THE CAPITANA PROJECT

FINAL EXCAVATION REPORT

The shipwreck believed to be *La Capitana el Rubí*.

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Caribbean Shipwreck Research Institute, Inc.

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1993 EXECUTIVE SUMMARY

This interdisciplinary proposal presents an operational plan and research design to conduct archaeological recovery operations on shipwreck remains of a Spanish treasure ship *La Capitana el Rubí* site which sank off the Florida Keys on July 14, 1733. The proposal outlines an innovative blending of private sector funding and archaeological expertise with state-of-the-art marine archaeological methodology with assistance from professional archaeologists, marine scientists, and museum specialists. The project will be initiated as a three year phased program which provides private sector funding for archaeological data recovery, site interpretation, artifact preservation, archival research and publications typical of what is expected from scientific projects conducted by the academic community.

Orderly, systematic operation conduction by commercial salvers and experienced marine archaeologists is the only way to insure that mutually beneficial goals are fully achieved in the recovery of archaeological data along with shipwreck artifacts in the most efficient way possible without the use of any tax payer dollars. The archaeological operations are explicitly outlined. These include site survey, archival research, archaeological mapping, excavation techniques, environmental monitoring, artifact stabilization, museum exhibits, public education, and publication.

This shipwreck project is neither a treasure hunt nor a scientific excavation. Instead it is an archaeological recovery operation using scientific procedures and archaeological techniques with an entrepreneurial interest in the profit motive. One of the major goals of this project is to mobilize private capital for the retrieval of invaluable archaeological data from a site which continues to suffer from degradation through storm action and unrecorded artifact discoveries. This project will vividly demonstrate how "private gain can be turned into "public good" at no expense to the American taxpayer. Moderate successes within this project could point the way for other such "partnerships" in the Florida Keys National Marine Sanctuary as a win-win situation for everybody.

The Project Director and Archaeological Advisor will work in close cooperation with the State Archaeologist, DHR, Department of State; NOAA, and FKNMS Project Manager; and scientific personnel in all matters concerning this project. A representative sample of all artifacts will be chosen from the total assemblage as collection for research, educational, and exhibition purposes within the Florida Keys. All work on the site will be conducted under the Federal Admiralty jurisdiction administered by the Southern District Court in Miami.

The overall research objective of the Capitana project is to compile archaeological data from the physical remains of the ship and its contents in order to answer anthropological and historical questions concerning maritime trade and life under sail in the mid 18th Century. Artifact dispositions will be decided by the ruling of the Federal Admiralty Court. Donations of representative cross samples of up to 50% of the total artifact assemblage may be negotiated with the State of Florida and Federal Government officials.

The Capitana Project represents a merging of entrepreneurial enterprise with a professional archaeological approach. This partnership between the private sector, the Florida Keys waterfront community, and the Florida Keys National Marine Sanctuary is being offered as a cooperative undertaking patterned after the ‘Pilar Shipwreck Archaeological Project’ in Guam. (Mathewson, 1991)

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SITE DESCRIPTION

By R. Duncan Mathewson III

The Federal Admiralty claim on the *Capitana el Rubí* site (Florida site designation 8M0146) covers a circular area having a radius of 2500 meters with its center at latitude 24° 54' 50" and longitude 80° 32' 00". The site lies in approximately 20' of water in an area of sand varying in depth from 3' to 20'. The site is situated in Federal waters approximately one mile beyond the three mile territorial limit for State of Florida State jurisdiction. (see Map 1 and 2)

The *Capitana el Rubí* site lies within a high energy reef zone of deep sand overburden overlying fossilized Key Largo limestone. The lack of natural hard substrate on the site does not permit the growth of soft coral or sea grasses anywhere near the main concentration of the site. The constant movement of the sand overburden particularly in winter storms that occur from October through April causes the cultural material to migrate according to prevailing hydrological conditions. Shipwreck remains of the *Capitana el Rubí* site have been very badly disturbed by both storm action and salvage activities which have continued periodically on the site ever since it was first discovered by Reggie Roberts in 1938 and subsequently salvaged by Art McKee. The site is not visible from the surface being completely buried by sand devoid of both sea grass and soft coral. According to Goin E. (Jack) Haskins, Jr. (personal communication May 31, 2002) the site was visible in 1976, but by 1980 only a few dislodged timbers and small amounts of ballast were visible. By 1986, Joe Kimbell (personal communication May 31, 2002) indicated that the site was not visible from the surface being 1 to 2 feet under the sand.

Depositional Environments

Similar to land archaeology, archaeologists working underwater must first understand the environmental factors which affect the cultural deposits before they can adequately interpret them in anthropological and/or historical terms. Any management decision involving shipwreck sites must first consider the benthic environments which affect the physical condition of the hull structure and associated artifacts. (Mathewson, 1991) Four major benthic habitats define varying depositional characteristics along the Keys: (Marszaiek, n.d.; Shinn, 1989)

1) Coral Reefs: Reef limestone of different relief and composition colonized by stony corals, gorgonians, sponges, algae and other reef building, benthic organisms. Reef rock rubble and fossilized hard bottom substrate often times associated on the periphery of coral reef systems usually show evidence of net loss of deposits through erosion rather than of accretion.

2) Limestone Bedrock; Exposed flat lying Pleistocene coralline limestone is composed of small corals, gorgonians, sponges, and algae. Locally covered with a thin veneer of sediment and patches of bottom sea grass. The bedrock in the upper Keys is the Key Largo limestone, while in the Middle and Lower Keys is under laid by Miami iolite.

3) Sea grass; Predominantly turtle grass (*Thalassia*) occurs on sediment of varying thickness at depths less than 10' water. Other abundant sea grasses are manatee grass (*Syringodium*) and shoal grass (*Diplanthera*).

4) Overburden Sediments: Deposits vary from thin muddy deposits to deep sand of over 15' thickness near the outer reef tract. Clean carbonate sands typically occur seaward of Hawk

Channel to 60' water depths; mud deposits usually increases landward and throughout Hawk Channel in water depths between 20' to 60'.

SITE HISTORY

By R. Duncan Mathewson III

Introduction

The *Capitana el Rubí* as other 1733 shipwrecks not only contain Spanish American cargo from Mexico and Peru, and Spanish-made merchandise, but also products from other European countries as well as Oriental luxuries which had originally arrived in Mexico from the East-West voyages of the Manila galleons. The cosmopolitan character of these archaeological assemblages linking Spain and China by way of the American colonies can clearly document the important role of Spanish maritime trade circling half way around the world in the early years of the 18th century. There has been little if any archaeological efforts made to interpret this gold mine of information. The Capitana Project presents an opportunity to greatly expand the work of Logan (1977) and Skowronek (1982) with artifact data they did not have access to.

On Friday the thirteenth in July 1733, the New Spain Fleet left Havana harbor on its return voyage to Spain. The convoy, commanded by Rodrigo de Torres aboard the newly built *La Capitana*, *El Rubí*, consisted of three other armed galleons, and eighteen merchant *naos* along with other smaller vessels carrying the products of Mexico.

The following day, after the fleet had sighted the Florida Keys, the wind shifted abruptly from the east and increased in velocity. Captain-general Torres, sensing an approaching hurricane, ordered his captains to turn back to Havana and sail as close to the wind as possible, but it was too late. By nightfall, all or most of the ships had been driven westward while being scattered, sunk or swamped along eighty miles of the Florida Keys. Only one ship, the 500 ton *Nuestra Señora de Rosario*, made it safely back to Havana.

Survivors gathered in small groups throughout the low laying islands and built crude shelters from debris that had washed ashore. Spanish admiralty officials in Havana, worried about the fate of the fleet, sent a small sloop to search for wrecks. Before the sloop returned the sole surviving vessel arrived in the harbor. When the sloop returned, it reported seeing many large ships grounded near a place called *Cabeza de los Martires*. Immediately, nine rescue vessels loaded with supplies, food, divers, and salvage equipment sailed for the scene of the disaster. Soldiers were on board to protect the shore camps and the recovered cargo.

A very through salvage of the ships was undertaken by the Spaniards. Vessels that could not be re-floated and towed back to Havana were burned to the waterline enabling divers to descend into the cargo holds, and also concealing the wrecks from freebooters. The work continued for years, with the salvors working under the watchful scrutiny of guard ships. The location of each shipwreck was charted on several maps. When the final calculation of salvaged material was made, more gold and silver was recovered than had been listed on the original manifests, the tell-tale evidence of contraband aboard the homeward bound fleet.

Further reading concerning the definitive history and salvaging of the 1733 Plate Fleet can be found in *Galleon Alley The 1733 Spanish Treasure Fleet*, by Bob Weller published in 2001 by EN RADA Publications.

Previous Work

Although shipwreck exploration and salvage have been ongoing along the Keys since prior to World War II, (Burgess, 1974, 1977; Marx, 1971) systematic archaeological survey efforts did not begin until relatively recent times. The first organized effort to document shipwreck remains off the Upper Keys began with Marty Meylach's (1971) publication of *Diving to a Flash of Gold* in 1971. His survey results were used in the late 1970's by National Park Service archaeologists as a basis for a shipwreck inventory study in Biscayne Bay National Park. Similarly his study was used by Roger Smith and Jim Dunbar (1977) to help locate and document eight merchant Naos sunk in the 1733 Spanish fleet. This was the first archaeological effort to determine the significance of the scattered remains of this Spanish fleet. (Smith 1988) More specific archaeological studies on individual 1733 sites were conducted by Patricia Logan on *San José y las Animas* (1977) and Russell Skowronek (1982) on the comparative analysis of trade patterns between the 1733 Plate Flota and 18th Century St. Augustine land finds.

