

traffics between the West and the East. There will in all probability be enough of it for all the four highways—if ever Panama is added to the existing triumvirate. Competition to some extent, however, must arise, although, if intelligently managed, as they are practically certain to be, the various routes may even be found to aid one another. Anyhow, some years must elapse before Panama has to be seriously reckoned with, and in that time all the three Mexican routes will have become thoroughly established and be handling as much business as they can conveniently carry.

What this triple provision of transcontinental and inter-oceanic traffic means to the Mexican Republic can only be surmised. The actual results may, and I believe will, astonish even the most optimistic. To say nothing of the increase in the Government's revenues, the opening up of the West Coast States of Sinaloa, Colima, and the East Coast route through Veracruz and Oaxaca, means the addition of hundreds of millions of dollars to the value of the lands on the Pacific and Gulf slopes. With or without Panama, these must become the recognised commercial highways of the world.

## CHAPTER XXXV

PORT OF MANZANILLO : Government improvements and expenditure upon harbours—Colonel E. K. Smoot's contract—Heavy engineering work—Simple plan cleverly carried out—Massive masonry—Smoot's work at Galveston—Constructional excellence—Breakwater and sea-walls—Prevention against heavy sea damage—Coaling station—Permanent and useful undertaking—Scenic beauty of Manzanillo Bay—Perfect safety for vessels.

In actual point of population, if not in geographical dimensions, the Republic of Mexico has probably spent more money in opening new, or perfecting existing, ports, than any country in the world. It has always been part of the policy of President Diaz to provide the necessary funds for this important form of enterprise, and, as evidence of the energy with which it is pursued, I may say that quite recently the Mexican Government undertook to expend no less than \$65,000,000 (Mex.) on new port works, this being in addition to what had already been expended, and which may be put at another \$50,000,000 or \$60,000,000. Among the more important undertakings of this character are the port works of Manzanillo.

Manzanillo is a great natural harbour, but, in order to render it suitable for the accommodation of ships, and afford them shelter and protection during storms, it was necessary to enclose the harbour more securely, constructing a breakwater as an extension of a natural promontory, sheltering the harbour on the west side; while, to provide safety during loading and unloading cargoes, extensive sea-walls had to be built within the tranquil area of the harbour. The Government and the contractor, Colonel Edgar K. Smoot, were at first faced with great difficulties, owing to the unhealthy condition and atmosphere of Manzanillo, which is mid-tropically

