MINUTE ITEM

27

12/23/80
W 23816
Lane

APPROVAL OF SALVAGE PERMIT

Calendar Item 27, attached, was pulled from the agenda prior to the meeting.

Attachment: Calendar Item 27.

CALENDAR PAGE
MINUTE PAGE 4089

CALENDAR ITEM
27

A 9
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12/23/86
W 23816
Lane

APPROVAL OF SALVAGE PERMIT

APPLICANT: Robert F. Marx
dba Phoenician South Seas
Treasures, Ltd.
330 Thyme Street
Satellite Beach, Florida 32937

AREA, TYPE LAND AND LOCATION
A 20.0 acre parcel of ungranted tide and submerged land, located in the Pacific Ocean, Drake's Bay, Marin County.

LAND USE: Retrieval and salvage of a sunken vessel and the contents thereof.

TERMS OF PROPOSED PERMIT:
Initial period: One year beginning January 1, 1987.

Renewal options: One successive period of one year.

Public liability insurance: Combined single limit coverage of $1,000,000.

CONSIDERATION: $500 land rental; and 25 percent of the net salvage value of $25,000 or less, and 50 percent of the net salvage value in excess of $25,000; said sum shall be due on the first of the month following the sale and bear 18 percent interest per annum, if not paid within 15 days of the due date.

BASIS FOR CONSIDERATION:
Pursuant to 2 Cal. Adm. Code 2003.

PREREQUISITE CONDITIONS, FEES AND EXPENSES:

Filing fee and environmental costs have been received.

STATUTORY AND OTHER REFERENCES:

A. P.R.C.: Div. 6, Parts 1 and 2; Div. 13

B. Cal. Adm. Code: Title 2, Div. 3; Title 14, Div. 6.

AB 884: 04/28/87.

OTHER PERTINENT INFORMATION:

1. This project involves the potential retrieval and salvage of the remains and contents of the "San Augustin", a Manilla Galleon purportly sunk in Drake's Bay in 1595.

   The applicant is a well known underwater archaeologist who has many scientific underwater explorations and recoveries to his credit. His specialization is Naval and Maritime history with an emphasis on the Spanish Colonial period in the Caribbean and Spanish Maritime trade between 1500-1800.

   Terms of Permit require the applicant to provide the Commission with an acceptable archaeological recovery plan prior to recovery of any items. The plan must furnish a detailed description of recovery information and specific methods for conservation.

   All items removed from the site will be inspected and appraised by competent appraisers. Whether the items will be sold or retained by the permittee, the State will be compensated according to terms of the Salvage Permit. For any items retained by the State, the Permittee will be credited against percentage rentals otherwise due th State.

2. Pursuant to the Commission's delegation of authority and the State CEQA Guidelines (14 Cal. Adm. Code 15025), the staff has prepared a Proposed Negative Declaration identified as EIR ND 411, State Clearinghouse No. 861104410. Such Proposed Negative Declaration was prepared and circulated for public review pursuant to the provisions of CEQA.

   Based upon the Initial Study, the Proposed Negative Declaration, and the comments received in response thereto, there is no substantial evidence that the project will have a significant effect on the environment. (14 Cal. Adm. Code 15074(b))

3. This activity involves lands identified as possessing significant environmental values pursuant to P.R.C. 6370, et seq. project, as proposed, is consistent with its use classification.

FURTHER APPROVALS REQUIRED:
National Marine Fisheries Service.

EXHIBITS:
A. Location Map.
B. Negative Declaration.

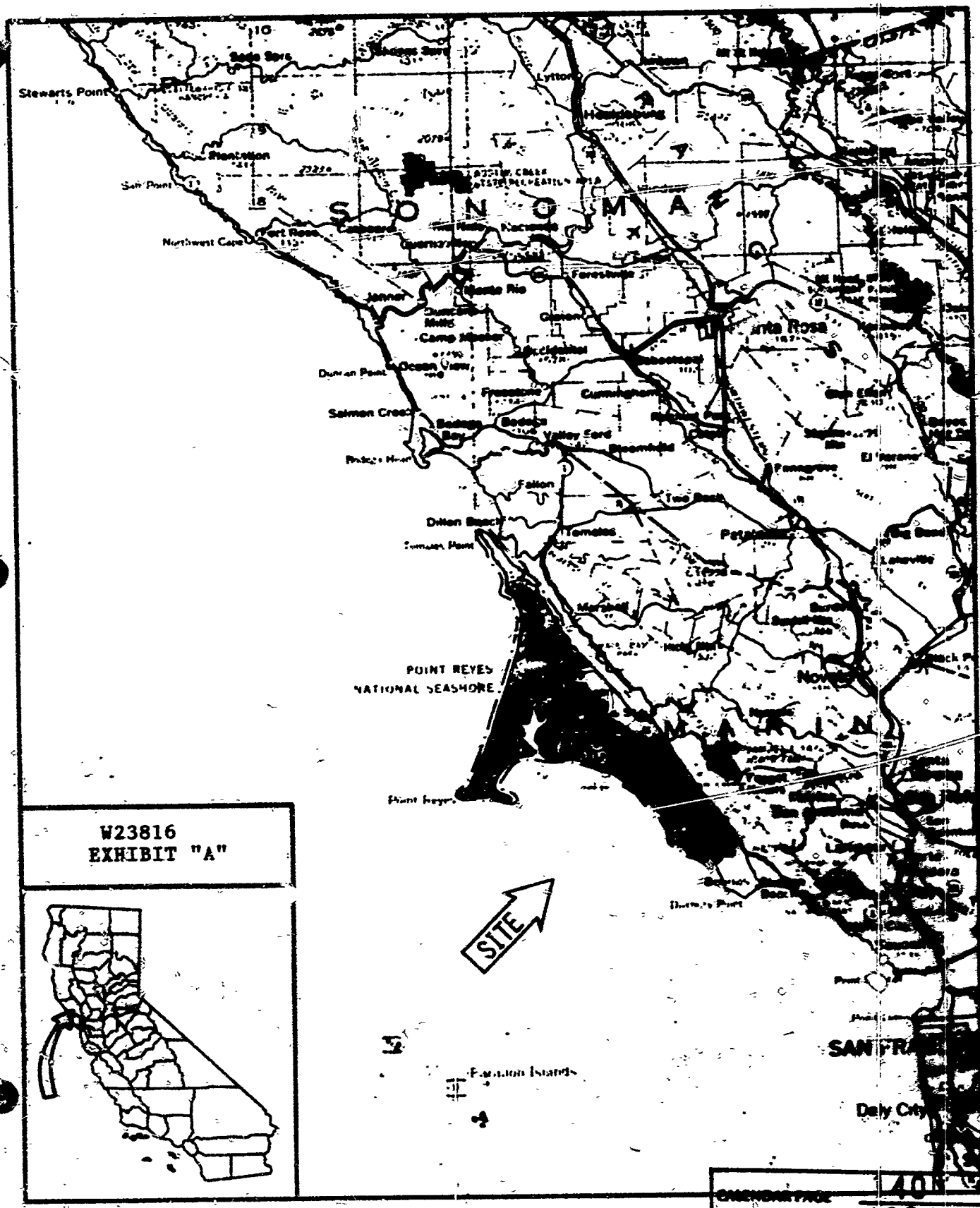
IT IS RECOMMENDED THAT THE COMMISSION:

1. CERTIFY THAT A NEGATIVE DECLARATION, EIR ND 411, STATE CLEARINGHOUSE NO. 861104410, WAS PREPARED FOR THIS PROJECT PURSUANT TO THE PROVISIONS OF THE CEQA AND THAT THE COMMISSION HAS REVIEWED AND CONSIDERED THE INFORMATION CONTAINED THEREIN.