Apart from the general description of the 1733 Plate Fleet by Mendel Peterson (1972, 1975, 1977), little efforts have yet been made to systemically study these archaeological remains in-situ. A general regional overview of the project area was included in an inventory study of shipwrecks lying between Cape Hatteras and Key West (Mathewson, 1981). But the scope of this study did not allow site specific survey work to be carried out. Although some shipwreck survey work and site mapping was done by Mathewson with field school participants from 1987 to 1990, this data remains as unpublished notes. Some of this archaeological information has been included in the State of Florida Site Files accompanying the Phase I Submerged Cultural Resource Survey off Islamorada. (Mathewson, 1991) Work is proceeding to compile site data in the eight 1733 sites located off Islamorada for a regional comparative study of the treasure fleet. (Mathewson and Drouin, 1991)

In 1988 a survey of the 1733 Plate Fleet sites was conducted by Roger Smith with the assistance of the Department of Physical Education, Indiana University. (Smith, 1988) This study was conducted with field school students to lay the basis for establishing an Underwater Archaeological Preserve in the Florida Keys. As a result of this study, the *San Pedro* was chosen as the best 1733 site to make into an underwater preserve. Archaeological investigations and a side-scan sonar survey were conducted on a number of 1733 wrecks as part of the 1990-1992 Summer Marine Archaeology Field School conducted by the National Center for Shipwreck Research (NCSR). Stephen James and Roger Smith also conducted a 1992 summer field school focused primarily on a magnetometer survey and archaeological mapping of the 1733 *El Lerri* site.

A literature survey of shipwreck sites conducted by Judy Halas in 1988, laid the basis for a much better understanding of wrecks including the 1733 sites located around the borders of the Key Largo National Marine Sanctuary. (Halas 1988) However, the scope of this study did not allow for underwater site identification or in-situ mapping.

Historical Documentation

Much has been done by Goin E. (Jack) Haskins, Jr. (see Appendix 1) to translate and interpret the microfilm rolls of 1733 documentation he collected from Spanish archives throughout the years. Haskins (personal communication, May 31, 2002) indicated that he only transcribed information relative to the wrecking event, shipwreck location, cargo, and final salvage disposition as much of the information on microfilm was either repetitious or pertained to

litigation and insurance claims. Haskins later donated the collection to the Florida Department of State and an index has been made by Jim Clupper of this microfilm. A copy was sent to the Islamorada library in response to the Islamorada Shipwreck Management Study.

The identification of the 1733 wreck sites has not yet been confirmed archaeologically. By carefully going over the manifested cargo listed for each 1733 ship mentioned in this documentation, a comparative base-line of artifact remains is being established for several of the larger vessels. Once particular 'finger-prints' have been archaeologically established for the major vessels by matching physical remains with the documentation, it may be possible to confirm the presupposed wreck identities which have been given to these sites based upon their general locations on the 1733 Spanish salvage map located many years ago by Art McKee. A large part of this effort would also be based upon personal interviews of the salvors who recovered material from these sites throughout the 1960's and 1970's.

This research effort has already been initiated by Jim Clupper, Branch Manager at the Islamorada Library. He is being assisted by Jinky Smalley, a 1991 & 1992 NCSR Summer Field School student who has decided to go on to get a graduate degree in Maritime Archaeology and is presently taking anthropology classes at the University of California at Berkeley.

The Capitana Project would be the ideal 1733 vessel to concentrate on in terms of 'finger-printing' its archaeological remains. Excavations on this site would primarily be focused on identity confirmation. This examination of the *Capitana el Rubí* would be very nicely coupled with the excavation data recovered by Ron Molinari on the *San José y las Animas* site located only a few miles to the south. Clear and definite identity confirmation of these two major 1733 ships should provide the means to confirm the location of many of the other vessels that are not nearly as well documented.

1993 RESEARCH DESIGN

By R. Duncan Mathewson III

Research Objectives

Shipwreck archaeologists, particularly those trained in the United States as anthropologists, would for the most part agree that artifact descriptions and classifications are not the principle goal of research. Artifacts should not be viewed as an end unto themselves but as a way to provide the raw data to deal with larger cultural questions. This belief was strongly reflected in the mid 1970's by anthropologists coming to grips with the rapidly changing world of underwater archaeology. Anthropologists eager to demonstrate the legitimate nature of underwater archaeology as a bona-fide theoretical pursuit were quick to champion the argument for the 'processual' approach as opposed to the more traditional 'historical' school.

The variability of material culture through time and space must be understood before aspects of cultural process can be delineated from archaeological remains. This is as true of historic shipwreck sites as it is of colonial land sites. Stanley South (1977) and Ivan Noel-Hume (1969) have made an excellent start documenting historic site artifacts for 17th and 18th century English colonial land sites. Kathy Deagan's (1987) work on Spanish colonial sites in Florida and the Caribbean is a most welcomed reference for the 1500-1800 periods. This work combines for the first time, shipwreck artifacts along with land assemblages. But much more descriptive work needs to be published on shipwreck assemblages before enough information is available to satisfactorily link artifact remains with cultural behavior. (Mathewson, 1991)

The Archaeological Recovery Operation on the *Capitana el Rubí* site is intended to provide a synthesis of descriptive information on the dating, cultural origins and functions of the material culture recovered from this 1733 shipwreck. Artifact data will facilitate comparative studies with other shipwreck and land assemblages around the world. The *Capitana el Rubí* study is seen as a contribution towards compiling a comprehensive reference for the study of Spanish maritime material culture of the 18th century. The Archaeological Recovery Operation will follow the Archaeological-Environmental Shipwreck Model (see Table 1) as proposed by Mathewson (1991) based on the following premises:

1) Primary Deposits: In-situ artifacts directly associated with wooden hull structures, major rock ballast concentrations, and/or cannon and anchor marking the original position of the shipwreck.

2) Secondary Deposits: Derived artifacts, transported by near off-shore oceanographic variables (wind, waves, and currents) within a short time following the sinking of the vessel. Human interaction such as recovery and salvage attempts.

3) Tertiary Deposits: Derived artifacts that are continually re-deposited in the normal erosion-sedimentation cycle of coastal geological processes.

Cultural Units	Nature of Deposits	Mapping Procedures	Shipboard Activity Data	Wrecking Process Data	Typological Data
Primary	Artifact assemblage stabilized by ballast rock, hull structure, underlying over-burden. In-situ artifacts provide a non-random distribution pattern reflecting human behavior in different shipboard activity areas.	Contextual artifact provenience determined by grid mapping, artifact trilateration, photo mosaic, video recording, individual artifact recording.	Excellent	Excellent	Excellent
Secondary	Scattered artifact deposition derived from the break-up of vessels following their sinking and progressive break-up under prevailing local hydrological conditions, subsequent human interaction such as recovery and salvage attempts my also be considered as contributing factors. Precise contextual data is unavailable but useful relative spatial relationships can be determined. Some random associations can be determined for certain categories.	Contextual artifact provenience is determined by base line surveys, artifact cluster recording.	Marginal	Good	Excellent
Tertiary	Continual artifact re-deposition in shallow in-shore waters by storms and long-shore currents. Environmental conditions produce random distribution pattern.	Contextual artifact provenience determined by base line surveys, artifact cluster recording.	Poor to non existent	Marginal	Excellent

Table 1. Archaeological-Environmental Shipwreck Model

Artifact Descriptions

As the primary component of the archaeological record of any site, artifacts are the essential tools archaeologists use to explain a wide variety of human behavior contained in that record. The surviving material remains provides the key for understanding many of the wider questions archaeologists like to think about such as temporal fluctuations, contextual associations, functional explanation, cultural change and social interpretation. But before these artifacts can be used in conjunction with their cultural contexts to explain some of these phenomena, they must be described first in site specific terms, and secondly, in a wider regional context.

Archaeological study of the *Capitana el Rubí* assemblage will focus on providing a framework for a descriptive study of different artifact categories including information on their date, cultural origin, physical characteristics and geographical distribution.

This is seen as a beginning step towards achieving a better understanding of Spanish maritime culture of the 1733 Spanish treasure fleet. The future utility of this descriptive study will be based on its use by other archaeologists working on their own research problems.

Comparative Studies

Archaeological recovery operations on the *Capitana el Rubí* should contribute significantly to the study of Spanish material culture of the 1733 Spanish treasure fleet. Deagan (1987) has provided a comprehensive cultural back drop to the Spanish colonial artifacts of Florida and the Caribbean period from 1500 through 1800 that can be used in a comparative 1733 study. Part of this project will involve an attempt to compile an artifact descriptive inventory of the material previously recovered from this site throughout the years by salvors, private collections, State of Florida records, and personal interviews. This information will be used to reconstruct the salvage history of the Capitana shipwreck. Published archaeological data from other historic shipwrecks will also provide an invaluable temporal and cultural comparative context in which to interpret the artifacts recovered from the Capitana site (see Table 2):

Date	Vessel	Cultural Context	Location	Publication
1715	*Nieves* & 5 others.	Spanish Treasure Fleet sailing from Havana to Spain.	East coast of Florida	Wagner & Taylor 1966, Clausen 1965
1724	*Conde de Tolosa Nuestra Señora de Guadalupe*	Spanish vessels sailing from Spain to the New World.	Northeast coast of the Dominican Republic	Borrell 1983, Peterson 1979
1733	*El Infante* & 11 others.	Spanish Treasure Fleet sailing from Havana to Spain.	Florida Keys	Logan 1977, Meylach 1978, Skowronek 1982
1766	*Nuestra el Constante*	Spanish treasure ship sailing from Vera Cruz to Spain.	Gulf of Mexico off the coast of Louisiana	Pearson 1981, Pearson & Hoffman 1985

Table 2. Comparative Archaeological Collections

Ceramic Questions

The predominance of ceramics in Spanish colonial material life has long been recognized by archaeologists. (Goggin, 1960) Ceramics have been studied more intensely than any other aspect of colonial Hispanic material culture. A great amount of effort has been made establishing the date of pottery 'types' along with their role in reflecting social attributes in the archaeological record. (Deagan, 1987) Much of this work has been centered on describing varieties of Hispanic ceramics that typically occur in New World land assemblages. Although some ceramic research has been done on shipwreck assemblages (Logan, 1977; Skowronek, 1982; Marken, 1988), much remains to be done before this source of ceramic data is built into an overall temporal-cultural framework. (Mathewson, 1991)

Study of the ceramic data derived from the *Capitana el Rubí* will provide some new insights into the following archaeological problems:

1) How can studies of middle and late style Olive Jars defined by Goggin in 1960 be used along with recent data from historic shipwrecks off Florida and the Caribbean to culturally and chronologically define the Olive Jar assemblage on the *Capitana el Rubí*?