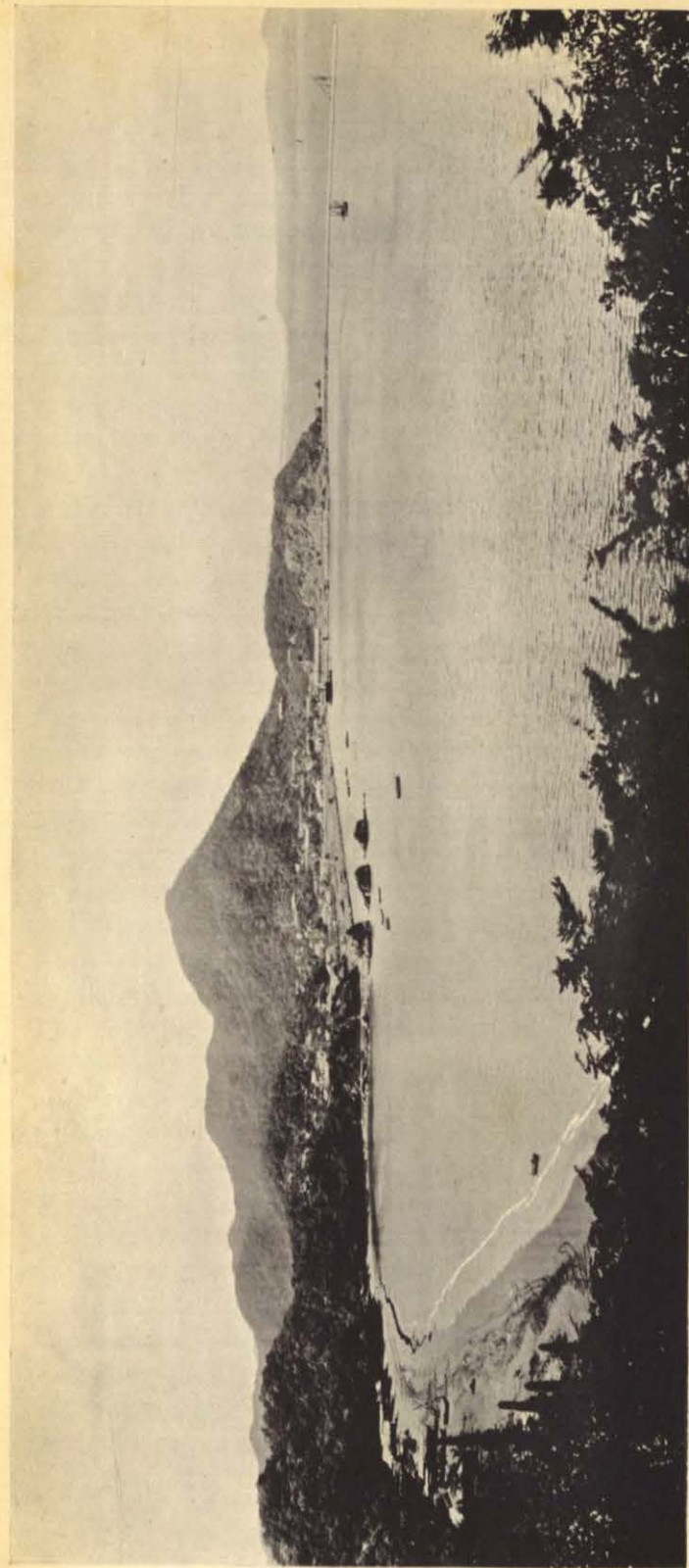


situated. The Laguna de Cuyutlán, whose shallow waters reach to the inhabited portions of Manzanillo, border it on the south and east, being separated by an abrupt range of hills from the Estero de San Pedrito, which, with the Laguna de Cacaluta, completely surrounds the town within an arc of 180 degrees, and in the direction from which the prevailing winds blow across the port.

The waters of the Laguna have no connection with those of the ocean, except, perhaps, through the medium of occasional overflows, resulting from the prevalence of storm-tides in the ocean. During the dry season, these waters evaporate rapidly, exposing the bottoms and margins of the laguna to a depth of more than one metre below its flood-line level. The heat of a tropical sun beating upon these areas of saturated and decomposing animal and vegetable matter have in the past given rise to an intensity of pestilential effluvia which, poisoning the atmosphere by the extent of surface over which it is generated, has been borne through the whole locality by every wind and breeze which blows from southwest to east and north-east. Therefore, as a preliminary measure, sanitary works had to be undertaken, and these necessarily occupied a considerable time.

Colonel Smoot's plan was simple and effective for dealing with this dangerous source of pollution. He decided to flood the pestilential marshes with the fresh water from the river Arenas, and with tide-water from the sea. In order to do this, he had to construct a dam and a canal, the former being known as Tepalcates and the latter as Ventanas. The canal introduces and discharges about one-fourteenth of the volume of water impounded in the lagunas during the rise and fall of each tide, while the dam divides the larger lagoon for the purpose of protecting the salt industry of Cuyutlán, which is situated on its western shores. Now the condition is an enormous improvement upon what it used to be, and with the construction of sewerage works in the Port, and a modern water-supply, all requisite conditions for health will have been secured.

Apart from its low latitude and climatic disadvantages, Manzanillo would almost appear to have been chosen by Nature for the great port of Mexico's Western provinces, and there are



BAY OF MANZANILLO, SHOWING THE SPLENDID ENTRANCE TO THE HARBOUR.



those who believe, with some good reason, that Mazanillo may yet become the San Francisco of Mexico. It is distant from Mexico City 861 kilometres, and when the railway communication, now being constructed by the Central is completed, it will take but 24 hours to reach Manzanillo from the capital-city.

