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NPS Form 10-900
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NATIONAL REGISTER

United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES
REGISTRATION FORM

1. Name of Property

historic name: **S.S. Antonio López, Shipwreck Site and Remains**

other names/site number: **N/A**

2. Location

street & number: **Angelina Reef, Off Mameyal Beach** city or town: **Dorado**
vicinity _X_
state: **Puerto Rico** code: **PR** county:**Dorado** code: **051**
zip code: **00646**

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this _X_ nomination ____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property _X_ meets ____ does not meet the National Register Criteria. I recommend that this property be considered significant ___ nationally _X_ statewide ___ locally. (___ See continuation sheet for additional comments.)

Arleen Pabón PhD
Signature of certifying official

December 13, 1993
Date

Puerto Rico State Historic Preservation Office
State or Federal agency and bureau

In my opinion, the property ____ meets ____ does not meet the National Register criteria. (___ See continuation sheet for additional comments.)

Signature of commenting or other official

Date

State or Federal agency and bureau

4. National Park Service Certification

I, hereby certify that this property is:

✓	entered in the National Register ___ See continuation sheet.	Janet E. Levensund	2-9-94
____	determined eligible for the National Register ___ See continuation sheet.	_____	_____
____	determined not eligible for the National Register	_____	_____
____	removed from the National Register	_____	_____
____	other (explain): _____		
		_____ Signature of Keeper	_____ Date of Action

5. Classification

Ownership of Property

___ private
___ public-local
_X_ public-State
___ public-Federal

Category of Property

___ building(s)
___ district
_X_ site
_X_ structure
___ object

Number of Resources within Property

Contributing		Noncontributing	
_0_		_0_	buildings
_1_	(contiguous remains)	_0_	sites
_1_	(split-open hull)	_0_	structures
_0_		_0_	objects
_2_		_0_	Total

Number of contributing resources previously listed in the National Register _0_

Name of related multiple property listing: **N/A**

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6. Function or Use

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Historic Functions
Cat: **Transportation** Sub: **Water-related**

Current Functions
Cat: **Not in use** Sub:

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7. Description

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Architectural Classification: **other: Steel Propeller Steam Liner**

Materials
foundation:**N/A**
roof: **N/A**
walls: **N/A**
other: **Steel Hull**

Narrative Description

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8. Statement of Significance

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Applicable National Register Criteria

_X_ A Property is associated with events that have made a significant contribution to the broad patterns of our history.

___ B Property is associated with the lives of persons significant in our past.

_X_ C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.

_X_ D Property has yielded, or is likely to yield information important in prehistory or history.

Criteria Considerations

____ A owned by a religious institution or used for religious purposes.

____ B removed from its original location.

____ C a birthplace or a grave.

____ D a cemetery.

____ E a reconstructed building, object,or structure.

____ F a commemorative property.

____ G less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance: **Archeology/Historic**
Commerce
Military
Transportation
Engineering
Architecture

Period of Significance: **1881-1898**

Significant Dates: **1881, 1882, 1898**

Significant Person: **Antonio López y López, Peter Denny, William Denny**

Cultural Affiliation: **N/A**

Architect/Builder: **Peter Denny, William Denny & Brothers**

Narrative Statement of Significance

9. Major Bibliographical References

Previous documentation on file (NPS)
___ preliminary determination of individual listing (36 CFR 67) has been requested.
___ previously listed in the National Register
___ previously determined eligible by the National Register
___ designated a National Historic Landmark
___ recorded by Historic American Buildings Survey # _____
___ recorded by Historic American Engineering Record # _____

Primary Location of Additional Data
_X_ State Historic Preservation Office
_X_ Other State agency
___ Federal agency
___ Local government
___ University
_X_ Others

Name of repository: **Museu Marítim (Barcelona, Spain), Museo Naval (Madrid, Spain), National Maritime Museum (Greenwich, London), Archivo General de Puerto Rico (San Juan, Puerto Rico)**

10. Geographical Data

Acreage of Property: **3.624 acres**

UTM References

	Zone	Easting	Northing		Zone	Easting	Northing
1	**18**	**792465**	**2045425**	3	__	_____	_____
2	__	_____	_____	4	__	_____	_____

___ See continuation sheet.

Verbal Boundary Description

Boundary Justification

11. Form Prepared By

name/title: **Jesus Vega PhD**

organization: **Institute of Archeology and Oceanography**

date: **December 1, 1993**

street & number: **519 Alverio St. Ext. Roosevelt** telephone: **(809) 767-3486**

city or town: **Hato Rey** state: **PR** zip code: **00918**

NARRATIVE DESCRIPTION

Summary

Antonio López was built in 1881-82 by William Denny & Brothers of Dumbarton, Scotland, for the Compañía Trasatlántica of Barcelona. A three-decked, brig-rigged, propeller steam liner, she was the first Spanish merchant vessel --and one of the earliest in the world-- built with a steel hull and complete electric lighting system. Antonio López was 370 feet long, with a beam of 42 feet, and a depth of hold of 30 feet. Besides her pioneer role in steel construction, Antonio López became the most significant blockade runner and shipwreck of the Spanish-American War in Puerto Rico. On 28 June 1898, during a gunrunning operation, Antonio López was stranded and subsequently burnt and sunk by U.S. warships. Although the hull has been flattened out by wave energy, much of Antonio López remains largely intact, including machinery, boilers, etc. The double bottom is complete and remains at the exact place of grounding on the rocky floor of Angelina Reef, now in thirty-two feet of water, 0.7 statute miles off Dorado's Mameyal Beach, north coast of Puerto Rico.

Antonio López as Built, 1881-82

On 21 September 1880, William Denny & Brothers offered to build a new steel propeller steam liner for the Compañía Trasatlántica of Barcelona. A Martin Siemens steel hull and a double bottom were recommended. The offer was accepted on the following day, 22 September 1880, evidence of the excellent relations between the two companies.

Built as yard 250, at Denny's Leven Shipyard by the River Clyde, Dumbarton, Scotland, the new vessel was christened Antonio López, after Don Antonio López y López de Lamadrid, founder and owner of the Trasatlántica.

Antonio López was launched on 8 November 1881. Delivery was set for 14 January 1882, but the great storm of Jan. '82 drove her against the yard sheerlegs, damaging the bulwarks and delaying her completion. Finally, on 20 February 1882, Antonio López left for Spain. The vessel was delivered at Puntales, Cádiz, on 2 March

1882. In order to comply with the 1877 regulations for steam mailers operating between Spain, Cuba and Puerto Rico, a detailed inspection of the vessel was conducted on 18 March 1882.

Antonio López was the first Spanish merchant vessel--and one of the earliest in the world--built with a steel hull and complete electric lighting system. The liner's construction was supervised by Lloyd's of London, which classified Antonio López as 100-A-I, the highest rating for a merchant vessel.

The following description of Antonio López as built, is based on the 1882 Inspection and Property Title (Museo Marítimo, Barcelona), supported by data from The Denny List (Lyon, 1975), and copies of the vessel's original plans at the National Maritime Museum, Greenwich.

Antonio López was a three-decked, steel-hulled, double-bottom, barque rigged, propeller steam liner. The vessel was 370 feet (112.77m) long, with a beam of 42 feet (12.8m), a depth of hold of 30 feet (9.14m), and had a violin or "diddle head" bow and round stern. The hull was made of Martin Siemens steel, and separated by nine (9) transverse bulkheads, seven of these watertight. The double bottom extended throughout the entire length of the vessel, and was divided into six (6) independent sections to be filled with salt water as ballast for proper flotation. Antonio López was registered in 1882 at 3,459.91 gross tons, and 1,979.02 net tons.

Black-hulled with a red stripe, the three-decked Antonio López provided the ultimate comforts in ocean travel. Marble floors, carved ceilings of the finest woods, ice, hot showers, electricity in every room and a grand piano were some of the comforts enjoyed by the 156 first-class passengers. The ship also had berths for 72 second-class passengers, 27 third class passengers and 1,100 additional bunks for transporting troops to the colonies.

From 1882 to 1891, Antonio López serviced the transatlantic liner route between Spain, Cuba and Puerto Rico. From 1891 to 1898, she operated between Spain and Buenos Aires (Todd, 1991, pers. comm.).

Antonio López was powered by a compound (2-cylinder) steam engine, 700 nhp/2800 effective hp, with six circular (Scotch) boilers and a single 4-bladed propeller, reaching 14.885 knots in marine tests.

As built in 1881-82, the vessel had a Mair & Caldwell Steam Steering Gear, powered by a small steel boiler on the main deck.

For auxilliary propulsion, the vessel was barque rigged, with mainmast, foremast, bowsprit, main yards and standing rig made of steel. The mizzenmast was made of Vancouver pine. Spars were of superior pine teak.

Antonio López had a cargo capacity of 97,030 cubic feet, and a coal capacity of 980 tons. The upper deck was made of steel with teak lining; the main deck was also of steel, with superior pine lining.

The electric lighting system used a recently-invented Tangye 5hp generator and a Siemens alternator, providing power to seventy (70) Sivan lamps for first class halls and saloon, aft on the main deck and poop. The vessel was also fitted with standard oil lamps.

Antonio López carried five large anchors, two Trotman small anchors, two chains (90 & 150 fathoms), three flexible steel cables, and four hemp lines. The original armaments consisted of two bronze cannon (12cm). The ship's boats included one steam-powered launch, five galvanized iron lifeboats, three teak lifeboats, one canoe, and one jolly boat made of teak.

Antonio López, Shipwreck Site and Remains

The shipwreck of Antonio López is located on the rocky floor of Angelina Reef, approximately 0.7 statute miles (1.15 km) off Dorado's Mameyal Beach, and seven miles (11 km) west of San Juan Harbor, north coast of Puerto Rico. The wreck lies approximately 1,700 ft. (518m) from the northwest tip of Angelina Rock, on a magnetic bearing of 332 degrees, under 10 to 32 ft (3-10m) of water.

Angelina Rock is an anvil-shaped, eolianite formation rising approximately 10 ft. (3m) above sea level, and easily seen from Mameyal Beach along Secondary Highway 165 from Levittown to Dorado. This rock formation is surrounded by shallow reefs, and should only be approached by small craft in dead-calm weather.