2) How can the *Capitana el Rubí* ceramic assemblage recovered from within a closed context better define the wide variety of unglazed course earthenware which appears as ubiquitous utilitarian vessels on 17th and 18th Century Spanish-American colonial sites? The confusing classification terminology used to type these vessels on the basis of paste, form and/or function needs clarification.

3) How can the *Capitana el Rubí* ceramic assemblage help to clear up uncertainty concerning the wide course earthenware found on Spanish colonial sites from the 16th through 19th centuries? The *Capitana el Rubí* pottery will provide data from tightly dated pottery, pre 1733, which can be used in a comparative study with conclusions drawn by Logan (1977) and Skowronek (1982) derived from the 1733 data available to them at the time.

4) How can the *Capitana el Rubí* assemblage be used to better understand Old World Majolica 'types' in St. Augustine and elsewhere in the Caribbean from Mexico City, Pueblo, and Panama which need to be more closely archaeologically defined during the 1650 through 1750 period? The *Capitana el Rubí* site might represent an excellent opportunity to compare the presence and absence of both Old World and New World Majolica types resulting in a much tighter temporal sequence than has been previously possible for the early 18th century.

Analysis of Materials

Pottery - All glazed and unglazed earthenware found on the site, will be sorted and classified by type. A typological break down within types will occur when specific stylistic/decorative modes can be identified (i.e.: El Morro ware or Pueblo blue on blue). Previously unknown wares will be described and typed by the bi-nominal classification system. It is expected that the sample size of the pottery collection will become quite large over a period of time.

Glassware - All glass will be treated and classified similarly to the pottery. Typological break down by type (i.e.: green glass, clear glass, or other) would be done in the first instance. The next stage would be to provide a further breakdown into actual types (i.e.: case gin, onion bottle tumbler, pane glass or ornamental glass).

Iron - Objects made of ferrous materials will undergo standard conservation procedures of electrolytic reduction followed by the application of protective coatings, in order to minimize future environmental degradation. Metallurgical analysis may be done on representative samples to ascertain the manufacturing techniques and the possible origin of material.

Organic - Organic materials will be preserved for analysis and study. Wood samples from major ship timbers will be collected for study. There are no plans to recover major hull timbers. If major hull timbers are found, they will be mapped, measured and photographed in-situ. No hull structures will be disassembled.

Ballast - All ballast rock will be examined using the major variables defined in the Atocha and Pilar ballast study as refined by Benson on the U.S.S. Alligator (1996) (Mathewson, 1977, 1992). Petrographic examination with binocular microscope and thin sections will be sought to further the ballast study already underway in the Upper Keys. (Mathewson, 1991)

Exhibition and Education

Shipwreck archaeological studies and salvage activities in the Florida Keys over the last 30 years has increasingly created the need to constructively utilize shipwreck artifacts to educate the public about how historic shipwreck archaeology can assist in writing of the maritime history of Florida and neighboring Caribbean waters.

A museum exhibit will be formulated based upon the excavation results of the Capitana Project using artifacts, historical documentation, and archaeological information. This exhibit will be designed to reach a general audience. Emphasis will be placed on defining historic shipwrecks as archaeological resources and historical time capsules. This exhibit will be available for display at public libraries and local museums throughout the Keys. A beginning will be made to compile teaching materials and lesson plans concerning the 1733 Spanish treasure fleet for a Monroe County Teachers Resource Guide for use in public schools.

Historic Shipwreck Privatization

More and more agencies at all government levels are becoming increasingly aware that they are incapable of performing the public services they are responsible for. As this is happening in areas as far a field as public education, garbage collection, jails, and public utilities. The archaeological profession has for the most part remained resistant to recent changes in public policy issues concerning private sector funding. Privatization of government services is quickly becoming a key element of the 1990's! How can the 'Privatization' concept affect the management of marine archaeological sites and the shipwreck salvage program in Florida? The 'Privatization Model' as demonstrated by the Capitana Project involves interrelationships between responsibilities and benefits of three different components: Private Sector, Government, and the Academic Community (see Table 3). The management and research of historic shipwrecks involves so many different facets, none of which are inexpensive and requires active participation from all the major players. This 'Privatization Model' can be successful because it provides a win-win solution for everybody concerned. By focusing on 'Public Good' criteria, research, management, and public education, goals become intertwined in a way which only can be developed when entrepreneurial enterprise is channeled by government and academic participation.

SECTOR	RESPONSIBILITIES	BENEFITS
Private Sector (shipwreck salvors)	-Compile comprehensive research designs -Conduct archaeological excavations under contract with state government -Provide 'public good' benefits including educational training programs, books, conservation lab, video an museum exhibits -Publish popular and professional reports and site monographs	-Receive all ancillary rights to promotion and sales -Receive 80% of artifacts recovered
Government (State Agency)	-Issue exclusive contract to private corporation -Participate in all excavation and laboratory research activities spelled out in the research design as an integral part of project operations -Assist in project public education programs -Assist in artifact analysis and site interpretation	-Receive all historical and archaeological data in monthly reports, preliminary and final publications -Receive cross section, representative samples of all artifacts recovered, 20% of total assemblage for research, educational, and exhibit purposes -Development of 'Cultural Tourism' as an archaeological preservation concept
Academic (University, Community College, Public School System)	-Assist in archival research artifact conservation and analysis of archaeological materials -Assist in project public education program	-University lecture series -Life long learning education program -K-12 curriculum development -Teaching museum collection -Student intern training

Table 3. Historic Shipwreck Privatization Model

ARCHAEOLOGICAL METHODOLOGY

By R. Duncan Mathewson III

Excavation

Shipwreck remains will be excavated in depths ranging from 8 to 12 feet of sand with airlifting equipment, injection water dredges, and a mail-box, also referred to as a blower. Digging operations will be constantly monitored to record empirical data concerning how the three excavation procedures affect the natural environment on the site. No excavations will endanger living coral reef systems and/or sea grass. Benthic invertebrate communities within sand and rubble habitats will suffer little if any long term adverse impact. Seechi disks will be used to measure changes in turbidity levels to obtain empirical data concerning possible adverse impact of silting upon benthic habitats. Fish counts will be made to measure habitat bio-diversity along transects across the excavation area. Excavation holes will be measured and monitored to provide base-line data about the rate of natural back-filling processes as part of biological regeneration.

Prop wash excavation

Since the mid 1960's the use of prop wash by commercial salvors has been a very controversial topic. Although government archaeologists have continually insisted they should never be used, they have been in fact used on a number of occasions by State archaeologists in Texas, North Carolina, and Florida during the 1970's to conduct shipwreck research. (Mathewson, 1989) The Submerged Cultural Resource Unit (SCRU team) from the National Park Service has recommended the use of 'blowers' on a shipwreck site in the Pacific. (Lenihan, et al 1981) More recently the use of blowers has been advocated in Massachusetts for uncovering deep sand and overburden on the *Whydah* site. (Reedy, 1991)

If 'mail-boxes' are carefully controlled, they can be used very effectively as an archaeological tool on historic shipwrecks in much the same way archaeologists have been using bull-dozers and back-end loaders on land excavations for many years (Van Horn, 1988; Van Horn, et al. 1986).

With this in mind four test holes were dug on the *Herrera* site with the 1991 archaeological NCSR field crew. The primary objective of this procedural test was to record the affect of the prop wash on archaeological materials taking into following variables: water depth, depth of overburden, blower size, engine RPM, and blower operational time. This data was recorded throughout the digging process. Observations were carefully made and recorded concerning the degree of bottom sediment dispersed and the impact on different archaeological features. This information was compared to the affect of a 4" airlift that was used for comparative purposes.

A video was taken before and after digging operations to adequately evaluate the bottom disturbance. All artifacts uncovered during this test, were recorded and placed back on the site were they had been found. All four test pits were back filled with ballast and sand to prevent site erosion. When the site was visited three months later, all signs of the test excavation had been covered over by normal storm and current action. The full results of this procedural test will be analyzed in the 1733 Spanish Fleet special publication now being prepared by A & A Research. (Mathewson and Drouin, n.d.)

Test excavations with a ‘mail-box’ were also conducted on the *San José y las Animas* during the NCSR 1991 and 1995 Summer Field Schools. Ron Molinari removed over 8' of sand from the *San José y las Animas* wooden hull structure to allow the field school participants an opportunity to photograph, video, and map the stern section of the vessel. (Mathewson, 1991)

Quite clearly there is a need to collect reliable empirical data concerning the use of the ‘mail-box’ so that it can be evaluated objectively like any other archaeological technique without emotional overtones it has created over the years.

Prop wash can clearly be used archaeologically on the *Capitana el Rubí* site in much the same way as it already has been demonstrated on both the *Herrera* and *San José y las Animas* sites. The following site-specific criterion for the use of prop wash on the *Capitana el Rubí* defines how it will be used on the site:

La Capitana el Rubí

Site specific criteria:

1) Water Depth: 18'-20'-

2) Blower: Prop Single
   Prop Dia. - 24"
   Prop Blade - 4"
   Prop Pitch - 24"-22"
   Mail Box Dia. - 26"

3) Sub-Surface Blower Depth: 2' (with 2' extension)

4) Digging Interval: 10 Min.
   In known and previously dug areas
   2 min. in new areas

5) Digging revolutions per minute (RPM): 1000-1200

6) Hole Inspection RPM: 400-600

The following guidelines summarize the methods and techniques which will guide the scientific Archaeological Recovery Operations and artifact mapping in all phases of the project. Underwater mapping of datum points will provide a frame of reference for griding off the entire site. Base-line offsets and trilateration will provide provenance data including stratigraphic and sedimentary data.