2. DETERMINE THAT THE PROJECT, AS APPROVED, WILL NOT HAVE A SIGNIFICANT EFFECT ON THE ENVIRONMENT.

3. FIND THAT THIS ACTIVITY IS CONSISTENT WITH THE USE CLASSIFICATION DESIGNATED FOR THE LAND PURSUANT TO P.R.C. 6370, ET SEQ.

4. AUTHORIZE ISSUANCE TO ROBERT F. MARX DBA PHOENICIAN SOUTH SEAS TREASURES, LTD OF A ONE-YEAR SALVAGE PERMIT, AS ON FILE IN THE MAIN OFFICE OF THE STATE LANDS COMMISSION, BEGINNING JANUARY 1, 1987; WITH AN OPTION OF ONE ADDITIONAL YEAR EXTENSION AT THE DISCRETION OF THE STATE LANDS COMMISSION AND UPON SUCH REASONABLE TERMS AND CONDITIONS AS MAY BE IMPOSED BY THE COMMISSION, IN CONSIDERATION OF $500 LAND RENTAL AND 25 PERCENT OF THE NET SALVAGE VALUE OF $25,000 OR LESS, AND 50 PERCENT OF THE NET SALVAGE VALUE IN EXCESS OF $25,000; SAID SUM TO BE DUE ON THE FIRST OF THE MONTH FOLLOWING THE SALE AND BEAR 18 PERCENT INTEREST PER ANNUM IF NOT PAID WITHIN 15 DAYS OF THE DUE DATE; PROVISION OF PUBLIC LIABILITY INSURANCE FOR COMBINED SINGLE LIMIT COVERAGE OF $1,000,000; FOR RETRIEVAL OF AN ABANDONED VESSEL AND THE CONTENTS THEREOF ON LAND AS DESCRIBED AND ON FILE IN THE OFFICES OF THE COMMISSION.



W23816
EXHIBIT "A"

ORDINANCE PAGE 40
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STATE OF CALIFORNIA--STATE LANDS COMMISSION

GEORGE DEUKMEJIAN, Governor

STATE LANDS COMMISSION
1807 13TH STREET
SACRAMENTO, CALIFORNIA 95814

PROPOSED NEGATIVE DECLARATION

EIR NO 411

File Ref.: 23816

SCH#: 861104410

Project Title: Salvage Permits for Remains of the "San Agustin"

Project Proponent: Mr. Robert Marx and Phoenician Explorations, Inc.

Project Location: In Drakes Bay, off the coast of Marin County

Project Description: Mr. Marx will attempt to determine the precise location and condition of the remains of the galleon "San Agustin," and will attempt a salvage of the vessel and her contents if feasible.

Contact Person: Goodyear K. Walker **Telephone:** (916) 322-0530

This document is prepared pursuant to the requirements of the California Environmental Quality Act (Section 21000 et seq., Public Resources Code), the State CEQA Guidelines (Section 15000 et seq., Title 14, California Administrative Code), and the State Lands Commission regulations (Section 2901 et seq., Title 2, California Administrative Code).

Based upon the attached Initial Study, it has been found that:

☐ the project will not have a significant effect on the environment.

☒ mitigation measures included in the project will avoid potentially significant effects.

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Form 13.13 (10/86)

INTRODUCTION

Over 70 percent of the earth's surface is covered by water. Only recently has man begun to plumb the depths of his watery planet, and countless traces of the past await the underwater archaeologist. Like the artifacts painstakingly unearthed from land sites, shipwrecks furnish clues to help archaeologists and historians reconstruct our past.

Underwater archaeology is a relatively new discipline, but one of the fastest growing around the world. Underwater sites are generally far less disturbed than those on land. With the exceptions of a few sites such as Pompeii, Herculaneum and Thera, entombed in a fiery flood of lava, land sites typically present stratum after stratum of occupation. One site often spans thousands of years and frequently artifacts from one period become mixed in with those of another period when the site is disturbed, making it difficult for the archaeologist to assign precise dates to the findings.

A sunken ship, however, is often an encapsulated unit. At the moment when disaster struck, time stood still. The vessel sank to the bottom and lies there, representing a single unpolluted moment of a bygone era. There are exceptions: Ships which sunk in port areas where other vessels sank on top of them, wrecks littered by trash from ships anchored above them, and shipwrecks on which salvors have left traces of a later time.

From a shipwreck the underwater archaeologist can recover virtually every artifact that might be found on a land site of the same era. And sometimes he finds objects never seen before. Everything from the smallest coin to marble columns weighing several tons have been found, even such seemingly perishable items as foodstuffs, cloth and paper. A shipwreck can be a time capsule from which the archaeologist gains important information about construction, rigging and armament.

A shipwreck can sometimes be the only source for revealing historical data on a particular type of ship and period of navigation. Such is the case with the famed Manila Galleons. In 1945, the United States was forced to bomb a section of Manila where the Japanese were entrenched and in so doing, totally obliterated the National Archives of the Philippines. Unfortunately, this archives contained three centuries of documents relevant to just about every aspect of the Manila Galleons from the manner in which they were constructed to the actual logbooks compiled during the

voyages. The documentation concerning Manila Galleons which can be found today in the Spanish and Mexican archives is just a drop in the bucket of what was lost in the Manila archives. Thus, in order to learn more about the history of these fabulous ships we must resort to underwater archaeology!

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THE MANILA GALLEONS

The first of the fabled Manila Galleons crossed the Pacific in 1565. The last one put into port in 1815. When the line began, Philip the Second was king of all the Spains and his enemy, Elizabeth Tudor, was queen of England. Hernan Cortes, conqueror of Mexico, had been dead but eighteen years. The same year Pedro Menendez de Aviles laid the foundations of St. Augustine in Florida. When the last Manila galleon sailed it was already five years since Miguel Hidalgo had begun the revolt against Spain which was to create the Republic of Mexico. The United States had been a nation for forty years and Andrew Jackson had just won the battle of New Orleans.

Yearly, for the two and a half centuries that lay between, the galleons made the long and lonely voyage between Manila in the Philippines and Acapulco in Mexico. No other line of ships has ever endured so long. No other regular navigation has been so trying and dangerous as this, for in its two hundred and fifty years the sea claimed dozens of ships, thousands of men and many millions in treasure. As the richest ships in all the oceans, they were the most coveted prize of pirate and privateer. The English took four of them, - the "Santa Ana" in 1587, the "Encarnacion" in 1709, the "Covadonga" in 1743, and the "Satisima Trinidad," largest ship of her time, in 1762.

To the peoples of Spanish America, they were the China Ships or Manila Galleons that brought them cargoes of silks and spices and other precious merchandise of the East. To those of the Orient, they were silver argosies, laden with the Mexican and Peruvian pesos that were to become the standard of value along its coasts. To California, they furnished the first occasion and motive for the exploration of its coast. To Spain, they were the link that bound the Philippines - and, for a time, the Moluccas - to her, and it was the comings and goings that gave some substance of reality to the Spanish dream of empire over the Pacific.

The Manila Galleons were the largest ships the Spanish used. In the sixteenth century they averaged about 700 tons; in the seventeenth century the average was 1,500 tons; and in the eighteenth century they were between 1,700 and 2,000 tons. Three or four of these ships sailed annually in each direction until 1593, when a law was passed keeping the number of sailings down to two a year in each direction.

The voyage from Acapulco to Manila was usually pleasant enough, with only an occassional stor unsettling the routine sailing from eight to ten weeks. On the other hand, the voyage from Manila to Acapulco was known as the most treacherous navigation in the world. Because the winds in the Philippine latitudes are from the east, the Manila Galleons had to beat their way as far north as Japan before reaching the belt of westerly winds which would carry them across the Pacific until they made landfall on the coast of California and then worked their way down to Acapulco.