NOAA Chart 25668, North Coast of Puerto Rico: Punta Peñón to Punta Vacía Talega (9th Ed., Jan. 1977) depicts a sunken wreck at the site of Antonio López. Although the NW-SE orientation of the chart symbol is not correct, our 1993 triangulation from the coast confirms that this symbol clearly refers to Antonio López. The wreck site is also depicted in USGS Map I-347, Preliminary Geologic Map of the Bayamón Quadrangle, Puerto Rico, by Watson H. Monroe and Maurice H. Pease, Jr. (1962). There are no other large, metal shipwrecks in the immediate vicinity of the wreck site.

Antonio López is best located on small craft by navigating NNE off the beach behind El Caracol Restaurant (by the southbound curve of Highway 165), until flushing the two white radar domes of Fort Mascaró U.S.A.F. Military Reservation in Punta Salinas. With the domes never overlapping, navigate east, on a magnetic bearing of 103 degrees. This bearing cuts across the three standing, starboard boilers of the Antonio López, easily seen from a slow-moving boat.

As most of Puerto Rico's north coast, Angelina Reef is a high-energy zone. Ocean currents generally flow W, at an average velocity of 0.2 knots. Tidal range is about 1 foot. In rough weather, particularly during winter northerlies, large waves may break over much of the reef, including the shallow areas of the wreck itself.

Small coral colonies grow on the shipwreck and the adjacent rocky bottom. However, Angelina Reef is not a true coral formation, but rather an eolianite reef of Pleistocene origin. To the south, approaching Angelina Rock, the reef becomes shallow and dangerous, then gains depth as it forms an irregular channel between the reef and the coast. To the north, the rocky floor slopes into open ocean, with depths in excess of 1,000 ft. (300m) about 1.5 nautical miles N of the wreck site.

The coast of Mameyal is lowland. An uninterrupted sandy beach runs from the beachrock point of Punta Corozo (E), to the cemented dune of Punta Boca Juana, by the mouth of La Plata River (W). The beach is mostly igneous rock and other dark minerals, quartz, feldspar and carbonate grains, and shows considerable erosion (Morelock, 1978:26). Evidence of local shoreline retreat includes an eroded, prehistoric site at Punta Corozo (Vega, 1990:76), and two cut-off meanders of the Cocal River.

Erosional processes appear to have played a significant role at the shipwreck site as well, depleting much of the sand veneer of Angelina Reef, and exposing the lower hull of Antonio López to the eolianite floor. This hypothesis has been inferred from historical sources indicating that the vessel was grounded on a sandbar, in fifteen feet (4.5m) of water (Rivero, 1973:174), contrary to the predominantly rocky floor observed under water.

The wreck of Antonio López lies on a north-south axis (180 degrees mag.), with the prow pointing S towards Dorado's Mameyal Beach. The area included in the site is a rectangle 500 ft. long by 300 ft. wide (152 x 91 m). The geographical center (amidships) is the charted vessel position, as follows:

UTM Zone 19: N-45,425; E-92,465 LAT. 18°28.8' -- LONG. 66° 13.9'

Prior to the 1993 survey campaign, corroboration of the shipwreck's identity had been firmly established through four years of library and archival research, and two preliminary archaeological dives conducted in 1991. Our primary contemporary source was Rivero's Crónica de la Guerra Hispano-Americana en Puerto Rico (1973), the original 1921 manuscript being available at the Archivo General de Puerto Rico, Puerta de Tierra, San Juan.

The initial link between the wreck site and the prewar history of Antonio López was The Denny List, a catalogue of Denny ship plans held by the National Maritime Museum, Greenwich (Lyon, 1975:206). This publication provided the place and date of construction of Antonio López, as well as her wartime loss in 1898. Other useful sources on Antonio López included Aguilera y Elías (1980:97, 130), Martínez-Hidalgo (1985), U.S Navy Department (1898, 1966), Van Deusen and Van Deusen (1903: 103), González Echegaray (1983), etc.

During our 1991 dives, the vessel's identity was further corroborated by the steel hull, double bottom, six Scotch boilers and single propeller shaft, as described in the 1882 vessel inspection and title located by the author in Barcelona, and in the original plans at the National Maritime Museum, Greenwich.

Of particular interest was the hypothesis that the reef has lost much of the sand cover that was present back in 1898. Seasonal sand migration was discarded as a possible explanation for the missing

sandbar, as Antonio López was grounded on 28 June, and the site was inspected from May to September (including dives in 1991 and 1993).

Factors affecting erosion of Mameyal Beach and Angelina Reef include dredging of the deep entrance channel of San Juan Harbor, construction of the causeway at Isla de Cabras, and a gradual rise in sea level. The first two anthropogenic factors have blocked most of the natural sand flow (W) to the coasts of Levittown and Dorado (Morelock, 1978:27). At Angelina Reef, erosion of the historic sandbar has kept the wreck site exposed down to the double bottom, possibly accelerating the flattening out of the grounded vessel, with the surviving structure achieving equilibrium in recent decades.

The substantially intact wreck of the steel-hulled, propeller steam liner Antonio López lies exposed on eolianite rock, at the exact place of grounding 95 years ago. Off the stern, the grounding mark on the reef is clearly visible. The lower half of the rudder post is still standing. The top weld of the rudder post to stern post lies to port, close to the 7.35 x 1.7m rudder lying flat on the rocky floor.

Between the standing rudder post and the propeller shaft, the four-bladed propeller is broken and partly buried under wreckage and sand. The broken blades and broken stern post suggest that the vessel entered the reef at top speed, supporting our hypothesis that there were no local pilots on board.

The intact propeller shaft is 38.25m long, and 0.5m in diameter. The line shaft bearings are intact, although slightly misplaced in relation to the bearing foundations, possibly disjointed at the moment of grounding. Moving north along the propeller shaft, the double-bottom steel hull and keelson are visible and fairly intact amidships.

In the machinery area, the broken crank shaft and connecting rods lie in context. The floor of the engine room appears largely intact. Archaeological examination of machinery confirms that the vessel of 1898 had a compound engine, probably the original of 1881. This is a feature that needed clarification, due to one secondary source erroneously reporting Antonio López as propelled by a triple-expansion steam engine (Hauck, 1985:2).

Much of the wreckage lies to port of the vessel's axis, extending over 35m E of the propeller shaft. This area includes sections of the main and upper decks, as well as bulwarks, stanchions, frames, beams and large sections of steel plates.

The round base of the smokestack has an internal diameter of 2.6m, and is intact. The vessel's circular, Scotch boilers have a diameter of 4.5m, and appear to be the original ones as built in 1881. The three starboard boilers remain intact and nearly aligned, while port boilers #2 and #3 now lie on their sides. Our inability to locate port boiler #1 suggested a boiler explosion. This was confirmed on the following dive, as we located half of the missing boiler to starboard, south of the first starboard boiler. The explosion literally created a cross section, so that the boiler tubes, furnace, uptakes and other features are now exposed.

The mainmast, foremast, bowsprit and main yards, all made of steel, are found in the vicinity of their original positions. Mast and rigging features include trestle trees, doubling rings and galvanized steel cables of the standing rig. The original mizzenmast was of Vancouver pine. Apparently, a wooden mizzenmast was still in use by 1898, and burnt following the heavy shelling from New Orleans.

The mostly-intact bow rests sideways to port. Three hawse pipes are still in place, with the fourth pipe exposed nearby. A long segment of anchor chain exits the attached starboard hawse pipe. Immediately behind the hawse pipes, another segment of the same chain leads to the chain locker.

A large bow anchor lies to starboard, in context, its great weight probably releasing it from the hull. A small anchor (1.6m) lies abaft, 3m E of the propeller shaft. This anchor probably belonged to the steam-powered launch of Antonio López. Another small anchor was recovered by Gandía and Hauck (1985), probably belonging to the galvanized iron lifeboats.

A large anchor is found 28m W of the main wreckage. This anchor stands partly buried on a small pocket of sand, with 2.7m of exposed shank. One arm is bent towards the shank. This anchor may have been used during salvage operations, to prevent boats from colliding against the stranded liner while loading cargo, a

hypothesis to be examined through further archival work.

Parts of the main and upper decks now lie upside-down, primarily in the eastern or port side of the wreckage, mixed with large steel plates, lifeboat davitts and remains of fallen bulwarks. Probable evidence of direct shelling hits from Yosemite or New Orleans include the broken smokestack, the exploded boiler, and various hull fragments. Extensive evidence of fire is also found, including small, burnt wooden fragments, yet to be identified but presumed to be teak or pine.

STATEMENT OF SIGNIFICANCE

Summary

Antonio López is significant both for her pioneer steel construction and electric lighting system of the early 1880's, and as the most important blockade runner and shipwreck of the Spanish-American War in Puerto Rico. Nomination of this vessel to the National Register of Historic Places is proposed under Criterion A (direct association with the Spanish-American War), Criterion C (outstanding representative of a 100-A- 1 transatlantic steel steam liner of the early 1880s), and Criterion D (a substantially intact site capable of yielding archaeological data on early steel shipbuilding technology, as well as the most significant blockade running episode of the Spanish-American War in Puerto Rico). Areas of significance include engineering (innovations in steel hull and electricity), architecture (of steam liners of the early 1880's), transportation and commerce (mail, passenger and cargo service between Spain and the Caribbean, late 19th century), and military history (U.S. blockade of Puerto Rico, Spanish-American War).

Although the wreck has been flattened out by nearly one hundred years of wave energy, much of Antonio López remains largely intact, including machinery, boilers, smokestack, complete double bottom, prow, rudder, anchors, bitts, masts, rigging, davitts and numerous other features still in context.

The shipwreck of Antonio López offers numerous engineering features of a world-class propeller steam liner of the early 1880's, as well as the first maritime archaeological insight into the Spanish-American War in Puerto Rico. The 370-ft. long Antonio López is a large historic shipwreck site likely to yield extensive data for years to come.

As an example of a first-rate ocean liner of the 1880's, Antonio López was distinguished by her architecture, luxurious ornamentation and engineering, the first and last categories surviving in the archaeological record. Designed and built by Peter Denny, this ship may be regarded as the work of a master of international reputation, as discussed in detail below.