1) Site Survey: Survey operations will establish a means of plotting and charting clusters of submerged cultural material to establish and record the location of all finds. The datum points of the site survey will be fixed with a Global Positioning System (GPS). Detailed mapping within the site will then be done as excavation proceeds.

2) Data Records: The boat captain and crew will be responsible to perform the following tasks;
   a. Determine the position of the boat.
   b. Plot the GPS readings on a base map. (l"=25')
   c. Use a standard coordinate system to record and describe location of artifacts and bottom features.
   d. Use a numbered artifact tagging system which will allow identification and provenance of all recovered artifacts to be maintained.
   e. Use a log book system which will provide an accurate record of boat location, operational activities and artifacts recovered by tag number and location together with other useful site information.

3) Recording of Survey Areas: All survey areas will be mapped by electronic position finding equipment to ensure accuracy of recording all remote sensing anomalies. Archaeological feature identification will be recorded on large scale base maps and will be identified with a unique two-letter abbreviation of the boat's name followed by consecutive numbers for search area beginning at the start of each day's digging operation. In the log, a brief description and tag numbers of all artifacts recovered will be recorded for each search area so that the tag number is sufficient to determine the provenance of any artifact. Representative and all unusual search area profiles will be recorded noting the general order and thickness of recognizable sediments and the location of artifacts or other useful in-situ information. All interpretations of stratification or artifact associations which might be useful in understanding the process of artifact scatter and deposition will be noted.

4) Artifact Tagging: All artifacts removed from the seabed will be mapped and tagged before being placed in containers and/or bags. All artifacts will be stored in a safe, secure stabilization repository. All recovered artifacts will be tagged individually or as a group having the same provenance. Anchors and cannon recorded and left on the bottom will also be tagged. Tags will be plastic with permanent imprinted numbers and affixed to artifacts by wire or nylon cord. For small or delicate artifacts the tag may be placed in the same sealed protective container as the artifact. Large objects will be individually tagged. Common occurring objects such as pottery sherds, spikes, barrel hoop fragments, musket ball or lead sheeting may be bagged as a group and assigned a single tag number if they are from the same context. Bags will be of sufficient strength that they will not tear or break in handling or rot in storage before processing. Cloth is recommended.

5) Artifact Management: Artifacts may be divided into the following categories: large objects such as anchors, cannon and hull structure; small unidentified encrusted objects (E.O.'s); identified small finds; and unique artifacts. After tagging and recording, artifacts in each category will be treated as follows:

a. Large Objects - These will be left in-situ on site until wet storage facilities are available. Once removed, they will be handled so as to minimize damage. They must not be allowed to remain out of the water for more than three days.

b. Encrusted Objects - All E.O.'s must be kept moist, while on board and in transit to the storage and processing laboratory. Ballast stones and encrustation may be separated from E.O.'s if their removal will facilitate handling and not break the E.O. E.O.'s will not be broken open on board the vessel; instead they will be processed on shore at the storage and laboratory facility where they can be X-rayed if necessary.

c. Small Finds - This Includes such items as pottery sherds, spikes, barrel hoop fragments, musket balls and lead sheeting. These may be bagged as a group from each search area or excavation unit. If iron is included, the bags or objects must be kept moist.

d. Unique Artifacts - These will be assigned individual tags, unless they are clusters of coins, and placed in individual small plastic bags or protective jars to prevent damage, unique objects will be placed in a safe, secure storage area immediately following their recovery. Precious metal artifacts such as coins, bullion, and jewelry will be stored in a local bank.

6) Artifact Processing and Stabilization: All artifacts recovered from the site are to be registered immediately in the artifact processing and stabilization shore facility. This facility will have storage and processing capability and will provide sufficient security to ensure the protection of all artifacts. In addition to the routine processing of small finds, E.O.’s, and other artifacts needing stabilization, all unique artifacts will be photographed with the tag number and provenance data recorded on the back of the photo prior to the object being conveyed to safe storage. Final records, artifact overlay maps and inventories of identified artifacts will be filed with the FKNMS office in Marathon at the end of each season's excavation. Copies of all field records and project documentation will be maintained at this facility during the excavation season. Log sheet copies of site operations, along with artifact inventories and photographs, will remain on file for review at any time by NOAA archaeologists.

7) Artifact Conservation: All fragile and unique artifacts of special interest will be given priority for conservation and/or restoration by professional conservators and museum specialists. Interesting encrusted objects will be X-rayed and preserved as soon as possible after recovery.

8) Diver Safety: Spinning shafts, high vacuum suction intakes will be caged while divers are in the water. Dive flags will be displayed and standard dive safety precautions will be followed

under supervision a crew member acting as the Dive Master. The Dive Master will assume control of all diving activities to assure that safe procedures are followed at all times.

9) Reporting Requirements: Semi-annual reports will be made available to NOAA archaeologists. Copies of professional papers, popular articles and manuscripts resulting from data derived from excavation activities will be provided to NOAA. Annual preliminary site reports will be prepared in order to facilitate preparation of the final site report and popular publications. Periodically reports of all phases of the operation will undergo peer review in preparation for the final publication. They will contain among other things a complete list and description of all major finds recovered together with an overall map of their horizontal and stratigraphic distribution pattern. In-situ photographs of major artifact clusters will also be included as part of the narrative describing the overall operation. All archaeological and historical data on the *Capitana el Rubí* will be freely exchanged with NOAA archaeologists and marine scientists as part of a reciprocal agreement.

Artifact Handling

Artifacts will be mapped on the bottom and plotted on the site map at the end of each day. As artifacts are recorded, described and photographed as part of the site records, they will be compiled into an inventory at the end of each month. As the artifacts are cleaned, stabilized and photographed, they will be interpreted in the overall horizontal and stratigraphic context of the site.

No artifact recovery will be conducted without a tag and provenance data recorded at the time of excavation with full site documentation of its contextual association.

All objects will be kept wet at all times immediately following their recovery from the bottom.

An artifact tag will accompany each object continually from the recovery and transportation through the stabilization process.

Artifact inventory forms will be completed as soon as possible following recovery. Artifact stabilization will be carried out in museum facilities.

Material Classifications

Iron - All objects will be placed in artifact tanks immediately upon recovery. Large objects which cannot fit into tanks will be kept wetted down on the boat until they can removed to larger storage shore facilities. No attempt will be made to remove shell/encrustation adhering to objects. All objects in shore facilities will be placed in 5% fresh water solution of sodium carbonate to retard rusting from oxidation.

Silver - All objects will be treated in the same way as iron objects. It is, however, not necessary to place those in sodium carbonate aqueous solution.

Copper/Bronze - Although these objects disintegrate out of water much slower than iron and silver, they will be kept wet. Because of galvanic action between copper/ tin/ lead/ zinc alloys, the metal can be very fragile.

Pewter - All such objects will be cleaned by soaking them in a lye bath in enamel or glass containers. Badly corroded pewter can be very brittle and must be handled with care.

Lead - These objects can become very brittle under anaerobic conditions. They are usually much better preserved in an oxidizing environment. They can generally be treated like other metals but will never be stored in contact with wood.

Gold - Made from an inert metal, such objects do not react with seawater. They are least affected of all metals. Occasionally, a calcium carbonate encrustation appears on surfaces.

Ceramics - Salt crystallization can cause fabric disintegration and surface flaking of glazes and post firing painted decorations Pottery fired under low temperatures is particularly susceptible. All ceramics including stoneware and porcelain should be kept immersed in fresh water prior to conservation treatment.

Glass - Disintegration rate is determined by composition, PH, and temperature of the depositional environment. Glass delaminating causing iridescent ‘onion skin’ layers is difficult to stabilize. No attempt will be made to remove them. These flaking layers can sometimes be used to date the objects. Badly flaking glass will be stabilized as quickly as possible with a surface sealant.

Stone - Although it usually has the appearance of excellent stability, seawater and marine borers can cause considerable structural weakening depending upon its mineral composition. Ballast rock samples will be collected for comparative studies.

Organic Material - Leather, bone, rope, teeth, seeds, wood, textiles, ivory, dyes and paper are the most common organic substances found on shipwrecks. These are fragile and must be carefully treated at all times. In some instances, evaporation and air exposure can cause irreparable damage in not much more that 10 seconds. All fragile organic material will be recovered with an artifact tray by placing it under the object with some sediment matrix adhering to it to provide stabilization. The more fragile material will be placed in polyethylene bags while still underwater.

Composite Material - Objects made of different types of material present the most difficult stabilization and conservation processes. Stabilization treatment will depend upon professional advice on a case by case basis.

FIELD WORK DESCRIPTION AND OBSERVATIONS

By Robert J Benson

The *Capitana el Rubí* site is not visible from the surface of the water and is covered by an overburden of sand. (see Map 4 and 5) It is impossible to relocate an exact position on the site after evidence of excavation holes have been naturally backfilled from the actions of wave movements without the aid some type of positioning system. Excavation holes are normally backfilled in one to three weeks time dependent upon localized weather conditions. This phenomenon has been documented by FKNMS volunteers Denis Trelewicz and Chuck Hayes. The site is located a little over three nautical miles from any land mass with the nearest reference maker being Davis Reef which is located one half nautical mile away from the primary excavation area. With these logistics in mind it was necessary to establish a means to plot the excavation holes in reference to themselves as well as to an already established and verified geographic reference point. Prior to July 12, 1995, a computerized system was developed by Joseph Kimbell and Ralph T. Garver to plot the location of excavation holes in reference to three marker buoys located within the primary excavation area for the site. The system resulted in an estimated accuracy of plus or minus three feet. The accuracy of measurements was determined by measuring exposed features during the repositioning of the vessel during subsequent and concurrent excavation days. A north-south and east-west coordinate chart was created utilizing yards as the unit of measure for the distance values between the three marker buoys and Davis Reef marker. The three marker buoys were attached to concrete blocks set in at least three to five feet under the sand. The primary datum for the site also had a buoy attached two feet off the bottom as an aid to relocate the site as necessary. Holes to set the markers in place were excavated with the salvage vessel's blower and than backfilled creating permanent mooring points to attach the buoys. Modern debris such as old lobster pots, steel cables, iron pipes and concrete cinder blocks that were located in the area surrounding the site were relocated near to each buoy mooring to aid in the relocation of the moorings as vandals and storms caused the loss of buoys. Most of the debris located in the area is attributed to the modern salvors prior to this excavation.

