tuna, the yellowtail, or the white sea bass, which abound in these waters.

Santa Rosa is the third largest of the Channel Islands. It is a poor third in charm. The further out to sea one explores these Pacific Islands, the more desolate he will find they become. Cruising even in the southern lee of Santa Rosa, one will want to turn back when he rounds South Point Light, and feels again the chilly draft that snarls southward from Point Conception!

Beyond Santa Rosa is San Miguel, a gigantic sand dune that is literally being blown into the sea. On this island, as on San Nicholas, to the south of San Miguel, the anthropological explorer will easily find, for many years to come, the remnants of earlier civilizations. But the yachtsman, for pleasure, will not proceed westward past the belly of Santa Rosa. Instead, he will return to the southern shores of Santa Cruz, to find milder breezes and more placid harbors.

Eastward-bound, along the lee-southern shore of Santa Cruz, the first harbor that affords certain protection is Willows Anchorage, three and a half miles east of Gull Island. Here the helmsman must use caution, because what appears to be a large continuous harbor is in reality two harbors, separated by a wide, flat shoal marked only by rocks awash at low tide. A verdant, broad canyon frames this bight, and invites on-shore investigation, since there were, in 1948, no "No Landing" signs here.

But only three miles further eastward is Coches Prietos—pronounced "Co-chay Pre-ay-to" and meaning "blackish coach"—a welcome sight for the most seasoned yachtsman! With its symmetrical half moon bay, with high protruding rocks which guard its entrance and protect its waters from the open ocean, it is one of the most placid anchorages of all the island group. A sandy bottom in two to six fathoms allows a 50-footer to swing on a bow anchor. Ashore, if one ignores the signs forbidding landing, a deserted farm house, with its overgrown orchard and shade trees, invites investigation. Up a verdant valley winds a road that must inevitably connect with the one from Pelican Bay, joining at the isolated colony of wine growers, sheep and cattle raisers that for decades has been an unnamed, uncharted village on the map of California. Wild flowers abound on the hillsides overlooking Coches Prietos—strange flora never seen on the mainland, such as an abundant plant whose green foliage flaunts a frothy topping resembling nothing so much as that of a lemon meringue pie.


Coches Prietos is one of the warmer spots on Santa Cruz, in midsummer, though not *hot*, as it is at Smuggler's (also on the southern shore of the island). The waters are warm for bathing, and the bottom clean. One would ordinarily give it more than an overnight stop.

The skipper bent on adding another landfall to his chain of islands can easily return to Los Angeles by way of Santa Barbara Island, by setting a compass course of approximately 115°. For a yacht of ten knots cruising speed, the trip is an easy five and a half hours, and there is a comfortable anchorage in a cove (in the kelp) 300 to 400 feet south of Arch Rock. But except for being able to say of Santa Barbara Island, "I was there," the trip were much better made directly back to Los Angeles Harbor, where Point Fermin

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would have been rounded, with a pleasing following sea all the way, in less than a couple of hours longer. Santa Barbara is a barren, dull hulk of decomposing rock, good only for military security and sport fishing.

There ends the log of a cruise of four of southern California's little-known islands. If it diverts any of the southern California readers of YACHTING from a vacation in the crowded coves of Catalina to a fortnight of exploration of Santa Cruz and Santa Rosa Islands, it will, partially, at least, have defeated itself; for part of the charm of these islands is that nobody knows about them or goes there.

MORE POWER

(Continued from page 77)

Sure, inspection is tough—but it works in lots of other boating classes. If you go to bore and stroke, you'll let in so many special racing engines that your stuff won't have a chance."

E.Y.G. and P.Y.G. (in unison): "Could be."

E.S.G.: "One more thing before you go back after that whale. If you want to attract big entry lists and encourage beginners—either bar the old-timers from racing, or set up two classes—one for experienced drivers and the other for novices."

ALBANY-NEW YORK MARATHON

► A maximum limit to the number of entries will be enforced for the 1950 running of the Albany-New York utility outboard marathon scheduled to take place over the familiar Hudson River course on Sunday, May 28. Only the first 50 entries received in each of the six classes (A,B,C,D,E, and F) will be accepted. Furthermore, no entry received after May 15 will be considered.

This year's race will be run under APBA stock utility rules, with the Race Committee reserving the final right to pass on the eligibility of entries, to limit the number of entries, and to order a staggered start.

Prizes will be on a scale commensurate with that established for the 1949 Marathon. Entrants will be required to register with APBA (\$3.00), join the sponsoring association (\$2.00) and pay an entry fee (\$10).

Full information may be obtained from the Albany-New York Outboard Assn., 572 Madison Ave., New York 22, N.Y.

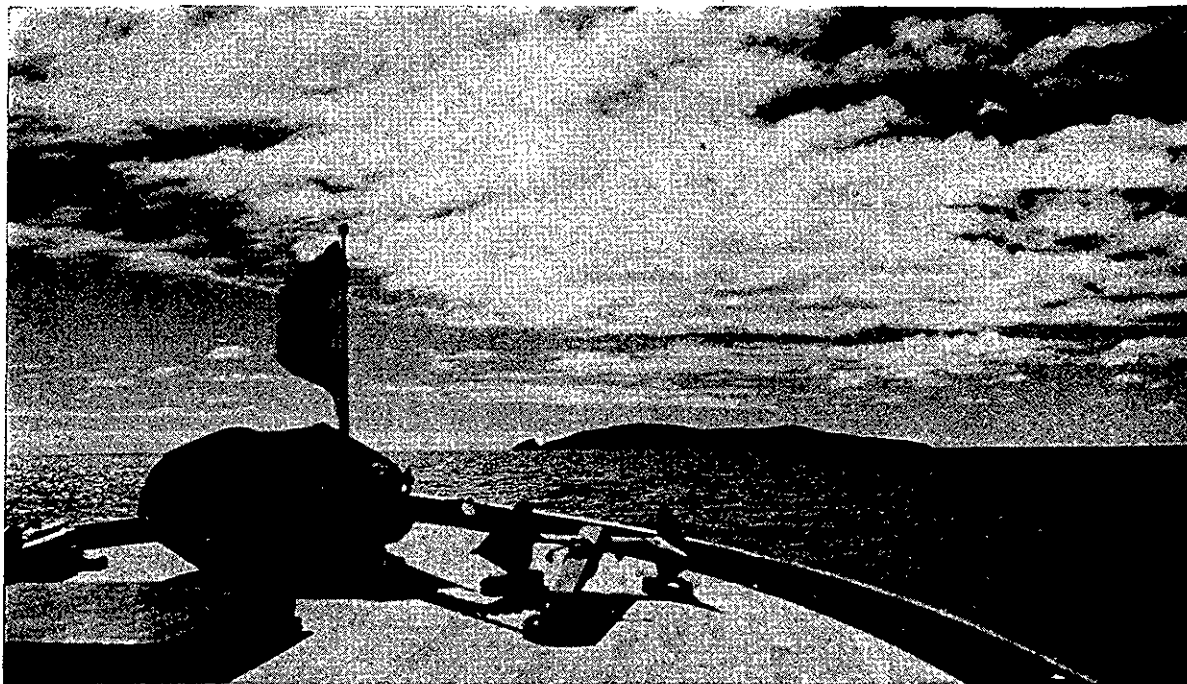
FLORIDA GRAPEFRUIT CIRCUIT

(Continued from page 70)

Stanford again closed out the other boys by winning both heats of C racing runabouts, followed each time by Earl Crutchfield and Bill Becker.

Eugene Minor of St. Croix Falls, Wis., took both heats of B, nosing out Chuck Lethemon and Bill Christopher, two Detroit drivers. Eddie Jones again appeared on the pay-off list with a third in the second heat. Bill Becker turned the tables on the Crutchfield team in C service by winning both heats. Jack Maypole, took a second place in the second heat of C hydros. This class was dominated by Eddie Jones who let Chuck Lethemon have both third place spots and gave the other second to J. B. Broadus. Eddie also won the Free-for-All against Jack Stanford and Stan Erickson of Fond du Lac, Wis.

On Sunday, Tampa offered the outboards a completely new race site. Tommy Hagood set the show off in the first heat of As by getting a little too much air under his three-point and walking her on her tail for a full 100 feet across the starting line. Don Eldredge took both heats of the class with Tommy running two seconds and Doug Creech and Joe Wotowitz doing the honors in third. Against a fine field of Midgets, Eleanor Shakeshaft won both heats. She was followed by Talbot Meeks and Bill Critchfield while Jack Redding took the thirds.



The barren hulk of Santa Barbara Island with a comfortable anchorage in its lee, affords a central base for cruising the Channel group

AROUND THE OUTER ISLANDS

Stark Beauty and Natural Wonders Await the Venturer to Southern California's Offshore Islands

By CARL M. BIGSBY

Photos by the Author

From Magazine "YACHTING" Sept., 1956

OFF THE COAST of Southern California lie eight major islands that are referred to locally, if at all, as the Santa Barbara or the Channel Islands. Fifty years ago these islands were the frequent haunts of yachtsmen who claimed Los Angeles as their home port. So popular were they that in 1910 Charles Holder, one of their most enthusiastic visitors, had published a 400-page volume, replete with information on the flora, fauna, and harbors of the islands, as well as the piscatorial life that abounded in the surrounding waters.

But today one may search in vain for a local skipper who has visited more than three of these islands. The farthest off shore in the group lies at most only two days' run from Los Angeles Harbor; all can be visited in a two weeks' cruise. Today probably not one Southern California yachtsman in a thousand has anchored off the most remote of these islands.

What has happened in the meantime, I tried to learn. "They're just afraid to try," said the oldtimer. "They listen too much about how tough it is." Whatever the reason, in 1946 these islands were reported by a Navy publication to constitute some of the "least-known areas in the United States."

Perhaps a little more inclined to exploration, I visited all of the islands, except San Nicholas and San Miguel, in 1947, 1948, and 1949, reporting my findings in the April, 1950 issue of YACHTING. In 1951 I set out to add San Nicholas and San Miguel to my "Island Chain," and to explore thoroughly the windward side of San Clemente. In addition, I wanted to penetrate and photograph the interior of

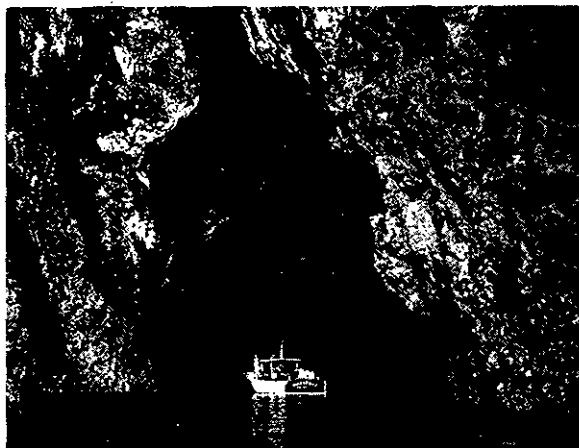
the Painted Cave of Santa Cruz. From the three previous visits to these islands, I knew that *Cazadora*, a sturdy, 48-foot custom built cabin cruiser, could take it. Powered by two Superior diesels, she has a cruising range of 450 miles, and carries enough fresh water for two weeks at sea. Before the cruise was over, however, I wished that she had been equipped with more and heavier ground tackle.

While the "outer islands" abound in ethnological and historical interest, they are now privately and government-owned. Landing may be found to be restricted and discussion of them here is, therefore, as a cruising objective.

San Nicholas is the farthest offshore, 53 miles, of the so-called "Channel Islands," but San Miguel is the most western, 43 miles, more westerly than San Nicholas, and 60 miles nearer to Point Arguello, where the California coastline turns due east. San Clemente, 50 miles offshore, is both the most southerly and the most easterly of the eight Channel Islands. The intensity of the prevailing summer winds, and the ferocity of the seas that whip up around these islands varies with the distance out to sea, and the proximity to Point Arguello.

It is presumed that the yachtsman who is intrigued by a cruise to the outer islands is one who doesn't shrink from a day's run in continual, drenching spray, or who, if he is a powerboat man, isn't unhappy as his boat pounds, hour after hour, in a succession of short, steep seas.

But, even to such a sailor, comfort at sea is not a negligible consideration. Hence, if this article contributes anything for the yachtsman to the scanty store of published material on the Channel Islands, it should be a guide to



The 48' "Cazadora" appears dwarfed by the imposing chamber of the Painted Cave of Santa Cruz



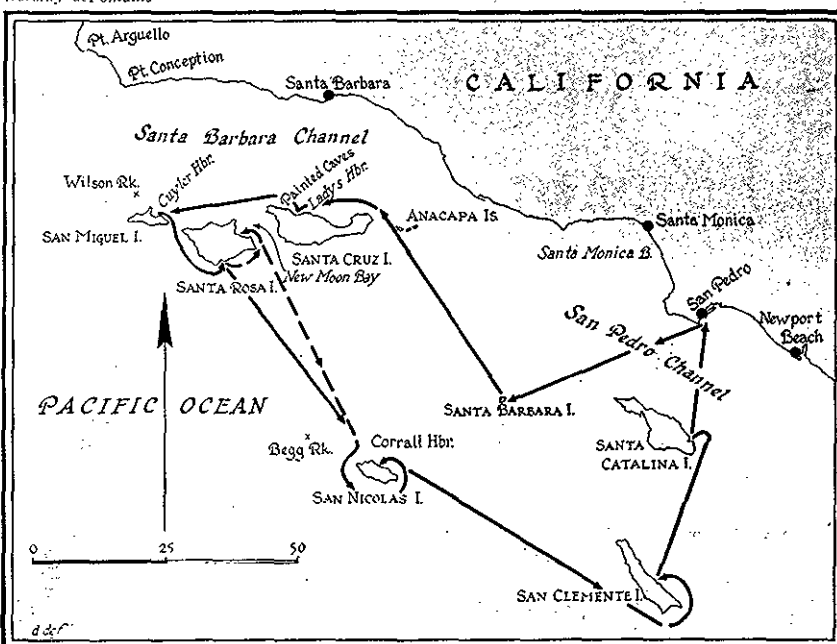
"Cazadora" in New Moon Bay, which is known as the "Gem Cove" of the Channel Islands

the most favorable summer course on which a cruise of these islands, either by power or sail, can be made. The suggested two weeks' cruise includes all eight of the Channel Islands. Unfortunately, vacation time in Southern California is a season of high winds around the outermost islands.

Starting from Los Angeles, there is only one proper direction in which to make the circuit: west or northwestward first! The proposed cruise starts with a first day's run to Santa Barbara Island, focal point of the entire group, and the one island from which all of the others can be reached on a comfortable course. There is unrestricted anchorage here on the lee side, at the foot of a long-abandoned funicular railway. From "The Rock," as it is known by old-timers, a run of a few hours will complete a course through the Anacapa Passage, with the Anacapa Islands to starboard and the many charming harbors on the northern shore of Santa Cruz at day's end. Of these, Fry's and Lady's have the advantage of being relatively near Painted Cave, and at the same time afford a westerly anchorage from which to take off for San Miguel.

A cruise of the islands should by all means include a day for

Dorothy deFontaine



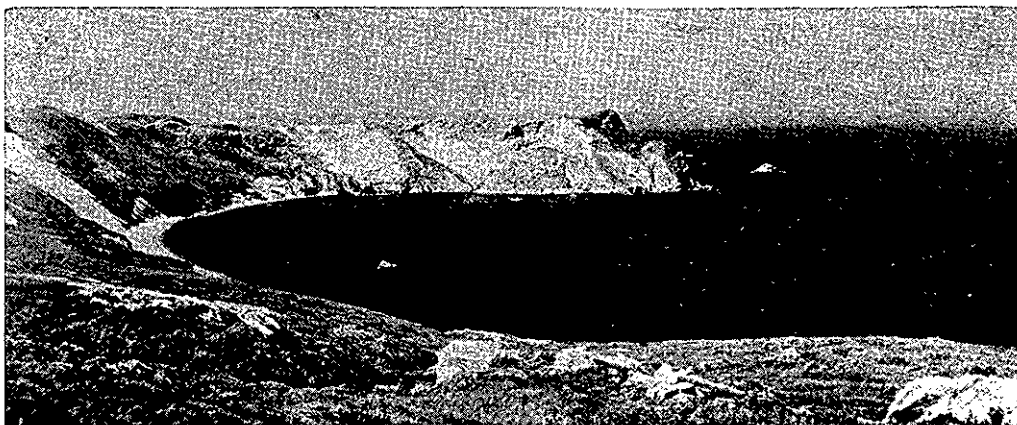
exploration of the Painted Cave. Magnificent in its vastness, this natural wonder is unduplicated (to my knowledge) on the Pacific Coast. It is strictly a marine cave. Its floors are the ocean itself, hundreds of feet in depth, into which the vari-colored walls of the cave drop perpendicularly. I judge that the waters of the Pacific enter the rugged rock of the island to a depth of at least 600 feet.

The Painted Cave's massive domes join one another, each smaller in size as they penetrate into the bowels of the mountain, forming an "L," the base of which is in total darkness. We put the dinghy overboard near the entrance, and *Cazadora* stood off outside for an hour and a half while the skipper and I entered the cave with our cameras.

Inside, as the flash bulbs went off, the din of the barking sea lions began to be heard, and the reverberations of their outcries increased in intensity as we penetrated farther into the pitch blackness of their lair. The third chamber, from which only a narrow beam of daylight can be seen, is smaller than the first two but still at least 60 feet in height and breadth; the last is in total darkness. The first, or outer, dome we found to be so large that we later decided to put *Cazadora* herself into it, and there she lay quietly while I went farther inside.