I. STEEL, STEAM AND SHIPS

Antonio López as Shipbuilding Innovation

Antonio López illustrates the best of a highly significant period in the evolution of shipbuilding. As a rigged steel steamer, Antonio López represents an evolutionary stage between late 19th-century tall ships and early 20th-century steel liners.

In the early 1880s, Antonio López was among the most advanced vessels in the world. The vessel was built by William Denny & Brothers of Dumbarton, Scotland, a pioneer in the use of steel. Fitted with masts, yards and sails for auxiliary propulsion, Antonio López exemplified the last phase in the demise of sail as the primary means of vessel propulsion.

The transition was a complex process, with enormous social, technological, political, naval, geographic, economic and ecological ramifications that archaeology has barely begun to explore. The evolution from wood/sail to steel/steam is the anthropological setting in which the significance of Antonio López as shipbuilding innovation is evaluated.

William Denny & Brothers

Throughout most of the nineteenth century, the British Navy was second to none (Burt, 1988). This was partly due to a powerful shipbuilding industry, seldom surpassed in this period, as well as a strong naval policy deeply related to Britain's insular geography. The strongest competitors to British shipbuilding were France and Germany, with Italy and the United States also joining the "race" in the 1890s (Ropp, 1987).

Among the most important and influential of British shipbuilding companies was William Denny & Brothers, widely regarded as "the most advanced and scientific shipyard in the world" (Lyon, 1975:1). Denny's innovations ranged from science and technology to industrial relations, including the pioneer use of steel, test tanks, progressive trials, shallow-draft steamers, turbines, workers-employer conferences, professional female employees, scholarship programs and production rewards.

The family saga began in 1812, when William Denny (1) was employed by a Dumbarton shipbuilder, eventually setting up his own business, and then buying his old employer's shipyard. Through three generations and diverse companies, Denny's became a trademark of excellence in the shipbuilding world.

Except for a few sailing vessels built in the 1840s, the family business was strictly concerned with metal steamers. In 1854, control of the company went to Peter Denny (1821 - 1895), seventh son of William. Peter gradually became a leading figure in the shipbuilding, shipping and banking world, earning the nickname of "Peter the Great."

In the 1860s, during the U.S. Civil War, Peter Denny built a number of blockade runners and disguised warships for the Confederacy. During that time, Denny's moved into the new, larger Leven Yard. In 1871, Peter Denny joined a special commission of the British Government to study warship design and construction. In 1879, he was a member of the Royal Commission to study the loss of life and property due to shipwrecks (Lyon, 1975).

During the move to Leven Yard, Peter's eldest son, William Denny (2) joined the company, soon becoming a master shipbuilder himself.

William was the strongest advocate behind Denny's pioneer use of steel, playing a key role in the 1878 construction of Rotomahana, the world's first ocean-going steamer built of mild steel. Three years later, Peter Denny and his son William designed and built the steel-hulled Antonio López for the Compañía Trasatlántica, becoming the first steel liner in Spanish history, and the best in sea travel between Spain and the Spanish Caribbean in the 1880s.

The Steel Industry in the 1880s

By the nineteenth century, the construction of large wooden ships had consumed much of the forests of Europe, including Great Britain. As the trees became scarce, the larger ones would be reserved for warships (McKee, 1972:235-236).

The deforestation would lead shipbuilders to consider the use of iron for the "knees" supporting the decks of merchant vessels. Gradually, other wooden parts began to be replaced by iron. In 1813, Robert Fulton built Demologos, a small, wooden steamer clad in iron plates. In 1821, the first true iron ship was built by Horsley Iron Works of Great Britain. This experimental ship was Aaron Mamby, a small steamer of 120 ft. (36.6 m), powered by a stern wheel (Robert, 1984:7).

The first iron ships were built for river and coastal shipping enterprises (Simmons, 1988). Gradually, the use of iron hulls became more commonplace, leading to the construction of larger, ocean-going, iron-hulled steamers for mail, cargo and passenger service.

While the private sector developed true iron ships, Europe's navies still favored wooden hulls, generally limiting the use of iron to warship protection belts. In 1859, the French Navy launched La Gloire, the first true ironclad (fully protected, wooden-hulled) battleship. In 1862, during the U.S. Civil War, the first ironclad battle was fought between Monitor and Merrimac, signaling the end of the wooden ship-of-the-line and the birth of iron battleships (Watts, 1988).

Besides protection against artillery, the use of iron hulls allowed shipbuilders to exceed the traditional 300 ft. (91.45 m) length

recommended as the maximum longitudinal resistance for wooden ships (Robert, 1984:6). Although a few clipper ships such as Donald McKay's Great Republic exceeded this length, they were regarded as shipbuiding feats (Cuttler, 1960).

With the development of commercial steam propulsion, shipbuilders noticed that the hulls of wooden steamers suffered from the great vibration of early machinery, often resulting in leaks. Thus, the transition from wood to metal became intricately linked to the transition from sail to steam.

Overall, the late nineteenth century was a time of rapid technological change; as soon as iron became the standard hull material, the more innovative shipbuilders began experimenting with steel. In Britain, the most influential of the steel pioneers was Denny's.

An alloy of iron and carbon, steel surpasses iron in strength, durability, ductility, rust-resistance and other qualities that make it a superior construction material. Although the use of steel dates back to ancient times, it was only in the 1850s that large steel parts for ships, bridges, towers, pipelines, buildings, etc., began to be smelt at industrial furnaces.

Two processes of steel production were developed: the Bessemer (converter system) in 1856, and the Martin Siemens (open-hearth furnace) in the 1860s. Both systems were successfully applied to shipbuilding. Yet, the Siemems process provided greater certainty of getting uniformly good steel, without brittleness. It was with the Siemens process that Denny's built Antonio López in 1881-82.

During the late 1870's and early 1880s, the English lagged behind the French in steel production. One reason was that the English companies had already invested heavily in iron. Also, there was a good supply of ore suitable for the more limited Bessemer system (Ropp, 1987:64) Finally, there was a notion that steel was less reliable than iron. It was in its opposition to this prejudice that Denny's achieved much of its international reputation as a scientific-oriented company.

In 1880, the first steel liners (large, luxury-oriented passenger ships) were built, including Denny's Ravenna, for P & O's

Australian and Far Eastern services (Hartman, 1983:195) In 1881, while Peter Denny began work on the steel liner Antonio López, his son William read an influential paper at the Iron and Steel Industry.

"What you have to dread in iron as compared with steel," declared Mr. Denny, "is not giving way under sea strains, but giving way in collisions and cases of stranding. That is what you have to dread from iron, and what can only be overcome by steel" (Bruce, 1956:152).

After much research and experimentation, William Denny concluded that the so-called "defects" in steel were due to poor workmanship. Being a finer material than iron, steel demanded finer work from the shipbuilder. Through the construction of a test tank, studies of ship strandings and losses, reseach in metallurgy, lectures, constant communication with Britain's leading shipping and naval organizations, and the construction of ships such as Antonio López, Peter and William Denny promoted the rise of the modern steel liners.

Steam Propulsion in the Early 1880's

Knowledge of the power of steam dates back to ancient times. Both Greek and Roman inventors used it, but only for toys and gadgets (Casson, 1982:37). In the late seventeenth century, French physicist Denys Papin developed the first known steam engine with a piston, also promoting the idea that multiple engines might propel paddle-wheel vessels.

Throughout the eighteenth century, a number of inventors became fascinated, if not obsessed, with the development of steam-powered navigation, most notably the French Marquis Jouffroy d'Abbons, the English Thomas Savory, Jonathan Hulls and Thomas Newcomen, the Americans John Rumsey and James Fitch and the Scotsmen Patrick Miller, William Symington and John Watts (Hartman, 1983:179-180; Simmons, 1988:189).

By the early nineteenth century, beginning with Robert Fulton's Clermont of 1806, commercial steamboating became a reality. In 1818, out of New York, the wooden-hulled Savannah became the first

steamship to cross the Atlantic, assisted by sail propulsion.

Early steamships such as Savannah were powered by paddle wheels. This type of propulsion had the advantage of reduced draft, ideal for river transport, but also presented numerous disadvantages for both ocean navigation and warfare. Beginning with the most obvious, the enormous side wheels reduced gun movement and presented an easy target for enemy fire. Second, in order to avoid splashing the ship's decks, paddle wheels had to be covered, causing increased resistance, less speed and more coal consumption. Third, the large machinery also took much space, reducing the ship's cargo and passenger capacity. Finally, in rough sea conditions, the rolling movement of the ship forced one paddle wheel to submerge beyond its intended depth while exposing the other above the water surface, causing the ship to navigate in zig-zag.

All of these problems were solved with the invention of the screw propeller, credited (through simultaneous invention) to Robert Wilson, Francis Pettit Smith, Frédéric Sauvage and John Ericsson. In 1839, Pettit's Archimides became the first seagoing vessel fitted with a screw propeller. Four years later, Great Britain became the first propeller steamer to cross the Atlantic (Johnston, 1988:238-242).

In 1845, the British Admiralty conducted a tug-of-war test between the propeller steamer Rattler and the paddle steamer Alecto, both with 200hp engines. Victory went to the propeller-driven Rattler (Hartman, 1983:89; Robert, 1984:10-11).

By the 1880s, steam technology had already reduced sail to an auxiliary or secondary means of propulsion. The new technological challenge was to maximize the efficient use of steam power. In 1870, the world's first steamers with compound engines were built in Great Britain. This new type of machinery incorporated two pistons, so that the steam could be used twice. This is the type of machinery that was used on Antonio López as built in 1881, and throughout her eighteen-year career.

The first vessel fitted with a triple-expansion engine was Aberdeen, of 3,684 tons, built in 1882 for the Aberdeen Line (Hartman, 1983:196). A closely-related type of machinery was the 3-cylinder compound engine, used in a number of British warships

of the 1880's. In 1888, six years after Aberdeen had been completed, Victoria became the first British battleship fitted with a triple expansion engine (Burt, 1988:35).

Electric Lighting

The adaptation of electric lights to ships began in the late nineteenth century, following the 1854 invention of the electric light bulb by German watchmaker Heinrich Goebel, and the first modern electric lighting systems, simultaneouly developed in 1880 by Thomas Edison and J. Swan (Grun, 1982:419, 439).