On July 12, 1995 a permanent set of three markers were installed at a distance of 200 yards due west of the primary site datum with the help of John and Judy Halas along with some other NOAA volunteers. (see Map 3) The markers were set 100 yards apart on a north-south axis and the mooring attachments were driven into the substrate with an underwater pneumatic hammer. This is the same type of system that dive site mooring buoys located in the FKNMS as well as other locales throughout the world have utilized. A line was attached underwater between each of the mooring rings to aid in relocating the mooring fixtures as buoys were lost due to storms and vandals. The three markers were part of a new sextant bearing system similar to how bearing were being taken for years by the salvors of the 1715 Plate Fleet off the east coast of south-central Florida. The main difference being that the 1715 Plate Fleet salvors system utilizes makers located upon dry land verses markers located upon the water due to the shipwreck sites proximity to shore. The new sextant bearing system was easily interfaced with the grid pattern mapping system previously being utilized and resulted in a similarly estimated accuracy of plus or minus three feet from the measured reading. The position of an excavation hole utilizing yards as the unit of measure for the distance values was determined with the computer programs Co-Geometry by Ralph T. Garver coupled with Excel by Microsoft. The angle resection between the north-center and south-center markers were derived with a sextant and recorded onto the daily

log sheet than inputted into Co-Geometry and subsequently loaded into Excel to create a simple but accurate pin point map for the site.

July 14, 1997 was the start of the use of differential Global Positioning System (DGPS) to determine the position of excavation holes. The system consists of a differential receiver unit and a Global Positioning System (GPS) receiver. Without the corrected DGPS signal standard GPS had an accuracy of within 300 feet. An estimated accuracy of 30 feet resulted when the military selective scrambling availability was turned off May 1, 2000. A differentially corrected satellite signal would be received from Miami, Florida resulting in a potential accuracy of plus or minus six feet from the measured reading for the *Capitana el Rubí* site. DGPS accuracy is dependent upon the distance from the differential transmitter and receiver. The *Capitana el Rubí* site is approximately 90 nautical miles from the Miami transmission station. The salvors felt confident that the accuracy is within the stated six foot parameters but judge the overall system to be accurate to within plus or minus of one foot for excavation hole pin point mapping as datum reconfirmation prior to subsequent anchoring and excavation has resulted in consistent DGPS reading correlated to the actual location of the primary datum.

NOAA has stated in each consecutive permit issued since 1993, that the use of blowers for excavation of the *Capitana el Rubí* site is permitted. "NOAA believes the use of blowers as a method of excavation is potentially harmful to the resources, but may not be damaging in controlled situations. Use of this methodology is to be considered experimental, for NOAA and the State of Florida to determine whether this method is appropriate for the removal of artifacts from privately owned vessels" (FKNMS, 1993, 1996, 1998). NOAA further indicated that the permittee must inform a designated NOAA officer when blowers will be utilized in order that NOAA may observe their operation and suspend their use if the observer believes that the blower activity is causing damage to natural and/or historic FKNMS resources. NOAA has not actively pursued observing blower excavation on the *Capitana el Rubí* site, but NOAA has been active in observing the effects of blower excavation on the *San José y las Animas* site.

Though the original research design called for a ten minute digging interval in known and previously excavated areas at 1000 to 1200 RPM, the majority of this type of excavation was carried out at 1000 RPM for five minutes with an intermediate inspection to determine if cultural materials were being uncovered. All other criteria of the original research design as relating to blower excavation has been adhered to and has produced maximum excavation depths of eight to ten feet. Average maximum excavation holes size were approximately, 32 feet across, nine feet in depth, three to four feet across at the base, with a sixteen foot side slope. Much of the blower excavation on J & J's Lady and R/V Deep Venture was carried out with a diver present underwater observing and monitoring the excavation progress. The diver was able to immediately determine if cultural materials were being uncovered as well as slow the blower RPM as timber remains were uncovered to avoid displacing the material. It was also noted that the disruption of the bottom sediment caused an influx of fish to appear in greater numbers than if the blowers were not operating. Though no quantitative study was performed to access this phenomenon, qualitative observations indicate that the fish were feeding on displaced material.

Unfortunately, the maximum achieved eight to ten foot excavation depth limited the salvors from reaching the bottom most areas of the site. One of the project goals added after the 1993 research design was to determine what the effects of nature and/or modern salvage had on the stratigraphy of the *Capitana el Rubí* site as the salvors were interested in excavating the lower most portions of the ballast assemblage. The known facts in relation to this are; 1: The original

shipwreck site when located in 1938 was in 18' to 20' of water. 2: The original ballast pile in 1938 measured approximately 125' long, 60' wide, and 6' to 8' high with timbers visible within the lowest portion of the ballast pile. 3: The ballast was cemented together in a mass by coral growth due to years lying on the bottom undisturbed. 4: The wreck site has been salvaged since 1938 and up until the issuance of the 1993 FKNMS research and recovery permit. 5: Methods employed in the prior salvaging included the use of dynamite, water jets, and airlifts to remove ballast and sand thus enabling salvors to gain access to the bottom most portions of the wreck site. 6: Presently the *Capitana el Rubí* site is not visible on the surface of the bottom.

Possible hypotheses that can be drawn from these facts are, 1: The *Capitana el Rubí* site is now covered by an overburden of sand caused by the effects of nature. 2: The *Capitana el Rubí* site has sunk into the sand caused by the effects of nature. 3: The *Capitana el Rubí* site has sunk into the sand caused because of the disruption of the site by modern salvors.

Testing utilized for these hypotheses comprised of; 1: Measuring the current water depth above a known area of the wreck site. 2: Digging test holes and measuring the amount of overburden above the main area of the wreck site. (The main area of the wreck site was defined as the area with the most concentrated ballast) 3: The ballast pile was checked for areas of cemented intact ballast and in situ timbers. After establishing a known area of the wreck site, measurements were taken using both depth recorders and manual tape reels. A water depth of 18' to 20' was recorded in all areas measured. The difference in depth was attributed to variations caused by tidal conditions and not differences in bottom topography. In 1995 a total of 121 test holes were dug. Of the 121 holes, 26 contained higher concentrations of ballast to be construed with being from the area of the main ballast pile. Excavation holes measured from top of the ballast to top of the sea floor averaged 9' in depth. All ballast found was loose and not cemented together. Ballast thickness was measured at over 4' deep and was noted to be much deeper. Equipment limitations precluded the salvors from being able to survey the complete depth of ballast encountered. The remaining 69 holes that contained artifacts and/or ballast were between 4' and 9' in depth, with the lesser depths being further away from the main ballast pile on average. All timbers that were located during the survey were clearly disarticulated from their original locations in such that no timbers were associated with concreted ballast nor did any timbers show any indication that they were attached to any adjoining timbers. (see Map 4 and 6)

In evaluating these test implications it was found that in the first hypothesis, if the *Capitana el Rubí* site was covered by an overburden of sand caused by nature, then the water depth over the shipwreck site would be less than the original 18' recorded in 1948 and subsequent salvage operations. Since the water depth was still found to be approximately 18' and there has not been any dramatic increase or decrease in sea levels since 1733, this hypothesis has been eliminated. The second hypothesis shows that if the *Capitana el Rubí* site has sunk into the sand caused by the effects of nature, then it seems nature would have shown more of an effect on the site in the 215 years before being disturbed by salvage work during the last 55 years. Since the site was found in 1938 intact and resting upon the surface of the sand and recent test implications have shown that the shipwreck had indeed sunk through the sand and the ballast is no longer concreted together, the second hypothesis was not validated because of the negative historical and scientific evidence to the contrary. The third hypothesis shows that if modern salvage on the *Capitana el Rubí* site has caused the shipwreck to sink into the sand, then the test implications will show that the ballast is no longer cemented together and timbers that were present under the ballast will be dislodged or missing. Test implications showed no evidence of concreted together ballast. In the

largest and deepest areas of ballast that were located, all timbers located during the survey were disarticulated from the ballast concentration and none showed to be attached to neighboring timbers or in situ. Even though equipment limitations precluded excavating to the bottom most portions of the ballast pile in order to locate any possible in situ timbers the test results can be used to validate the third hypothesis as the most probable cause for the reason why the *Capitana el Rubí* now lay under a 9' layer of sand.

Stratigraphy, for the *Capitana el Rubí* site, the deepest most portion where cultural materials are expected to be found is referred to as the hardpan. The hardpan does not necessarily have to be the underlying bedrock but any layer of substrate that is dense enough not to allow penetration of overlaying material as the material migrates down. When salvaging on the 1715 Plate Fleet one looks for a hard compact layer of coquina-shell rock as in indication for both an area that may not have been previously salvaged and also as a stratigraphic indicator for the maximum excavation depth that normally will be productive. Even if the *Capitana el Rubí* site had not been overly disturbed as it had been (Meylach, 1971:133-134), some denser material would have migrated down throughout the site. Bob Weller indicated that modern salvors undercut the bottom most portions of the ballast pile in an attempt to find these dense materials such as silver and gold coins that might have been stored in the lower portions of the cargo holds. (personal communication February 25, 2000) Since the 1993 salvors were interested in finding items of monetary value they needed to establish where the hardpan was for the *Capitana el Rubí* site. Dr. E. A. Shinn, geologist for the United States Geological Survey (USGS) has been involved in continuing research consisting of core drilling and sound wave probing also referred to as seismic profiling throughout the Florida Keys. The USGS study has helped understand the geologic sequence of events that has created the Florida Keys and adjacent reef systems as well as provide sediment mapping for the region. “Sediment thickness maps for the reef tract reveal that mud and sand are only 3 ft thick over 20% of the area and 9 ft thick in 30% of the area. Sediments 20 to 30 ft thick represent less than 2% of the reef tract” (Shinn, 2001). Dr. E. A. Shinn (personal communication August 6, 2001), believes that the *Capitana el Rubí* site was in an area covered by approximately 20' of sediment.