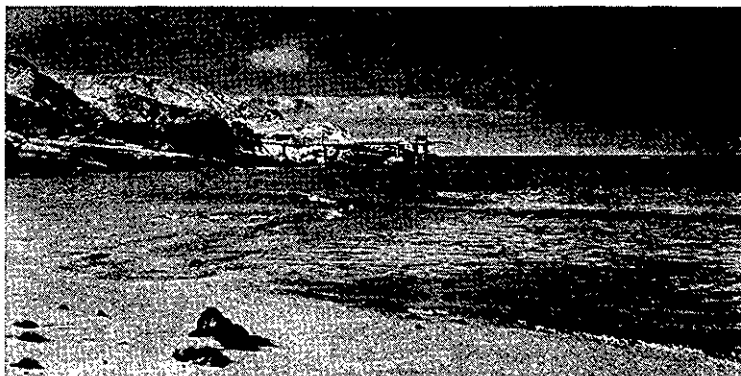
A start at daybreak from a westerly harbor on Santa Cruz is imperative for the run to San Miguel, for winds off the Southern California coast are as unpredictable as they are variable. Periods of high offshore winds usually last several days. They may come up as early as nine a.m., and whatever the winds are anywhere else, the stiff breezes that are spawned at Point Conception vent their initial fury on San Miguel. This island, most formidable of them all, is so isolated from the mainland that it receives no mention in the "Coast Pilot." The seas that make up in the narrow entrance to the comparatively shallow San Miguel Passage are the shortest and steepest ones I have encountered in all my cruising.

San Miguel, in the opinion of some, is the most picturesque of all the Channel Islands. Long sandy beaches, with multiple white caps incessantly rolling in upon them, and jagged volcanic abutments, frame beautiful turquoise coves; and virtual waterfalls of sand etch their descent over the rocks and into the sea. The almost unbelievable process of erosion by the winds on San Miguel is so positive that Arthur Sanger, of Los Angeles, who has been cruising to the Outer Islands since 1905, reports finding a deep canyon



The white speck across San Miguel's Cuyler Harbor is the 65-foot schooner "Flying Cloud"

An abandoned cattle chute identifies this recommended harbor on San Nicholas. The abandoned radio station on the slope above aids in locating this island's only good unrestricted anchorage



Typical of the coastline of Southern California's offshore islands is this huge rock flanking the entrance to Seal Cove on the windward side of San Clemente

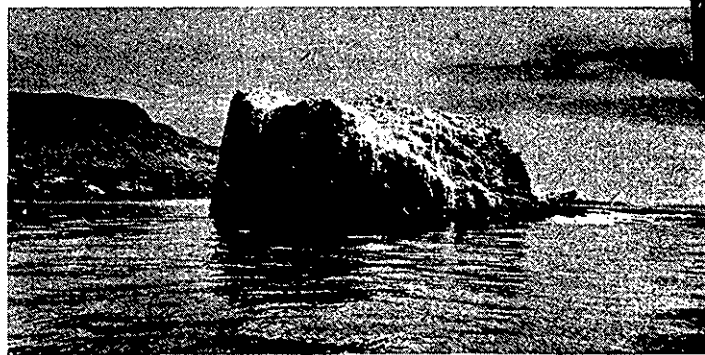
that a few years previously had been entirely covered with sand.

San Miguel, since the turn of the century, has been a major source of relics of its former Indian civilizations. Found five feet or more below the surface, in what were originally graves, the knives, spear heads, arrows, beads, necklaces, flutes, pipes, pots, and the bleached bones of human beings as well as of seals, whales, and otter, trace the impact of both Spanish and Russian conquest of the island. Ornamented variously with beads of Italian, Russian, and local origin, these finds have established the ethnological pattern of the early populace of this and other Channel Islands. Sanger is said now to have the largest collection of these curios in America.

The only recommended anchorage on San Miguel is at Cuyler Harbor, which itself has a wealth of historical romance associated with it. It is here that Cabrillo, Portuguese-born explorer, and discoverer of the Channel Islands, is alleged to have been buried. It was here that he spent many of his last years, though why he should have done so has never been explained satisfactorily to those who know the island today. Certainly Santa Catalina, which he also discovered, with its much more secure harbors and pleasant climate would appear to have been more enjoyable. Whatever Cabrillo's reasons, San Miguel, now only 830 feet in height, for the most part a gigantic sand dune that is being eroded by the incessant sniping of wind and sea, still exists as the ephemeral monument to its discoverer. Perhaps he willed that his ashes be thus cast upon the sea, not at his death, but over the centuries.

From San Miguel, the choice of passage to the other seven islands will depend on (a) weather, (b) one's personal preferences, and (c) the speed and draft of one's boat. In general, almost any course that is chosen will be "down hill"—or at least comfortable.

If the weather is good, if your craft draws no more than five feet, and if you have a full two weeks and want to enjoy the quiet life for the first few days, you would do well



to proceed around the south side of Santa Rosa to New Moon Bay.* This is, to me, the gem cove of the Channel Islands, its undefiled white sand beach, turquoise water, and ever-present sunshine, making it a dream spot for loafing. In addition, Santa Rosa, though privately owned, is the "friendly" island of the entire group in that every year that I have anchored there, one or more of the local residents have come aboard to swap yarns over highballs.

An alternate anchorage on Santa Rosa, for vessels of deeper draft, is Johnson's Lee. This is a wide bay at which the U.S. Air Force has established a large base and radar operation. There is a good holding bottom, but if one elects to stay there overnight, one should not be fooled by its name. In this anchorage I have seen it dead calm at noon, with winds I estimated at 60 miles an hour whipping up in the early afternoon and blowing until midnight, with powerful rollers fighting the offshore gale. Heavy ground tackle is recommended for Johnson's "lee".

The 50-mile run from Santa Rosa to San Nicholas (or from San Miguel, if one elects to skip Santa Rosa) is made

*New Moon Bay is not named on the chart, the name being my own. It is the first light west of Southwest Anchorage on the Santa Rosa Side of the Santa Cruz Channel.

(Continued on page 105)

AROUND THE OUTER ISLANDS

(Continued from page 57)

with following sea, and if the afternoon winds are not too strong, a swing around San Nicholas can be made the same day. The approach should be made down the windward shore of the island, keeping well offshore as the eastern tip is rounded, to avoid the shoal waters, which create an awesome and memorable spectacle.

Literally shaping San Nicholas into their own image, the seas that surge down both sides of the island have built a long sand spit at its eastern end, upon which the rollers meet again in an explosive mating that create a half-mile long finger of frothy breakers, sending spray aloft as they hiss and roar upon each other in what would otherwise be open ocean. It is a sight not readily forgotten.

Retracing a northwesterly course along the lee side of San Nicholas, one will find the only good unrestricted anchorage on the island. Unnamed on the chart, it is located by the buildings and toppled power poles of an erstwhile radio station that are plainly indicated on the chart. A cattle chute, now in decay, can be spotted from offshore and is indicated by a small line on the chart. Lt. Commander Stanley A. Wheeler, USNR, identifies a picture of this bay as "Corrall Harbor" but Sanger, who has anchored here dozens of times, insists that Corrall Harbor (also mentioned by Holder as "Coral Harbor") lies farther west. In any event, all agree that this harbor, marked by the cattle chute, is the best on the island.

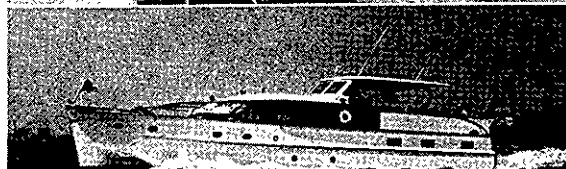
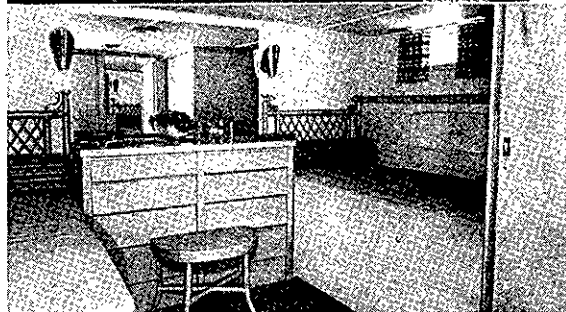
To avoid the thick kelp, as much as possible, entrance should be made from the west. Heavy duty bow and stern anchors are recommended; the winds at San Nicholas vary from day to day but are never moderate. One oldtimer told me that the length of his visits to San Nicholas had always been determined by the winds. When his ground tackle began dragging, he left. The twice-daily radio weather reports give wind velocities at San Nicholas. My feeling is that when the report predicts that winds there will exceed 20 miles an hour I'd lay over where I was for another day before proceeding to San Nicholas. During the winter months, however, the island may frequently lie in a tranquil calm.

San Nicholas Island, like San Miguel, has yielded tons of Indian curios, but little if anything is left today. Possibly the lure of discovery was the impetus that accounted for the yachtsmen's greater interest in these islands 40 years ago!

San Clemente Island, the final objective of our outer island cruise is, at the nearest point, 42 miles southeast of San Nicholas. By comparison San Clemente is a paradise of mild breezes and comfortable anchorages. The proper approach, again, is to coast down the windward side. In moderate weather one might spend a night at Seal Cove, protected in four fathoms by a huge rock where the seals, from which the indentation is named, are very much in evidence.

The formerly-standard overnight stop on San Clemente was Pyramid Cove, on the southern end, but this is now shown as a "Danger Area," though not as a "Restricted Anchorage." Around on the leeward side of the island is Mosquito Cove. This refuge, often referred to as "the most picturesque on the island, is so slight an indentation that we missed it in broad daylight, although diligently looking for it. But there are many others. We were happy in three and three-quarter fathoms in the shelter of a slight promontory a mile and a quarter northwest of White Rock. Others prefer to anchor in the lee of the light, northwest of the Restricted Area surrounding Wilson Cove. Choose an anchorage to your liking. Fishing is usually good anywhere around San Clemente, and you may want to tarry there long enough to explore more than one of the many unrestricted anchorages around this island.

From San Clemente, one may hop directly back to the mainland, or may stop off to jostle with the crowds of



Lady Eve
Mr. and Mrs. David Roaman
Port Washington, N.Y.

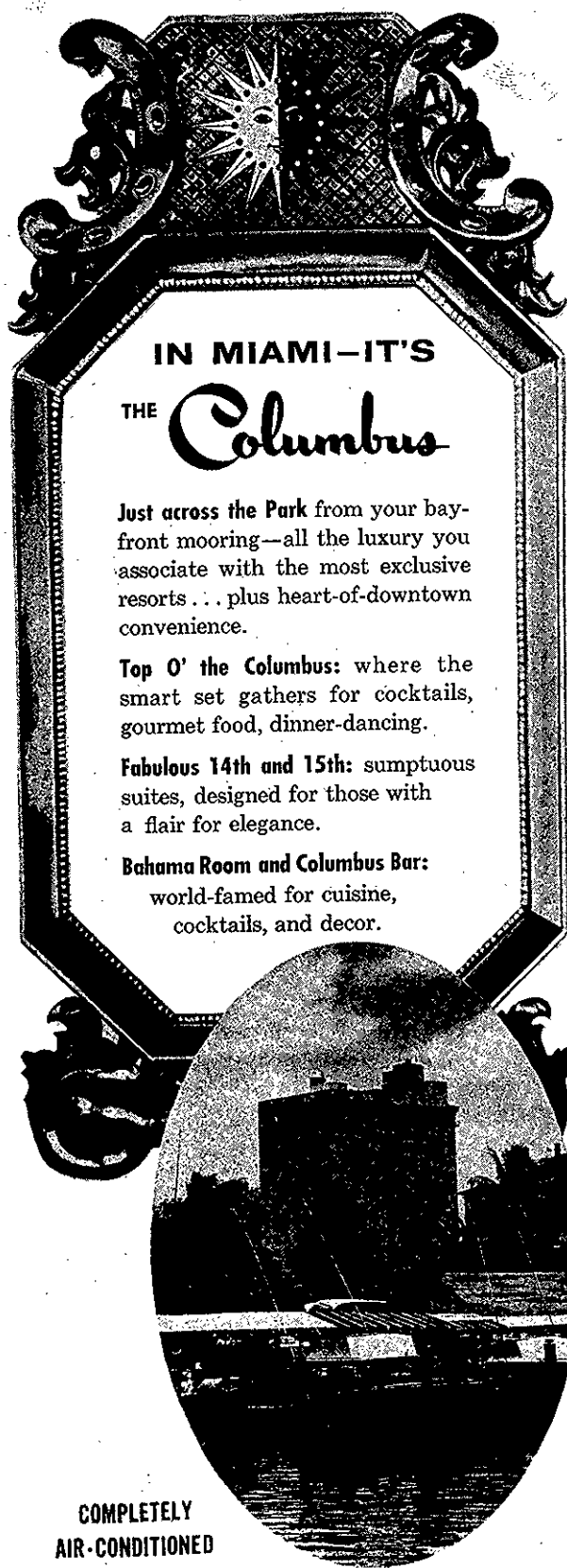
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Avalon, on Santa Catalina depending, I presume, on whether or not the two weeks' taste of exploration and isolation has conquered one's gregarious instincts.

For me, I'll wedge myself in the companionway of a sturdy power cruiser as the green water comes over the bow, listen to the gales whistle around the pilot house at night, and revel in the sun and seclusion of some "far off" harbor of the lesser-known islands.

POSTSCRIPT

In 1955, I returned to San Miguel, Santa Rosa, Santa Cruz, and the Anacapa Islands, aboard *Flying Cloud* bent, particularly, on further cave discovery. This year we pursued an even more comfortable course to San Miguel than described previously and, for anyone who has the time, we highly recommend it.

We sailed from Newport Harbor, clinging to the lee of the mainland all the way to Point Conception, then early in the morning took off with following seas for Cuyler Harbor on San Miguel Island. We rounded Harris Point in a brisk wind at 10 a.m. with short, steep, choppy seas, and made a good anchorage in the west end of Cuyler. For three nights, the wind never blew less than an estimated 40 knots. The principal objectives of this cruise were the uncharted caves of Santa Cruz and Anacapa Islands. These caves, hitherto unknown to us and not shown on any of the geodetic charts, have recently been surveyed by the Santa Barbara Museum.

We were able to locate Yates' Cave, which the museum says is the most interesting on the islands, and Sponge Cave, which to us was even more interesting. I have never talked to any yachtsmen who have been in either of these caves, though it is said that the cave bearing his name was discovered by Dr. Yates in 1890. Yates Cave is reached through the second opening west of the east end of the west Anacapa Island. It is 100 feet high and 200 feet across.

Sponge Cave is located by entering through a narrow crevice, wide enough only for a dinghy, but this cave extends 350 feet into the mountain, and the slight aperture which is its entrance generates the same type of iridescent blue light within that has caused so many world travelers to go to Capri to see the Blue Grotto. It is much shallower than Painted Cave, on Santa Cruz and, after a few minutes, when one's eyes get accustomed to the darkness, one can see white sponges growing on the bottom. Sponge Cave's main amphitheater is 75 feet wide and 30 feet high. No sea lions were encountered.

Since Sponge Cave's entrance is less than 200 feet west of the entrance to Lady's Harbor, here are combined the nicest power boat harbor on Santa Cruz Island and the most interesting cave.

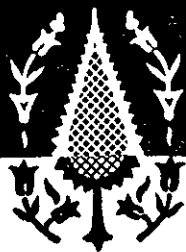
Our last night at sea was spent in Paradise Cove, on the mainland, from which either Los Angeles or Newport Harbor can be comfortably reached on the final leg.

(Before setting out on a cruise of the Outer Islands, says the author, one should know the restrictions that apply to anchoring off, and landing on, them. Generally, landing privileges on all the islands are restricted, unless permission has first been obtained from the owners. As a further precaution, the latest charts of the islands should be carried, and any applicable "Notice to Mariners" should be obtained from the Coast Guard office, Times Building, Long Beach, Cal., immediately before departing. The owners of the several islands, to whom application for landing privileges should be made are: Santa Barbara Island; National Parks, San Francisco; Santa Cruz, Stanton Oil Co., 2780 St. Louis Ave., Long Beach, Cal.; Santa Rosa, Vail and Vickers Co., 5658 Wilshire Blvd., Los Angeles, Cal. San Nicholas, San Miguel, and San Clemente are Naval Reservations, contact: Commandant, Eleventh Naval District, San Diego, Cal.)



YACHTING

MUSEUM TALK



PART OF SAN MIGUEL REPORT
REPLACE IN REPORT

FALL 1956

VOLUME XXXI NUMBER 3

SANTA BARBARA MUSEUM
OF NATURAL HISTORY

SANTA BARBARA • CALIFORNIA

MUSEUM TALK

VOL. XXXI

FALL 1956

NUMBER 3

PUBLISHED QUARTERLY

by the

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BOTANIZING ON THE BURN

In September, 1955, Santa Barbarans were witness to one of their worst forest fires. It began in the Refugio Pass area in the early hours of the 6th and by the 16th, some 75,000 acres were blackened in the Santa Ynez Mountains between Gaviota and San Marcos Passes. The fire was very destructive, exposing a tremendous watershed to erosion. On the south lay the inhabited area west of Santa Barbara. On the north lay the rising Cachuma Lake.

Much was at stake and, before the fire had cooled, local, State and Federal agencies were formulating plans for flood control. Creeks were soon cleared, a seeding program set up, and in time several weedy grasses, mostly Australian Rye (*Lolium multiflorum*), Soft Chess (*Bromus mollis*) and Blando Brome, a form of the latter, were sown into the ashes by helicopter.

In the meantime, we at the Museum realized an opportunity to study at first hand the after-effects. A botanist is interested in a burn for several reasons. He wishes to determine the type of plant cover that follows, its difference from the original, the growth rate, the abundance of individuals and their kind. This rehabilitation by Nature is extremely interesting and has been going on for thousands of years.

Historically, the chaparral evidently migrated from the Mexican plateau during Pliocene times, 1-4 million years ago. It is a vegetational type that is characterized by thick, hard,



Looking across headwaters of El Capitan Canyon towards Santa Ynez Peak shortly after fire. Today this is abundantly dotted with native growth.

Photo by J.F.H.

evergreen leaves and rigid branching; adapted to rocky, well-drained situations of little soil, it is found in regions of winter rain and summer drought. There are similar areas in Australia, South Africa, the Mediterranean region, Chile and Mexico.