In 1876, the French liner Amérique was fitted with external lights for navigational safety. Three years later, the British Inman liner City of Berlin became the first vessel in the world providing internal electric light, consisting of 6 lamps in the dining room and engine/boiler rooms. Complete electric lighting was first provided in 1881 onboard the British liner Servia (Hartman, 1983:195, 211), the same year that Denny's began construction of Antonio López, one the of the earliest liners in the world fitted with modern electric lighting.

Antonio López and the Compañia Trasatlántica

The owner of Antonio López and the Compañía Trasatlántica was Don Antonio López y López de Lamadrid (1817- 1883), the most powerful shipping mogul of late nineteenth-century Spain. Born in Comillas, Santander, López migrated to Cuba at the age of fourteen, where he gradually made a small fortune. In 1850, purchasing the steamer General Armero, he opened a shipping service between Santiago de Cuba and Guantánamo (Martínez-Hidalgo, 1985:92). Built by the shipyard of Ambrose W. Thompson of Philadelphia, General Armero was the first propeller steamer in Spanish maritime history (Casasses and Riera, 1987:5).

With its home port in Santiago de Cuba, the enterprise flourished and López married Luisa Bru, daughter of a promiment Spanish businessman. Returning to Spain, in 1856 he opened a service between Alicante and Marseille, with the steamers Alicante, Madrid and Marseille (all built by Denny's). The following year, in

Madrid, López created **Antonio López** & Cía. in partnership with Patricio de Satrústegui. Gradually, the steamer service was extended to Cádiz, Málaga and Barcelona.

In 1861, López was awarded a contract by the Spanish Government for the steam-mailer service between Spain, Cuba and Puerto Rico. In 1877, a new contract and new ships extended the mailer service to other American ports. On 28 April 1881, with construction of the steam liner Antonio López already under way by Denny's, the old Antonio López y Cía. was transformed into the Compañía Trasatlántica Española (González-Echegaray, 1983:95).

For his powerful shipping interests, López relied exclusively on steamers. This was a giant step in the modernization of the Spanish and Caribbean maritime world, with the Trasatlántica comparing favorably with British, French, German and Italian merchant fleets. For his numerous achievements, economic power and services rendered to Spain, López was awarded the titles of Marqués de Comillas and Grande de España, as well as the Gran Cruz de Isabel la Católica.

II. U.S. BLOCKADE, SPANISH-AMERICAN WAR

Antonio López as Wartime Memorial

The Spanish-American War of 1898 was a brief but complex conflict with enormous international repercussions. For some, this most popular war in U.S. history was "a national rite of passage, transforming a former colony into a world power" (O'Toole, 1984: 18).

While Spain struggled to keep its last overseas colonies of Cuba, Puerto Rico, the Philippines and the Marianas, the United States was in a phase of expansion. Following the Mexican and Indian Wars, the U.S. had closed the "wilderness gap" between the East and West Coasts, leading many entrepreneurs and politicians to begin looking south for new territories and new markets.

Since the Cuban rebellion of 1895, popular feeling against Spain had been growing at a grass-roots level in the U.S. The feeling was supported by sensationalist, even entirely made up newspaper articles, led by William Randolph Hearst's Journal and Joseph

Pulitzer's World.

On 15 February 1898, USS Maine exploded in the harbor of Havana. European and U.S. specialists would later conclude that the explosion that killed 268 men had most likely been an accident, probably caused by heat from the coal bunker. But the sensationalist press did not wait to accuse Spain of mining the Maine. The people were outraged. On April 1898, the U.S. declared war on Spain.

The war would last 113 days. From a U.S. naval perspective, the conflict had three major stages: blockade of Spanish colonies, destruction of the Spanish Navy, and the transportation of U.S. troops to the Caribbean and Pacific theaters of war.

U.S. Blockade of San Juan

The Commanding Officer of the U.S. Naval Forces in the Atlantic was Rear-Admiral William T. Sampson. (For a biography of Sampson, see Goode, 1899). Originally proposing a bombardment of Havana, Sampson was turned down by the Navy Department, fearing that the U.S. Fleet would suffer considerable losses while the Spanish Fleet remained at large.

As soon as the Navy Department discovered that the Spanish Fleet had orders to sail to Puerto Rico, the idea of atacking San Juan became a practical concern. By then, Philip C. Hanna, U.S. consul to Puerto Rico reporting from the nearby, then Danish island of St. Thomas, had suggested that the U.S. should invade Puerto Rico as an ideal coaling station between the Atlantic Ocean and Panama (Picó, 1987:48).

The U.S. blockade of San Juan began on 29 April, with Yale, St. Louis and St. Paul. All three were auxiliary crusiers, large steamers armed with rapid-firing guns (Rivero, 1973:70). That same day, the Spanish Fleet under Rear-Admiral Pascual Cervera left the Cape Verde Islands for San Juan, Puerto Rico.

On 8 May, Sampson reported from Cape Haitien that, if granted permission, he would "proceed to San Juan, probably destroying fortifications, establishing a temporary base at Culebra Island to

the east of Porto Rico, as entrance to San Juan is obstructed" (U.S. Navy Department, 1898:367).

It took ten days for Sampson's squadron to steam from Havana to San Juan. The squadron included Indiana, Iowa, New York, Amphitrite, Terror, Montgomery, Detroit, the torpedo boat Porter, the tug Wompatuck, the cargo steamer Niagara and two yatchs for the Associated Press.

"Upon arriving in San Juan," Sampson reported, "it was seen that none of the Spanish vessels were in the harbor." Still, by daybreak of the following day, on 12 May, San Juan was bombarded. The attack lasted about three hours, resulting in the deaths of two U.S. sailors (one from heat stroke) and seven wounded (U.S. Navy Department, 1898:368).

In San Juan, the attack killed two soldiers and four civilians, wounding about fifty others and destroying the north wing of the Ballajá Barracks, damaging Casa Blanca, the Civil Guard Barracks, the Cathedral, the Intendencia, the Church of San José, the marketplace and other buildings and houses (Van Deusen and Van Deusen, 1931:102).

While Goode (1899) claims that the attack was aimed at destroying Cervera's fleet, Sampson's own report, quoted above, clearly indicates that he was aware that the Spanish fleet was not inside the harbor. According to Rivero (1973:115), there is little doubt that Sampson's real goal was to capture San Juan, thinking perhaps of surpassing Commodore Dewey's superb victory at Manila Bay (O'Toole, 1984:174).

Sampson's attack was conducted without formal orders from Washington, and disregarding the international protocol of warning the city prior to bombardment (for avoidance of civilian deaths). In any case, San Juan was not Manila, Sampson was not Dewey, and the harbor was not subdued.

Notified that Sampson's fleet awaited off San Juan, Cervera changed course towards Santiago de Cuba, where Spain would suffer one of its most tragic naval defeats. Thus, Cervera's intention of defending Puerto Rico never materialized.

Throughout the blockade of San Juan, the U.S. Navy attempted to keep at least one cruiser in sight of the harbor entrance at all times. To the people of Puerto Rico, these blockade ships came to be known as fantasmas or phantoms, appearing at any moment on the night or day to capture and, if necessary, sink any vessels atempting to enter or depart San Juan.

The impact of the blockade was soon felt. Puerto Rico's economy was then largely based on sugar production, with extensive importation of basic items, including tools, clothing, foods, etc. Picó (1987:46) reports "hunger and insatisfaction" due to the blockade. However, the blockade was far from perfect (usually a single vessel off San Juan), and the war too short to pin all island shortages on it.

On 22 June, while San Juan regimental bands played inspiring music and a great crowd cheered, Isabel II and Terror left the bay to attack the blockading St. Paul. This vessel was under Capt. C. D. Sigsbee, previously commanding Maine. In a strategic meneuver, St. Paul effectively separated the two Spanish vessels, rapidly engaging Terror at 5,400 yards. Soon Terror was nearly disabled, limping back with four dead (including the chief engineer) and seventeen wounded. In San Juan, the bands kept playing, and the crowds began spreading the rumor that the two Spanish vessels had engaged the entire U.S. Fleet offshore (Wilcox, 1898:242).

On 25 June, St. Paul was relieved by Yosemite, soon to become the hunter of the Trasatlántica blockade runner Antonio López. Two days later, from Mole St. Nicholas, Haiti, Sigsbee reported to the Secretary of the Navy:

> **I decided to come here instead (of proceeding to New York for coaling) in order to recommend to you promptly an increase of the blockading force off San Juan, where the Yosemite now remains alone. I beg to respectfully suggest that the difficulties of blockading the single port of San Juan are greater than those to be met in blockading Havana, where there are no Spanish war vessels and no torpedo-boat destroyers, and where ports are blockaded both to the eastward and westward. . .**

Vessels intending to run the blockade of San Juan can, owing to the short length of Porto Rico east and west, make telegraphic communications with San Juan for advice with reference to the disposition of the blockading force. And this they can do within a few hours of their expected arrival at that port. This can be done by visiting the east and west anchorages of that island or St. Thomas. San Juan being well to windward in the trade region, and having no land influences to windward of it, the seas off that port are naturally continuously rough day and night, making boarding both prolonged and difficult, especially for auxiliary crews . . .

. . . blockading a well-fortified fort containing a force of enemy's vessels whose aggregate force is greater than her own, is an especially difficult one.

. . . a considerable force of vessels is needed off that port (of San Juan), enough to detach some occasionally to cruise about the island. West of San Juan the coast, although bold, has outlying dangers, making it easy at present for blockade runners having local pilots to work in close to the port under the land during the night . . .

--Captain C. D. Sigsbee to the Secretary of the Navy, 27 June, USS St. Paul (U.S. Navy Department, 1898:220).

Regarding the last sentence above, there is no evidence that Capt. Carreras ever intended to navigate close to the land from Dorado to San Juan Harbor. Although we know that some of the sailors aboard Antonio López were Puerto Rican (Sevillano, 1993, pers. comm.), we have no knowledge of local pilots on the ship. In any case, the approach appears highly dangerous, if not impossible, for an ocean liner with a 22-ft. draft. Even today, in times of peace and with sophisticated electronic navigation, the U.S. Coastal Pilot advises that San Juan Harbor "should not be entered at night without local knowledge" (U.S. Dept. of Commerce, et al., 1991:298).