This voyage took from four to eight months, depending on luck. Counting the crews, from 300 to 600 persons sailed on each galleon with an average of from 100 to 150 of them perishing enroute from epidemics, scurvy, thirst, starvation, or the cold. On one of two Manila Galleons sailing jointly in 1657, all 450 persons aboard succumbed to a smallpox epidemic. About half the 400 aboard the other galleon also died.

Notwithstanding the great risks to life, ships, and property involved in this navigation, the financial gain accruing to those involved in the Manila galleon trade and to the Royal Crown seemed well worth the hardships. The cargoes carried from Acapulco to Manila were basically the same as those carried on the flotas between Spain and the Indies ports, except that silver specie and bullion were also carried on these galleons, coming from the mines of Peru and Mexico to pay for the cargoes sent to Manila. The Crown restricted the amount to be sent to Manila at 500,000 pesos a year, but like many other laws, this was almost always disregarded so that an average of 3 to 5 million pesos were sent to Manila annually. In 1597, the fantastic amount of 12 million pesos reached the Asian port.

The cargoes plying the route from Manila to Acapulco were of a more exotic and diversified nature. The main item was silk from China and Japan of varied types. There were crepes, velvets, gauzes, taffetas, damasks, and grosgrains. Packed in chests were silks in every stage of manufacture from lengths of raw silk to finished apparel - robes, kimonos, skirts and stockings. Finely embroidered Chinese religious vestments, silken tapestries and bedcoverings were also shipped. Fine cottons from the Mogul Empire of India comprised a good part of the cargoes during the latter part of the trade as were Persian carpets, imported into the Philippines via India.

In addition, the Manila Galleons carried exquisite jewelry including pendants, earrings, bracelets and rings. There were gem studded sword hilts, rugs, fans, combs and a

wide range of precious spices and drugs (including rhubarb which was much sought after in Europe). The ships carried a great deal of beautiful Chinese porcelainware, objects carved of ivory and sandalwood, gold bells, copper cuspidors and exquisite and unusual devotional pieces such as crucifixes, reliquaries, rosaries and religious sculptures in wood, ivory and gold, crafted in the Orient for Roman Catholics.

Considerable gold in the form of bullion or manufactured articles was exported to Mexico. Though there was legal ban on the importation of jewelry from the Orient, in a large consignment confiscated at Acapulco in 1767 there are enumerated hundreds of rings, many of which were set with diamonds and rubies, bracelets, pendants, earrings and necklaces and a number of gold religious articles including a cross set with eight diamonds. On the same occasion officials also seized "a golden bird from China," some jewel-studded sword hilts, and several alligator teeth capped with gold. Many unset or uncut gems were also carried to Mexico by the Manila galleon. Henry Hawks, an English merchant who spent five years in Mexico in the sixteenth century wrote: "There was a mariner that brought a pearl as big as a doves eggs from thence, and a stone for which the Viceroy would have given 3000 duckets."

When the richly laden Manila Galleons reached Acapulco, merchants arrived from as far away as Peru and a fair was held at which the bulk of the goods were sold. Peruvian merchants would carry their newly acquired merchandise down to Panama City and sail home later in the year on the ships of the Armada of the South Seas. Mexican merchants had their goods carried over the mountains by mules. The agents who represented the merchants in far off Seville also used mules and travelled all the way to Veracruz to board the New Spain Flota back to Spain.

More than 90 percent of all the Manila Galleons lost over the centuries went down in Philippine waters. Ships sailing for Mexico foundered on treacherous reefs or fell victim to typhoons before they were far from Manila and even though the Acapulco-Manila route was less hazardous overall than the route east to the New World, once the heavily laden galleons entered the waters around the Philippines they were in dangerous territory.

Dozens of Manila Galleons lie beneath the seas around the Philippines. Unlike so many of the treasure galleons lost in the New World, none has ever been found or salvaged. They sunk in deep water, beyond the reach of Spanish Colonial salvors but well within the reach of modern salvage efforts.

DRAKE'S BAY MANILA GALLEON

Drake's Bay, located approximately 24 nautical miles west-northwest of the entrance to San Francisco Bay, is so named because it is believed that Sir Francis Drake stopped there to careen his ships during his renowned circumnavigation of the world in 1578. He dubbed the surrounding coastline Nova Albion and took possession for England - a move that infuriated the Spanish who resented intrusion into their territory.

On July 5, 1595, four Manila Galleons were dispatched from Manila enroute to Acapulco, their crowded holds crammed with treasures. The smallest ship of the fleet was the San Agustin, commanded by Captain Sebastian Rodriguez Cermeno. And, although she was only 200 tons, she carried 130 tons in valuable oriental cargo - silks, spices, porcelain and some chests of gold, silver, ivory, jade and ebony objects, in addition to an undetermined amount of precious stones.

Unlike the three larger ships which were to proceed directly to Acapulco, the San Agustin had orders to stop along the coast of California for purposes of exploration. The main objective was to locate one or more safe havens where Manila Galleons could stop to make necessary repairs and take on fresh water and firewood before continuing on to Acapulco.

On November 6, 1595, after a difficult crossing, the ship anchored in Drake's Bay. While most of the crew and passengers were ashore, a sudden storm struck causing the ship to sink. Very little of her cargo was saved. However, the ship's launch was spared and the majority of people managed to reach the port of Chacala, Mexico after a hazardous voyage of more than two months.

Most of the information concerning the loss of the San Agustin comes from Cermenos own account, which was translated by Henry Wagner in 1924 and published in the California Historical Quarterly.

The following is from the original account of Sebastian Rodrguez Cermeno and is signed by him.

> ... As the weather was severe we kept getting near the land, and having reached it, a morro was discovered, which makes a high land and seemed like the Punta del Brazil of Tercera. Running along a musket-shot from the land, we saw a point which bore northwest, and entering by this we say that there was a large bay. Here I went on casting the lead,

with the bow headed north a quarter northeast, with the bottom of the sea of sand, and went on to seven fathoms, where I anchored. The point on the west side bore southwest quarter west, and the one on the east, south-southeast. The bay is very large and shaped like a horseshoe, and a river runs into it, and on the bar at high tide there are three fathoms of water, and from the bar outside to the entrance of the anchorage there is a distance of two shots of an arquebus. Having anchored in this bay, we saw in the middle of it three small islands which bore south-south-west, and to the south a small island of half a league in size. The islands trended northwest-southeast. The land is bare. The river above referred to enters into the land three leagues and has a narrow mouth, while above in some parts it is a league in width, and in others a half a league. On the west side it has two branches of half a league each, and on the east side one, the entrance of which is a matter of a quarter of a league from the bar ...(Wagner 1924)

... The land seems fertile as far as three leagues inland, according to what I saw and what the other Spaniards saw whom I took with me to seek food, of which there was need on account of the loss of the ship ... (Ibid)

... On Friday morning the 8th of December, we left the bay and port of San Francisco--or as its other name is, Bahia Grande--where we were shipwrecked. This bay is in the 38 2/3° and the islands which are in the mouth (of the bay) are in 38 1/2°, and from one point of the bay to the other there may be a distance of twenty-five leagues ... (Ibid)

The following is from a Declaration made by Cermeno on November 30, after he and the expedition survivors arrived in Chacala.

In the port and bay of the new discovery of Cape Mendocino in the camp of Santa Fe, the 30th of November, 1595, before me, Pedro de Lugo, escribano of the King our master, Captain Sebastian Rodriguez Sermeno, chief pilot of the said discovery, said that the reason of having lost, while at anchor in the port, the ship San Agustin which he brought and which Captain Pedro Sarmiento had offered to the King in Manila, without being able to save any of the supplies and other property which was on board, ...