At present, man is primarily responsible for starting these fires. In prehistoric times, lightning was probably the prin-

cipal cause, although the fires may have been much less frequent. However, it is quite evident that the chaparral is an expression of a climax vegetation that has evolved or matured under repeated conflagrations and thus is adapted to return to normal with renewed vigor in a minimum of time.

This may be demonstrated by our first Museum trip on October 20. No rain had fallen since the blaze, yet in the San Marcos Pass area some ten plant species were noted as sprouting from their burned bases. Others were added to this list when more of the burn was covered four days later.

This power of regeneration is great in many plants. In some, it is aided by a swollen growth at the junction of the roots and stems from which sprouts may arise when the top is destroyed. This is commonly known as a burl and is possessed by such species as Red Heart (*Ceanothus spinosus*), Hollyleaf Cherry (*Prunus ilicifolia*), and Eastwood Manzanita (*Arctostaphylos glandulosa*). Plants that lack this growth are usually killed by fires, and their reproduction is accomplished through prolific seeding as in Big-pod Ceanothus (*C. megacarpus*) and Big-berried Manzanita (*Arctostaphylos glauca*). To be on the safe side some plants employ both methods, for instance Chamise (*Adenostoma fasciculatum*). Others may have dormant buds along the branches, man-sized roots as in the Wild Cucumber (*Echinocystis macrocarpa*) or bulbs. Some of the pines open their cones only after a fire to scatter their seeds in the ashes.

Rain finally came on Sunday night, November 13, when about two inches fell on the upper mountains. Another inch followed on the 20th. Within a few days, aided by warm weather, the burn became alive. Grasses and Filaree were

up along roads in the lower elevations; sprouts from burls and other perennials were 2-8 inches high. Death Camas and Wild Cucumbers were appearing everywhere. Wildlife was returning. In the upper mountains the sown grass seed had not yet germinated.

By December 22, however, the planted seed had sprouted, along with many of the native plants, including those "fire followers" so abundantly seen only after fires. This miracle of Nature is one of its processes to stem erosion, the result of plant selection over thousands of years. After the accumulated seeds break dormancy, some remaining viable for over 50 years, or any interval between fires and other disturbances, they germinate by the millions. Competition is removed, the soil loose and friable, and with chemicals from the ash, the plants grow to abnormal sizes.

Under the favorable conditions that followed, the sowed weedy grasses made truly phenomenal growth, becoming exceedingly dense, attaining shoulder height in places and offered considerable impediment to a botanist searching for native plants. But one learned to follow the rocky ridges and hillsides on the south slopes where the grasses did not fare so well.

Nevertheless, with all this competition from man, many of the expected "fire followers" were eventually located, along with several species that never have been reported from the Santa Ynez Mountains. Some of the most productive sites were in depressions of the chaparral and a few moist areas along El Camino Cielo, now sprayed with shrub killing chemicals.



Photo by R.S.F.

Big-flowered Phacelia

One of the most conspicuous of the fire followers was the Big-flowered Phacelia (*P. grandiflora*) which colored acres a rich lavender in the warmer areas. Normally, this flower between fires is seen as a few plants here and there in disturbed places along trails and roads. Another is the brick-red Wind Poppy (*Papaver californicum*). It was quite common on the cooler slopes, although somewhat crowded by the grass and not looking too happy. Scattered everywhere were the creamy-white stalks of the Death Camas (*Zygadenus fremontii inezianus*).

Along the summits near Santa Ynez Peak is the rare yellow False Lupine (*Thermopsis macrophylla*). This colony is possibly an undescribed form and its future is in doubt as more chemicals are applied; however, seedlings were coming up everywhere in the vicinity. Also in this area and on the highway near Paradise was the rare and tall straw colored Ear-drops (*Dicentra ocbroleuca*).

On the north slopes, an exceptional display of Fairy Lantern (*Calochortus albus*) and Chinese Houses (*Collinsia heterophylla*) were to be seen along Highway 150 near Paradise. A similar spectacular show was in the woodland of Refugio Canyon where giant Brodiaea, Larkspur, Checker-bloom, Meadow Rue and many others were at their best. Brilliant red Indian Warrior (*Pedicularis densiflora*) was noted in new locations with clearing of the chaparral.

An unexpected discovery was the abundance of Trefoil (*Lotus salsuginosus*) and seedling Morning Glory (*Convolvulus occidentalis cyclostegius*), especially on the south slopes where there was a sparsity of grass. In association with chaparral, the Morning Glory is scattered and the Trefoil is usually along sides of roads.

A problem was raised when certain species were not found. For instance, we missed the Golden Ear-drops (*Dicentra chrysantha*) which occurs in the Santa Ynez Mountains to the east, where it is growing in disturbed places along roads. Not one plant was seen in the burned area.

In several years, when the chaparral is well on its way to covering the mountains again, these fire-following plants will mostly disappear and their seed will lie in wait for another disturbance to awaken them.

C.F.S.

A few of the interesting plants collected are as follows:

Fire followers

Calandrinia breweri
Calyptidium monandrum
Arenaria douglasii
Polycarpon depressum
Silene multinervia
Streptanthus heterophyllus
Thelypodium lasiophyllum
Astragalus nigrescens
Phacelia brachyloba
Antirrhinum hookerianum
Malacothrix clevelandii
Malacothrix obtusa
Senecio aphanactis

Moist places or depressions

Scribneria bolanderi
Juncus kelloggii
Allium lacunosum
Sagina occidentalis
Phacelia grisea
Specularia biflora
Heterocodon rariflorum
Githopsis specularioides
Erax sparsiflora brevifolia
Senecio astephanus

FALL LECTURE COURSE

Following is the schedule for the Fall series of lectures for members:

October 14—"Brazil," Karl Robinson.

October 21—"Land of Scarlet Macaws," Ernest P. Edwards.

November 11—"Sweden", Mrs. Hjordis Parker.

November 25—"From Dodos to Devil Rays," Quentin Keynes.

December 9—"Cypress Kingdom," Alexander Sprunt.

THE MUSEUM LIBRARY wishes to take this opportunity to thank Dr. C. H. Richardson for the recent gift of Biological Abstracts, 1941 to date. This publication abstracts the biological literature of the world and is extremely valuable in locating source material.

EARLY MAN ON SANTA ROSA ISLAND

One hundred years ago the State Geologist of California announced to the scientific world the discovery of the Calaveras Skull, which he believed to have come from the Pliocene beds of Calaveras County, California. This began a long, tedious controversy among scientists which has continued to this day. Paleontologists (those who study prehistoric animals, including man) and Archeologists (those who study prehistoric man and his culture) have been on opposite sides of the fence, so to speak. A very few of us "paleoarcheologists" have been caught between the two viewpoints, therefore it has been a great pleasure indeed as evidence after evidence has piled up during these hundred years, indicating that Man has been in America, not for the mere five to ten thousand years that the archeologists have claimed, but for much more than 10,000 years.

Dr. Willard F. Libby, of the University of Chicago, recently devised a means of measuring radioactive carbon, the Carbon 14 method of determining age. Preliminary tests on ancient objects of known age, such as remains from the Pyramids of Egypt and tree-rings from the Southwest, as well as some very carefully measured geological specimens of greater age, bore out Dr. Libby's theory and it was acclaimed by the archeologists. This was especially true when a few preliminary dates seemed to show that the paleontologists had been "wrong" in their estimates of the time that man had been in America.

One of these early tests was made on the remains of a camp-fire believed to be of Folsom Man. Folsom was considered the oldest known American man by the paleontologists, who

estimated an age of around 10,000 years at a time when the archeologists considered a sedate 4,000 years proper. Radio-carbon measurements from Libby's laboratory did not support the paleontologists' contention, but Dr. Harold J. Cook paid a second visit to the quarry, and discovered that the dated charcoal came from a campfire which was, in the words of the geologists, "intrusive" or "dug into" the older sediments. Fresh material proved a more ancient date of Folsom Man.

We at the Museum have claimed an antiquity of man in North America somewhat less than the "radical" paleontologists, but very much older than the archeologists would accept. In 1925, Dr. D. B. Rogers, then Curator of Anthropology at the Museum, discovered and later named the Oak Grove Culture. Subsequent work made us believe that this was an "Early Man," dating at least to the Pleistocene, the last Ice Age. But this was before the days of the Genii magic of the modern scientist who takes a gram of carbon, boils it in acid or burns it in a retort, sends the gas through tubes and subjects it to a battery of highly sensitive Geiger counters, shoots the impulses through a maze of electronic wiring and comes up with the carbon's age in years BP (before present.)

We are always looking for a means of dating these ancient inhabitants, because "How old is it?" is one of the first questions people ask. The Western Speleological Institute—Santa Barbara Museum's Moaning Cave Expedition gave us our first proof of antiquity. In the deposits of dripstone covering human bone in Moaning Cave, California, compared to the rate of deposit during a known time indicated no less than 12,000 years. This at a time when 4,500 years was considered by the majority of archeologists as the maximum time. I say "majority." There were exceptions, one of whom was Dr. M. R. Harrington of the Southwest Museum, who some

twenty years before had estimated the age of the human and ground sloth remains in Gypsum Cave, Nevada, at around 10,000 years.

One of the first things we saw on the Museum's Santa Rosa Island Expeditions in 1946 was evidence of fire, buried deep in the Pleistocene deposits. Were these fires natural or man made? One spot east of Tecolote Canyon, and about forty feet up on the cliff (we now know that represents about 30,000 years ago), showed what *appeared* to be a distinct hearth, created by man. Unfortunately, at that time in 1946, there were no roads or any means of land travel except horseback, and a forty foot ladder could not be carried by horse—nor airplane. On our next year's visit, prepared to drop down by ropes from above, we found that a land slide had obliterated all sign of our hearth.

For several years we were engaged in excavating the dwarf mammoth bones and digging into the ancient Indian village sites—always watching for evidence of that elusive character "Early Man." Twice we thought we had found him. Twice we were disappointed when careful examination of the site on high sea cliffs showed intrusion of later human material into the Pleistocene mammoth beds, but nevertheless the evidence was piling up—some of it highly circumstantial, to be sure.

An archeo-paleontologist works a good deal like a detective. As the detective deals in fingerprints and ballistics or alibis and motives, we deal in little chips of bone—or shell, geological strata, erosional evidence. The details and the eventual aim are different but the methods are closely similar—in fact, many police tactics, such as making plaster impressions of foot prints, or moulage molds are identical to paleontological methods.

An abalone shell from an animal which would weigh about six pounds when alive was found some three miles inland and forty feet deep. Who could have brought it here? Foxes, the largest native mammals existing on the Island? No. A fox weighs only about six pounds himself, and tests have shown they refuse to eat abalone. A dwarf mammoth? We had no means of determining, except that all living species of elephants eat hay or leaves, not abalone. Birds? Quite a load for even the Bald Eagle, the largest bird on the Island, and again ten years observation has not shown that eagles ever eat abalone. Man? A likely possibility.

Archeologists considered man as being in California only about 4,500 years. We felt he must have been here for close to 20-30,000 years from the evidence on Santa Rosa Island and the Santa Barbara mainland but, like the detective who is sure of the culprits' guilt but lacks "evidence acceptable beyond a reason of doubt" in a court of law, we lacked this evidence.

The Moaning Cave excavations had turned up evidence indicating Man's existence at 10,000 years plus—while this has not been wholeheartedly accepted by the conservative archeologists, neither has it been disproved. The Western Speleological Institute and Nevada State Museum began excavations in the Winnemucca Caves of Nevada, and here found positive proof of the co-existence of Man and the extinct horse and camel, later radiocarbon dated at 11,100 years ago.

This was at that time the oldest date for Man in the Americas, older even than Gypsum Cave, and older than Folsom. It was indeed encouraging, especially as the Museum, through its Curator of Anthropology, was in charge of the operations with Mr. J. W. Calhoun, Director of the Nevada State Museum. Later Dr. Harrington submitted material from

Tule Springs, near Las Vegas, Nevada, and this was dated at more than 23,800 years.

The Museum had continued work on Santa Rosa Island and at last it was felt there was sufficient evidence to present to a "court." A group of scientists, specialists in various fields, were invited to spend a week on Santa Rosa Island, examining not only the evidence for Pleistocene Man, but the complete geo-chronological column of man's activities contained in a two square mile area, dating from the present to—as we later determined by C14 methods, more than 37,000 years ago.

Dr. Carl L. Hubbs, Scripps Institution of Oceanography, University of California, Dr. George F. Carter, Geography, Johns Hopkins University, Mr. Wallace S. Broecker, Lamont Geological Observatory, Columbia University, and the writer made up the party. We were guests at the Island ranch home of Mr. and Mrs. Ed Vail. Transportation to the Island was provided by a Scripps Institution vessel.

Results? Four dwarf mammoth kills were found in which evidence shows Man had built fires, and "barbecued" elephants. In one site rude chipped stone artifacts were found, with a completely carbonized front foot. In another, charred bones of mammoth were found in strata which indicates a pit similar to that dug for trapping animals or for barbecuing. These bones were radiocarbon dated by Mr. Broecker at 29,650 years, for the oldest evidence of human occupation in the Americas.

Who was this man? How does he correlate with the Moaning Cave Man, Fishbone Cave Man, and our own very ancient Santa Barbara Oak Grove? These and many other questions will, just like a continued story in a magazine, have to wait until the next episode, when we go again to Santa Rosa Island and, at a later date, have more of this story to tell.

P. C. O.

STAFF CHANGES

Mr. Richard Finley, who has been with the Museum for the past eight years in the Department of Anthropology and Geology, resigned on September 1. Mr. Finley also was the leader of the Junior Nature Club for Boys, as well as doing photography.

Mr. John Maples Thompson joined the Staff as Assistant in this department in September. Mr. Thompson is a graduate of the State College of Washington at Pullman, and has done graduate work at the University of Washington.

ELLEN S. CHAMBERLAIN

The recent passing of Miss Ellen Chamberlain recalls the fact that she was a member of the original Board of Trustees of the Santa Barbara Museum of Natural History and Comparative Oology, now the Santa Barbara Museum of Natural History. An active Trustee from 1916 to 1946, she has been an Honorary Trustee for the past ten years.

For many years she was active in the social, educational, and cultural development of this community, and was especially interested in the Hale Flower Hall, gift of her step-mother, Mrs. Clinton B. Hale, and the Junior Department of the Museum. For several years past her health had been failing, and the end was not unexpected. However, because of her wide acquaintance and her keen interest in the Museum and other institutions, including particularly the Santa Barbara Botanic Gardens, her demise caused general mourning and regret.

At the Museum we cannot forget her. To the older members of the Board of Trustees and the Staff, her memory will always remain a happy and constructive one, marked by appreciation of her love for beauty in nature.

Fred H. Schauer

MUSEUM NOTES

THROUGH THE INTEREST OF MR. C. D. WOODHOUSE, of the Board of Trustees, the Museum received from the American Museum of Natural History two excellent mineral specimens. A very beautiful section of a large amethyst geode was a gift to the Museum, while a large piece of native silver is on loan. These two specimens are now on exhibit in the Geology Hall.

MR. ORR attended the Third Great Basin Archeological Conference held at the University of Utah in Salt Lake City, on August 19-21, where he delivered an illustrated talk on the Santa Rosa Island Excavations. Following the meeting members of the group made an extensive tour of ancient Lake Bonneville and Lake Lahontan to investigate and collect material for geological dating by Radiocarbon 14 and Chlorine 35.

DR. ARMAND SPITZ, of the Spitz Laboratories, met with Mrs. Harold S. Gladwin, Mr. Chase and Dr. Coggeshall on August 20 to discuss the plans and problems of the Gladwin Planetarium. Work has begun on the building and should be completed early next year, at which time installation of equipment can begin.

AN IMPORTANT EVENT OF THE FALL will be the opening of the Campbell Insect Hall. Exhibits in half of the Hall will be complete, with two habitat cases on the left, and three cases on the right outlining the natural history of insects, and showing various types of insects and their relatives. The first habitat case contains a jungle scene, with colorful moths and butterflies against the lush vegetation of the American Tropics. By pressing a button, the visitor can change the scene from daylight to night, with nocturnal insects featured. The second habitat group is a local scene, showing our familiar

insects of the foothills. Many of the specimens going into these exhibits are from the fine collections of Mr. Harold S. Gladwin and Dr. Theodore Lehmann.

THE WESTERN MUSEUMS' CONFERENCE met this year in San Francisco on October 5 and 6. The Museum was represented by Mr. Smith and Mr. Cunningham.

ON SEPTEMBER 7, 8 and 9 the Santa Barbara Branch of the American Begonia Society held its annual educational show in the Hale Flower Hall. The Hall was a mass of rich color with many large specimen plants for interest and accent.

THE MUSEUM has received a beautiful bronze statue by Miss Marie Zimmerman of New York, as a gift of the artist. The statue shows an Eagle attempting to take a fish from an Osprey. The bronze has been placed in the Hazard Room.

THE FOLLOWING GROUPS visited the Museum recently: Hess Kramer Camp, Camp Ramah, Girl Scouts, Boy Scouts, Madison Junior High, Y.M.C.A. groups, Camp Lorr, Devereux School.

MR. RETT spoke on "Birds" to the Sierra Club at the Museum on August 7. Mr. Abbott spoke to the Exchange Club on "Birds of the Sierras and Nevada," and showed movies on July 26.

THE FIFTH INTERNATIONAL SALON OF NATURE PHOTOGRAPHY showed the winning color slides at an evening program on July 18.

MEETINGS were held by the Santa Barbara Mineral Society on July 11, and September 5; Santa Barbara Humane Society on July 9, and September 17; Santa Barbara Geranium Society on September 14; "Star Cluster" on September 25; Mission Canyon Association Board on July 2, August 6 and September 10; Bird Study Group on September 28; Sierra Club on August 7.