Blockade Runners

In 1898, the Trasatlántica owned 32 liners, the undisputed leader of Spanish shipping interests. A distant second was the Compañía Marítima de Barcelona with 18 ships (Gómez Nuñez, 1899b:118). Prior to the war of 1898, the Trasatlantica had already played an enormous role in the transport of Spanish troops to-and-from the overseas colonies. Between 1868 and 1886, Trasatlántica steam liners had transported over 250,000 soldiers to the island of Cuba alone.

When the war broke out, some 213,000 soldiers were transported in 15 Trasatlántica voyages. The company's war effort also included hospital ships, contribution of personnel and vessels to the Spanish Navy, and blockade-running expeditions (Cassases and Riera, 1987:8).

Blockade runners included vessels from Spain, Cuba, France, Great Britain, Honduras, Norway, Mexico, Germany, and possibly other nations. Most of these vessels were steamers. An extensive listing of blockade runners and Spanish warships captured by the U.S. North Atlantic Fleet was included in the Appendix to the Report of the Chief of the Bureau of Navigation (U.S. Navy Department, 1898:316-325). Due to the numerous vessels in the listing, only those directly relevant to Puerto Rico's blockade are discussed in this report.

On 8 May 1898, the Spanish cargo steamer Rita was captured with a coal shipment en route from St. Thomas to San Juan. The capture was made by USS Yale, Comdr. N. C. Wise, sending Rita with prize crew to Charleston, North Carolina (U.S. Navy Department, 1898:367). On 9 May, Yale was driven off by an armed transport out of San Juan. This was the auxiliary cruiser Alfonso XII, an ocean liner armed with 4 Hontoria guns of 12 cm (Gómez Nuñez, 1902:75). The maneuver allowed the approaching blockade runner Paulina to enter San Juan Harbor from St. Thomas (Rivero, 1973:72).

On 25 May, St. Paul captured the English steamer Restamel, which had left San Juan with 2,400 tons of coal for Cervera's fleet in Santiago de Cuba. Upon questioning by Sigsbee, the British captain responded that there were two other cargo steamers (of the same British company as the Restamel), both loaded with coal, still

inside San Juan Harbor.

On 10 June, the British steamer Tuickenham, en route from Martinique to Jamaica, was captured near Puerto Rico, possibly its unofficial destination. The capture was made by the St. Louis (U.S. Navy Department, 1898:316).

On the night of 27 June, Antonio López arrived off San Juan, and was grounded on the following day, as discussed in detail below. On 26 July, one day after the invasion of Guánica on the south coast, Captain Davis of Dixie reported that the blockade of San Juan continued with New Orleans, and that there was a German steamer inside San Juan Harbor. At present, it is not clear if this was a blockade runner, or the visiting German battleship Geier (Rivero, 1973: 16g).

The Loss of Antonio López

Antonio López was the most distinguished of the Puerto Rico blockade runners, not only by her luxurious prewar career, but more importantly, by her secret cargo for the defense of San Juan, including six breech-loading, bronze cannon of 12 cm; four breech-loading, Mata bronze mortars of 15 cm; two breech-loading, Mata bronze howitzers of 15 cm; also 3,600 projectiles, 500,000 rations, an electric searchlight, fifty tons of gunpowder, etc (op. cit., 1973: 173).

The arrival of this modern matériel was crucial for the Spanish defense of Puerto Rico. This is reflected in the secret telegram received by Capt. Carreras from Don Claudio López Bru (1853- 1925), son of Antonio López and president of the Trasatlántica: "You must deliver the cargo to Puerto Rico, even if it means losing the ship" (op. cit., 1973:176).

On 16 June 1898, Antonio López departed from Cádiz with a total of 79 men, including officers, medic, priest, etc. She had no guns above deck, as Captain Carreras had removed her four Hontoria cannon of 12 cm in Cádiz (Vega, 1992).

After eleven days at sea, on the night of 27 June 1898, Antonio López reached the north coast of Puerto Rico. The previous week,

on 20 June, the Spanish Governor of Puerto Rico had received a coded cable message. While El Morro's lighthouse and the city itself were to remain in blackout as a safety measure against possible bombardments at night, the Madrid Government had ordered that the entry bouys to San Juan Harbor be lighted for the nocturnal arrival of Antonio López.

But there were no lighted buoys awaiting the blockade runner on the night of 27 June. Instead, the entrance to San Juan Harbor was invisible. From previous experience, Carreras knew that the waters off San Juan were burdened with deadly reefs. Even in daylight, the narrow channel into the harbor had to be negotiated slowly.

According to Rivero (1973:180), while Antonio López was lost in the dark, Governor General Macías and General Vallarino drank brandy and played cards at La Fortaleza. And when the socializing was over, instead of giving orders to light the bouys, General Vallarino went to sleep.

By dawn of 28 June, Antonio López was a few miles off Dorado. To the east, beyond the morning rain, was San Juan. At that moment, Yosemite patrolled off Isla Verde, unable to see Antonio López behind the contoured coast and the heavy rain. Yosemite was an unprotected, auxiliary cruiser of 389 ft., Cmdr. William Emory, with a crew largely composed of Michigan Naval Reservists, and university students and graduates.

In the light of dawn, Yosemite's watchers noticed the hoisting of signal flags at Fort San Cristóbal. Incredibly, a signal man was announcing the liner's arrival from the west (Rivero,1973:173). A simple blunder? Anti-Spanish defiance?

Now, with both vessels speeding at full steam towards San Juan, six shells from Yosemite rained on the ocean liner. Aboard Antonio López, taking hit after hit, Carreras was painfully aware that a good shot could ignite the coal and 50 tons of gunpowder.

Eager to stop the Spanish liner, Cmdr. Emory brought Yosemite well within firing range of Morro Castle and Fort San Cristóbal. But the Spanish guns remained silent. The commanders of both strongholds had explicit orders not to fire until given the OK by the high command. With Admiral Cervera's fleet expected anytime, as well as

the arrival of blockade runners from neutral nations, fear of firing at their own ships had locked the Spanish forces into an embarrasing inertia.

With Yosemite coming closer and always firing, Carreras remembered his last orders: to deliver the cargo in Puerto Rico, even if it kills the ship. At this point, that could only mean one thing: to ground the ship on the beach.

At first, it seemed like a good idea, until a loud screech came out of the sea. The ship had been grounded! Suddenly, Carreras had the distinct sensation of wanting to be elsewhere, anywhere but stuck on a reef with shells raining from Yosemite and enough gunpowder and coal to explode Antonio López in a million pieces.

> "Abandon ship!" cried Carreras. "Every man for himself!"
> "Abandon ship!" the command echoed in every room.

Boats were lowered into the sea, departing quickly from Antonio López. Undaunted by the distance of over half a mile to shore, some sailors dove into the sea and swam. Carreras himself abandoned the ship, leaving behind his first officer, eight wounded sailors and the ship's priest.

While Yosemite fired at the liner, out of San Juan Harbor rushed Isabel II, a 2nd class, unprotected, auxiliary cruiser of 210 ft., followed by the smaller General Concha, variously described as a third-class auxiliary and a gunboat, and the fast gunboat Ponce de León.

In San Juan, men, women and children rushed to the city walls to see the spectacle. Soon the three Spanish vessels opened fire, with Yosemite firing back at all three.

Under heavy fire, shooting its Nordenfelt 75 mm. rifle, Ponce de León sped towards the grounded liner. Circling around Antonio López, the fast gunboat bounced against the liner with such power that the gunboat's mizzen mast droped like felled timber. Soon the wounded began stepping down into Ponce de León.

At Morro Castle, Cmdr. Iriarte finally received orders to open fire on Yosemite. For more than half an hour he had waited for the high

command, watching the unprotected American cruiser within range of El Morro's big guns. Now, just as the coastal guns were allowed to fire, Yosemite was retreating out of range.

Out went the first shell, splashing water about 300 ft. ahead of Yosemite. The second shot was already short. Not daring another attack on the grounded liner, Yosemite sped towards the horizon. At 1 :30 p.m., the tug Ivo Bosch left San Juan Harbor, followed by the steamboats Carmelita, Catalina and Esperanza. For three days and nights the boats unloaded the precious and deadly cargo. Meanwhile, Yosemite watched from a distance, with Isabel ll, General Concha and Ponce de León riding shotgun on the salvage boats.

The mastermind behind the operation was Captain Ramón Acha, a Puerto Rican military engineer later promoted to general in the Spanish army. On the night of 29 June, Acha attemped to free the grounded liner with the auxiliary Juan Mantilla. But it was an impossible mission.

Day and night, the salvage continued. Virtually everything was rescued, including the grand piano, the coal, and personal items of the crew. Only a bronze cannon was lost to the sea, when the boat carrying it floundered at night. The following day, the salvors returned with divers and a larger boat, but they were unable to relocate the lost cannon.

By dawn of 15 July, New Orleans arrived at the scene. A protected cruiser of 354.5 ft., New Orleans was armed with 23 guns, including ten 50-caliber guns. She had already seen combat at Santiago de Cuba. Exchanging messages with Yosemite, New Orleans proceeded to three miles of Antonio López. In the morning of 16 July, New Orleans fired twenty incendiary shells on Antonio López. On the third hit, the liner caught fire, blazing into the night of the following day. Weeks later, the once luxurious Spanish liner disappeared beneath the sea.

Upon reaching St. Thomas, Comdr. Emory wired a report on Antonio López to the Secretary of the Navy, but for some unknown reason failed to report the event to Admiral Sampson. As told by Mortimer E. Cooley, ex-Chier Engineer of Yosemite, to Rivero (1973:188), this was the only U.S. vessel to engage in combat in 1898 and not

receive the standard double pay. Years later, Truman H. Newberry, who had served as lieutenant aboard Yosemite, became Secretary of the Navy. It was only then, through an Act of Congress, that Sampson's medal was awarded to the men of Yosemite for their bravery in detaining Antonio López in enemy waters, without support from other vessels.

Blunders notwithstanding, the secret mission of Antonio López was a Spanish victory, which may explain the belated recognition of Yosemite's crew, and the omission of Spanish salvage operations in diverse official reports and publications (U.S. Department of the Navy, 1898 and 1966). The success of the salvage was reported in U.S. newspapers, including New York's Evening Journal of 23 August, doubting the official naval press release regarding the liner's destruction by Yosemite (Rivero, 1973: 185- 186).