The date of the contract which was entered into by the Mexican Government with Colonel Smoot, of Washington, was May 25th, 1899. It may be said that the Government did not lightly make this agreement, but selected for the execution Colonel Smoot, the engineer who carried out the great Galveston Harbour Works. An evidence of Colonel Smoot's promptitude is afforded by the fact that the following day after the contract was signed his engineers started from the city of Mexico, while in less than ten days they were on the ground carrying on active surveys. The same spirit of activity was displayed throughout, and the Works are to-day almost completed. I spent some two weeks in Manzanillo examining what had been done, and having explained to me what the Government of Mexico have still further determined to do. New contracts have been signed with the Minister, Señor Fernandez, of the Department of Public Works, for the final completion of the breakwater, while a sufficient assignment has been provided for continuing the work of general improvement of the harbour, including a large amount of dredging. All this will be undertaken during the current year, and it is the express intention of the Government to continue the same annually until the entire work is finally completed.

Before proceeding to detail the work which has been done at Manzanillo, a few words may be said about Colonel Smoot's previous great engineering undertaking at Galveston, Texas, U.S.A.

Galveston Bay is a shallow body of water, separated from the Gulf of Mexico by an island of sand, twenty-seven miles in length, and from one to two miles in width, and the City of Galveston is situated on the eastern end of this island. The total area of the Bay is about 490 square miles, of which 450 miles receive the tidal flow through the Bolivar channel or Galveston entrance, which is the main inlet of the bay.



The greater part of this sheet of water is quite shallow, but to the south, in front of Galveston, there are considerable depths found, and this area forms the Harbour of Galveston proper. It was in 1870 that Congress decided to deepen the entrance, and Colonel Smoot was awarded the contract. What this meant in actual labour may be gleaned from the fact that 54,000 ft. of railway and trestle, 1,400,000 tons of sandstone riprap, and 684,000 tons of granite blocks were used. Moreover, the whole of this stone had to come from quarries situated from 200 to 300 miles from Galveston, along the lines of seven different railways.

The experienced engineer at the head of affairs knew exactly what to do, and speedily provided an enormous plant of tug-boats, steam derricks, and barges, locomotives, and special machinery, at the same time building more than 30 miles of the branch railroads to the quarries, and some 20 miles of yards and siding, mostly constructed on trestles in the sea. Before a single stone could be delivered for use in the work, the construction of this plant called for an expenditure of between \$400,000 and \$500,000 U.S. Cy. (£80,000 to £100,000), and a perfect army of labourers and mechanics had to be engaged. For years the work went on without any serious interruption, and gradually, out of the sea, arose the remarkable jetties for which Galveston is famous. Not only is the construction work extremely solid and permanent, but it is admirably finished off, every possibility or probability in regard to the heavy storms to which Galveston is subjected having been provided against. The height of the crest of the jetty is 5 ft. above mean low tide, whilst its width at the base is as great as 123 ft. where the water is deep. The foundation of the rock-work is immediately upon the sandy bottom of the gulf, and yet, during construction, the subsidence or settlement of the jetties was in no place more than a few inches. Whereas, when the work began, the depth of water on the bar at the entrance to the Harbour was only 12 ft., in January 1898, when the work was completed, the depth of water was 30 ft. at mean low-tide, capable of floating the largest freight vessels in the world at that time when loaded. The jetty cost nearly \$7,000,000 U.S. Cy. (£1,400,000) to complete, which was \$475,000 less than the estimated cost,

and in 4 years the saving in reduced transportation charges was more than \$10,000,000, and this in one State of the Union alone.

Galveston occupied the position of fourteenth in importance when work was inaugurated. It is to-day the second port of America, exceeded only by New York in the value of its imports and exports.

The disaster which overtook Galveston in 1900, when a tidal wave destroyed the greater part of the city, and swept over the whole harbour, left this great mass of rock work intact without damage. A greater tribute to the solidity of the construction-work could not possibly be paid, and it was no doubt this, among other factors, which induced the Mexican Government to award the contract for the Manzanillo harbour to the same successful engineer.