NEW MEMBERS

Mrs. Wallace W. Arendt, Mr. Tommy Baldwin, Miss Laura B. Coleman, Mrs. Bertie de L'Arbre, Elaine Dewhirst, Mrs. Patricia May Edwards, Miss Martha C. Ehrlich, Mrs. Blanche M. Fraile, Miss Bertha L. Fredenbur, Mrs. Hugh Hardin, Mr. and Mrs. Francis C. Kellogg, Mrs. M. N. Morehouse, Mr. Daniel S. Morrison, Mr. Robert M. Newhouse, Mr. Edward A. Northam, Miss Mae V. Pruner, Mark Sorensen, Mr. and Mrs. James A. Westcott.

GIFTS AND ACCESSIONS

ANIMALS—from Dr. N. Bolduan, Mrs. Merritt Bower, G. W. Burkhardt family, Mrs. Estelle Donahue, Dr. Mary Erickson, Steven Henriksen, Anne Ingalls, Mrs. R. La Fond, Robert and Richard Latter, Kit Myers, Mrs. R. B. Nelson, Marilyn Phoenix, Mrs. J. W. Reed, Mr. Fred Reppine, Richard Roston, Mr. Max Richter, Sharan Schmidt, Ken Smedley, Mr. Von Schrader, Mrs. Barbara Tempske, Mr. Frank Van Schaick, Dr. Clarence E. Weaver, Darrel Weaver, Raymond Weber, Bobby Williams, Gill Williamson, Russel Yennans, Mr. R. Ziesenhenne.

ANTHROPOLOGICAL MATERIAL—from Dr. and Mrs. H. C. De Vighne, Mrs. C. W. Stone, Mrs. David Banks Rogers.

BOOKS AND PAMPHLETS—from Dr. Ernest L. Bickerdike, Miss Frieda Boeckman, Mr. Harold S. Chase, Mr. Walter J. Knecht, Mr. Angus Mackechnie, Dr. C. H. Richardson, Mrs. David Banks Rogers, Sierra Club.

BRONZE STATUE—from Miss Marie Zimmerman.

FLOWERS AND HERBARIUM SPECIMENS—from Mrs. Harold S. Chase, Miss Katherine Harvey, Mr. Lee Ramirez, Mrs. Ray Sommerfield, Santa Barbara Park Department, Mr. R. Ziesenhenne.

ROCKS AND MINERALS—from Mr. Vance Phillips, American Museum of Natural History, Mr. C. D. Woodhouse.

MEETINGS

SANTA BARBARA GERANIUM SOCIETY

Second Friday of the month

8:00 P.M. ARTHUR COGGESHALL LECTURE HALL

SANTA BARBARA HUMANE SOCIETY

Second Monday of the month

7:30 P.M. MUSEUM OFFICE

SANTA BARBARA LEPIDOPTERISTS' SOCIETY

Third Monday of the month

8:00 P.M. ARTHUR COGGESHALL LECTURE HALL

SANTA BARBARA LITTLE GARDENS CLUB

Third Tuesday of the month

2:30 P.M. MUSEUM AUDITORIUM

SANTA BARBARA MINERALOGICAL SOCIETY

First Wednesday of the month

8:00 P.M. ARTHUR COGGESHALL LECTURE HALL

BIRD STUDY CLUB

To be announced by postcard

SIGMA XI

Second Monday of the month

8:00 P.M. ARTHUR COGGESHALL LECTURE HALL

SANTA BARBARA "STAR CLUSTER"

Fourth Tuesday of the Month

8:00 P.M. ARTHUR COGGESHALL LECTURE HALL

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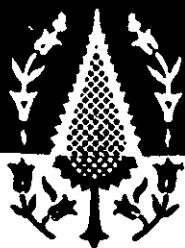
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MUSEUM TALK



PART OF SAN MIGUEL REPORT
REPLACE IN REPORT

SUMMER 1950
VOLUME XXV NUMBER 2

SANTA BARBARA MUSEUM
OF NATURAL HISTORY

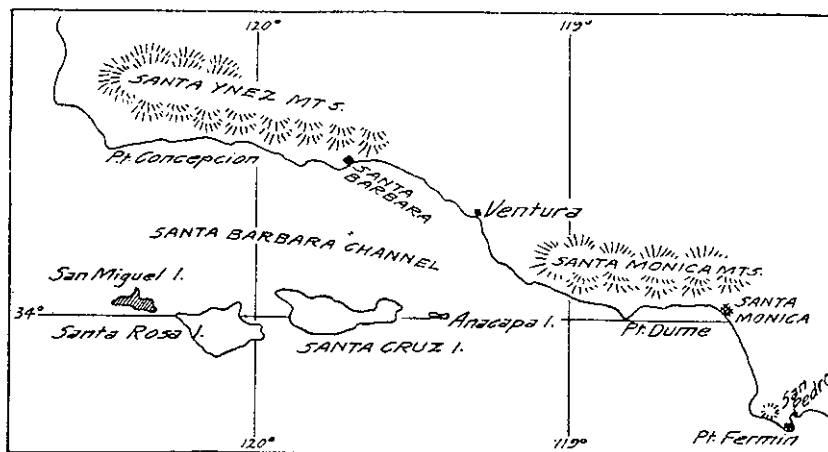
SANTA BARBARA . CALIFORNIA

ON SAN MIGUEL ISLAND

The Museum's study of the Channel Islands proceeds whenever opportunity arises. When the Navy gave Mr. Robert Brooks, lessee of San Miguel, thirty days to remove his sheep from the island, the curator of geology and anthropology with his assistant, Richard Finley, and David M. Gray volunteered to herd sheep in order to have a good look at the natural history of this westernmost of the Santa Barbara Islands.

David Gray, Jr. furnished our air transportation to the island where we joined the four Brooks men and started rounding up the half-wild sheep. These were driven in small bands to the harbor where they were loaded on a barge and taken to the mainland.

Early in the morning the Museum party would start across the barren wind-swept island on foot. While we gathered stray sheep, we looked for mammoth bones in the deep erosional gullies and for Indian remains on the tops of the huge dunes, recording and mapping our observations as we went.



Hours later we would join Don Butler and the ranch hands, who had combed the hills on horseback, and start the drive back to the corrals. Typically perverse, the sheep would break and run into gullies and ravines we had never seen before, so by the end of our two weeks, they had led us into almost every crack and cranny on the island, which is eight miles long and four wide.

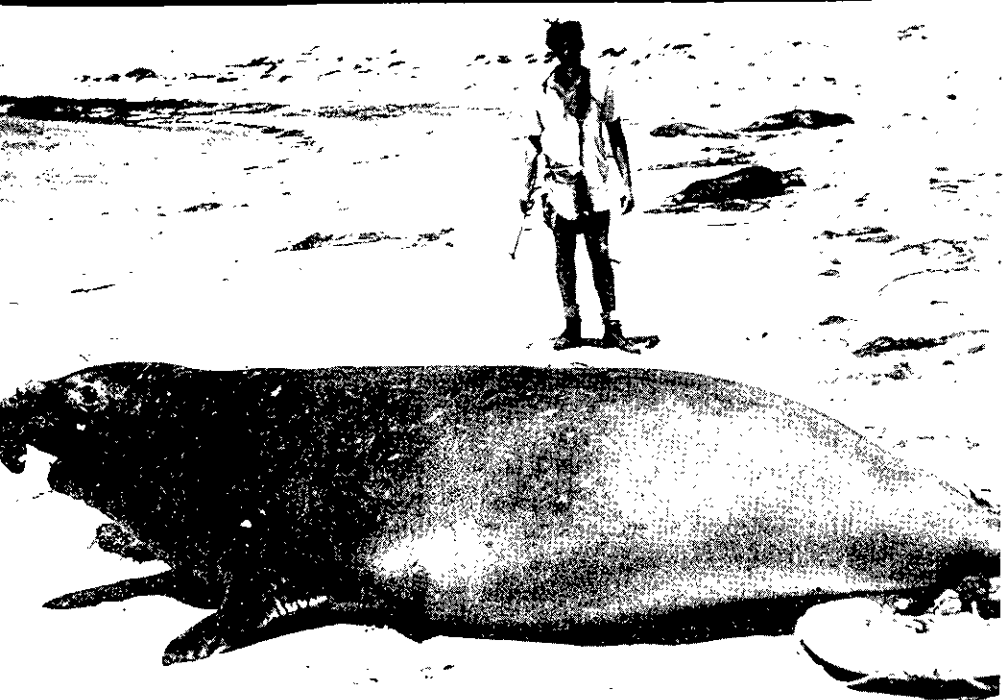
Naturally we discovered things. We found three localities of fossil elephants—more than had been located during the thirty years Mr. Brooks has leased the island. Of course, we were experienced after finding many on Santa Rosa Island. These mammoths died about a million years ago at the close of the Pleistocene Period after the islands became separated from the mainland.

Near the cliff where Ralph Hoffmann, former director of the Museum, lost his life in 1932 while collecting plants, we found a cave in which ancient Indians had been buried. This and two on Santa Rosa Island are the only instances of cave burials yet found on the islands or the adjacent mainland.

At the back of this cave were two small rooms with sparkling ceilings encrusted with crystals known as gypsum roses from the way they grow from the center. These uncommon crystals, found only in caves, have not been reported before in Santa Barbara County.

We found no evidence that white men had ever visited this cave and, since the old timers on the island had never heard of it, we called it Hoffmann Cave.

While herding sheep we surveyed and mapped some sixty ancient Indian village sites, which resemble those of San Nicolas Island more than they do those of the other islands. Huge dunes were piled high with the



A male elephant seal roused by David Gray

broken bones and shells which the Indians had carried from the ocean, sometimes several miles. Here and there the sand-cast ghosts of long-dead trees and shrubs projecting above the skyline show that this island, like San Nicolas, was not always barren. Except for two fig trees sheltered by the old ranch house, there are no living trees on the island.

At the west end of the island we were surprised to find over fifty sea elephants, or elephant seals, basking on the sandy beach. These marine mammals are the largest of the seals. The male has an extended snout and is much larger than the female. Unlike sea lions, they are

not easily disturbed and we could walk right up to them and take pictures, prodding them for an animated look.

This unwariness made them easy prey to the whalers who almost exterminated them for their oil. The Mexican government has protected them on Guadalupe Island since 1922 and elephant seals are reestablished there, but finding such numbers this far north was unexpected. Mr. Rett reported one at San Miguel in 1926 and in 1945 we saw two on San Nicolas Island. Under the strict protection of the California Fish and Game Commission we look for their numbers to increase in the Channel Islands.

We used all the still and movie film we had with us so Mr. Rett brought more cameras and film in a chartered plane flown by Russel Robinson. Our record of the sea elephants includes black and white photographs, kodachrome slides, and colored movies.

All species of the land-going marine mammals of this region were on San Miguel Island between June 21 and July 9. On the west end there were sea elephants and both California and Steller sea lions. On the south coast at Crook Point were harbor seals.

To young Dave Gray go the honors of the expedition for finding a perfect skull of the almost extinct sea otter. This animal, important in California history, was hunted to near extinction for its prized fur. Although once so abundant along this coast, there are only a few specimens in museums. The type specimen of the southern sea otter, in the U.S. National Museum, was taken on San Miguel Island by G. M. McGuire in 1904. Skeletal fragments occasionally turn up in Indian shell mounds but we had never found a complete skull.

Reid Moran, formerly of the Santa Barbara Botanic Garden and now of the University of California, joined us briefly and collected plants, including seaweeds for algalogist Paul Silva.

A half mile from the dock in Cuyler Harbor, Prince Island (sometimes called Princess Island) is a rock about a half mile long and 330 feet high. At the west end, where cormorants were nesting, we found a large sea cave. At the entrance blue fishes swam among the brightly colored corals and algae. An inner passageway was filled with crystal-clear water which reflected the outside light in a wide green shaft like a neon tube.

Two elephant seals and a mixed group of California and Steller sea lions



As we rowed along the island and climbed to the top we could find no evidence that Indians had ever lived there nor any sign of Cabrillo's grave reputed to have been seen there. The only animal we found, besides the cormorants, seagulls and pelicans, was an alligator lizard, the first recorded from Prince Island.

Two lizards, a blue-bellied and an alligator, are known from San Miguel, as well as a slender salamander, but no snakes have been reported. The only land mammals are the island fox and a white-footed mouse.

San Miguel has had a varied and interesting history. Prehistorically, mammoths, foxes and mice roamed the forest. A drought may have destroyed the trees and vegetation on which the mammoths lived and they in turn became extinct, while the once abundant snails barely survived. Much later the Indians came in their plank canoes and for many centuries lived in and abandoned some fifty villages before the historic period began with Cabrillo's visit in 1542. Cabrillo died from an accident on San Miguel but history does not say where he was buried. Being a sailor, it is probable that he was buried at sea.

The Indians disappeared during the mission period and for the past hundred years the island has been used as a sheep ranch by various owners and lessees, George Nidever being one of the first. For some thirty years it has been owned by the U. S. Navy which began two years ago using it as a bombing target. To those who fear that Naval bombardment will destroy the island, let it be said that the might of man is puny compared to the elements which have been trying for a million years to blow this island into the sea.

P.C.O.

MISS BUTNER RESIGNS

Miss Joan E. Butner, Museum botanist since August 1946, shortly after graduation from Mills College, leaves the Museum staff in September. She will work for her Masters Degree in botany at the University of Washington where she will be a graduate assistant in the botany department.

Miss Butner plans to specialize in mycology in which she became especially interested during the past season of unusually abundant fungi.

Mrs. June Hopkins, who as Miss June Wheeler was botanist from 1942 to 1945, will take her place, transferring from the Junior Department where she has been assistant for three years.

DR. COGGESHALL

An honorary degree of Doctor of Science was conferred on Mr. Coggeshall at Occidental College, June 12.

Mr. Coggeshall was presented for the degree by Mr. Schauer, president of the Museum and a member of the board of regents of Occidental College, and by Major Fleischmann, executive vice-president of the Museum, upon whom the University of Nevada conferred an honorary degree of Doctor of Laws in 1945.

Dr. Arthur G. Coons, president of Occidental College, conferred the degree honoring Mr. Coggeshall for his long career in museum work. His special contribution to paleontology was his work with dinosaur skeletons, for which he has received many honors abroad. Before becoming director of the Museum in Santa Barbara in 1937, Mr. Coggeshall had been director at the Illinois State Museum and the St. Paul Institute and paleontologist at the Carnegie Museum in Pittsburgh.

HANDSAW FISH

A strange four-foot fish with fearful teeth was found in a bass net one-half mile off China Harbor, Santa Cruz Island June 5 by Andrew Castagnola. Since it was also strange to the other fishermen at George Castagnola's, the Museum was notified.

As usual with rare fishes, the Museum arranged to have it sent to the California Academy of Sciences. Dr. W. I. Follett, curator of fishes, assigned it catalog number 20413 in the Academy's study collection of fishes and verified our tentative identification.

The common names, lancet, handsaw and wolf fish refer to the dentition of this voracious, soft-bodied fish. The large teeth in the roof of the mouth resemble a surgeon's lancet and the teeth at the back of each lower jaw resemble those of a handsaw. It is a species of *Alepisaurus* but ichthyologists are still deciding about its specific name.

MUSEUM NOTES

THE AMERICAN ASSOCIATION OF MUSEUMS meeting in Colorado Springs, May 29-June 1, was attended by Mr. Coggeshall, Miss Morres, Mr. Rett and Miss Irwin.

Mr. Coggeshall presided at the Science Technical Section and Mr. Rett presented his method of replacing with latex the feet of water birds and mammals.

En route Mr. Coggeshall, Miss Morres and Mr. Rett visited museums in Flagstaff, Santa Fe, Vernal and the Dinosaur National Monument. Miss Irwin examined the collections of the Department of Native Arts of the Denver Art Museum and attended meetings of the Indian Arts and Crafts Board in Santa Fe.

MISS RAYMONDE FRIN, who represented the Division of Museums and Historic Monuments, UNESCO, Paris, at the museum meeting in Colórado Springs, visited the Museum June 27 on her tour of noteworthy American museums. Miss Frin is editor of MUSEUM, to which the Museum subscribes.

FIELD NOTES

A BIRD CENSUS of Dune Lakes, near Oceano, was taken April 29 and 30 by Mr. William Body, Mr. Abbott and Mr. Rett at the invitation of Mr. Harold S. Chase. Sixty-one species were listed.

CHROMITE SPECIMENS were added to the Museum's mineral collection by Mr. Ralph Colcord, who collected them at the mines during the field trip the Santa Barbara Mineralogical Society made to Figueroa Mountain in May.

FOSSIL BONES of a Miocene whale at Sulphur Mountain in Ojai, reported by the Ventura Star-Free Press, were investigated by Mr. Orr in April. He found that fossil fishes and a sea turtle have also come from the quarry there.

AT THE MUSEUM

AN AMPHITHEATER recently built across the creek from the Junior Department is an added facility for classes and groups visiting the Museum. It was built from sandstone boulders from the Museum grounds cut and put in place by Museum staff members, directed by Mr. Coggeshall.

THE JUNIOR DEPARTMENT's annual program, held May 19, featured the biennial pet and hobby show. Four diplomas and two post graduate stars were awarded and many prizes were won by the pets and hobbies exhibited.

Mr. Schauer and Mr. Coggeshall officiated in this program supervised by Mrs. Cooke and Mrs. Hopkins.

CLASSES from the following schools visited the Museum recently: Santa Barbara College, Vertebrate Field Zoology Class of the California State Polytechnic, Briggs School of Santa Paula, Haydock School of Oxnard, Nordhoff School, Vista del Mar School, Orcutt School, John Burroughs Junior High School, Montecito School for Girls, Goleta School, Cold Springs, Dolores, Hope, Roosevelt, Wilson, Harding, Garfield and Lincoln Schools.

GROUPS visiting were the Alhambra Girl Scouts, Camp Conestoga and a group from the summer camp of the Montecito School for Girls. The Southern California Botanical Society, meeting in Santa Barbara, visited the Museum herbarium and Flower Hall April 15 under the guidance of Miss Butner. The staff of the Public Library met at the Museum on May 21 for a tour of the Museum with Mr. Coggeshall, and on May 23 Mr. Coggeshall guided a group from the Latter Day Saints through the Museum. A Girl Scout Court of Awards and supper was held in the Junior Department on June 8.