Lastly, the Balanos-Ascension Derrotero, which was translated by Wagner (1926), but which we have taken from Aker (1965), states:

> ... It is called "La Punta de los Reyes" and is a steep morro. On its northeast side this furnishes a very good shelter, making it a good port for all ships. It is in the latitude of 38 1/2°. Note that in anchoring in this port, called "San Francisco," for shelter from the south and southeast winds, you have to do so at the end of the beach in the corner on the west-southwest side ...
>
> ... Here it was that the ship San Agustin was lost in 1595, coming on a voyage of exploration. The loss was caused more by the man commanding her than by the force of the wind ...

The only additional piece of information that is available in a primary source is a comment in the Declaracion of Cermeno before Pedro de Lugo, Scrivener of the King. Although most of the relevant text is repetition of his "account" quoted above, one significant comment is added: "The ship anchored in the bay and port about a quarter of a league from shore" (Aker 1695 as taken from Wagner 1926).

As can be seen, these accounts give only a brief mention of the actual sinking. This may be due to a separate declaration having been taken to cover the loss of the ship. Such a document has never shown up, but it is likely to have been considered a "State secret," both because of the value of the ship and the comment above that the loss was "...caused more by the man commanding her...," and it will most likely never be found.

The approximate location of the San Agustin, within several hundred yards, has been known by scholars for years. Since 1940, more than 800 artifacts, primarily porcelain sherds, have washed ashore on the beach adjacent to the wreck site. Among the artifacts are other ceramic objects, iron nails and spikes, pieces of ships rigging and a brass mortar. An amateur diver reportedly recovered a small bronze cannon, several harquebuses and a few pieces of intact porcelainware.

Due to the fact that the San Agustin is not only the oldest, but possibly the richest shipwreck lost on the west coast of North America, it has been the subject of a great number of scholarly reports and popular articles.

PRIOR ATTEMPTS TO LOCATE THE SAN AGUSTIN

The area of Point Reyes and Drake's Bay are strategically located and offer safe haven from northerly storms and has been used by mariners for many centuries. The San Agustin is believed to be the first ship to have been lost in this area, but at least 72 others over the centuries have met a like fate.

Raymond Aker, a maritime historian associated with the Drake Navigator's Guild, has produced a comprehensive analysis of the portions of the Wagner translation that relate directly to the location of the wreck, and has settled on a probable site just seaward of the present mouth of Drake's Estero. He was assuming that, in 1595, the actual cut through Limantour Spit was located east of its present location.

The step-by-step rationale that Aker develops to justify his conclusion is well-thought-out and unfortunately may be proven correct. It would be unfortunate because it would place the vessel within or very near the existing breaker zone at the mouth of the estero. This area would be extremely difficult to survey adequately, and next to impossible to excavate for the purpose of ground-truthing any remote sensing anomalies. Analysis of this data by the National Park Service, however, put the wreck as much as 1.5 miles west of Aker's projections, and out of the present breaker zone. The logic for this conclusion is based on some very slight differences of interpretation of the documentary evidence. Other analysis have produced still other locations, but these two appear to be the best grounded in the few murky facts available.

In December 1963, discussions were held between John Huston of San Francisco (one of the founders of the Council of Underwater Archaeology), Adan Treganza of San Franciso State Unviersity, and Paul Schumacher who was then the National Park Service Regional Archaeologist, about the need for an underwater archaeological survey of Drake's Bay. Two years later in March 1965, a survey was undertaken using a rubidium magnetometer owned by Varian Associates of Palo Alto and supervised by John Huston. Their main objective was to locate the remains of the San Agustin. Huston reported obtaining a number of "strong anomalies" in the area where the San Agustin was presumed lost but no excavations were ever undertaken to identify the targets. Huston was known to have carried out a great deal of historical research on the San Agustin but failed to write a report on his work before his death in 1968.

In 1982, between August 23 and September 5, and October 4 to 14, the National Park Service conducted a survey of Drake's Bay using remote sensing instruments. A magnetometer was ued to cover an area of 2.5 square miles and they obtained 686 anomalies. These anomalies were analyzed, and 49 clusters of anomalies were indicated for priority test excavation. The majority of these no doubt were from modern-day wreckage and debris. Side scan sonar was also used covering an area of 10 square miles in Drake's Bay to locate any targets which were protruding above the sea floor. A sub-bottom profiler sonar unit was also used covering 30 linear miles to obtain an accurate picture of the bay geology. It was learned that the depth of sediment in the bay ranged from a few inches to seven meters in some areas. The NPS produced an excellent report on their work in this bay but unfortunately were unable to follow up with excavations. Some of their magnetometers anomalies were in the area where the San Agustin was presumed lost and they may have located some sections of this shipwreck.

There have been numerous reports of sports divers and treasure hunters conducting unauthorized searches in Drake's Bay and there are unconfirmed reports that both airlifts and blasters have been used in some cases. There are also reports of divers finding two bronze cannons, numerous intact pieces of porcelain, several muskets and a brass mortar - similar to the one located on land by archaeologists.

ANALYSIS

Over the years a great deal has been written about the loss of the San Agustin in Drake's Bay and the explorations in this area undertaken by Cermeno and his men. Some accounts state that the ship was anchored in five fathoms and others state the depth as seven fathoms. All agree that the location was a quarter league offshore but few authors agree on the exact measurements of a league. My own research indicates that a league was three and a half nautical miles during this period. This would put the anchorage at .875 nautical miles offshore. However, there is geological evidence pointing to the fact that the shoreline has receded over the years and this would put the anchorage even further offshore today.

We know that a storm arose while most of the crew of the ship was ashore and "the ship was lost." Some authors assert that the ship was driven ashore and went to pieces but historical information does not confirm this fact. No doubt her masts and rigging, as well as a part of her superstructure went ashore, but the main section of her hull and all of her armament, ballast, cargo probably remains further offshore. The fact that the survivors were not able to recover any of her cargo and very little of her stores substantiates this fact.

One of the main differences in analysis of the wreck's location is to what degree the ship was blown from her mooring location before sinking. The Park Service analysis combines an ocean swell from west-northwest and a southeast wind to push the San Agustin directly onshore from her anchorage. Aker argues against the southeast wind, believing that under such conditions the crew could have tacked out to safety. But with the captain and the bulk of the crew ashore, and an incompetent (?) in charge, the logic of very little eastward drift could be valid. Information from the Spanish Archives, however, would indicate that the ship actually sunk at her moorings, and didn't drift at all.

The Drake Navigators Guild published a report entitled, The Cermeno Expedition at Drake's Bay by Raymond Aker in 1965 and he has the following to say on page 12: "Cermano's own account, of which there are two original copies not in his handwriting but signed by him, also omits a deposition on the loss of the ship. The reason for not including information concerning the loss of the San Agustin can only be conjecture, but the most compelling apparent reason was that the wreck represented salvage potential. The possibility that this was the case is suggested in Father de la Ascension's account of

the Viscaino expedition in which he wrote that Viscaino had put into Drake's Bay to see if he could find any trace of the San Agustin and a quantity of wax and silks that had been left on shore. In this light there may have been deliberate intent on the part of the persons having a vested interest in the ship and goods to keep the true nature of the loss from becoming known to others who might attempt to salvage the wreck."

The fact is that if the ship had totally broken up and gone ashore as some historians and authors believed, there would not have been any possibility of future salvage operations and everything would have been scattered over a wide area and covered over by shifting sands. Likewise, Cermeno and his people would have been able to obtain baldy needed food supplies and some of her valuable cargo - which did not occur. Recently obtained historical documents from the Spanish Archives indicate that the ship sank in the general vicinity of her anchorage and only some of her upper-works and deck cargo (Such as the wax and silks) were cast upon the shore.