The most important and expensive part of the Manzanillo construction has been the breakwater and sea-walls. I believe I am correct in stating that the Manzanillo breakwater is the heaviest that has ever been built, exceeding in both height and width the proportions of the great sea-walls at Plymouth and Cherbourg. No less than 1,500,000 tons of blue granite from the Colomo quarries, which are, fortunately, close by, were employed, the greater portion being sunk for the foundations of the breakwater. A glance at the plan of Manzanillo Harbour, which I give elsewhere, will show the exact formation of the breakwater and sea-walls. This wall extends a distance of 600 metres into water 60 ft. deep, having a width at bottom of 300 ft., and at the top of 25 ft., while the cement crown is 16 ft. thick. It is unnecessary to point out how costly such a work as this would be anywhere; but at Manzanillo, where cement costs 45s. (\$9 U.S.A.) per barrel, laid down at the port, and labour is both expensive and unskilled, the cost of the undertaking was enormously increased. Stones of random size, from 2,500 to 3,000 kilograms form the foundation of the breakwater, and these, when quarried, were conveyed on railroad flat cars to the brink of the sea and there allowed to fall, the travelling steel-crane in use being capable of handling 50-ton blocks at a time. On the seaward side, the breakwater is protected by huge blocks of granite, weighing 30 tons each; while on the inner

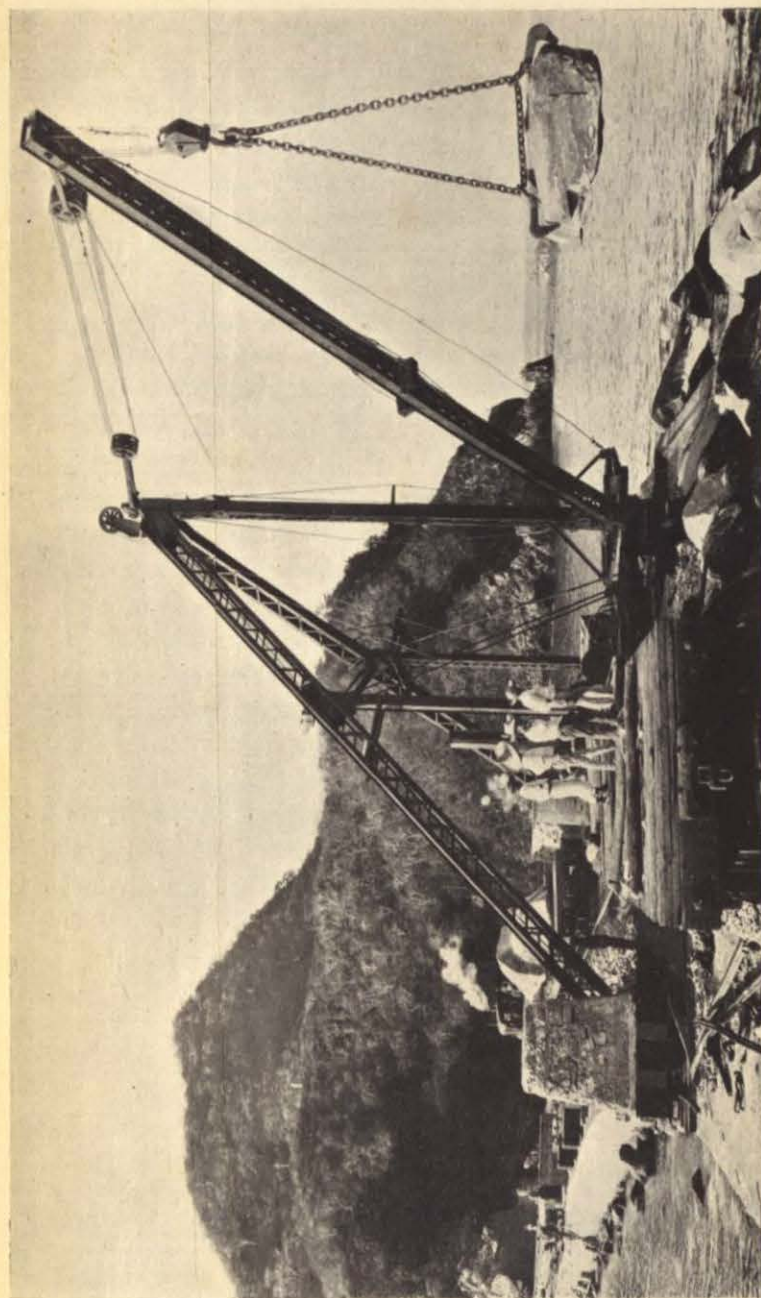


side, the blocks weigh from 3 to 15 tons, and those destined for the lower slope from 10 to 25 tons each.