MEETINGS were held by Sigma Xi on April 3; Santa Barbara Orchid Society on April 22 and May 24; Santa Barbara Historical Society on April 23; University Faculty Wives on May 9; Santa Barbara Little Gardens Club on April 18, May 16, and June 20; Santa Barbara Mineralogical Society on April 5, May 3, and June 7.

PELARGONIUMS were featured in the Flower Hall May 19-22 and the Santa Barbara Little Gardens Club held its annual flower show here June 17-20.

TALKS OUTSIDE MUSEUM

MR. RETT talked at the Carpinteria Elementary School on April 14.

MR. COGGESHALL spoke and showed pictures at the Methodist Church on April 26, and on May 9 talked at the Latter Day Saints Church on "The Museum and the Community." On June 15 he spoke to the Junior Chamber of Commerce.

MR. ABBOTT talked to the Cub Scouts on June 20.

NEW MEMBERS

Mr. and Mrs. Howard G. Fletcher, Mr. and Mrs. Edward Masson, Captain E. A. Salisbury.

GIFTS ACKNOWLEDGED

ANIMALS—from S. F. Harberts, Mr. John Hilton, Mrs. Ruth Porter Jones, Laurence Lewis, Miss Marjorie Lusink, John M. Milner, Mr. Andrew Oppel, Mr. and Mrs. Vance Phillips, Mrs. W. B. Pinkerton, Mr. H. Swoboda.

BOOKS, PAMPHLETS, MAGAZINES — from Mr. E. Stanley Atkinson, Mr. Harold S. Chase, Mr. H. Hanse, Dr. Marian Hooker, Mr. George M. Newell, Mr. Peter Riedel, Mrs. J. A. Westcott.

CUT FLOWERS AND HERBARIUM SPECIMENS—from Miss Carrie Brant, Canyon Gardens, Miss Ellen S. Chamberlain, Mrs. Harold S. Chase, Mrs. Robert E. Easton, Mrs. Charles R. Finley, Mrs. Max C. Fleischmann, Mrs. Ruth Hemple, Mrs. Fred D. Jackson, Mrs. John P. Jefferson, Mrs. Jane S. Pinheiro, Santa Barbara Little Gardens Club, Miss Mariette Sexton, Mrs. George F. Steedman, Miss Kate E. Walker, Mrs. J. A. Westcott, Mrs. Roy L. Wheeler.

FALL LECTURE SERIES

- October 15—"Venezuela Venture," Nicol Smith
October 22—"Beneath Buckeye Skies," Karl Maslowski
(*Audubon Wildlife Tours*)
November 5—"Rainbow Canyons of the Colorado,"
E. P. Hunt
November 19—"Erie's Changing Shores," Harrison
Orians (*Audubon Wildlife Tours*)
December 10—"An Afternoon with a Living Sea Lion,"
Homer Snow

INSTITUTE OF NATURE STUDY AND CONSERVATION

August 14-27

The University of California Extension, in cooperation with the Santa Barbara Botanic Garden and the Santa Barbara Museum of Natural History, again offers a two-week summer session.

Scheduled are NATIVE BIRDS by Mr. Rett, and ELEMENTARY SCIENCE METHODS by Mrs. Cooke and Mrs. Hopkins, of the Museum staff, SEASHORE LIFE by Dr. Donald Wooton, CONSERVATION OF NATURAL RESOURCES by Mr. A. L. Rickel, AFTERNOON WORKSHOPS by Bernard J. Lonsdale, WESTERN TREES by Dr. Katherine Muller, Institute Coordinator.

Three units of credit are allowed to holders of a degree or teaching credential. Others may obtain a certificate of attendance. The enrollment fee is \$27 and application blanks and schedules are available now at the Museum.

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SAN MIGUEL ISLAND, CALIFORNIA

By Professor T. D. A. COCKERELL

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF COLORADO

OFF the coast of Southern California, for the most part in plain sight from the mainland, are eight islands. They are divided into two groups, northern and southern. The northern islands, arranged in a row east and west, are San Miguel (the outermost), Santa Rosa, Santa Cruz and Anacapa. The southern are Santa Catalina, San Clemente, Santa Barbara and San Nicolas. Geologists suppose that during the Tertiary Epoch there was a land, which has been called Catalina, extending from the northern islands southward, including the southern islands and the vicinity of San Pedro on the present mainland, and possibly going as far as Guadalupe Island, far out in the Pacific. How much of this land persisted into the Pleistocene remains uncertain, but during the latest geological period there were undoubtedly great changes of level. During the Tertiary, maritime conditions are shown by the presence of numerous Eocene and Miocene sea shells fossil on Santa Cruz. Chaney and Mason postulate a peninsula in Pleistocene times, extending westward from south of Ventura and including all the northern islands. This leaves us to suppose that the southern islands were independently connected with the mainland, but there is a comparatively shallow bank (the greatest depth 96 fathoms) extending from Santa Rosa to San Nicolas. That the islands were really connected with the mainland during the Pleistocene appears to be proved by the occurrence of remains of mammoths (*Elephas*) on Santa Cruz, Santa Rosa and San Miguel, and the endemic salamanders (*Batrachoseps*) on Catalina and the northern islands. Chaney and Mason describe a formation of Pleistocene age,

on Santa Cruz, containing a flora similar to that in the vicinity of Fort Bragg, about 440 miles N.-N.W. This includes large logs of Douglas fir (*Pseudotsuga taxifolia*), wood and cones of cypress (*Cupressus goveniana*), seeds of *Garrya elliptica*, and in general a flora differing almost entirely from that now on Santa Cruz and not ancestral to it. The only species still existing on Santa Cruz is the pine tree, *Pinus remorata*, which must formerly have had a very wide distribution, since it is found on Cedros Island, off the coast of Lower California. We apparently must conclude that a Pleistocene fauna and flora which inhabited the islands at one time has entirely or almost entirely disappeared, to be replaced by the quite different assemblage we find to-day. When these changes took place, and under what conditions, we do not know. Munz gives a list of 35 kinds of plants, found to-day on the northern islands, which occur on the mainland mostly from Monterey County northward. These may well have inhabited the mainland of Santa Barbara County (one of them, *Vaccinium ovatum*, does so to-day¹) when the climate was moister.

Whatever may have been the history of the islands, they are of great interest to the biologist to-day on account of the large number of peculiar (endemic) species and races found upon them. Taking the islands as a whole, there are about fifteen endemic mammals, fifteen birds, two lizards, two salamanders, sixteen land mollusks and over eighty flowering plants. Many insects are apparently en-

¹ As shown to me by Mr. M. Van Rensselaer, who also pointed out a grove of *Lithocarpus*, a tree not cited by Munz in his "Flora of Southern California."

demic, including a quite distinct butterfly on Catalina. Numerous fungi have been described from Santa Catalina, but whether any are truly endemic is uncertain. Some of them are found on introduced plants, such as *Eucalyptus* and *Nicotiana glauca*. These endemics may be classified under two headings. First, the relict endemics, which must have been much more widely distributed in former times, but now survive only on the islands. Second, the true island endemics, which acquired their special characters on the islands. Of the former type must be the wholly endemic genus of trees, *Lyonothamnus*, of which there are two forms, one only on Catalina, the other on Catalina, San Clemente, Santa Cruz and Santa Rosa. To the latter group we must assign the island foxes, having special races on Santa Catalina, San Clemente, San Nicolas, Santa Cruz, Santa Rosa and San Miguel. No one could imagine that there were six kinds of these foxes on the mainland, and on the islands being formed each took one for its own.

Although the ancient Catalina is presumed to have included all the islands, this is of no particular significance in relation to their present population, which must in the main date from quite late Pleistocene. It has been supposed that there were two extensions from the mainland, one in the north, as already indicated, the other southward, from somewhere near San Pedro. Reed suggests that San Pedro Hill is a "land-tied" member of the island group; it is at present largely covered with *Opuntia littoralis*, the prickly-pear so characteristic of the islands. If the islands were not connected north and south when the ancestors of the present populations mostly arrived, it is puzzling to explain why there are 21 kinds of plants and several birds which are island endemics, but occur on both the northern and southern groups. The birds may have acquired

their racial characters on one island, and reached the others by flight, aided perhaps by the strong prevailing winds. But if so, why has the very distinct Santa Cruz jay, abundant on that island, never crossed to any other? There are seven kinds of birds, each confined to a single island.

Otherwise, we have to ask whether the endemics, common to the two groups of islands, may have acquired their characters independently, so that they are now, so far as we can see, alike. A. B. Howell gives a summary of the characters of the endemic birds, showing that in general they have darker markings, larger bills and heavier or longer tarsi and toes.² Thus it would seem that there are environmental factors tending in certain directions, which might be expected to give parallel results on different islands. In the case of plants we may note the tendency to more robust or arborescent types, and in a good many cases pale or canescent foliage. I visited Santa Catalina many years ago, but only for a very brief visit, during which I found a new moth, described by Miss A. Braun, of Cincinnati, and a new snail, which I described. The validity of the snail has been disputed by California conchologists, but it has lately been reexamined by Dr. H. A. Pilsbry, who writes me that he finds it a good subspecies.

Until the present year (1937) I had failed to find an opportunity to reach the northern islands. On July 26, I was very kindly invited by a group of the Senior Boy Scouts to accompany them to San Miguel Island, returning on August 1. I was especially glad to have this opportunity, as no wild bees had ever been collected there,³ and there was every

² The local song sparrow of the Coronados Islands (*Melospiza melodia coronatorum*) is paler, with smaller bill.

³ I have since found that E. P. Van Duzee collected a bee (*Anthidium*) on San Miguel many years ago.

prospect of finding other insects of interest and possibly endemic forms of various groups. It took us five and a half hours to reach the island in a fishing vessel. The sea is very choppy in the Channel (recalling the English Channel), and several of us were seasick. The botanist E. L. Greene went to San Miguel in 1886, leaving Santa Barbara on August 19, and he relates that he and four others sailed in "a very small sloop, bearing a cargo of fence boards . . . that our voyage was not without adventure will be indicated by the testimony that we did not reach the shores of San Miguel until nine days later." But going to the other extreme, Mr. George Hammond, in his red aeroplane, makes the journey in twenty minutes, having a landing place on the flat top of the island.

San Miguel has a length of about 8½ miles, with an average breadth of 2½ miles; the area is estimated as 14 square miles. The highest points are 860 and 850 feet above sea level. The western end is about 25 miles south of the nearest mainland, but the sea between reaches a depth of over 250 fathoms. The nearest island, Santa Rosa, is only three miles away, and the channel is shallow, with a depth of only 17 fathoms.

We camped on the north side, at Cuyler's cove or harbor, the best landing place on the island. The Scout group, numbering about twenty, was in charge of Mr. John H. Leecing, Scout executive of Santa Barbara, with the aid of Mr. J. W. Vickers, serving as cook, and Mr. M. McGregor, ready to render medical aid if necessary. The well-known efficiency of the Scouts was apparent throughout, and we all had a very good time. I climbed to the top of the island in two places, but some of the boys went all round.

The island consists largely of sand dunes, and must have been so for a very long while. Rocks of Tertiary age, near the shore, are tilted at an angle of per-

haps 50 degrees, and consist of solidified sand, with occasional layers of dense stone. They were not fossiliferous where examined, but they are referred to the Eocene by Bremner in his work on the geology of San Miguel. It was in an adobe like deposit, near the top of the island, that Mr. H. S. Lester found remains of elephants. Mr. Lester, who lives in the one ranch house on the island, had for years longed to hunt elephants in Africa, and it was considered rather a joke that he eventually found them close to his home on San Miguel. The undoubted Pleistocene beds containing Elephas have not been observed to contain other fossils, but it is reasonable to hope that something else may yet be found. On the top of the island, alternating with sandy deposits, I found a caliche or travertine-like deposit, very solid but composed of sand, and standing up on this are numerous objects which look like small trunks of trees, but are actually limy concretions formed around roots which formerly occupied the ground. Some people have thought that these objects were relicts of a former forest, but this is not the case. The roots were probably those of the Lemonadeberry, *Rhus integrifolia*, a kind of sumac which once abounded on the island, so that the wood is even now used for fuel. Greene reported that as far back as 1886 he saw only two or three of these shrubs, showing feeble signs of life, but he found the wood, in one case branches 30 feet long, but not more than a foot above ground. Hoffmann, of the Santa Barbara Museum, found one shrub overhanging the ocean bluff, on April 10, 1930. But on Princess Island, at the mouth of Cuyler harbor, the plant still survives and was found by the Scouts during our expedition. Two other more or less arborescent plants were found by Greene, but have now entirely disappeared. One is Toyon, *Photinia arbutifolia*, "two stunted specimens," and the other, of



CUYLER'S COVE, SAN MIGUEL ISLAND. —Scout Expedition photo

more special interest, is *Lavatera assurgentiflora*, the Malva Rosa or tree mallow. Greene tells of finding some thirty small trees of the *Lavatera* and also three or four depressed and straggling bushes at the very western end of the island. He commented that the San Miguel plant seemed to differ from those in cultivation; the branches much stouter, the leaves larger, the corollas of a deeper color, and the stellate pubescence of the pedicels and involucres a good deal more pronounced and conspicuous. Later, he found differences in the fruits, and many years after set up the San Miguel plant as a species, which he called *Sarimonia dendroidea*. It has not been accepted by botanists, but presumably it constitutes a local subspecies, to be called *Lavatera assurgentiflora dendroidea*. Hoffmann, in all his explorations of the northern island, found *Lavatera* only once; four or five plants on a steep hillside above the old sheep landing, on Anacapa, on September 22, 1930.

There are thus no trees on San Miguel, if we except a fig tree (which duly bears figs) at the ranch house, where it is sheltered by the building. There has lately arisen considerable discussion concerning a project in which the Scouts were to have a part, for the "reforestation" of San Miguel. There is little reason to suppose that trees could be induced to grow in any numbers, but there are several good springs, and in the vicinity of these, especially in places more or less sheltered from the persistent high winds, it may be presumed that trees such as the lower-growing kinds of *Eucalyptus* would succeed. The experiment would cost little and is worth trying.

Although the list of species of plants on San Miguel shows only a small proportion of endemics, this list is swollen by the names of many plants certainly or probably introduced in recent years, and when it comes to the number of individuals, the endemics are conspicuous. The most conspicuous is the grey-green bladder-pod, *Astragalus miguelensis* of

Greene, which covers a large part of the surface. It is found on all the other northern islands (Hoffmann found it on Anacapa); but nowhere else in the world. Mr. Robert Brooks tells me that it acts on the sheep as a loco-weed, and is avoided by them. This circumstance favors the island snails, which cling to the branches of the *Astragalus* and would have difficulty in existing without it. These snails, a form of *Helminthoglypta ayresiana* (described from Santa Cruz) are very abundant, and have long existed on the island, as shown by their presence in the concretionary rock on the top of the island and in alluvial deposits near the shore, these surely antedating the period of human occupation. The shells are about as large as the end of one's thumb, and are light brown, with a broad white band on which is a very dark, nearly black, band. The subfossil shells are bleached white, but all show traces of the dark band. I searched long, but could find no other snails on the island; I suppose that any small forms, living on the ground, would soon be overwhelmed by the drifting sand.

Another island endemic, which occurs on San Nicolas as well as the northern islands, is the shrubby *Malacothrix implicata* of Miss Eastwood, regarded by recent writers as a variety of a mainland species. The white, daisy-like flowers are very conspicuous on the cliffs by the shore, and I found them attractive to wild bees.

The yellow-flowered *Erysimum insulare* of Greene, related to the garden wall flower, is very abundant, and noteworthy for the spreading instead of erect pods. This was described as an endemic, but has lately been taken from the list, as it occurs in some quantity in one district on the mainland. I am inclined to suppose that it is a genuine island endemic, and has been introduced on the mainland in comparatively recent times. I can even imagine that the yellow-spined

prickly pear, *Opuntia littoralis*, so characteristic of the islands, owes its presence on the mainland to introduction by man; but should this be true, there would be no possibility of proving it.

The ice-plant, *Mesembryanthemum crystallinum*, is excessively abundant, and in case of need will keep animals alive in the absence of water. But Mr. Robert Brooks tells me that it acts as a purgative on the sheep, and is generally avoided by them. This plant is generally supposed to have been introduced from Africa, but Greene thought it was native, and it may be one of the group of strand plants, such as certain *Convolvulaceae*, which have been spread widely over the world, presumably through the agency of birds. I do not know whether the African and Californian plants have been carefully compared in the living state; as herbarium material they are almost unrecognizable.

There is much grass on the island, including a tall and very robust form of rye grass, *Elymus condensatus*, growing in the vicinity of springs, mixed with the introduced beard grass, *Polypogon monspeliensis*. Among the specimens I brought back Mrs. Agnes Chase, of Washington, recognized *Distichlis dentata* Rydberg, a plant new to the islands, and not given by Munz in his Manual of Southern California Botany, although they have a specimen at Washington which was collected in Orange County.

We did not plan to collect vertebrates, but Bruce Davis, one of the Scouts, found a specimen of the very interesting endemic salamander, *Batrachoseps pacificus*, by the spring at the landing place. It is a worm-like creature, with short legs; our specimen is darker than the descriptions indicate, at least as preserved in alcohol. Mr. Davis said that it appeared more brightly colored when alive. We also obtained a specimen of the endemic white-footed mouse, *Peromyscus maniculatus strea-*



—Scout Expedition photo

CONCRETIONS

RESEMBLING TRUNKS OF TREES, ON TOP OF SAN MIGUEL ISLAND.

tori, which was skinned by Mr. McGregor. This was not considered important at the time, but it proved to be of unusual interest. At the Santa Barbara Museum, Mr. E. Z. Rett showed me three mice from San Miguel and a dozen from Santa Cruz, the latter belonging to the subspecies *P. m. santacruzae*. The Santa Cruz mice, about half from near the beach and half from the central part of the island, all look alike, and are very dark. The tails vary from 77 to 92 mm long. The three San Miguel mice are much paler and redder, and are smaller, the tails 66 to 71 mm. But the mouse I brought back was considerably darker than Mr. Rett's series, with a dark dorsal stripe, and the tail 78 mm. On examining the skulls, Mr. Rett found that his three mice were all very immature, while mine was adult. Thus it appears that the characters of the San Miguel race are more evident in the young mice than in the adults. The pale color is what might be expected in a sandhill species. The

tracks of the mice indicated their abundance on San Miguel, and Mrs. Lester told me that some time ago they were so numerous as to amount to a plague, and they had to destroy them around the ranch house, by traps and poison, to such an extent that they were buried in trenches. Hearing this, I lamented the waste of so many specimens of this endemic race, hardly represented in museums. We hope to see a good series secured for the Santa Barbara Museum.