In August of 2001 blower excavation deviated from the original research design parameters. The Ella Warley III captained by Allen Gardner worked the site for six days. The Ella Warley III was equipped with two 36" blowers that protruded into the water for 3'. The propellers were 28" in diameter, 11" wide, with a 30" pitch. The blowers were run at 1000 RPM for 15 minutes, with a 3 to 4 minute inspection interval for an average hole. An average hole had a surface dimension of 25’ wide, 10 to 15'deep, and 10' bottom width. On August 17, 2001 the Ella Warley III succeeded in finding a hard compacted clay bottom under 14' of sediment at the edge of the main ballast concentration in hole number 2001019. (see Map 7) The clay is dark gray in color and required a great effort to penetrate with a hand trowel. If Dr. E. A. Shinn is correct in estimating that there is 20' of sediment over the site before reaching bedrock than that would indicate the possibility that there is 6' of clay. There were eight timbers associated with the excavation hole but all were disarticulated and out of situ. Five of the timbers (see Figure 1) had been previously located and tagged in May and June of 2000, while of the three new timbers located and tagged one was identifiable as a floor member number 406. Though a floor member had been located it was not attached nor relative to the keel and keelson that should have been associated with it had the timber been found in situ since none of the remaining seven timbers located were thought to be identifiable as being keel or keelson remains.

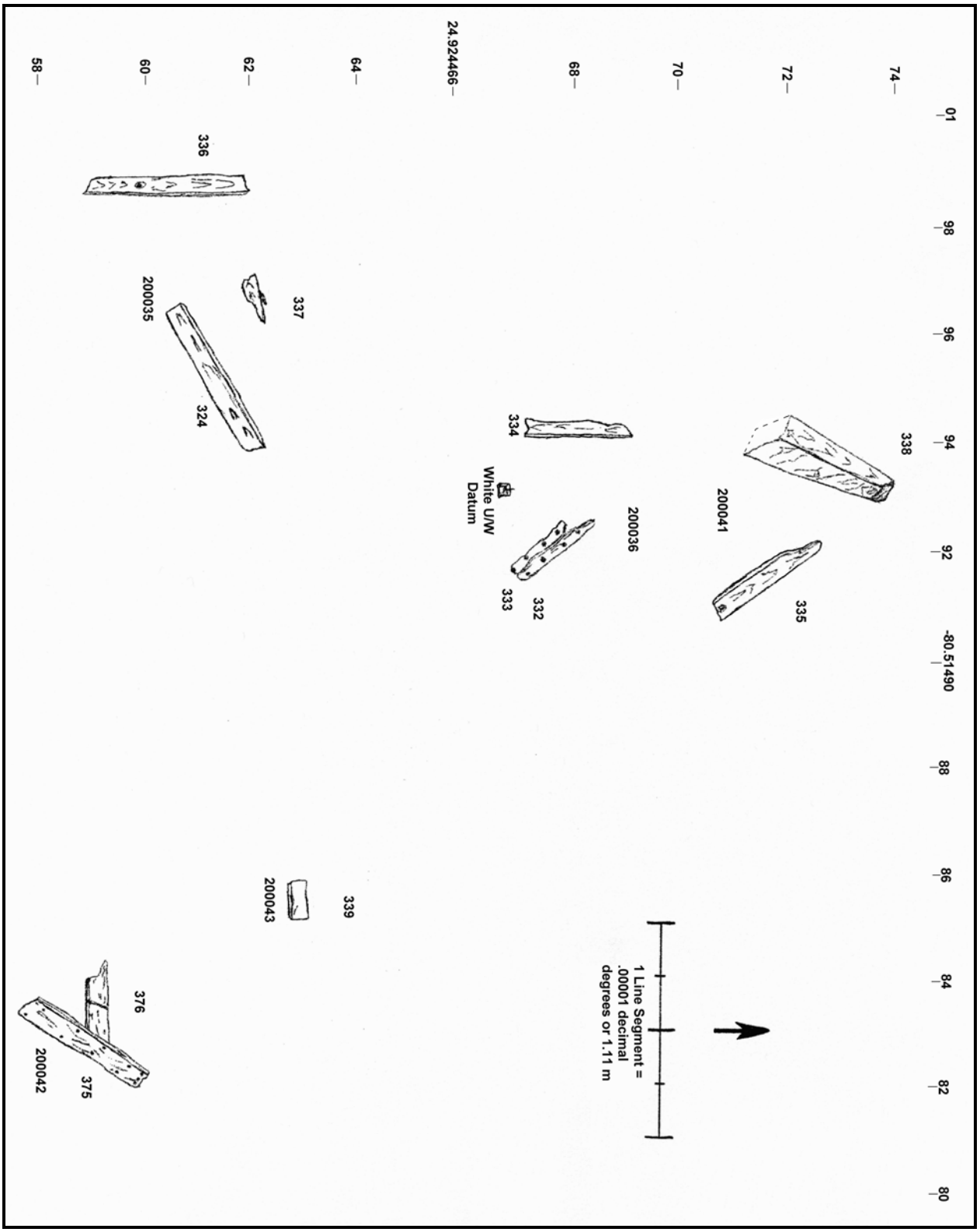


Figure 1. Map of disarticulated timbers originally located in 2000 and then subsequently relocated in 2001 near the area of the white underwater datum.

Though most of the excavation work on the *Capitana el Rubí* site was accomplished with a blower, a six inch airlift was employed as an aid to remove the overburden that refilled the holes created when four holes were excavated to create a large square area that would have an overall greater bottom surface area to counteract the effect of the sides from an excavated hole collapsing back into itself. A normal excavation hole that was nine feet deep had only a three to four foot bottom surface area compared to a square boxed hole that had the potential of a twenty to thirty foot bottom surface area. Of the 88 dive days logged from 1994 through 2001, a dive day being equal to the activity of each salvage vessel working, 20 days were spent ground surveying with metal detectors with no excavation performed, 60 days were spent utilizing a blower for excavation, 4 days were spent using only an airlift for excavation, and 2 days used both a blower and an airlift for excavation. Eight seasons of excavations produced an average of 8.25 excavation days per year. The salvors found out in 2001 that optimum results were had by utilizing both a blower and airlift for excavation. Unfortunately, the use of this configuration was only possible during relatively flat and calm seas when the vessel was outfitted with a complete compliment of crew. The 2001 excavation season did not provide the salvors with either or of these necessary criteria.

DATA ANALYSIS

By Robert J Benson

Artifacts utilized in the Capitana Project study have been broken down into three distinct recovery categories. The first category of artifacts has been archaeologically recovered and has provenience. This category of artifacts is referred to as 'archaeologically recovered'. Artifacts that have been archaeologically recovered posses the greatest possibility to supply data pertinent for compiling material typologies and ship board activity studies. As previously mentioned in the 1993 research design, the main research objective of the *Capitana el Rubí* site excavation is to provide a synthesis of descriptive information for the dating, cultural origins, and functions of 18th century Spanish maritime culture. This category of artifacts include those artifacts that were excavated from 1993 through 2001 under a FKNMS research and recovery permit from the *Capitana el Rubí* site (see Appendix 10) and those artifacts that were excavated from 1997 through 2001 under a FKNMS research and recovery permit from the *San José y las Animas.* The second category of artifacts is those that were salvaged prior to a FKNMS research and recovery permit but for which there is definitive knowledge that the artifacts were recovered from a specifically named 1733 site. This category of artifacts is referred to as 'salvaged material'. They include those artifacts recovered from the *Capitana el Rubí* site under State of Florida permit number S-14. Artifacts recovered by Goin E. (Jack) Haskins, Jr. in the 1980's from the *Capitana el Rubí* site and all other specifically named 1733 site recoveries made with or without a State of Florida salvage permit. The final category of artifacts was definitely recovered from a 1733 site but the specified site name can not be determined, hence these artifacts are referred to as 'pot-hunted materials'. Artifacts that have been recovered as salvaged material and/or pot-hunted materials can only help supply data pertinent to material typology studies. The reasoning behind categorizing the artifacts by method of recovery is that a small but relative assemblage of 1733 artifact material that had been recovered prior to the implementation of archaeological research and recovery permits is available for comparative analysis. The salvaged material and pot-hunted material categories are also referred to in portions of this report as preexcavation materials. (see Appendix 2)