Four years were required to bring the work on the breakwater to a point where the crown of cement concrete could be put in place. For this the Government engineers passed very stringent rules, and every portion of the work, as well as all the material used, had to pass their closest test. As in the case of the Galveston jetties to which I have called attention, the sea-slope of the surface of the breakwater at Manzanillo, covered with its granite coating, presents a resisting obstruction to the waves, which slide over the masonry mass of the breakwater during the prevalence of heavy storms and high seas, and expend the energy of their impact obliquely, displacing no materials, the great weight of the blocks and the solidity of the surface rebutting the immense force of the seas.

Manzanillo Harbour covers about 160 acres, and is one of the most secure and convenient for shipping to be found in the world. Here a hundred sea-going vessels may ride at anchor with the most perfect safety. From the inner end of the breakwater, a sea-wall, or, as it is called in Spanish, "malecon," has been built out for a distance of 2 kilometres along the line of beach. Here, also, will be constructed the splendid range of wharves which the Mexican Government will build and equip, and which will have a total frontage of 5 kilometres. This sea-wall, like the breakwater, is of the most solid construction, being of blue granite, and rising 3 metres above mean tide. At the back of the wall the space is filled in with immense stones. In addition to these two walls the contractor was called upon to dredge the anchorage grounds and the western part of the harbour to a depth of  $8\frac{1}{2}$  metres below mean tide, which depth will probably be increased to 12 metres, or 40 ft.

The construction of a coaling station at Manzanillo is in contemplation, to include docks in which the largest merchant ships and war vessels can come alongside. They will be equipped with modern electric appliances for loading and unloading. This proposition has been in progress for about three years, and had just matured at the time when I left Mexico. The value of this coaling station is generally recog-



THE PORT OF MANZANILLO. — The Breakwater, showing 100 ton steel crane at work.



nised in view of the fact that the only coaling station on the western coast is at Acapulco, where coal has to be handled and conveyed to and from vessels by means of lighters and solely by the slow and expensive method of manual labour.

Manzanillo Port and Harbour will, I have no shadow of doubt, amply compensate the Republic for its outlay. Not only is the present harbour exceptionally well designed, but, as I have intimated, the work put into the construction is so excellent that its permanency is a matter of absolute certainty. Indeed, the breakwater has already proved of service in completely protecting shipping in the harbour and the water-front from the disastrous equinoctial storms which visit the coast with never-failing regularity.

The beauty of Manzanillo Bay has been compared, not inaptly, with that of Naples; to my mind it is even more beautiful, the circle of surrounding hills being far greener and more deeply clothed with luxuriant trees. The hills come right down to the coast from the mountains, and vary considerably in size, the highest, the Vigia Grande, standing 217 metres above the ocean which laps its base. The deep red of the exposed earth, with the brilliant green of the foliage and the bright-hued roofs of the houses, peeping out from their verdant surroundings, the whole surmounted by a brilliant blue sky such as one sees nowhere but in the tropical latitudes, form a scene of transcendent beauty which words are totally inadequate to describe. Passengers upon vessels entering Manzanillo Harbour for the first time imagine that they have fortuitously encountered an earthly paradise.