The insects obtained will be reported on later.* Among the smaller insects, I expect to find few endemics, as they can be blown from the mainland by the strong prevailing winds. Collections made in the air by means of aeroplanes have demonstrated that many small insects are thus transported. Spiders, when young, can travel on their gossamer

* I have since worked up the bees. I find I collected sixteen species, of which seven are new species, and five others new races of mainland species.

threads. Many years ago, the well-known zoologist Eisen collected ten species of spiders on Santa Rosa, and these were recorded in 1904 by Dr. N. Banks. Two of them were new species and peculiar to Santa Rosa, so far as the records then showed. Of butterflies, I found on San Miguel only two species, a Lycaenid or "blue," and a small yellow skipper which I failed to catch. There are probably others, but they can not be nearly so numerous as on Santa Catalina, where 27 species were taken by Don Meadows. The few moths taken were pale colored, like the sandhill species of other countries. A kind of mealy-bug, perhaps new, was found on *Astragalus miguelensis*. The females can not fly, and the males fly feebly, but the young larvae can be transported on the feet of birds. We found cricket-like orthoptera, entirely wingless, of the genera *Stenopelmatus* and *Ceuthophilus*, and these may well prove to be endemic.

Mr. M. E. Rodehaver very kindly took several of us over to Princess Island, a small island at the entrance to the bay. It is commonly called Prince or Prince's Island, and is so marked on maps, but Hoffmann, in his herbarium, always wrote Princess. Mr. Brooks states that the name was due to a legend of an Indian "princess," whose conduct was not approved of, and who was transported to the island, where she would soon have perished. Princess Island has been chiefly known as the breeding place of innumerable sea birds, especially pelicans (*Pelicanus californicus*), cormorants and gulls. It is quite steep, and so covered with ice-plant that it is slippery and hard to climb. There is a good deal of prickly-pears (*Opuntia littoralis*), but the common *Astragalus* and *Erysimum* of the main island appear to be entirely absent. There are no snails, so far as I could discover. The boys found *Rhus*, as already mentioned, and on the top blackberry



THE TOP OF SAN MIGUEL ISLAND
WITH SHIFTING SAND DUNES, LARGELY COVERED WITH *ASTRAGALUS MIGUELENSIS*.

—Scout Expedition photo

(*Rubus vitifolius*), which had previously been collected there by Hoffmann. A single bee (*Agapostemon*) was found in a spider's web.

We had no opportunity to make any study of the marine mammals, but seals (*Phoca richardii geronimensis*) were seen about Princess Island, and many dead ones were found on the shores of the main island, shot by the fishermen. In addition to the common seal, no less than four different marine mammals (exclusive of Cetacea) have been found about the islands, namely, the Guadalupe fur seal, the northern elephant seal, the Steller sea-lion and the California sealion. The first of these has not been seen for some years. Mr. D. B. Rogers reports remains of the Guadalupe fur seal and elephant seal in Indian middens. The kitchen middens of the ancient Indians are very conspicuous on San Miguel, consisting mainly of great heaps of shells of the edible mussel (*Mytilus*), with numerous red abalones. Rogers (1929) recognizes three successive types of aboriginal inhabitants on the mainland of Santa Barbara County. The first or earliest, called the Oak Grove People, offer remains in great abundance, but of such fragmentary nature and so imbedded in a semi-fossil state in a strong matrix that their recovery and restoration are extremely difficult. The second group is called the Hunting People, and the third the Canalina People. The latter are supposed to have been in full possession of the entire region as early as 1000 A. D., and these are the people found by J. R. Cabrillo when he discovered the islands in 1542. The

matrix in which the Oak Grove remains occur may possibly be contemporaneous with and similar to the dense deposit, containing snail shells, on the top of San Miguel.⁵ On San Miguel, it appears to be definitely older than any of the Indian remains, but this should be expected, as according to Rogers the first two types of inhabitants never reached the islands. It was the Canalina type, presumably coming from the north, who had boats, and colonized the islands.

The recorded birds of San Miguel appear to number only 41 kinds, as against 149 from Santa Cruz. This may be partly due to the fact that Santa Cruz has been more frequently visited by collectors, but in the main it is an expression of the comparative poverty of the island, with a comparatively limited fauna and flora. Mr. Brooks states that the white-headed eagles (*Haliaeetus leucocephalus*) do attack the sheep, but are not nearly so injurious as the ravens (*Corvus corax sinuatus*), which prey on the young lambs as they are born. A form of song-sparrow (*Melospiza melodia micronyx* of Grinnell) is peculiar to San Miguel.

⁵ Mr. Rogers thinks that this is not the case. He agrees with me that this deposit appears to be older than the middens on the island and must antedate the coming of the Indians. Bremner, in his "Geology of San Miguel Island" (published by the Santa Barbara Museum, 1933) has a very good figure of the deposit, marked "Sand cemented with calcium carbonate, preserving the forms of roots and stumps of vegetation destroyed in the past century," but he gives no reasons for assigning such a recent date. The shells in the middens have not disintegrated, and the calcium carbonate is probably derived from minute fragments of shells in the sand.

SANTA BARBARA MUSEUM OF NATURAL HISTORY

OCCASIONAL PAPERS

NUMBER 2

GEOLOGY OF
SAN MIGUEL ISLAND
SANTA BARBARA COUNTY, CALIFORNIA

BY

CARL ST. J. BREMNER

PART OF SAN MIGUEL REPORT
REPLACE IN REPORT

SANTA BARBARA, CALIFORNIA

PUBLISHED BY THE MUSEUM

JUNE 1, 1933

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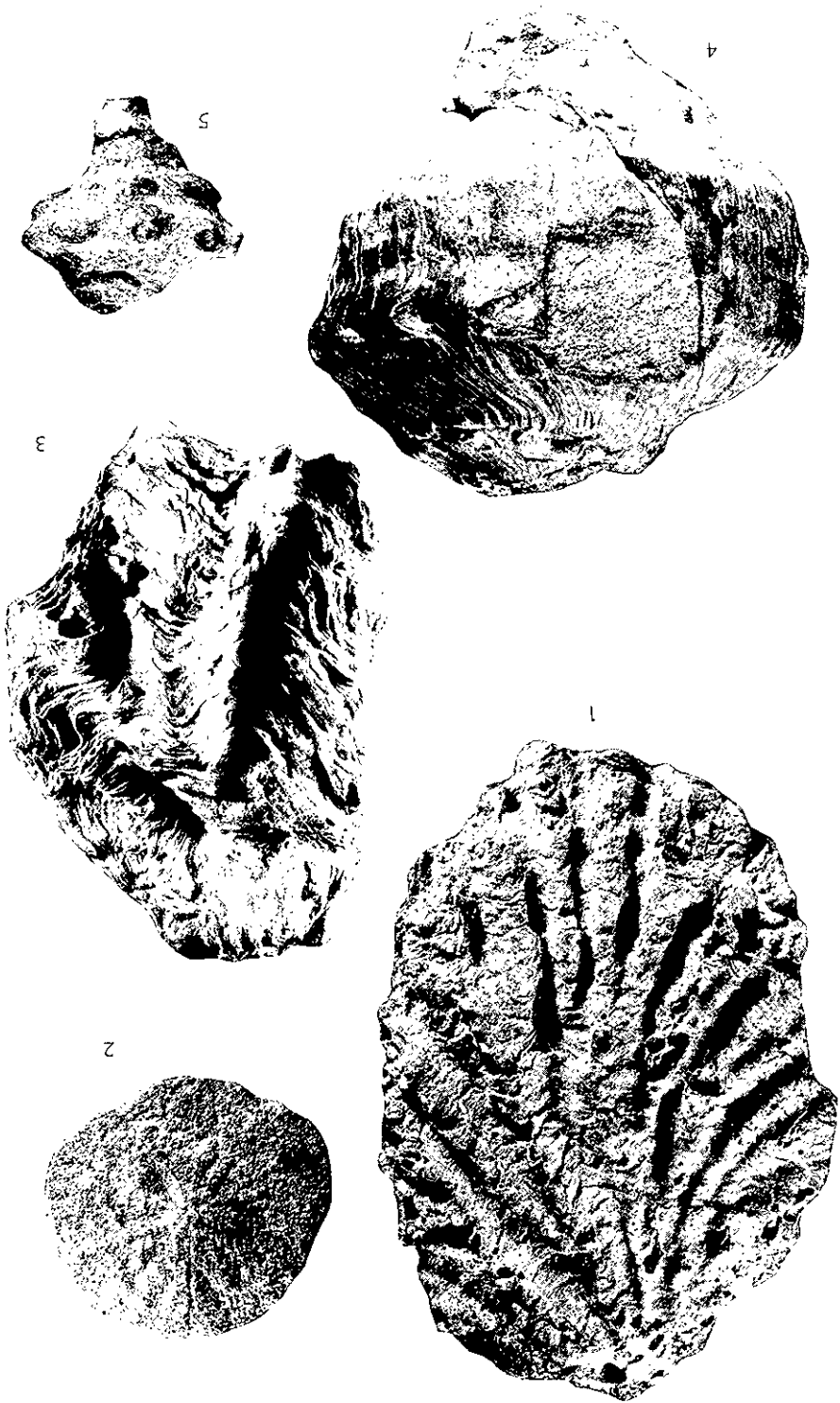
In memory
of
Ralph Hoffmann

Director of the Santa Barbara Museum
of Natural History, who lost his life on
July 21, 1932, from a fall while in pur-
suit of botanical studies on this island.

GEOLOGY OF SAN MIGUEL ISLAND
SANTA BARBARA COUNTY, CALIFORNIA

BY

CARL ST. J. BREMNER



GEOLOGY OF SAN MIGUEL ISLAND SANTA BARBARA COUNTY, CALIFORNIA

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INTRODUCTION

The island of San Miguel is the most westerly of a chain of four islands that form the south side of the Santa Barbara Channel. A distant view of these islands readily suggests that they form a geologic unit, and but little imagination is needed to visualize a continuous range in place of the four islands. In fact, if the land were evenly uplifted a little less than 200 feet the islands would be connected in one unit, but there would still be a strait 10 miles in width and over 700 feet deep between the eastern end of the group and the Santa Monica Mountains, of which they structurally form a part. The greatest depth, over 2100 feet (350 fathoms), of the Santa Barbara Channel lies midway between Santa Rosa Island and the mainland.

The Santa Barbara Channel Islands have until recently, been neglected by geologists, probably because an early map showed them to be composed almost entirely of volcanic rocks. It was not until 1927 that work by Kew² on Santa Rosa Island disclosed the important rôle played by sedimentary rocks in the stratigraphy of the islands. The early report on the Channel Islands by Yates³ refers to Anacapa Island, and that of Goodyear⁴ and Rand⁵ concerned Santa Cruz Island. Kew⁶ described the geology of Santa Rosa Island, and Hertlein,⁷ in a preliminary report deals with the invertebrate paleontology of Santa Rosa and San Miguel islands. A recent paper by the writer⁸ described in detail the geology of Santa Cruz Island.

The writer acknowledges with appreciation the assistance of Mr. R. L. Brooks, the lessee of San Miguel Island; also the technical assistance of Mr. W. H. Corey in the determination of Miocene fossils, and of Messrs. H. L. Driver and W. H. Holman in the determination of foraminifera. Dr. W. S. W. Kew kindly reviewed the manuscript and prepared the plates of fossils. The aerial map of this island was furnished by the Continental Air Map Company, Los Angeles, California.

¹ Published by permission of G. C. Gester, Chief Geologist, Standard Oil Company of California.

² Kew, W. S. W., *A Geologic Sketch of Santa Rosa Island*: Geol. Soc. America Bull., Vol. 38, pp. 645-654, Dec. 1927.

³ Yates, L. G., *Stray Notes on the Geology of the Channel Islands*: Calif. State Min. Bur., 9th An. Rept., pp. 171-174, 1890.

⁴ Goodyear, W. A., *idem*, pp. 139-170, 1890.

⁵ Rand, W. W., *Preliminary Report on the Geology of Santa Cruz Island, Santa Barbara County, California*: Rept. State Miner., California State Min. Bur., Vol. 27, pp. 214-219, April 1931.

⁶ Kew, W. S. W., *op. cit.*

⁷ Hertlein, L. G., *Preliminary Report on the Paleontology of the Channel Islands*: Jour. Paleon., Vol. 2, No. 2, pp. 142-157, June 1928.

⁸ Bremner, C. St. J., *Geology of Santa Cruz Island*: Santa Barbara Mus. Nat. Hist., Occas. Papers No. 1, 1932.

LOCATION AND TOPOGRAPHY

San Miguel Island is the most westerly of the Santa Barbara Channel Islands. It lies about 25 miles south of Point Concepcion and is separated from the most westerly point of Santa Rosa Island by a strait three and one-half miles wide which has a maximum depth of a little more than 100 feet (17 fathoms). The island is roughly triangular in shape, measures about eight miles long and averages about two miles wide, though the maximum width is four miles. The area is about 14,000 acres.

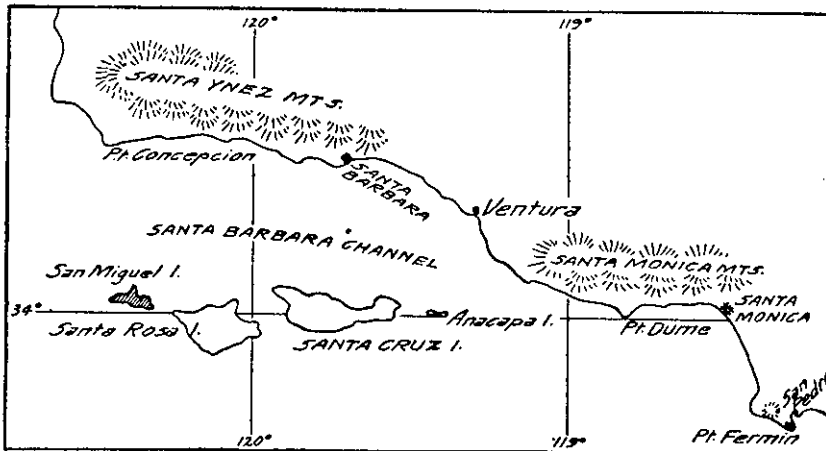


Fig. 1. Map showing the location of the Santa Barbara Channel Islands.

The topography of San Miguel is quite low in contrast to the high rugged peaks and ridges of the other islands of the group and, therefore, it can rarely be seen from the mainland except on a very clear day. Most of the surface of the island is a wave-cut terrace from 400 to 500 feet in elevation, above which rise two rounded hills, one to 850 feet and the other to 861 above sea level. A lower terrace from 20 to 100 feet in elevation borders the south coast, and narrow scattered remnants of the same terrace can be seen on the northwest shore. The island has been eroded but little since the terraces were cut. Two streams heading on the flanks of Green Mountain and flowing northward and southward respectively, have cut deep narrow canyons in the sandstones that underlie the terrace deposits. Another steep narrow canyon heads on the terrace near the ranch house and drains northward to Cuyler Harbor. Willow Canyon, which is in the southeast corner of the island and drains eastward, has cut but a narrow shallow trench through the terrace sands and into the underlying rocks. This stream is prevented from deepening its channel

rapidly by the ridge of hard andesite agglomerate that it crosses near its mouth. The embayment of Cuyler Harbor has been formed where a fault offset the hard ridge of volcanic rocks that forms the northeast coast, and allowed the waves to attack the softer rocks behind.

The island when first visited by Europeans, was covered with a dense growth of brush, such as sumac and manzanita. Cattle and sheep were placed on the island about fifty years ago and allowed to multiply without restriction, with the result that much of the vegetation was destroyed. The strong prevailing winds from the northwest then formed dunes of drifting sand that now cover most of the surface. The drifting sand is gradually filling up Cuyler Harbor to the extent that anchorage is impaired by the huge swells that break inside the harbor during the winter season. It seems very probable that this condition did not exist when Juan Rodriguez Cabrillo, on the first voyage of discovery into these waters, wintered his boats there in 1542.