This analysis, then, assumes that the main section of the San Agustin sank at her mooring, or close to it, and lays in waters under the jurisdiction of the State of California and not in the zone closer to shore controlled by the National Park Service.

FUNDING, PERSONNEL AND EXPEDITION RESEARCH VESSEL

Phoenician Exploration Limited

There is still a great deal of preliminary work to be done before the total cost of this project can be determined, but it is expected to cost somewhere between one and three million dollars to first locate and then carry out a proper underwater archaeological excavation of the San Agustin. If wooden remains are located, which is one of the main objectives of this project, additional funds will also have to be spent on the proper treatment and preservation of these wooden remains. We could have another "Mary Rose" on our hands with the San Agustin and this could result in the construction of a major museum to display the ship's hull and her cargo.

Phoenician Exploration, which is a Canadian limited partnership, has been conducting underwater archaeological work for the past eight years, under the direction of Robert F. Marx. They have worked in Nova Scotia, Florida, the Bahamas, Brazil, Mauritius Island in the Indian Ocean and in other areas. Recently, this group has formed another limited partnership named Phoenician South Seas for the purpose of locating and excavating Manila Galleons in the Philippines and, hopefully, in Drake's Bay. One of the main objectives of this group is to obtain enough data to enable them to reconstruct an authentic replica of a Manila Galleon and then undertake a voyage in the replica between Manila and Acapulco, with stops along the coast of California, as part of the 1992 celebration of Columbus's 500 year anniversary of the discovery of the New World. Phoenician South Seas will provide all of the necessary fundings for this project. Attached as Appendix A here is a list of the limited partners of Phoenician Exploration, who are also the General Parnters of Phoenician South Seas, as well as a brief resume of some of those involved.

It is anticipated that a large number of people will be involved in this project. We plan to invite archaeologists and divers from the National Park Service to participate, as well as other scholars from California and elsewhere. Hopefully, John Foster and one or more assistants will be assigned to the project by the Division of Parks and Recreation. The research phase which is underway at this time is being undertaken by Dr. Nicholas Cushner and Robert F. Marx. After the shipwreck has been located Dr. Maria-Lusia de Brito Pinheiro Blot will also join the team as both a historian, draftsperson and diver. The search phase will be conducted by Robert F. Marx

with the assistance of Dr. Harold E. Edgerton of M.I.T. and also personnel of various seismigraphic firms. The overall excavation will be conducted under the direction of Robert F. Marx. Dr. Ian D. Spooner and Dr. Jean-Yves Blot will serve as assistant archaeologists to Robert F. Marx. Ms. Jenifer G. Marx will serve as artifacts officer. Mr. Marc H. Wulf and Mr. James E. Hill, Jr. will serve as chief of diving operations. Additional divers and qualified experts in cleaning and preservation of the artifacts recovered will also be hired as needed.

During the search phase of the project, a suitable vessel will be chartered from the local area. After the shipwreck has been located, the research vessel Rio Grande, which is owned by Phoenician Explorations, will be utilized. See attached description and photograph of the Rio Grande.

KEY PERSONNEL

Detailed resumes of the principal investigators in this proposal are included as Appendix B.

Robert F. Marx

Mr. Marx has been managing marine archeological recoveries since 1957, including work on the U.S.S. Monitor the galleon Nuestra Senora de los Milagros, the submerged Roman cities of Cartega and Bolonia, the French Soleil Royal, and Greek and Phoencian vessels from the 5th and 4th century B.C.. An accomplished diver, Mr. Marx is well equiped to lead an expedition such as this one.

Dr. Jean-Yves Blot

Dr. Blot has his Doctorate in underwater archeology from the Sorbonne in Paris in addition to a Masters degree in anthropology. He has over 15 years experience as a diver on archeological sites all over the world. He is currently employed as an archeologist for the museum of Archeology in Belem, Portugal.

Dr. Maria-Luisa de Brito Pinheiro Blot

Dr. Blot has her doctorate in history from the University of Coimbra, Portugal. She is an accomplished researcher, with many years of experience checking out wrecks in Europe, India, and Indonesia and the United States. She also dives and is an expert underwater photographer.

Jenifer G. Marx

A diver and writer of many years, Ms. Marx is the author or co-author of several books and articles on history and marine archeology.

Ian D. Spooner

A diver with full archeological training, Mr. Spooner obtained a post graduate diploma with distinction in Maritime Archeology. He is on committees for maritime archeology in Britain and Australia, and has published several findings.

Mark H. Wolf

Over 12 years experience diving in marine construction and salvage, beginning as a diver aboard a submarine tender. Mr. Wolf recently performed as a contract diver for NASA on the Challenger shuttle recovery team.

James E. Hill, Jr.

Mr. Hill has been a diver and diving supervisor for many years. His experience includes work at up to 1,000 foot depths, pipelaying and maintenance work, and drilling support, as well as archeological div[illegible] since 1983.

DESCRIPTION OF THE RESEARCH VESSEL -- RIO GRANDE

The Rio Grande is a well equipped research vessel for accomplishing shipwreck search and recovery operations. The Rio Grande is valued at U.S. $2,000,000 and her replacement cost is much greater. The vessel has an overall length of 100 feet, weights 61 net tons, has an all aluminum hull and is ocean-going certified by the U.S. Coast Guard. She has four water tight bulkheads, making her nearly unsinkable. The vessel is powered by three large General Motors Detroit diesel engines, carries 7,500 gallons of fuel (and can also carry portable bladder fuel tanks for long ocean crossings) and cruises at 22 knots. She is fully hydraulic powered throughout the vessel, has two large electrical generators and is completely air conditioned for maximum living comfort. At sea, the Rio Grande is totally self-sufficient with two salt water to fresh water conversion units which produce 1,000 gallons of fresh water daily. Her large storage areas, two large deep freezers and refrigerator enable crews to stay at sea for months at a time. The vessel accommodates ten persons comfortably, but has the capacity to berth twice that number.

The Rio Grande's navigation electronics and other equipment has been duplicated to prevent breakdowns from hindering any operation at sea. Among the electronic equipment in the pilot house are:

- a Sperry autopilot
- Ritchie compass
- Furano radar with perimeter defense scanner
- two Furano satellite navigators
- Micrologic Loran C position indicators
- Texas Instrument Loran C position indicators
- Alden Marinefax weather data receiver
- RDI Radar Watch MOD Mark II
- seven marine radio-telephones (including two single sideband units)
- three fathometers

A hydraulic crane on the aft deck can lift up to five tons, and all anchors are powered by hydraulic winches. There is a helicopter landing pad over the aft deck. Two rubber Zodiac boats in addition to a 20 foot fiberglass Aquasport skiff are carried on deck. The Rio Grande can operate anywhere in the world, is totally self-contained, seaworthy and strong enough to weather almost any kind of adverse sea conditions. With her own machine shop and duplicated stock of most

equipment and spare parts, the Rio Grande can stay at sea or on a site for up to three months, a vital factor to be considered when involved in offshore operations.

All types of diving equipment are carried on board the Rio Grande, from standard Scuba gear to the more sophisticated Kirby-Morgan gear used for deep diving. Both high and low pressure compressors are aboard for shallow and deep diving. The vessel is outfitted with two large "blasters" or "prop-washes," the primary tool used in excavating shipwrecks. "Airlift" and "water jets," which are also used in excavations, are also carried on board. Even more important is the fact that Mr. Marx has recently developed and produced a portable underwater "blaster" which is hand-held and controlled on the bottom by a diver. This will enable the Joint Venture to excavate at much deeper depths than the conventional "blasters" which require the vessel to be directly over the shipwreck, and which can operate only up to depths of approximately 75 feet. With this new system, the Joint Venture can operate and excavate a site at all diving depths and also in very shallow water such as around dangerous reefs where the Rio Grande cannot maneuver.