What is significant about Antonio López as a blockade runner, is the fact that San Juan was empowered by the influx of artillery, projectiles, gunpowder, rations and other cargo salvaged from the stranded liner. After Antonio López, there were no more attempts to capture or bombard San Juan. Although the U.S Atlantic Fleet had the firepower to destroy the city, now a direct attack would have been costly for both sides.

Shipwreck Integrity

Archaeological Significance of Antonio López

The wreck of Antonio López has integrity of location, design, setting, materials, workmanship, feeling and association. Although the cargo was salvaged in 1898, the shipwreck itself is substantially intact, at the exact place of grounding. Machinery, boilers, deck remains, masts, rigging, anchors, hawse pipes, chains, rudder, smokestack, extensive steel hull remains, and the complete double bottom are some of the diagnostic features capable of yielding extensive data for addressing a wide variety of anthropological research questions.

Antonio López may yield two types of archaeological data: (1) site-specific information on the most important blockade runner of the Spanish-American War in Puerto Rico, and (2) information on

steel shipbuilding of the early 1880's.

Documentation of Antonio López indicates no major transformations in machinery, hull, and rigging throughout her eighteen-year career. As the shipwreck of a Denny 100-A-1 steel liner, Antonio López is capable of yielding siginificant data on compound steam engines, Scotch boilers, steel hull design and construction, and other engineering features of the 1880s. Comparative studies with historic steel and iron shipwrecks will provide new avenues of inquiry into the history of metal shipbuilding, as well as corrosion and shipwreck patterning studies.

The wreck of Antonio López represents a shallow, high-energy, yet substantially intact site, contrary to the standard notion of "shallow=dispersion" developed from wooden shipwreck archaeology. If shipwreck archaeology is regarded as a science, then its general theories should encompass variability within all shipwrecks, including late 19th-century metal liners.

Another potential area of theoretical research is the traditional dichotomy between maritime and naval history. As a civilian vessel destroyed in a blockade-running operation, the archaeology of Antonio López implies both merchant and naval behavior simultaneously. The fact that Capt. Carreras abandoned his ship should not be reduced to a personal act of cowardice or dishonor, but rather be studied in the context of a civilian seaman caught up in a war that was eminently unpopular among various sectors of Spain's maritime sub-cultures (Arderius, 1903; Cerezo, 1977; Cervera, 1899; O'Toole, 1984).

The Spanish-American War was a crucial period in the history of Puerto Rico and the United States. Antonio Lopez is a significant cultural resource which, combined with other shipwreck and terrestrial sites, will allow us to develop new anthropological perspectives on naval warfare, blockade runners, maritime technological innovation, transportation between Spain and the Caribbean during the late 19th century, and other areas of human behavior.

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GEOGRAPHICAL DATA

Verbal Boundary Description

The substantially intact shipwreck of Antonio López lies on a north-south axis (180 degrees mag.), with the bow pointing S towards Dorado's Mameyal Beach. The area included in the site is a rectangle 500 ft. long by 300 ft. wide (152 x 91m). The geographical center is amidships, and is the charted vessel position.

Boundary Justification

The boundary for this site is based upon visual examination of the bottom, accomplished by (1) snorkeling above the wreckage and immediate area, (2) towing from a small motorboat along the reef, (3) site measurements taken by scuba diving from a mag. N-S baseline, and (4) undersea video and photography. The boundary includes the main area of continuous hull wreckage, as well as a large anchor and other isolated features on the rocky floor. The site is stable, with the hull flattened towards equilibrium atop the relatively level, eolianite floor of Angelina Reef. Most of the site is exposed, with a veneer of coral growth.

LIST OF FIGURES

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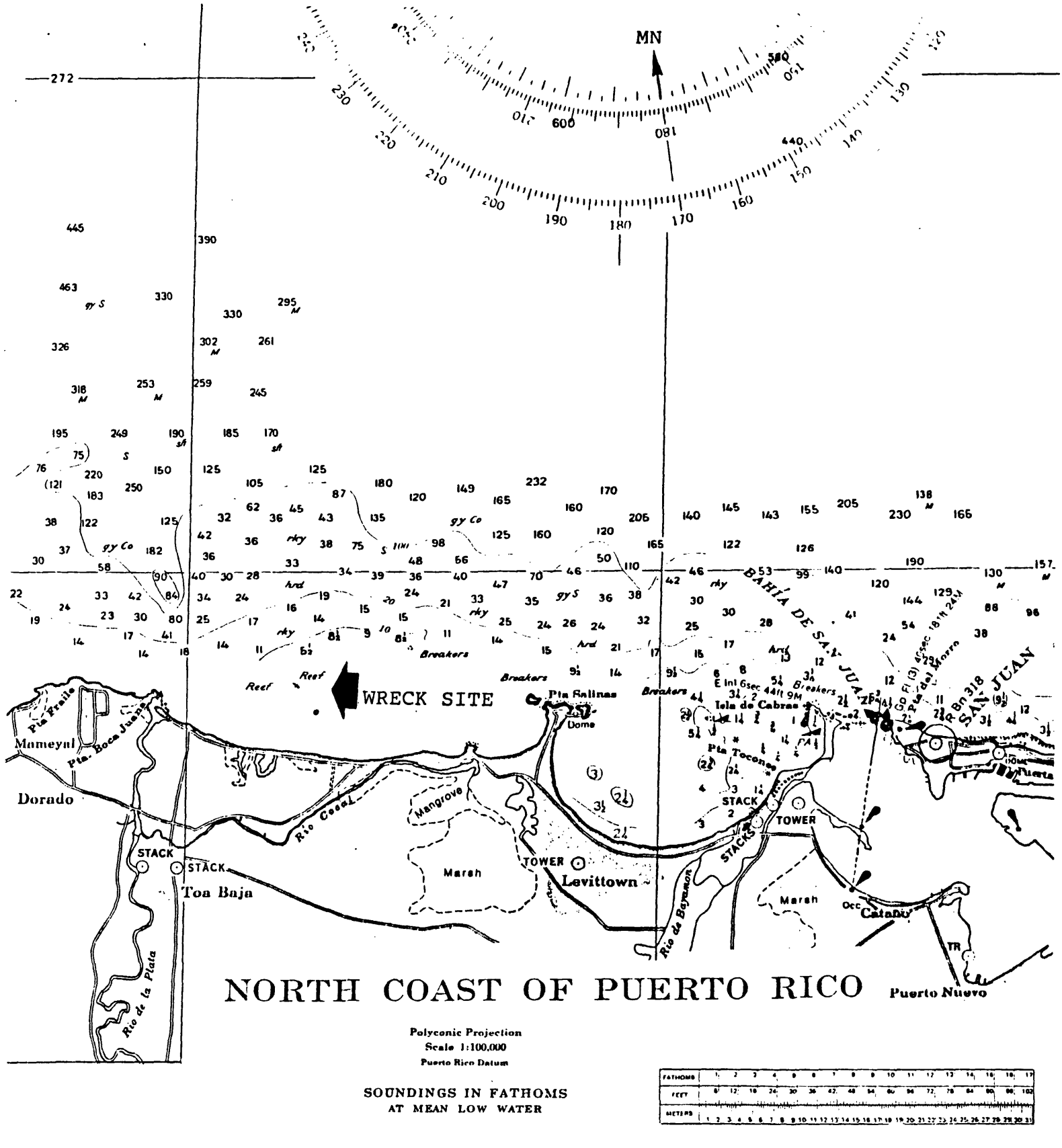


Figure 1. Study Area, North Coast of Puerto Rico.
Source: NOAA Chart 25668, 9th Ed., Jan. 15, 1977.

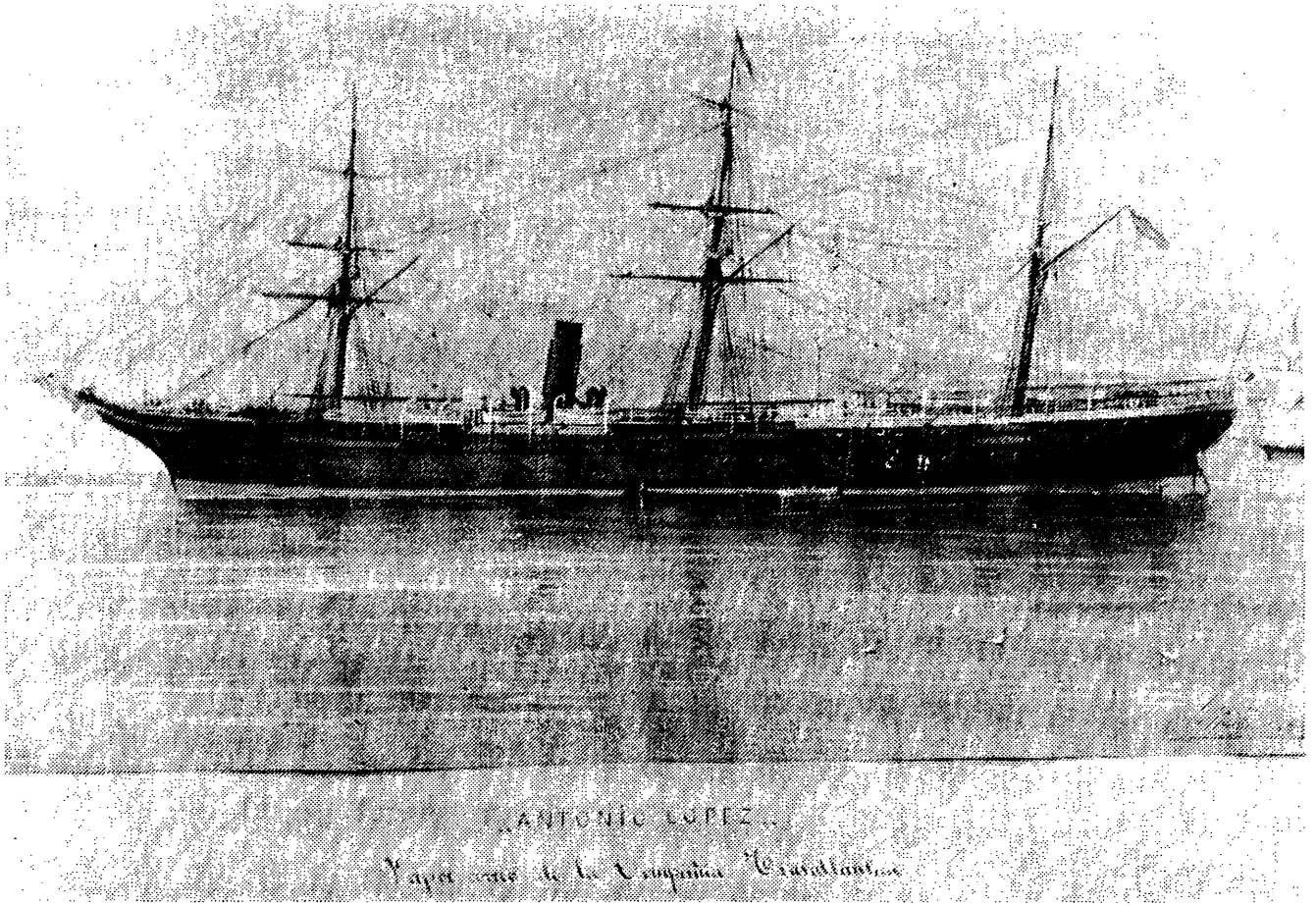


Figure 2. Watercolor of S.S. Antonio Lopez, by Monleon.
Source: Museo Naval, Madrid.