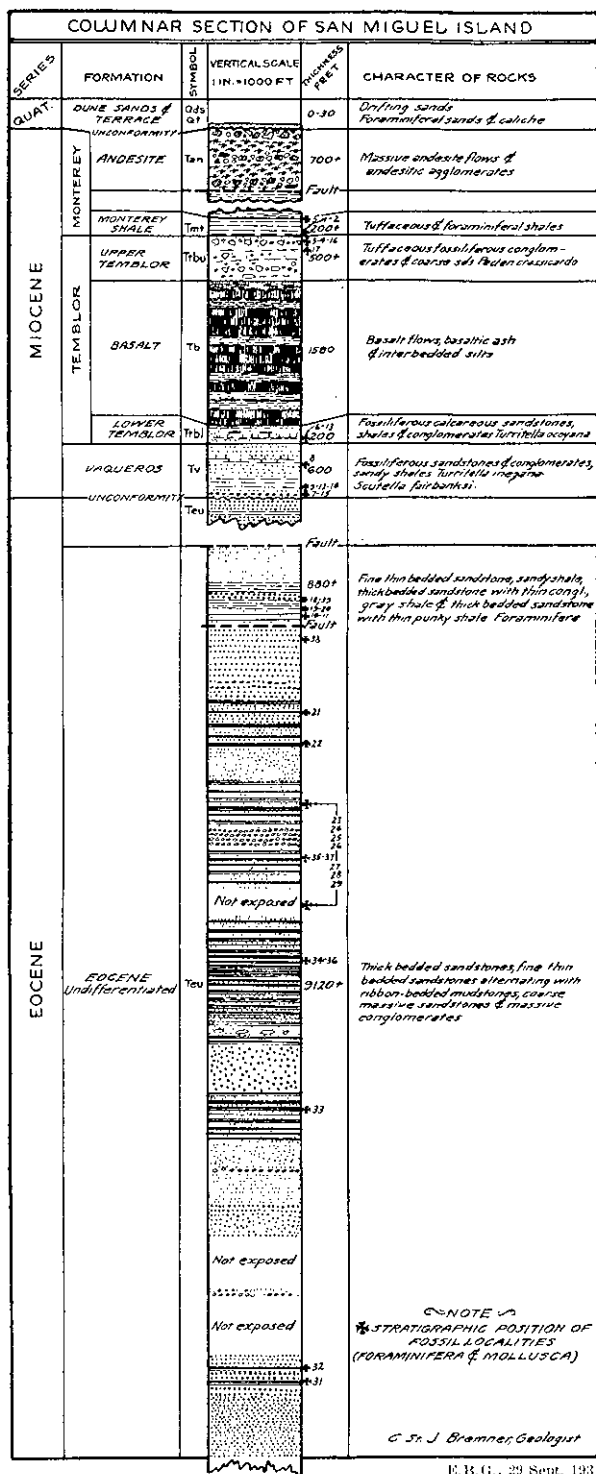
STRATIGRAPHY

The stratigraphic section of San Miguel Island is composed of Tertiary rocks with the exception of the Pleistocene terrace deposits. More than 10,000 feet of Eocene marine sediments are represented, 1500 feet of Miocene marine sediments and over 2300 feet of Miocene volcanic rocks. The Miocene rocks are confined to the eastern part of the island and the Eocene to the western part.

EOCENE SERIES (UNDIFFERENTIATED)

The oldest rocks on the island are those referred to the Eocene series and crop out continuously along the shore from Crook Point on the south coast, westward to Point Bennett and thence eastward on the northeast coast almost to Harris Point. They are also seen on the surface at Green Mountain and in a faulted block on the shore of Cuyler Harbor.

The section is composed essentially of massive marine sandstones which alternate with zones of thin-bedded sandstones and mudstones. Some thin beds of fine conglomerate and one thick massive bed of coarse conglomerate occur with the sandstones. The sandstones are either thick-bedded or massively developed, vary in grain from medium to coarse and even assume the character of grits, which in places are finely conglomeratic. Large spherical concretions weather out of the sandstones exposed on the south coast. The color of the sandstones is light to dark gray, weathering to buff. Sandstones comprise about 60 per cent of the entire Eocene strata and occur mostly at the bottom and top of the section.



E.R.G., 29 Sept. 1931

Fig. 2. Columnar section of rocks exposed on San Miguel Island.

The middle part of the section consists mainly of fine-grained, thin-bedded sandstones and mudstones, but thin beds of mudstones are also intercalated with the massive sandstones. The mudstones are



Part of San Miguel Island viewed from Cuyler Harbor, showing the terraced surface of the island and the steeply-dipping Eocene strata on the shore.



Massive Eocene sandstones at Point Bennett, the oldest beds exposed on the island.

dark gray in color and occur usually as laminae about one-half inch thick. They alternate with very fine, light-gray sandstone, giving the section a distinct banded appearance. In other places where the sandstone laminae are absent, the mudstones are uniformly dark and massive.



Massive Eocene conglomerate on the northwest coast
opposite Castle Rock.



Sand dunes on the upper terrace two miles northwest
of Cardwell Point.



Thin-bedded Eocene sandstones on the south coast $1\frac{1}{2}$
miles east of Point Bennett.



Basalt faulted against Monterey shale on the south
coast near Cardwell Point.

The conglomerates in the lower part of the section occur in thin beds or lenses and, in general, the pebbles are small, about one-half inch in diameter, and are well-rounded and polished. They are composed of hard dark-colored aphanitic rocks such as chert and chalcedony together with some light-colored quartz and quartzite. On the northwest shore of the island there is a bed of very coarse massive conglomerate that, due to faulting, is repeated in the exposed section three times. This bed is from 200 to 220 feet in thickness and is composed of rounded and polished boulders varying in diameter from three inches up to one foot. These boulders consist of diorite and other granitic types, red and gray felsite porphyry, and quartz. The lithology of this conglomerate is similar to the massive conglomerate that occurs in the Domengine formation (upper Eocene) of Santa Cruz Island.

If these two conglomerates can be correlated, then the 2200 feet of thin-bedded sandstones and mudstones under the conglomerate on San Miguel Island would correspond with the Domengine lower shale member and lower sandstone member of Santa Cruz Island, and the massive sandstone below the mudstones of San Miguel would correspond to the Martinez formation of Santa Cruz. The foraminifera in samples collected from the mudstones below the conglomerate on the northwest coast of San Miguel and from approximately the same horizon on the south coast, have affinities, according to H. L. Driver and W. H. Holman, with the foraminiferal faunas of the Domengine lower shale member of Santa Cruz Island.

The uppermost part of the Eocene section occurs in a block between two faults and is exposed on the shore of Cuyler Harbor. About 880 feet of strata are exposed which consist of fine thin-bedded sandstones, gray sandy shale and light-gray clay shale that breaks with a conchoidal fracture, and thick sandstone beds separated by very thin grayish bands of punky shale. The shale beds in these strata contain an abundance of foraminifera. A thin bed of conglomerate in thick-bedded sandstone occurs between the two shale zones and contains finely comminuted fragments of oyster shells and other molluscs, but no other megascopic fossils were found. The foraminifera in the shale beds are similar to those in the upper shale member of the Domengine of Santa Cruz Island.

The entire Eocene section shows a striking paucity of molluscan fossils. A fragment of *Solen* found in sandstone opposite Castle Rock, and the comminuted shells in the conglomerate on the shore of Cuyler Harbor, are the only Eocene molluscs noted. Foraminifera are present in most of the argillaceous beds though not abundant, and the arenaceous forms predominate over the calcareous types.

The following is the stratigraphic section of Eocene rocks exposed on San Miguel Island:

SECTION AT EAST END OF CUYLER HARBOR

	Feet
(fault)	
Fine thin-bedded sandstone.....	410
Sandy shale	110
Thick-bedded medium-grained sandstone with thin bed of fine con- glomerate containing comminuted shells.....	80
Light-gray shale	110
Thick-bedded sandstone with thin beds of grayish punky shale.....	170
(fault)	Sub-total
	880

SECTION ALONG NORTHWEST COAST

(fault)	
Thick sandstones with lenses of conglomerate at bottom.....	690
Not exposed (thin sandstones and mudstones?).....	700
Massive coarse sandstones and grits, finely conglomeratic, with a few six-inch beds of mudstone.....	320
Fine thin-bedded sandstones and mudstones.....	240
Thick sandstone.....	10
Thin gray sandstone and mudstone.....	250
Very massive coarse conglomerate with polished boulders of diorite and felsite porphyry.....	430
Massive sandstone.....	20
Not exposed (thin-bedded sandstone and mudstone?).....	310
Thick sandstone and thin mudstone.....	120
Thin-bedded sandstone and mudstone.....	230
Laminated mudstone.....	350
Laminated sandstone and mudstone	530
Massive concretionary sandstone.....	70
Thin-bedded sandstone and mudstone.....	110
Massive sandstone	530
Thin-bedded sandstone and mudstone.....	520
Massive sandstone with fine conglomerate at bottom.....	360
Thin-bedded sandstone	350
Massive sandstone.....	350
Not exposed	570
Coarse sandstone and conglomerate.....	100
Not exposed	640
Thick sandstone with thin bands of mudstone.....	410
Massive sandstone.....	710
(Base not exposed).....	
	Sub-total ...
	8,920
	Total ...
	9,800

MIOCENE SERIES

VAQUEROS FORMATION (LOWER MIOCENE)

The oldest sediments of the Miocene series belong to the Vaqueros formation, and form a continuous sequence with the overlying Temblor formation, from which it is separated only on paleontologic evidence.

The Vaqueros formation rests upon the underlying Eocene rocks with a slight angular unconformity. This unconformity is exposed for a distance of 200 yards in the short canyons that cut the upper bluff opposite Crook Point on the south coast. The actual contact shows a gentle undulating surface of erosion in the massive Eocene sandstones upon which the fine, silty conglomerate of the Vaqueros was deposited. The discordance in dip is very little, probably under five degrees at this point, but the trace of the contact perceptibly crosses the strike of the older rocks. Over 800 feet of the uppermost Eocene strata that are exposed at Cuyler Harbor have been apparently overlapped, as they do not appear on the south coast.

The Vaqueros formation measures 600 feet in thickness and consists of interbedded thin-bedded fine conglomerates, sandstones, and shale. The conglomerates are composed of small pebbles of quartz, hard, dark-colored chert and other aphanitic rocks, well-rounded, polished, and not exceeding one-half inch in diameter. The beds range from a few inches up to four feet in thickness and in places are fossiliferous. The sandstones are medium to fine-grained, weather brownish in color, and in places are calcareous or contain very thin limestone partings. The calcareous beds are also fossiliferous. The shales are sandy or silty, weather olive-gray, and are interbedded with the sandstones.

The following section is exposed in the upper part of the canyon that empties at Crook Point and represents the lowermost beds of the Vaqueros formation:

	<i>Feet</i>
Sandy shale with thin calcareous beds carrying <i>Spondylus perrini</i> and <i>Pecten miguelensis</i>	40
Medium-grained brown sandstone	20
Fine conglomerate with well-rounded pebbles	4
Sandy shale calcareous in places, carrying <i>Scutella fairbanksi</i> cf. <i>santanensis</i> ..	35
Fine muddy sandstone, conglomeratic at base	25

Total 124

unconformity

Massive sandstone and thin mudstone, Eocene.

Fossils from beds referred to the Vaqueros formation. (See map Pl. 2 for localities.)

	7	8	9	12	14	15
Echinoidea						
<i>Scutella fairbanksi</i> cf. <i>santanensis</i> Kew	x		x			x
<i>Scutella</i> cf. <i>vaquerosensis</i> Kew				x		
Pelecypoda						
<i>Pecten miguelensis</i> Arnold s.s.	x					
<i>Pecten miguelensis</i> (Arnold) <i>submiguelensis</i> Loel & Corey						x

	7	8	9	12	14	15
<i>Spisula catilliformis</i> (Pack).....		x				
<i>Spondylus perrini</i> Wiedey.....					x	
<i>Tivela?</i> cf. <i>inezana</i> Conrad.....						x
Gastropoda						
<i>Natica</i> cf. <i>reclusiana</i> Deshayes.....		x				
<i>Rapana vaquerosensis</i> Arnold.....	x					
<i>Rapana vaquerosensis imperialis</i> (Hertlein & Jordan).....		x				
<i>Turritella inezana</i> Conrad s.s.....			x	x		
<i>Turritella temblorensis</i> Wiedey.....		x				
<i>Turritella tritschi</i> Hertlein.....				x		
Bryozoa						
sp.?		x				
Arthropoda						
<i>Balanus</i> sp.		x				

The forms *Scutella fairbanksi* cf. *santanensis* Kew, *Scutella vaquerosensis* Kew, and *Turritella inezana* Conrad are diagnostic for the Vaqueros formation, but *Pecten miguelensis* Arnold, *Rapana vaquerosensis* Arnold, and *Turritella tritschi* Hertlein are also found in what Corey regards as a transition zone between the Vaqueros and the true Temblor faunas.

TEMBLOR FORMATION (MIDDLE MIOCENE)

The rocks comprising the Temblor formation may be divided into three parts, (1) a lower member of marine elastics, (2) a middle member of volcanics, and (3) an upper member of marine elastics containing tuff.

Fossils from beds referred to the Temblor formation. (See map Pl. 2 for localities.)

	Lower Member		Upper Member			
	6	13	3	4	16	17
Pelecypoda						
<i>Arca</i> n. sp.?.....	x	x				
<i>Ostrea vespertina</i> Conrad.....	x					
<i>Ostrea</i> sp.					x	
<i>Pecten</i> cf. <i>andersoni</i> Arnold.....						x
<i>Pecten crassicaudo</i> Conrad.....	x		x	x	x	
<i>Pecten miguelensis</i> Arnold s.s.....		x				
Gastropoda						
<i>Turritella ocoyana</i> Conrad.....	x	x				
<i>Turritella ocoyana</i> (Conrad) bösei (Hertlein & Jordan)	x	x				
Arthropoda						
<i>Balanus</i> sp.		x				

The sandstone bed underlying the oyster beds that contain *Turritella ocoyana* Conrad was arbitrarily chosen for the division between the Vaqueros and Temblor formations, although this bed might be in the Vaqueros-Temblor transition zone and not true Temblor. The upper member which contains *Pecten crassiscardo* Conrad and *Pecten andersoni* Arnold is probably true Temblor.

Lower member.—The lower member of the Temblor formation represents a continuation of the Vaqueros sedimentation under the same conditions, and the lithology is, therefore, essentially the same. The beds are exposed on the south coast east of Crook Point, and in the bluff between the lower and upper terraces. They consist of thin fine conglomerates, calcareous sandstones, and olive-gray shales. The member is about 200 feet thick and like the Vaqueros, is fossiliferous.

INCOMPLETE SECTION OF LOWER MEMBER EXPOSED ALONG SOUTH COAST EAST OF CROOK POINT

	<i>Feet</i>
Platy tuffaceous shale (in basalt member).....	200(?)
Bed composed mainly of <i>Ostrea vespertina</i>	2
Sandstone with calcareous nodules.....	15
Brown silty sand.....	15
Calcareous sandstone with <i>Turritella ocoyana</i>	2
Sandy clay with abundance of <i>Ostrea vespertina</i>	10
Sandy clay with calcareous nodules.....	4
Olive-gray silty shale.....	2
Oyster bed.....	2
Hard brown calcareous sandstone with calcareous fucoids.....	20

Basalt member.—The basalt member comprises a series of volcanic and elastic rocks, 1580 feet in thickness, that overlies the lower member of the Temblor formation. It is apparently conformable with the lower member but at one locality it seems to overlap the Vaqueros formation. The relationships at this point, however, are not clear. This overlap might be due to a slight unconformity between the basalt member and the lower member of the Temblor. This possibility is supported by Hertlein's⁹ discovery of a worn fragment of *Turritella incana* in conglomerate interbedded in the andesitic series that overlies the Monterey shale.

The basalt member consists of an alternation of dark-brown silts, basaltic ash and tuff, with thin flows of basalt in the upper part. The brown silts were evidently derived from the contemporaneous erosion of the volcanic material. The relation of the basalt with the associated brown silts strongly suggests that much of the basaltic material was either extruded under the sea in shallow water, or were flows extending from the land into the sea. These beds are exposed on the beach,

⁹ Verbal communication.

in the upper bluff in the southeast corner of the island, and also near Cuyler Harbor where they are faulted against the Eocene rocks.

Upper member.—The upper member of the Temblor formation consists of tuffaceous conglomerates and sandstones with much fragmental volcanic material. These beds are conformable and gradational with the underlying basaltic member. The fragmental volcanic material, however, is more acidic than the basalt. The beds are exposed only in Willow Canyon and its tributaries. This member measures 500 feet in thickness but it is probable that the complete section is not exposed due to faulting.

Fossils were found at three localities with *Pecten crasscardo* Conrad the most common, and *Pecten andersoni* Arnold occurring at one locality. The member was referred to the Temblor formation on the occurrence of *Pecten andersoni*.

MONTEREY FORMATION (UPPER MIOCENE)

Shale member.—The Monterey shale is the youngest sedimentary member of the Miocene that occurs on the island, and lies conformably upon the upper member of the Temblor formation. It is exposed in Willow Canyon in normal contact with the tuffaceous conglomerate, and also on the south coast near Cardwell Point, faulted against the basalt.

The beds consist of soft yellowish tuffaceous to punky thin-bedded shale, with some fine soft sandstones in the lower part. *Pecten* cf. *peckhami* Gabb was found at two localities in Willow Canyon. The abundant foraminiferal fauna (localities 1, 2, and 5) was referred by H. L. Driver and W. H. Holman to the Monterey (uppermost part of *Valvulineria californica* zone). The shale exposure in Willow Canyon lies in a narrow syncline along a fault. Only 200 feet of beds are visible which thickness undoubtedly represents only a part of the complete section.

Andesite member.—A series of volcanic rocks that form bold cliffs on the northeast shore of the island are the youngest of the Miocene rocks that are found on the island. These consist of very hard coarse reddish-colored andesitic agglomerates with grayish-yellow and grayish-white andesites and felsites. They are so massive that their attitude is very difficult to determine, but in general the dip appears to be southwestwardly toward the older formations against which they are undoubtedly faulted. The existence and location of the fault cannot be determined accurately because the contact of the andesite with all other rocks is covered by sand dunes. The exposed part of the andesitic member is only 700 feet thick, but the complete section is probably much greater.

The sequence of the older Miocene formations is readily established by a completely exposed section, so that the stratigraphic position of the andesite above the Monterey shale can be logically inferred. It is impossible to determine, however, if any other rocks lie between them.

A part of the upper Miocene section on Santa Rosa Island consists of a thin section of Monterey shale followed by a thick series of massive sandstones which in their upper part contain beds of tuff and andesitic agglomerate. These agglomerates appear to be the correlative of the andesitic series of San Miguel. The sandstone series with the associated agglomerates on Santa Rosa, have been referred to the Santa Margarita formation by Kew.¹⁰ Foraminifera recently collected from a bed of shale intercalated with the tuffs, were determined by H. L. Driver to belong in the upper part of the Monterey. The andesitic member of San Miguel Island has, on this evidence, been included in the Monterey, but it is logical to assume that it might include a part of the Santa Margarita formation (upper Miocene).