SEARCH PHASE OF THE PROJECT

During the last and present centuries thousands of vessels of all sizes have used Drake's Bay as an anchorage. During storms when anchors are dragged and even in lowering and lifting anchors it is a well established fact that the remains of old sunken ships are disturbed and in some cases destroyed. Hopefully, the San Agustin is buried in one of the deeper areas of the bay where there is substantially sand covering the site to protect her. Yet there is the possibility that she has been damaged or destroyed by the dragging anchors or by a later shipwreck ran aground over her remains. Thus, this is another valid reason why the San Agustin, which is without a doubt the most important shipwreck in California waters, should be located and excavated at this time.

One of the most difficult aspects of underwater archaeological work is the actual detection and locating of a shipwreck site. A good recent example is the 1622 Spanish galleon ATOCHA which took fifteen years and $16,000,000 to locate. Over the years I have worked closely with many scientists and organizations trying to overcome this major problem.

Problems in Underwater Shipwreck Detection

The basic tool used in the location of shipwrecks in the Western Hemisphere is the magnetometer which has its limitations. The magnetometer will only detect the presence of ferrous materials such as iron or steel. In certain instances it will not even locate materials made of these metals. In some cases where large bodies of ferrous metals are in close proximity the different individuals objects may null out the magentic properties of one another. It has also been found that some individual large ferrous objects give no magnetic anomalies; when cannon or anchors were cast and the metal cooled on a particular polar axis something causes the object not to show magnetic properties if this object lays on the sea bottom within a 15 degree axis either east or west of the original position the object when cast. Consequently, cast iron objects have one chance in twelve of not exhibiting any magnetic properties which can be detected by magnetometer.

Contrary to popular belief most ships did not sink, but rather were wrecked on a lee shore or hit upon a reef or shoal in relatively shallow water. During the age of sail probably less than two percent of the ships were lost in deep water;

usually as a result of fires aboard or sea battles. In most cases, even when a ship capsized at sea, it would drift into shallow water before breaking up. Deep water shipwrecks (over 100 feet deep) generally have all of their armament and cargo situated in a relatively small area unless they exploded before sinking. However, rarely are these ships sought as potential targets by archeologists or salvors because their locations are generally very vague in contemporary historical documents and their are a great deal more costly to locate and salvage. A good example is the Spanish galleon San Jose which blew up in 1708 and sank in 600 to 2,000 feet of water off Cartagena, Colombia during a sea battle with the British. To date, various oceanographic and treasure hunting firms have spent over $25 million in the search for this rich target with negative results.

In most cases the ships struck a shoal or reef and was scattered over a wide area, sometimes even over miles. Usually the bottom of the ship containing the ship's ballast would stay in the area of the initial impact while the seas and currents would carry the remaining part of the ship to other areas. In some cases, only a large hole would result from the initial impact and the ship would keep moving with no only its ballast falling out but also a great deal of its cargo. I have seen this latter event result in a 1733 spanish galleon scattering its remains along a six mile stretch from its original impact area to its final resting place, resulting in its contents being so badly scattered that most of it was impossible to locate either by contemporary or modern day salvors. Hurricanes which occurred even years after a ship was wrecked could cause a ship's contents to be widely scattered.

So now we must go back to the magnetometer and what it can accomplish. On old sailing ships a sounding lead was always used at least once an hour so the mariners on those old ships gonerally knew when they were getting into shallow water even if land could not be seen because of darkness or a storm. If unable to bear away from shoal water the captain would order anchors dropped and sails taken in to avert a disaster. In many cases, countless anchors were dropped and when they ran out of anchors as the anchor cables sanpped in storms or were cut on reefs, cannon were even used as anchors. Thus, in many cases, the final resting place of a shipwreck might not have a single anchor left on it and when anchors are located in the general area of a shipwreck they can be miles from the ships location. Naturally, finding a lost anchor doesn't always signify a ship was lost in the area as the ship which lost the anchor may have managed to escape disaster.

So this leaves us with the only remaining target which can be located by a magnetmeter - the cannon. Generally, the important ships used bronze cannon and these cannot be found with a magnetometer, so if the shipwreck does not have any of her anchors still on or near her, she will go undetected unless the cannon can be located visually, or some other part of her. A good example is Mel Fisher's 1622 spanish galleon Atocha. Six of her bronze cannon were located when a salvage boats anchor was snagged on the bottom and a diver went down to free the anchor and spotted the old guns. Just two weeks ago, eight years after the first six bronze cannon were found on this wreck, Fisher located still another bronze cannon over two miles from the location of the first six. This was accomplished by conducting a visual search from a small plane and videotaping the sea floor from an elevation of 500 feet. The Atocha is a very good example of the difficulties modern salvors face in trying to salvage an old shipwreck which has been widely scattered over a large area and in which most of her cargo is buried under deep sand. Despite the wide amount of publicity that Fisher has received since 1970 when he found a part of the Atocha, to date he has not found the main part of the wreck or the treasures she carried. To date he claims to have spent somewhere between six and ten million dollars in this search, sometimes using as many a six search vessels using the best equipment available.

This still leaves us with iron cannon as potential magnetic targets. When ships were dashed to pieces on a lee shore during a hurricane, such as occurred with some of the 1715 ships lost on Florida's East Coast, the iron guns generally were deposited in the vicinity of the remainder of the wreck - but not always. On one of the wrecks the ship struck bottom about three miles offshore and her top deck and superstructure broke off and drifted right on shore in the breakers, whereas her main hull and cargo are located somewhere in between. On some of the 1715 wrecks the ships and cargoes also went into shore in the breaker zone and although the cannon can be easily found (if iron) her cargo can be spread up and down the coast for several miles. The remains of the Capitana of this fleet are spread along the shore for four miles to the north and one and a half miles to the south of where most of her guns lay. During the past two decades modern day salvors first worked the area where the cannon lay and, after exhausting the area, worked up and down the coastline in hopes of finding more treasures from this wreck. Objects coming ashore in recent hurricanes generally give a vague location of other parts of the wreck hidden under the deep sands.

The same problem occurs when ships are wrecked far from shore. The topsides of the ship, with the cannon and anchors, if any remain, are generally swept far away from the main part of the wreck, making it very difficult to find the smaller non-ferrous items which are usually buried under sand, mud or reef or a combination of them all.

Added to the problem is the fact that on many shipwrecks, the cannon and anchors which are the signpost of a shipwreck, no longer exists. They were salvaged by contemporary or modern salvors. During World War II for example, when there was a great demand for all kinds of metals, many salvage companies scoured the sea floors up and down the U.S. East Coast and throughout the Bahamas and Carribean, recovering everything which could be found. In recent years, this has also been done, and the most recent example on a big scale took place on the Little Bahama Bank where a Bahamian Government bouy tender was employed for months to pick up all cannon and anchors visable. The reason it was done, according to government spokesman, was to prevent their being pirated by unauthorized divers and salvors. The fact is that many of these sites will be lost forever unless some other method is developed to find the smaller objects still on these buried sites.

Before going further I will cover sonar. There are two types: side scan and sub-bottom profilers. Side Scan Sonar can be useful in locating deep water wrecks in which some part of the wreck, such as a ballast pile, is sticking above the surrounding sea floor. However, few wrecks fit into this catagory in this hemisphere. Sub-bottom profilers give a picture of what is buried directly below the boat and only cover a narrow area of the sub-bottom. They are only useful after a shipwreck has been located by another method to try and pin-point objects hidden under the sea floor. In theory they should solve the problem of finding the non-ferrous smaller objects on a shipwreck but such is not the case. In mud or silt, generally only in harbors or near river mouths, they can be useful. However, in sand, where the majority of shallow water wrecks lay, this type of sonar has very limited penetration - generally less than two meters. Also as mentioned above, you have to be almost directly over the buried object to locate it and this is very difficult when many square miles of sea floor have to be searched.