SHEER DRAUGHT

S.S. ANTONIO LOPEZ

LENGTH BETWEEN PERPENDICULARS 370-0
BREADTH MOULDED 42-0
DEPTH DO. 30-0
DO. OF HOLD 27-8

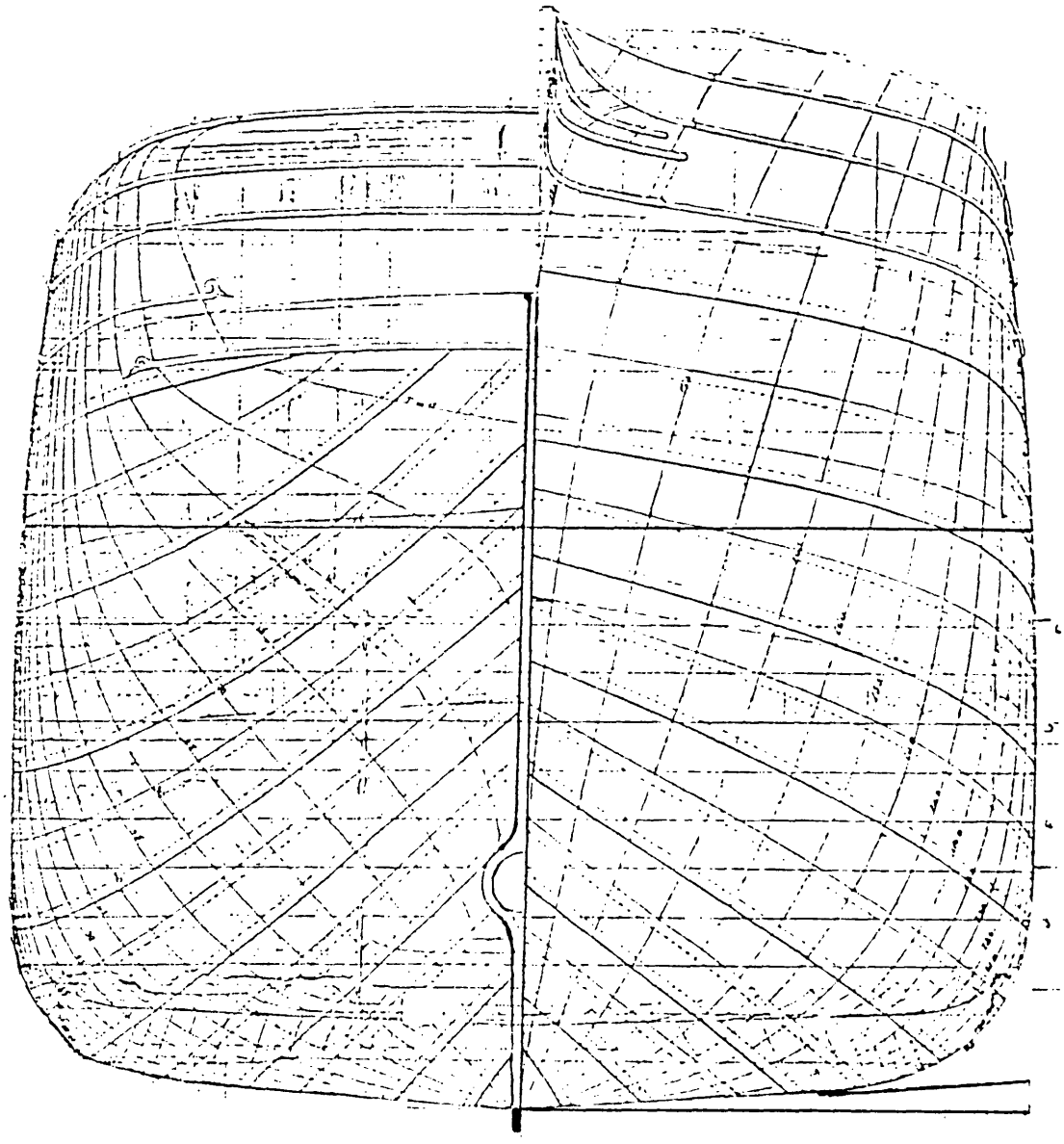
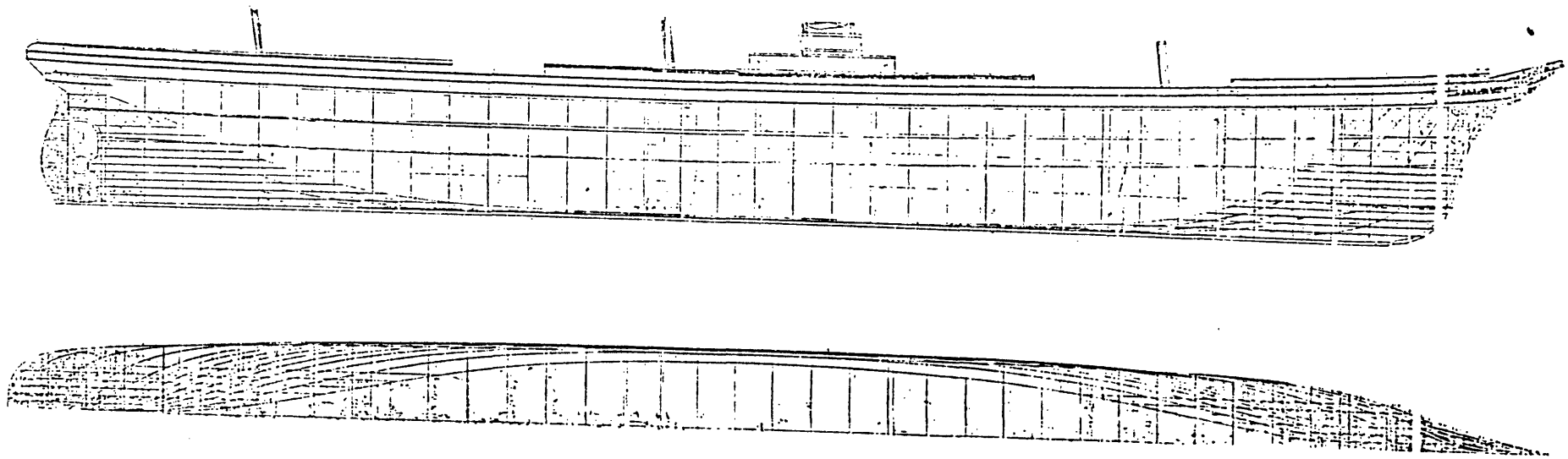


Figure 3. Body Plan, S.S. Antonio López. Source, all plans: National Maritime Museum, Greenwich, London.



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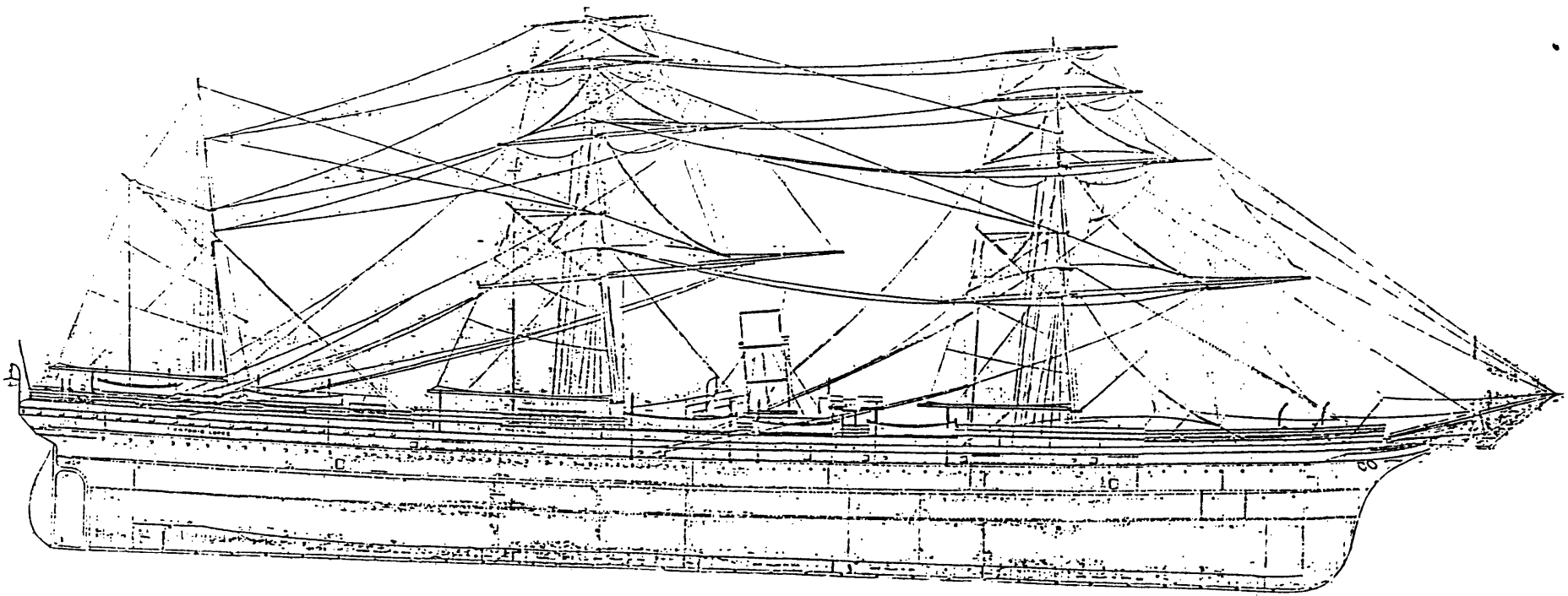