QUATERNARY SERIES

TERRACE DEPOSITS (PLEISTOCENE)

Deposits of unconsolidated sand from 10 feet to 30 feet in thickness cover the wave-cut terraces that extend over most of the area of the island. The sands on the upper terrace contain foraminifera, shark teeth, whale bones, and comminuted shells. These beds might be in part the correlative of the beds of coquina at the east end of Santa Cruz Island which are referred to the San Pedro formation. Irregular patches of soft white porous caliche, derived from the leaching of the calcium carbonate of shell fragments, are found on the surface of the terrace.

SAND DUNES (RECENT)

Sand dunes derived from the erosion of the terrace deposits and from the beaches on the northwest shore, are swept across the island by the strong prevailing wind from the northwest (see Pl. 1). The wind, blowing down the heads of the stream courses at the top of the upper bluff on the south side of the island, forms veritable rivers of sand that flow down the slope and across the lower terrace to the water's edge.

The preëxistant vegetation that was killed and covered by the dunes, apparently left holes that were filled by sand cemented with lime, thus roughly preserving the original forms. On removal of the dunes by the wind, curious white pipes are left standing above the surface.

¹⁰ Kew, W. S. W., *op. cit.*

INTRUSIVE ROCKS

Intrusive rocks are quite rare on the island. Two dikes of basalt not over 30 feet wide, have intruded the Eocene rocks on the north-



View southwestward toward Crook Point, showing bedded silts in the Miocene basalt member, the lower wave-cut terrace, and the sand blown from the upper terrace down upon the lower terrace and out to sea.



Sand cemented with calcium carbonate, preserving the forms of roots and stumps of vegetation destroyed in the past century, one mile northwest of ranch house.

west coast. A small outcrop of dark perlite with abundant spherules, which occurs just below the Vaqueros contact on the south coast, also appears to be intrusive. Castle Rock, the sharp-pointed rock 145 feet high that lies one-half mile off the northwest coast, viewed through

binoculars, shows the massive character and jointing more or less common to the felsite intrusives, and appears to be a volcanic plug. The rock probably belongs to the same period of volcanic activity as the andesitic extrusives.

STRATIGRAPHIC CORRELATION OF THE SANTA BARBARA CHANNEL ISLANDS

The correlation of the various stratigraphic units of the channel islands, based upon lithologic similarity and fauna, is relatively certain for the Miocene, but for the Eocene, only a more general correla-

Stratigraphic Correlation of the Santa Barbara Channel Islands

	ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL
	Terrace	Terrace	Terrace	Terrace
Pleistocene		<i>San Pedro?</i>		<i>San Pedro?</i>
			Rhyolitic and andesitic ash and agglomerate, thin sandstone with schist fragments	Andesite and andesitic agglomerate
			Massive sandstone	
		<i>Silicious shale</i>	<i>Silicious shale and sandstone</i>	<i>Silicious shale</i>
Miocene				<i>Tuffaceous conglomerate</i>
	Basalt	Andesite Basalt	Basaltic muds and ash	Basaltic muds and ash
		Rhyolite		
		Schist conglomerate		
		<i>Temblor</i>	<i>Temblor</i>	<i>Temblor</i>
			<i>Vaqueros</i>	<i>Vaqueros</i>
		<i>Domengine</i>	Eocene	Eocene
Eocene		<i>Martinez</i>	(undifferentiated)	(undifferentiated)
Jurassic? and Triassic?		Diorite and Metamorphics		

(Fossiliferous beds in italics)

tion can be made. The Eocene of Santa Cruz Island contains a diagnostic fauna of both mollusca and foraminifera, but on Santa Rosa and San Miguel islands, only foraminifera were found in the strata below the Miocene. The shales and mudstones in the upper and middle part of the San Miguel section contain foraminifera that are similar to the faunas of the upper shale and lower shale members of the Domengine, respective, of Santa Cruz. This correlation is strengthened by the presence of a characteristic massive conglomerate in both sections. Foraminifera obtained from the lower part of the shales in the Wreck Canyon section on Santa Rosa, show affinities with the fauna of the Domengine upper shale member of Santa Cruz. The massive sandstones at South Point on Santa Rosa Island, called Chico (upper Cretaceous) by Kew, have the same characteristics as those at the west end of San Miguel. These sandstones are now known to be a part of the Domengine formation.

Anacapa Island, although not visited by the writer, is composed of dark massive rocks that dip northward about 20 degrees. These are identical in appearance with the basalts on the eastern end of Santa Cruz, and are undoubtedly continuous with them. These rocks were briefly described in a short paper by Yates¹¹ in 1890.

STRUCTURE

General features.—The island of San Miguel marks approximately the eastern end of a range of mountains that extends westerly from the Santa Monica Mountains of the mainland. The Santa Barbara Channel Islands are characterized by a westerly trend of their structural lines, parallel with the Santa Ynez Mountains, in contrast with the north-westerly structural trend of the mainland north of Point Concepcion. San Miguel, however, shows a stronger influence of the northwesterly trend in contrast with the other islands.

The entire section of strata on San Miguel, from the west end to the northeast coast, strikes uniformly from N. 40° W. to N. 60° W., and dips homoclinally northeastward from 45 to 20 degrees, with the exception of the volcanic rocks on the northeast coast, which, due to faulting, dip gently southwestward. No folds occur other than the small syncline developed between two faults near the east end of the island, in which lies the Monterey shale.

Faults.—Faults are fairly numerous and fall mainly into two systems that strike approximately N. 40° W. and N. 70° W. respectively. A few small faults near the west end of the island strike northeasterly. The two largest faults were named by the writer for convenience, the Cardwell fault and the Simonton fault.

¹¹ Yates, L. G., op. cit.

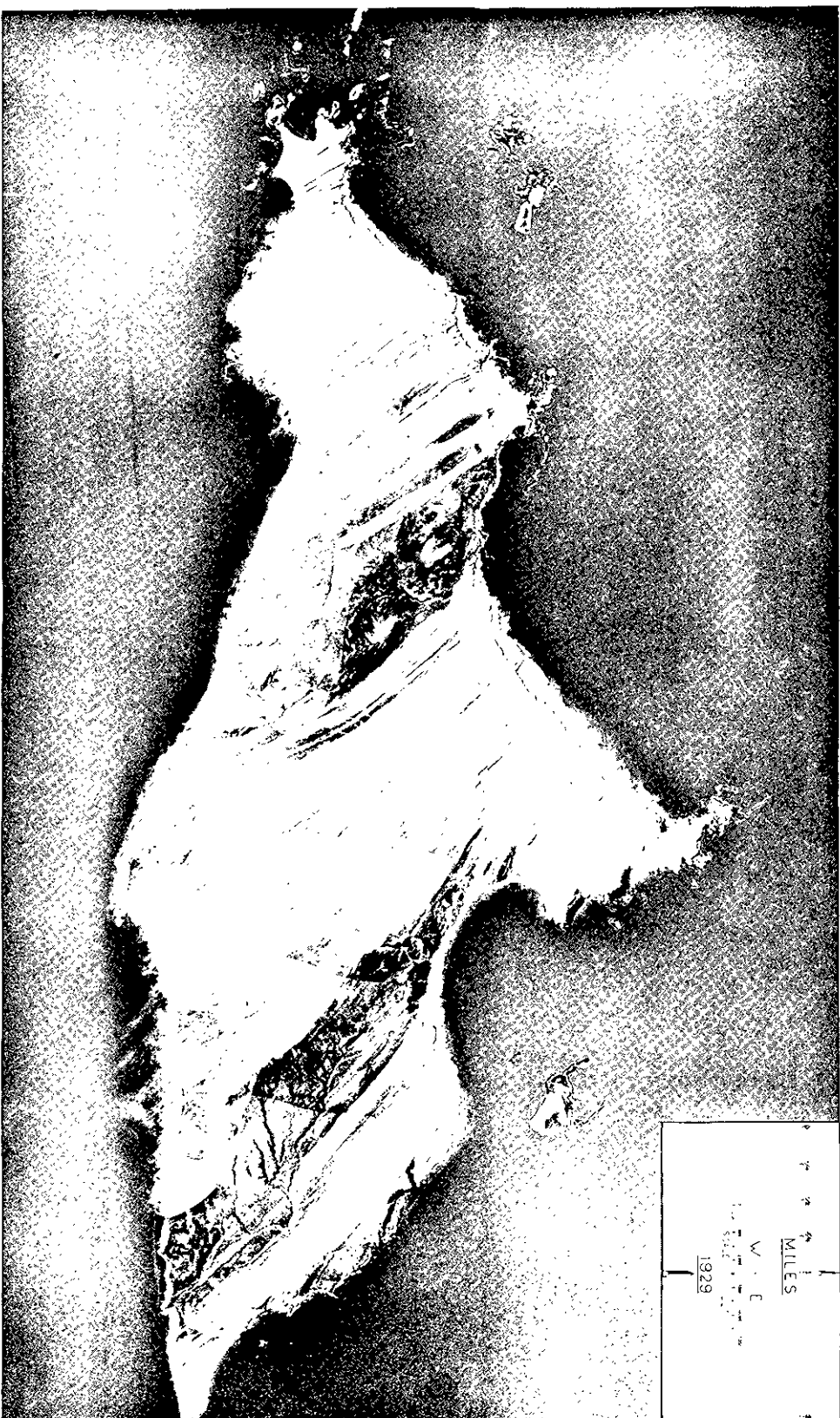
The Cardwell fault forms the southwestern contact of the andesitic series and the older sedimentary formations from Cardwell Point to Harris Point. The location as shown on the geological map is approximate, because the fault contact is everywhere covered by sand. The existence of a fault at this place is the only logical explanation for the stratigraphic and structural relations that occur. The movement which dropped the andesite on the northeast side of the fault, must have been considerable, as some of the upper Temblor conglomerates and most of the Monterey shale have been cut out, as well as any additional thickness of the andesitic series that might be present beneath the exposed 700 feet. The minimum throw of the fault, therefore, is 1400 feet. An offset in the Cardwell fault appears to have been responsible for the development of Cuyler Harbor.

The Simonton fault branches from the Cardwell fault, passes south of Cuyler Harbor and extends into the sea at the west end of Simon-ton Cove. The fault plane which is visible in the canyon on the road from the harbor to the ranch house, dips 80 degrees south, and the basaltic series is downthrown on the south side of the fault against the upper Eocene strata. The minimum stratigraphic throw of the fault at this point is 1700 feet. The trace of this fault westward is hidden by the cover of wind-blown sand, but its location on the north-west shore can be determined by the duplication of the beds in the section. The duplication or stratigraphic separation on the coast is 2200 feet, which is equivalent to a throw of 3800 feet on the fault.

EXPLANATION OF PLATE 2

TYPICAL FOSSILS OF SAN MIGUEL ISLAND

- FIG. 1. *Ostrea vespertina* (Conrad) var. *loeli* (Hertlein) Loel and Corey. Referred to as *Ostrea weideyi* by Hertlein in Journ. Pal., Vol. II, No. 2, June, 1928. Specimen No. 32.1 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 6 (Bremner) San Miguel Island; lower member of Temblor formation. Altitude of specimen 94 mm.
- FIG. 2. *Scutella fairbanksi* Arnold cf. *santaensis* Kew, Specimen No. 32.2 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 7 (Bremner) San Miguel Island; Vaqueros formation. Width of specimen 37.3 mm.
- FIG. 3. *Ostrea vespertina* (Conrad) var. *loeli* (Hertlein) Loel and Corey. Specimen No. 32.3 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 6 (Bremner) San Miguel Island; lower member of Temblor formation. Altitude of specimen 85 mm.
- FIG. 4. *Rapana vaquerosensis* (Arnold) var. *imperialis* (Hertlein and Jordan) Loel and Corey. Specimen No. 32.4 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 7 (Bremner) San Miguel Island; Vaqueros formation. Altitude of specimen 74 mm.
- FIG. 5. *Rapana vaquerosensis* Arnold. Specimen No. 32.5 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 7 (Bremner) San Miguel Island; Vaqueros formation. Altitude of specimen 39 mm.

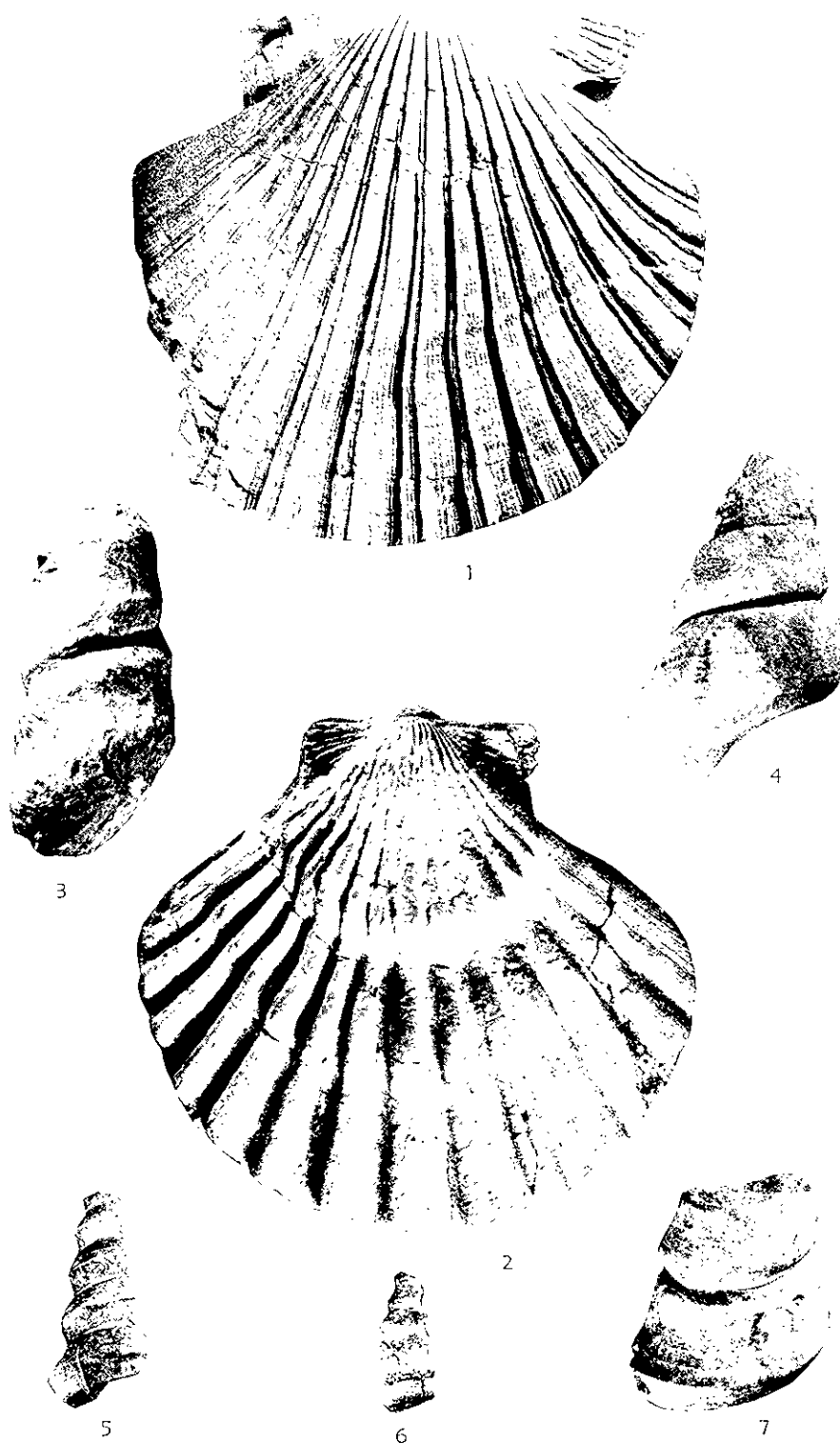


SAN MIGUEL ISLAND
SANTA BARBARA COUNTY
CALIFORNIA

EXPLANATION OF PLATE 3

TYPICAL FOSSILS OF SAN MIGUEL ISLAND

- FIG. 1. *Pecten miguelensis* Arnold s.s. Specimen No. 32.6 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 16 (Bremner) San Miguel Island; upper member of Temblor formation. Altitude of specimen 120 mm.
- FIG. 2. *Pecten crassicardo* Conrad. Specimen No. 32.7 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 16 (Bremner) San Miguel Island; upper member Temblor formation. Altitude of specimen 75 mm.
- FIG. 3. *Turritella ineziana* Conrad s.s. Specimen No. 32.8 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 9 (Bremner) San Miguel Island; Vaqueros formation.
- FIG. 4. *Turritella ocoyana* Conrad s.s. Specimen No. 32.9 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 6 (Bremner) San Miguel Island; lower member of Temblor formation.
- FIG. 5. *Turritella temblorensis* Weidey. Specimen No. 32.10 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 8 (Bremner) San Miguel Island; Vaqueros formation.
- FIG. 6. *Turritella tritschi* Hertlein. Specimen No. 32.11 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 12 (Bremner) San Miguel Island; Vaqueros formation.
- FIG. 7. *Turritella ocoyana* (Conrad) var. *bösei* (Hertlein and Jordan) Loel and Corey. Specimen No. 32.12 (S.B.M.N.H. Coll. Pal. Molusc.) from loc. 13 (Bremner) San Miguel Island; lower member of Temblor formation.



GEOLOGIC MAP

SAN MIGUEL ISLAND

SANTA BARBARA COUNTY

CALIFORNIA

0 1/4 1/2 3/4 1

MILE

C. ST. J. BREMNER

LEGEND

Qds	Dune sands	Tu	Basalt
Tl	Terrace, lower	Tb	Tembler, upper
Tu	Terrace, upper	Tb	Tembler, lower
Tan	Andesite	Tu	Vaqueros
Tmt	Monterey	Tu	UNCONFORMITY
		Tu	Eocene, undiff.

* Fossil localities (Mollusca & foraminifera)

--- Faults