So lets now assume that a shallow water shipwreck has been located and its remains are scattered over a large area. A magentometer can be placed right on the bottom and either dragged slowly or hand carried by a diver to locate smaller ferrous objects such as cannon balls or ships fittings. Unless

these objects are laying in a big mass or are very close to the surface of the sea floor and only a few feet from the magentometer head sensor, no anomalies can be detected, which is the case in most instances. A hand-held metal detector will locate metals of all types but again the objects must be very close to the detector or no reading will be obtained. If a large anchor or cannon (bronze or iron) is more than six feet deep in the bottom sediment, no readings will be obtained. On smaller objects such as hand weapons, tools or coins, the detection range is usually less than a foot. This is fine if the site is only covered by a foot of sand, mud or coral, but this only occurs in very few instances. The average shallow water shipwreck has six to eight feet of sand over it and some, especially in the Bahamas or California, have as much as 25 feet of sand covering them. In one case, we recently found a site with over 30 feet of sand covering it and were never able to identify it because we could not dig deeper with either the prop-washes or airlifts.

The previous three pages all lead up to the most difficult problem we face in location of shipwreck remains - that of finding the smaller items on each site. It is too expensive and time consuming to try and dig up several square miles of ocean bottom and at the moment, with what equipment is presently available, that would be the only solution.

I should also mention at this time that in Florida, the Bahamas, Bermuda and some parts of the Caribbean the magentometers and metal detectors work well because they are being used in areas of sedimentary rock. However, elsewhere they are more difficult to get proper readings, or in some cases, any readings, because of the magentic properties of non-sedimentary rocks.

We plan to first utilize the standard equipment for locating the remains of the San Agustin - magnetometers, sub-bottom profiling sonar, metal detectors and visual search. There is little likelihood that any of her remains will be above the sea floor so we will exclude the use of side-scan sonar - especially since this was already undertaken by the NPS in 1982.

After the visual and electronic survey is completed, we will then make small test holes on each target using a small airlift to determine the identity of each one. If we fail to locate the main remains of the San Agustin by using the above mentioned methods, I will then use a very special instrument which is being developed by SRI International in Menlo Park. See attached letter in Appendix C written by

Dr. Lambert Dolphin. This instrument is capable of locating very small objects under 20 to 25 feet of sand. Phoenician South Seas has agreed to provide the funding for the development and construction of this instrument and the initial work on this instrument will commence in the very near future.

EXCAVATION OF THE SAN AGUSTIN

Until the remains of the San Agustin are actually located it is very difficult to determine the exact methods which will be used in properly excavating the site. One thing is certain; the best archaeological techniques and equipment will be used on this project and the maximum effort will be utilized in collecting all pertinent archaeological data. Likewise, the operation will be conducted in a manner which protects the gathering of the archaeological data and protection of the artifacts and wooden remains - if any remain - of the ship's hull. The staff and equipment of Phoenician Explorations, Limited, are as well prepared as anyone in the world today to do as professional a job as can be done on wrecks of this vintage.

There are two different possibilities to consider. One that the ship remains and cargo are scattered over a wide area, which would make the project more difficult and expensive to undertake. However, I do not contemplate this being the case with the San Agustin. The other that the shipwreck is more or less confined to a small area. If this is indeed the case, which I believe it to be, the "blasters" on the Rio Grande will only be used to remove the overburden. Then a grid system will be erected on the bottom over the site and the actual digging will be done by the use of airlifts and hand-fanning in conjunction with the gathering of the archaeological data - i.e. measurements, drawings, photographs, etc.

Detailed archaeological recovery plans cannot be provided until the completion of the search phase; however, staff of Phonecian Explorations will draw up full plans at such time as the remains of the San Agustin are located and identified. These plans will be shared with qualified archeological staff from the National Park Service, the California State Historical Preservation Office, the State Lands Commission and other agencies having a legitimate interest in the recovery and preservation of such a prize. Actual techniques for such a salvage must maximize the data recovery phase to be acceptable to the partners of Phoenician Exploration, and we fully realize the value of this search to the people of California.

Once the methods and degree of salvage are agreed to, we can discuss and draw up plans for the proper conservation and display of the recovered materials. Again, it would be premature to draw up such plans until we know what we have to work with, but it is conceivable that an on-site museum could

be built, as part of the National Seashore, or that institutions in the San Francisco area could share funding of the conservation effort in exchange for displaying them. As we prepare the excavation plans, and before major excavation begins, we will consult with State and Federal experts and present our detailed proposals to archeologists from these agencies for approval.

If we find that the remains of the shipwreck lay in an area of heavy sea swells, making the excavation difficult, we may have to resort to building a cofferdam around the shipwreck and working inside it, such as they are presently doing on one of the Revolutionary War shipwrecks off Yorktown, Virginia. Underwater visibility is another problem in Drake's Bay and this too may be solved with the use of a cofferdam. It is also known that Drake's Bay is the breeding grounds for the White Sharks and the cofferdam might also eliminate the dangers from these predators. If a cofferdam is not required, we will probably have to erect nets around the site to keep the sharks out of the area.

No work will commence on the site until a proper place has been established for the storage and conservation of the artifacts. A laboratory will have to be set up with qualified personnel to operate it.

I also plan to establish a group of advisors who will supervise the overall excavation of the site. Some of these will come from the State of California, the National Park Service as available, and others will be people knowledgeable in different aspects of the history of the site such as Raymond Aker and Edward P. Von Der Porten.

At this time it is impossible to determine the amount of time that this project will take but I think we should count on a minimum of three years and it could take as much as twice that amount of time. Weather and working conditions will be the main factors that will decide this issue.

ENVIRONMENTAL CONSIDERATIONS

Environmental Setting

Drake's Bay is located on the southern edge of the Point Reyes peninsula, approximately 24 nautical miles west-northwest from the entrance to San Francisco Bay.

The Point Reyes peninsula is roughly triangular in shape, with the longest side lying on the east, along the San Andreas Fault Zone. The angle opposite juts out into the Pacific Ocean, forming Point Reyes and its associated headlands. The most prominent feature of the area is the Inverness Ridge, a forested line of hills reaching a maximum elevation of about 1,400 feet above sea level. This ridge drops steeply on its eastern face, to the San Andreas Fault Zone, which is expressed here by Tomales Bay, Olema Valley, and Bolinas Lagoon. The western slopes of the ridge are gentle, and drained by many streams cut into canyons.

The curve of Drake's Bay itself is sheltered by Point Reyes, and is generally a gently shelving sandy beach. Drake's Estero projects north from the Bay into the center of the Peninsula. It is separated from Drake's Bay by a long sand spit, Limantour spit, which has a variable entrance to the ocean.

Geology

Certainly the most prominent geologic feature in the Point Reyes area is the San Andreas Fault. This fault and its rift zone can be traced for hundreds of miles from the Mendocino County coast north of Point Reyes to the desert regions north and east of Los Angeles. The northward movement of the Pacific plate, of which Point Reyes is a part, was graphically illustrated during the 1906 San Francisco earthquake. During that event, Tomales Point, the northernmost point within the Point Reyes Peninsula, moved approximately 20 feet northward in relationship to the adjacent continental land mass on the east side of the fault. Even the present shape of Point Reyes seems to illustrate the north-northwest direction of movement, for it seems to be bent by forces from the northwest, contorting the peninsula into the hook that forms Drake's Bay.