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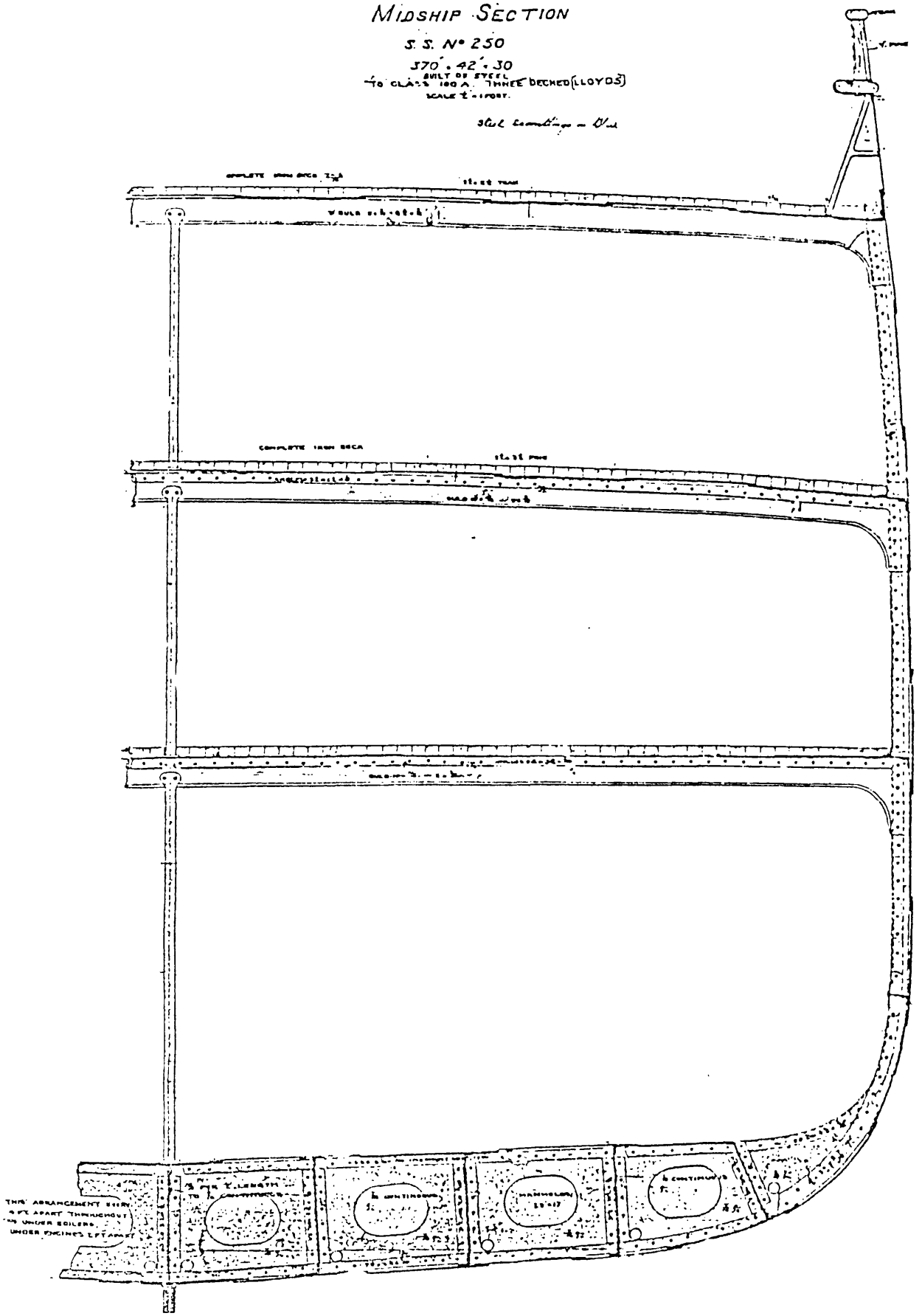

Figure 8. Midship Section, S.S. Antonio López.

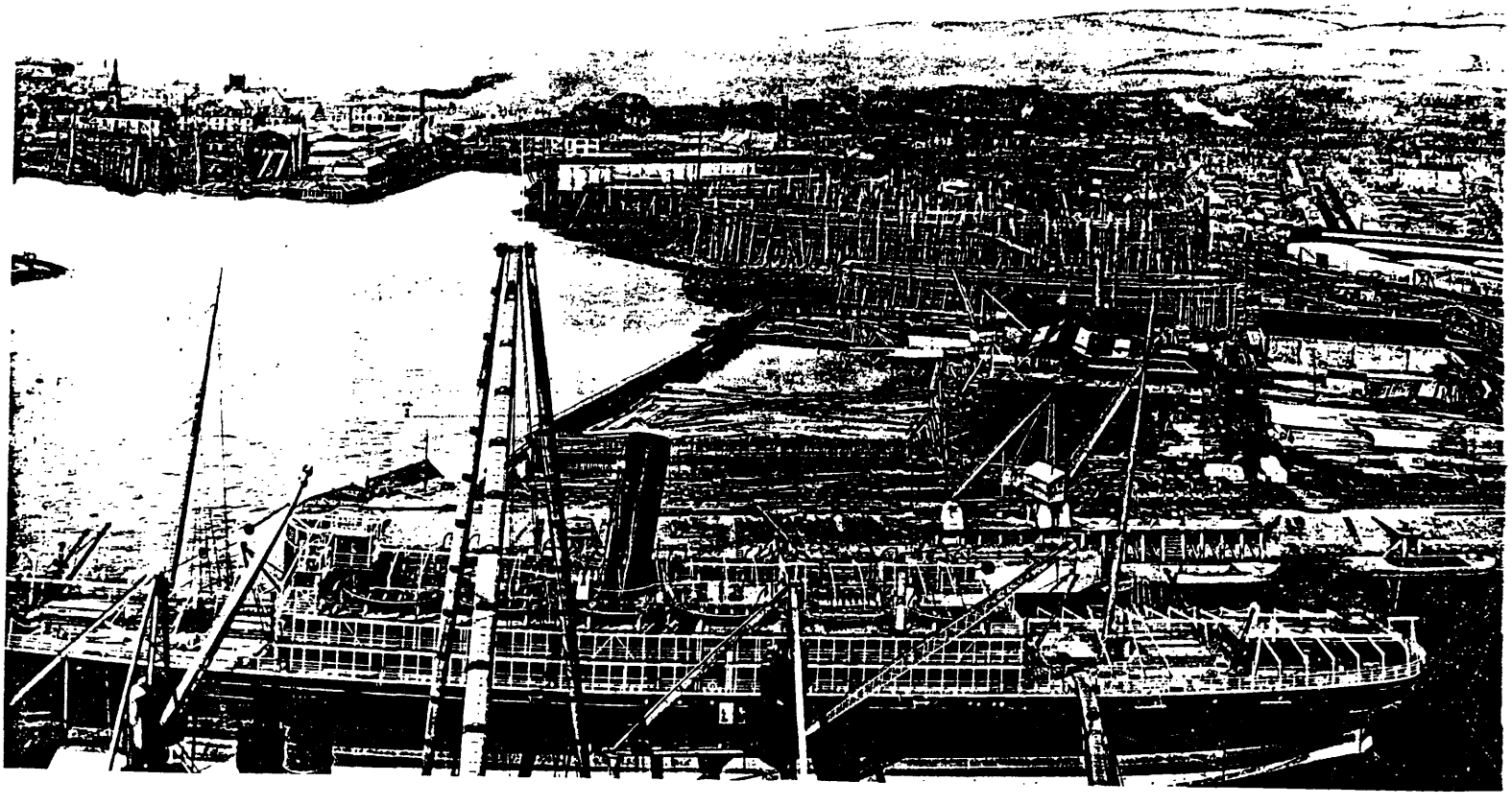

Figure 9. Denny's Leven Shipyard, Dumbarton, Scotland.
Source: Denny Ship Model Experiment Tank.

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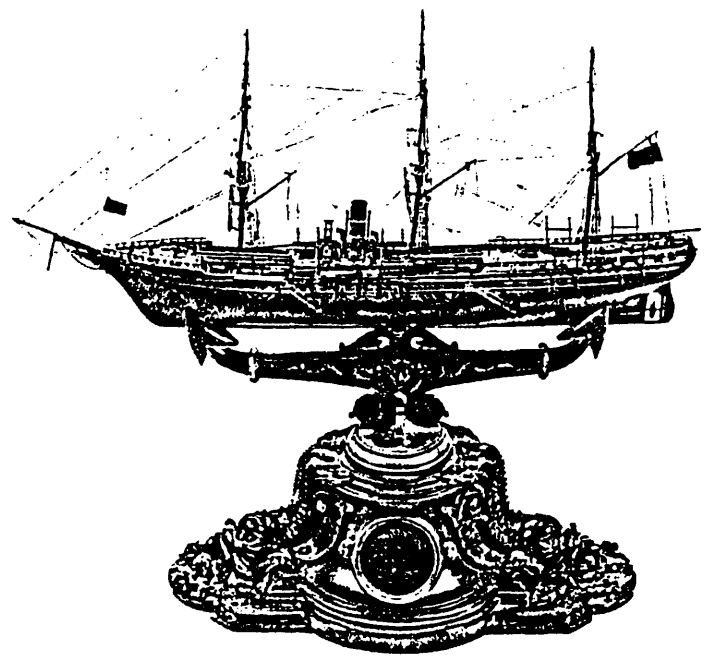
Source: R. González Echegaray (1983:92).

Figure 11. Antonio López y Cía., Logotype.
Source: Cassasses i Riera (1987:3).



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Source: Martínez-Hidalgo (1985:95).