The Capitana Project was intended to provide a synthesis of descriptive information for the dating, cultural origins, and functions of Spanish 18th century maritime culture. A question proposed is, what viable archaeological data can be gotten from a previously disturbed site? Land sites have always had to deal with human disturbances whether they were from agricultural, development, or looting damage, yet viable archaeological data, especially typological data has been acquired after the disturbances. In the southwestern United States, looting has always been a problem, with an average of 60 to 90 percent of sites affected (Renfrew and Bahn, 1991). Deagan and Cruxent (2002a, 2002b) have derived both typological and activity area data from *La Isabela,* a site that has been subjected to extreme development and looting prior to proper archaeological excavations. The *Capitana el Rubí* site represents an example of a site that consists of secondary cultural deposits since no evidence has been indicated to support the existence of primary cultural deposits that would have been stabilized by ballast, hull structure, and/or sediment overburden. The conditions that contributed to the existence of secondary deposits were the original break-up of the vessel following their initial sinking along with 18th century salvaging by the Spanish, but modern recovery and salvage attempts are considered the major cause for the nature of the secondary deposit. Evidence to support the existence that the shipwreck was comprised initially of primary deposits exists only in the historical record as narrative and film documentation that was done in the early years of discovery by Art McKee. Because these records were not combined with archaeological documentation, conclusions relevant to shipboard activity and the wrecking process are nonexistent. In the case of the *Capitana el Rubí* site, shipboard activity data and wrecking process data based on secondary cultural deposits has shown to be less than marginal in both cases as compared with the 1622 *Nuestra Señora de Atocha* site secondary deposits that showed shipboard activity to be marginal and wrecking process data to be good (Mathewson, 1983). *HMS Fowey* though disturbed prior to any formal excavation was deemed to possess good shipboard activity data. This above average anticipated norm for the 'Archaeological-Environmental Shipwreck Model' (see Table 1) for secondary deposits on the *HMS Fowey* has been attributed to the minimal human intervention of recovery and salvage attempts (Skowronek and Fischer, 1984). It is thought that the reason the *Capitana el Rubí* site had not adhered to the anticipated norm for the 'Archaeological-Environmental Shipwreck Model' was because the site had been subjected to excessive human intervention in the form of recovery and salvage attempts. These recovery and salvage attempts not only disarranged artifact spatial relationships, but recovery of artifacts has caused the loss of establishing many spatial relationships that would have existed previously. Accordingly, the *Capitana el Rubí* site still was able to provide excellent typological data despite the lack of shipboard activity and wrecking process data.

Ceramic Analysis

A shipwreck site presents a unique opportunity because it can be assumed that the pottery vessels were intact at the moment of loss while the contents of the vessels, if such were had, were also present at the moment of loss. Land finds on the other hand, excepting grave finds and recoveries from disasters such as Pompeii, most likely represent vessels that have been discarded because of breakage that deemed them unusable. A shipwreck site can provide a more securely dated artifact assemblage than that of what is normally found at a land site. Though a land site usually affords the archaeologist with a greater temporal range of material, a shipwreck site can provide the uniqueness of a more accurate date in time for verifying and refining typologies of artifact assemblages. The analysis of the ceramic collection from the *Capitana el Rubí* site is relatively unique in that the collection for the most part was excavated, conserved, and studied

by a single individual who acted as both project archaeologist and conservator. This differs from most other studies which have to relay primarily on secondary information verses that of mostly primary data since the person studying the collection more than likely would not have excavated the samples and thus does not possess first hand knowledge of its recovery. The *Capitana el Rubí* site ceramic assemblage consists of examples of coarse earthenware, stoneware, and porcelain. There is considerable confusion concerning the classification of both coarse earthenware utilitarian and non-utilitarian vessels. The Capitana Project ceramic analysis was designed to propose redefinition for the classification of selected coarse earthenware. Prior to any proper analysis it was first necessary to reiterate current ceramic terminology definitions and make amendments relative for this study. (see Table 4) Deagan (1987:30) defines coarse earthenware as ". . .pottery with a relatively soft paste that has been fired at a temperature of about 1100° to 1200° C. Coarse earthenwares can usually be scratched with a fingernail, and have a high porosity. With the exception of the majolica group, the coarse earthenwares can be generally included in a 'utilitarian', or non-tableware, category and can be defined by their use in storing, transporting, cooking, and washing". Deagan goes on to indicate that certain other types identified as belonging to the coarse earthenware group that have been previously type named overlap between the utilitarian and non-utilitarian group. The Capitana Project ceramic study is proposing the addition of previously unnamed ceramic types that will expand the present knowledge of the coarse earthenware utilitarian group.

Ware	A ware consists of types that are defined by specific forms that indicate uses such as utilitarian, non-utilitarian, or both
Type	A type is a potential ware and is defined by the existence of a unique combination of recognizably distinct attributes such as paste type, paste color, and surface treatment
Variety	A variety is a variation within a type such as differences in paste or glaze color
Group	A group is defined as either coarse earthenware, refined earthenware, stoneware, or porcelain (the term category is used interchangeable within the literature)
Sherd	The sherd possesses minimal diagnostic properties but is utilized to establish groups, varieties, types, and wares along with determining vessel forms.

Table 4. Standardized Ceramic Typology Definitions

When the Capitana Project ceramic analysis was originally undertaken it was thought that each bag of sherds would be sorted separately and typology assignments would be determined for the samples from what information was contained within the available ceramic literature. Obviously this did not work for a number of reasons. First, the available literature did not adequately describe paste attributes such as hardness nor define color with any uniformity between references or for that matter within references. Also lacking in the available literature were color photographs of what would have seemed to be probable type matches. Eventually the realization was made that the collection of approximately 868 sherds needed to be separated into such a way as to divide the collection into recognizable groups based on a system of attributes rather than trying to match individual sherds to a particular existing type. With this in mind, the collection was laid out onto large tables and each individual sherd was permanently numbered to their respective artifact tag number. Before a workable attribute identification system was designed, the collection was divided by sherd thickness into eight thickness ranges with a bias toward

separating Guadalajara sherds from the collection. The bias toward separating the Guadalajara sherds first was due to the fact that the literature was very precise in helping identify this ware. A visible pattern emerged that laid the foundation to refine the collection further by scaling down the thickness size inclusive of paste color and temper. This seemingly erratic method of sorting materials resulted in a now controllable group of material for which a basic reference system based on paste attributes (see Table 5) was created to help further define the collection. Other attributes such as glaze, slip, paint, and firing core color were also noted, but were not incorporated into the 'Basic Attribute Reference System'. Ultimately the collection would be organized to allow sample study by classification without the inclusion of too many variables within any single classification grouping.

Color	Common non-Munsell color designation
Temper	Coarse, medium, and fine
Hardness	Based upon the Mohs' scale. 2-2.5=fingernail 3-4.5=copper penny <6=glass
Thickness	Taken as an average in millimeters

Table 5. Basic Attribute Reference System

Initially, Munsell color designations were not utilized until after the point in time that the collection had been divided into attribute types that could be compared to known named types. Temper refers to the average grain size for inclusions within the paste fabric. Fine indicates that the grain size will not be visible without the aid of a microscope. A hand lens is necessary to see medium temper grains but the texture will be visible by eye as compared to being fine grained. Coarse temper grains are easily visible with the naked eye. Hardness is based upon the universally accepted Mohs' scale of hardness.

In categorizing the *Capitana el Rubí* site ceramic collection it was necessary to incorporate selected attribute features within a database that not only allowed for quantitative information but more importantly qualitative information that were easily defined and replicable. In order to keep the database manageable, attributes such as form had to be determined and defined. As such if a piece is listed in the database as a handle, the piece may also include attributes of a body and/or a rim. The same would hold true when referring to a basal or rim piece. It is the most obvious feature of the piece that determines its placement within the context of the database and no attempt was made to create further subdivisions as it was felt that doing so would only complicate matters while providing only limited benefits. Originally the attribute of glaze was included in the database, but proved to complicate quantitative analysis. Since an individual tag number could have been assigned to more than one sherd, the overall count of glazed and unglazed was skewed. To correct the problem, study type names that had both glazed and unglazed sherds were divided into two varieties. This was only applicable for two of the study types as it was determined that the remaining study types were either possessing or not possessing the attribute of glaze. During excavation as many as fifty or more sherds may have been recovered from a single excavation hole. The group may have been bagged as a single part number to avoid complicating artifact inventory and control. The ceramic database contains only those coarse earthenware materials archaeologically recovered from the *Capitana el Rubí* site and those preexcavation coarse earthenware materials collected from various 1733 sites that are held in the Caribbean Shipwreck Research Institute (CSRI) collection (see Appendix 2),

although comparative samples were studied from the *San José y las Animas* site Ron Molinari collection along with the University of Florida Museum of Natural History and FDHR research collections. Many of the Florida Museum of Natural History and FDHR research collection samples are attributed to excavations performed by Kathleen Deagan and are referred to in her book, *Artifacts of the Spanish Colonies of Florida and the Caribbean, 1500-1800* (Deagan, 1987).

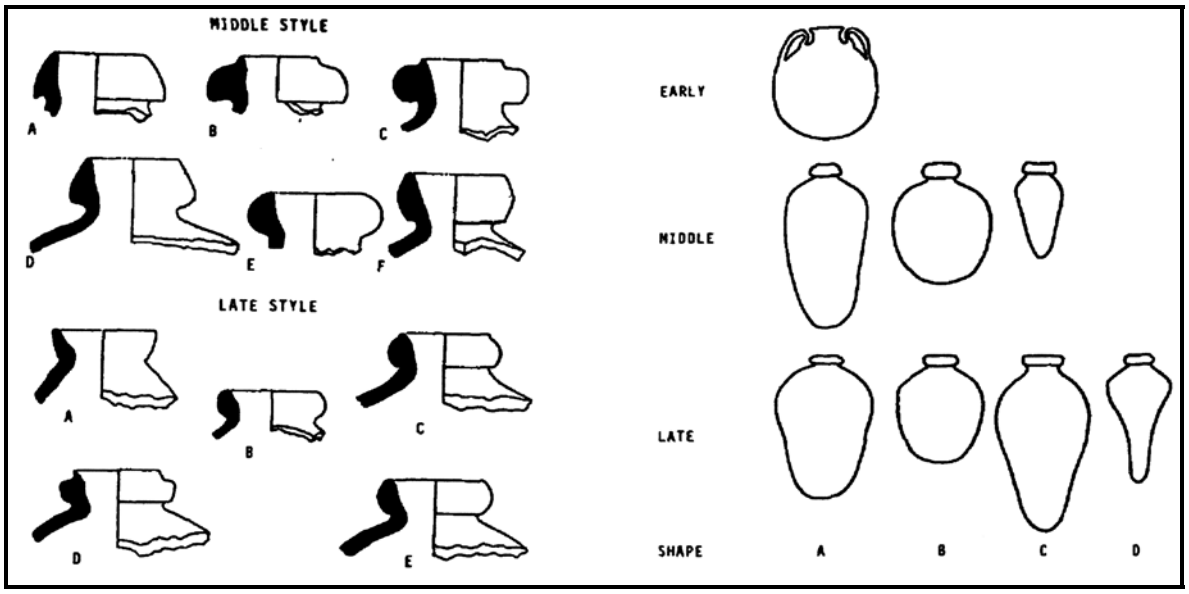
After the samples were sorted into generically labeled type names, the basic attribute reference system was expanded to include Munsell color name and number designations for both paste and glaze colors, possible forms, and possible date ranges. In utilizing Munsell color designations it must be understood that minor variations in value and/or chroma are acceptable since color uniformity even between a single sherd can vary to some degree. It is best to use the system as an approximate average rather than attempting to make exacting determinations that hold no justification in either qualitative or quantitative analysis. It must be understood that the term form has two distinct meaning dependent upon its use. Form can refer to how the vessel was utilized, such as a bowl or jar, or form can refer to an attribute of a sherd, such as a rim, body, or base description. Additionally, comparative named type wares that may have been possible matches for the La Capitana el Rubí site samples were included in the new '1733 Earthenware Pottery Attribute Types and Comparatives' table (see Appendix 3). Possible comparatives utilized for the study were determined from the available literature. Decisively accurate attributes were unattainable from the available literature so samples were studied from named type samples located at the University of Florida Museum of Natural History and FDHR research collections.