The backbone of the Point Reyes Peninsula is formed by a core of igneous (granitic) rock, which gives structure and definition to Inverness Ridge. This core is overlain by a

series of metamorphic and sedimentary strata. The stratigraphy of these rocks is generally uniform and extends laterally from Inverness Ridge toward the south, west and northwest. At the Point Reyes headlands, the granitic core or basement rock of the peninsula is again exposed. Here the igneous rock is overlain by a consolidated conglomerate of well-cemented sand, gravel, cobble and boulder-sized materials. The hard and resistant nature of the granite and conglomerate along this uplifting fault has created a very impressive and dramatic series of headland cliffs.

Between the headlands and Inverness Ridge, the various sedimentary rocks, marine shales, sandstones, siltstones, and claystone form a shallow dish with its centerline running northwest-southwest through the western part of Drake's Estero. These sedimentary rocks end abruptly at Drake's Bay, forming a series of cliffs. On the more exposed side of the peninsula (Point Reyes Beach) a long, narrow, and uniform beach with hind dunes has been formed. The shore of Drake's Bay has a narrow beach, and a sand spit that lies between Drake's Estero (a flooded stream valley) and the bay also helps define Limantour Estero, which lies behind the spit. Both esteros drain through a break in the spit, whose location shifts continuously east and west due to seasonal storms.

The cliffs facing Drake's Bay are claystones and siltstones of the Drake's Bay Formation, and sandy shales of the Monterey Shale Formation. These formations are generally poorly cemented and erode rapidly; in some places the cliff faces are receding at a rate of 12 inches or more a year.

Within Drake's Bay, the immediate marine substrate are believed to be the Monterey Shale Formation and the lower sections of the Drake's Bay Formation. Overlying these substrata is a layer of unconsolidated marine sands of varying and unknown thickness.

Oceanography

The continental shelf in the project area extends farther seaward than it does along any other portion of the west coast. This area of the continental shelf, known as the Gulf of the Farallons, reaches a width of 26 nautical miles (48 km). The gulf contains two major currents that represent significant components of the northeast Pacific Ocean's circulation system. One current flows southward (the California Current), the other (Davidson Current) flows northward, and there are a number of localized eddy currents systems. The California Current has a broad southerly flow, it

generally close to the coast, and supplies water which is cooler and less saline than the waters farther offshore. This current normally flows along the coast from August or September through mid-November.

Toward mid-November, dominant northwest winds decline sharply. With this change in wind pattern, the cold surface water sinks and is replaced at the surface by a thin layer of warmer water. The warmer waters belong to the normally deeper Davidson Current, which runs counter to the California Current. Once it surfaces, the Davidson Current forms a wedge between the California Current and the mainland coast. The inshore, northward, and downwelling movement of the Davidson Current usually lasts well into the winter, bringing with it relatively high surface temperatures. However, by mid-February, prevailing winds shift from the south to the northwest, thus diminishing or reversing the northward flow of surface water. As a result, the California Current flows southward, carrying surface water offshore, and deeper water that is cold and dense rises up to replace it.

During each of the seasons, local geography and topography influence local current patterns. The dominant influences of the California Current and the prevailing northwest winds have an effect on the movement of sediment in the survey area that is the reverse of what would be expected. As it flows past the Point Reyes headlands, the California Current sets up an eddying effect within Drake's Bay, and onshore waves, driven by prevailing northwest winds, meet the headlands and deflect, bending east and northward into Drake's Bay. The overall effect is a localized south and east to north and west transportation system for sediment.

The movement of sediment along the Point Reyes Beach (Pacific coast area) is altogether different. While the south-flowing California Current is the dominating element, the eddying effect caused by the Bodega headlands seems to be an effective trap for most of the sediment from the north. In comparison to the California Current, the prevailing northwest winds have a much greater effect on nearshore sediment movement. However, because of the north-northeast to south-southwest orientation of the Point Reyes Beach and the prevailing surface north-northwest winds, there seems to be no significant movement of sediment. And what sediment transport there is results in material being moved past the western extent of the Point Reyes headlands where it is increasingly influenced by the California Current and ultimately carried into deeper water off the headlands. Overall, little sediment is carried to the Drake's Bay area from the north, the sands here are derived from local and southern sources.

Climate and Weather

The climate of the Point Reyes Peninsula and its immediate environs is characterized by cool, dry, foggy summers and cool, rainy winters. Because there are upwellings of colder waters during the summer, cool temperatures and fog are very common along the coast and seaward. The reverse is generally the case during the winter months, with clear but cool weather that is occasionally interrupted by storms from the southwest. High winds are common in this area, which is generally considered to be both the foggiest and windiest location of the Pacific coast. Winds of more that 100 mph are occasionally recorded. This extreme is due in part to the topography of the Point Reyes headlands. However, gale force winds along the Point Reyes Beach are also common. These high winds are most characteristic of late and early winter, and generally occur out of the north and northwest. Winter storms with accompanying winds usually confront the coast from the southeast, and as the storm system moves inland, the winds move to the northwest. End-of-storm winds out of the northwest are usually the most violent. Drake's Bay provides ships a safe refuge during the strong northwest winds, but this area has the potential for unexpected changes in wind direction due to eddying conditions.

Ocean temperatures generally show little annual variation. For example, the mean monthly surface water temperatures at the Golden Gate Bridge (Fort Point, San Francisco) and at North Farallon Island range from 50.9°F to 60.2°F and 52.2°F to 56.2°F respectively, from January to December (1926-1950).

Marine Biology

The area proposed for this permit lies within the Point Reyes/Farallon Islands Marine Sanctuary, and has had its biology studied extensively.

One of the most spectacular components of the area's wildlife is the concentration of nesting seabirds, with a population exceeding 100,000 pairs. The largest concentration of these pairs exist in the Farralon Islands, far removed from the project site, but the Point Reyes headlands, Drake's Estero, and Estero de Limantour are also important nesting areas.

The Point Reyes headlands provides nesting locations for the Common Murre, Brandt's Cormorant, Pelagic Cormorant, Pigeon Guillemot, Western Gull, and the Black Oystercatcher. The

population of all these species has been increasing over the recent past and they are not threatened by the proposed project.

Drake's Estero and the Estero de Limantour provide estaurine areas for various diving birds, especially the Black Brant.

Within sight of the project area twenty three species of marine mammals have been sighted, including five pinniped species, 17 cetaceans, and one fissiped (the Sea Otter). Most of the pinnipeds (seals and sea lions) are year-round inhabitants. Again, the most important part of the sanctuary for these species is the Farallon Islands, where major breeding, pupping, and haul-out areas have been established. Within Drake's Bay, only the Harbor Seal has established haul-out areas, mostly along Limantour Spit.

In contrast, the cetacean (whale) species are all migratory through this area, especially the California Grey Whale which are usually observed each year from late November through June or July. None of the cetacean species noted with the Sanctuary spends time in the shallow waters proposed for this project.

Fish resources are abundant over a wide portion of the Point Reyes and Farallon Islands areas. The area has many factors which make it vital to the health and existence of many species.

The area has many diverse habitats, but as this project is restricted to the nearshore part of Drake's Bay, this study focuses on this particular environment. Several studies describing the fish resources of the entire area can be found in the "Final Environmental Impactment Statement on the Proposed Point Reyes-Farallon Islands Marine Sanctuary" put out by the Federal Office of Coastal Zone Management in 1980.

Drake's Bay is important as a feeding spawning, and nursery area for many fin-fish. In addition, Drake's Estero and the Estero de Limantour provide nurseries for Pacific Herring, smelt, Starry Flounder, Surfperch and Silver Salmon. Various bottom fish, such as California Halibut, Rex Sole, adult Starry Flounder and occasionally other soles migrate to the Bay at different times of the year. Sharks and rays use the Bay as a feeding ground throughout the year.

Kelp beds, an important marine community, are established within Drake's Bay. The dominent species near the project area is the Bull Kelp (Nerocystis luetkeana), which is an annual