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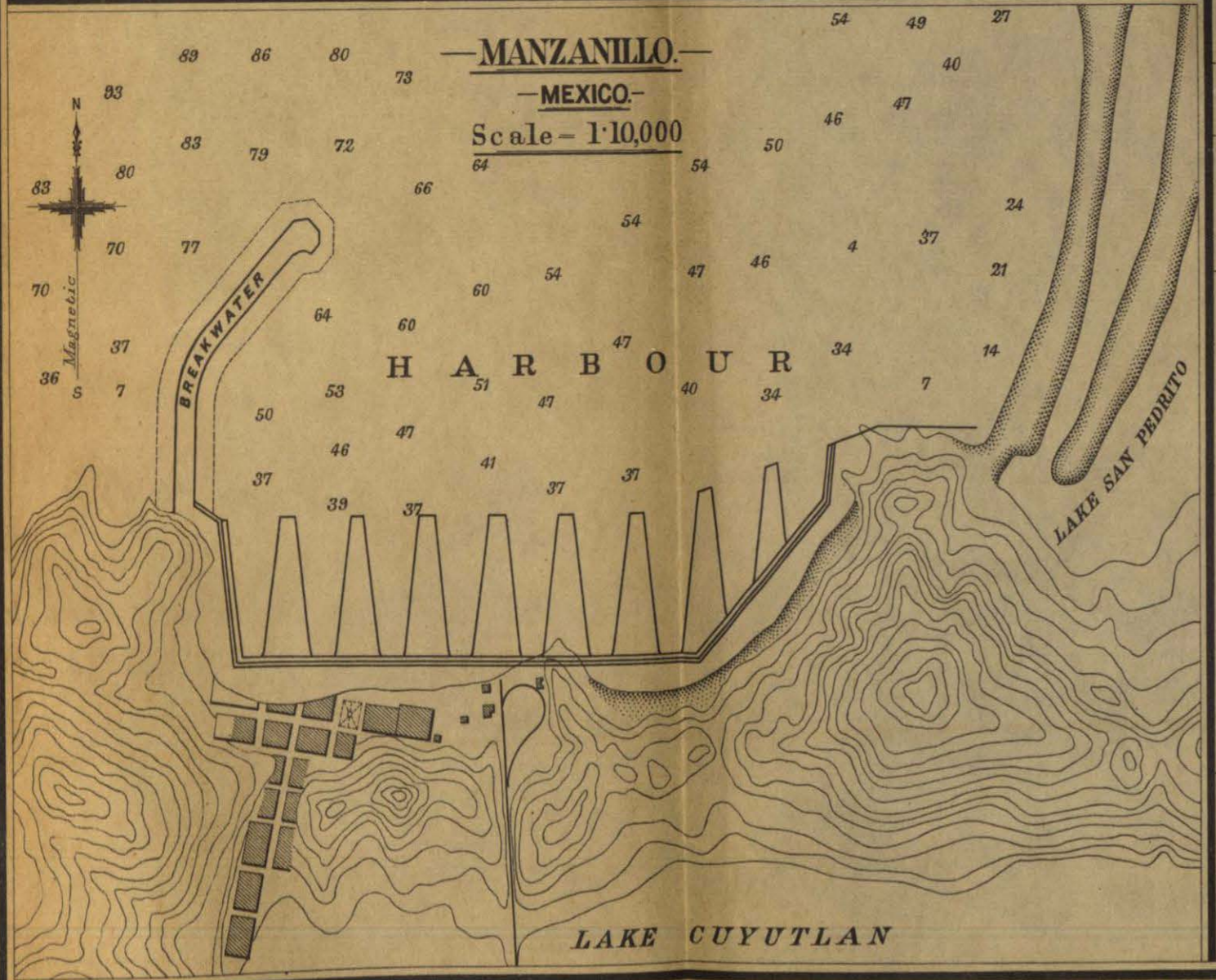
# MAP OF THE BAY OF MANZANILLO

AND THE ADJACENT COAST OF THE PACIFIC OCEAN

SHOWING THE SITUATION OF THE HARBOUR OF MANZANILLO

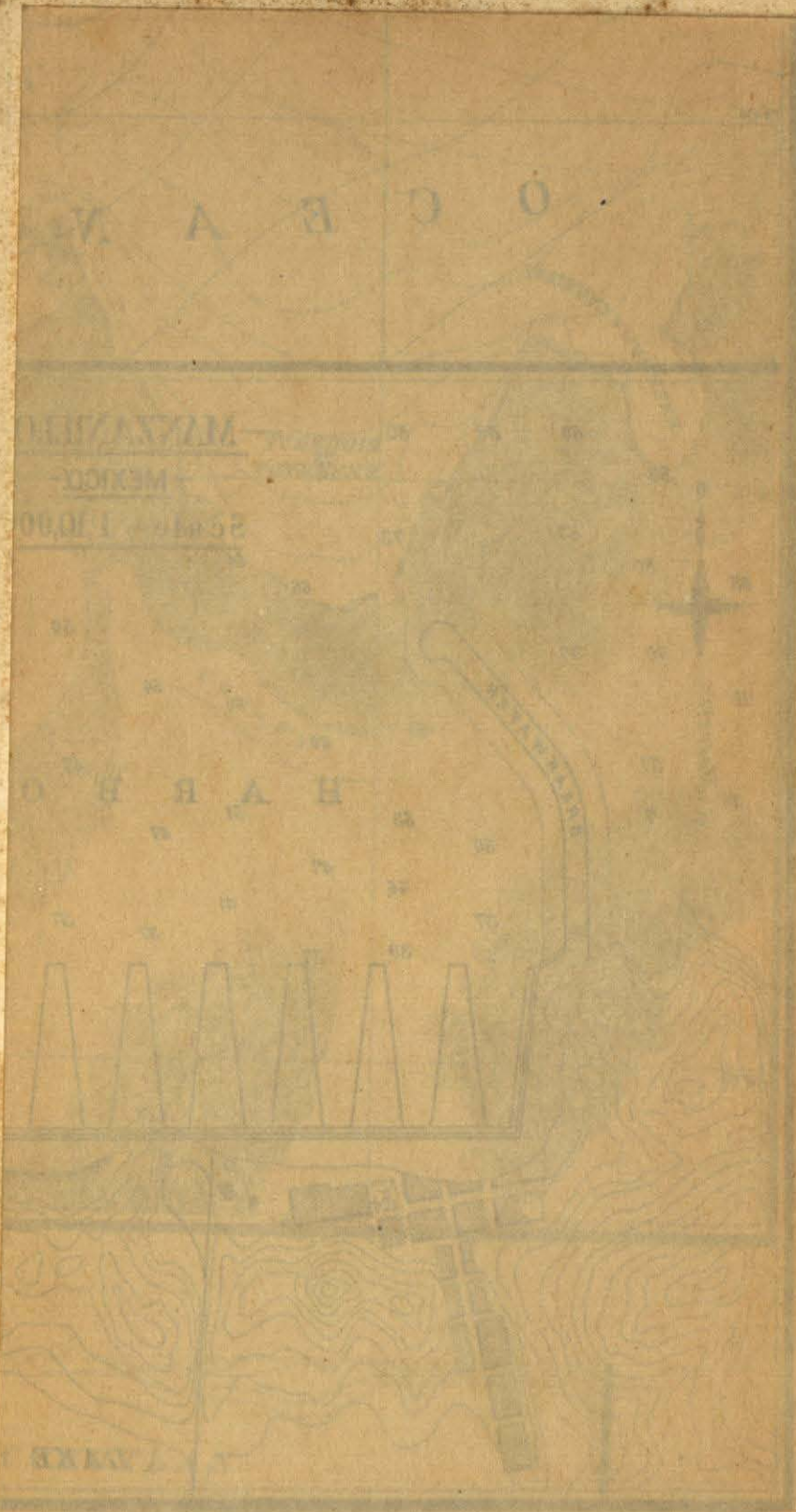
Scale: 1:58,000

LONGITUDE 5° 8' 12" W. OF MEXICO CITY  
To accompany "MEXICO OF THE XX. CENTURY" by PERCY F. MARTIN, F.R.G.S.



Establishment of the Port		METERS		
Highest Tide observed above mean low Tide	0.82			
Lowest Tide observed below mean low Tide	0.58			
Average of High Spring Tides above mean low Tide	0.56			
" " Spring Tides	0.26			
" " Low Spring Tides	0.04			
" " High Neap Tides	0.45			
" " Neap Tides	0.25			
" " All High Tides	0.51			
" " All Tides	0.26			
" " All Low Tides	0.00			
Mean Range of Spring Tides	0.60			
Average " " All Tides	0.51			
" " Neap Tides	0.40			
Antilunar-Tides	Mean rise	0.627 meters	Duration	6.53 H. M.
" " fall	0.277	"	"	4.38
Lunar Tides	Mean rise	0.430	"	5.47
" " fall	0.763	"	"	7.17





J. P. BAYNE



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TITULO

México of the twentieth...

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