The comparative study yielded both known types and previously unnamed types. In order to place the samples within a study type, one first had to make a determination of what the major attribute was that dictated the decision to formulate differences between study types. Immersion in seawater can have a detrimental effect upon glaze. This detrimental effect also holds true when determining paste color. No one attribute singularly determined the naming of a study type, but paste color was decidedly the most important attribute considered. Temper and hardness helped define the study type, while glaze attributes helped establish previously known types and make the final determination for the naming of previously unnamed types.

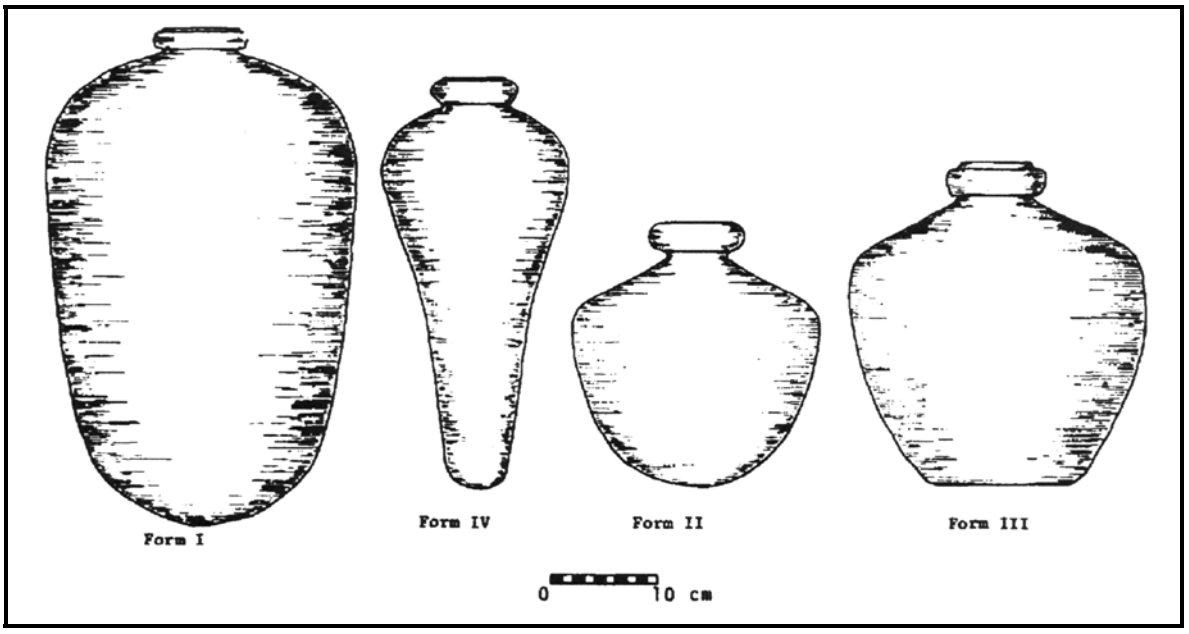
The Olive Jar is perhaps the most studied of any coarse earthenware found in New World sites. John Goggin (1960) facilitated the ground work for a typological classification system based upon vessel body and rim shape dividing Olive Jars into three temporal ranges. The Olive Jar is defined as an amphora, a large high shouldered jar that has a tapered or rounded base. The tapered base allows the vessel to fit into a wooden rack, soft earth, straw packing, or wedged with sticks. The vessel may or may not have handles. Amphoras have been continually produced from Graeco-Roman periods to the present and were the universal shipping cask of the Mediterranean (Lister and Lister, 1976:17). Though it may seem that the Olive Jar was the sole shipping and storage container for commerce to and from the New and Old Worlds, it is evident from shipwreck remains from throughout this period that wooden casks and barrels were utilized side by side with Olive Jars. Evidence of iron barrel rings and wooden staves found from Spanish New World 18th century shipwreck sites attest to this notion, but further research would be required to make any legitimate qualitative and/or quantitative determinations of the matter other than the indication of their related existence together.

Deagan (1987:31) indicated that, ". . .little new information has been added to the understanding of Olive Jars since the publication of Goggin's research (1960)". Since Deagan made that comment, only two major studies dealing with the Olive Jar have been published, James (1988) and Marken (1994). Goggin's (1960) typology was based on paste attributes but utilized body shape for temporal indicators divided into three styles represented by various forms. James was able to study 602 complete Olive Jars recovered from the *Nuestra Señora de Guadalupe* and the *Conde de Tolosa*, both wrecked in 1724. His typology was based on form as paste attributes were similar between all samples. (see Figure 2)

During the FKNMS research and recovery permit excavations, a total of 187 Olive Jar (Type D) sherds were recovered from the *Capitana el Rubí* site including four basal pieces, but only one complete and one partial rim were recovered. The absence of rim sherds has been contributed to prior salvage operations on the site. It has been indicated by numerous residents of the upper Florida Keys that Art McKee's treasure museum contained dozens of mostly intact Olive Jars though no historical data could be located to substantiate the claims. In retrospect, the FKNMS research and recovery permit excavation on the *San José y las Animas* site has yielded 9 rims from approximately 700 Olive Jar sherds recovered. The *San José y las Animas* site had only been discovered in 1968 and had not been excessively salvaged or subjected to destructive recovery techniques. Ron Molinari has been the sole salvor in possession since 1984. The *Capitana el Rubí* and *San José y las Animas* site Olive Jar samples from both archaeologically recovered and preexcavation material conform to Goggin's (1960) middle style shape A with a majority being type F rim style. Type A, B, and E rim styles are also present. (see Appendix 4) In comparison Olive Jars recovered from the *Nuestra Señora de Guadalupe* and the *Conde de Tolosa* 1724 sites consisted of 73% Form II analogous to middle style shape B with type E rims and 21% Form I analogous to middle style shape A with type C rims. The remaining percentage of Olive Jars were made up of Form IV analogous to middle style shape C and form III both having type C rims (James 1988). (see Figure 2) Even though the sample size reviewed for 1733 Olive Jar material which possessed attributes that were analogues for determining form was small, one conclusion can be drawn that parallels with James (1988). The use of rim shape as a temporal indicator does not seem valid considering the numerous variations present within the 1724-1733 temporal range. The question of glaze being utilized as a temporal indicator can not be adequately answered from the *Capitana el Rubí* site archaeologically recovered samples as only 38% contained traces of glaze and the percentage may in fact be higher if elements of saltwater environmental disintegration were more understood. Jars were glazed to allow for reuse so using glaze as a temporal indicator my not be advisable. It may be possible to determine a correlation between what types and shapes were utilized for the return trip to the Old World as compared to those that were shipped to the New World. Accordingly, a virgin shipment from the Old World would be more akin while the return shipment may have utilized what ever types and shapes were available since it has been speculated that Olive Jar production may not have been prominent in the New World. Thus these questions are speculative and can only be approached with study on a regional scale, hence the importance of establishing accurate typologies. With this in mind, Olive Jar assemblages may be better temporal indicators than typological indicators.



Jar types and rim shapes. No scale. (after Goggin, 1960)



Jar forms (after James, 1988)

Figure 2. Comparative Spanish Olive Jar vessel form and rim shapes as proposed by Goggin (1960) and refined by James (1988).

Marken (1994:80-89) indicated that there appeared to be a flat-bottomed variety of Olive Jar found in context from the 1622 *Nuestra Señora de Atocha* and 1627 *Santa Ana Maria* sites. His determination was made from a very small sample size and this new variety of Olive Jar does not seem to conform to the typical described attributes of the Olive Jar type for the following reasons. First, the internal rim width is almost twice as large as to be expected while the rim is conical shaped lacking the typical doughnut-like shape of the typical Olive Jar type. Secondly, an amphora should clearly have a tapered base to conform to the accepted definition. The only

example that I have found to contradict statement are the eleven examples of small globular jars similar in form and paste to a Middle style type B Olive Jar, but having a flat concave base that enabled the jar to stand erect, though these would probably be better classified as Spanish Storage Jar, listed as Type J in this study rather than Olive Jar (James 1988). Third, the paste for the new type was described as being fine to medium tempered while Olive Jar paste clearly possesses a definite medium temper. Finally, though there seemed to be no indication of glaze on the 1622 *Nuestra Señora de Atocha* and 1627 *Santa Ana Maria* samples, effects of immersion in seawater may have degraded the glaze to a point where remnants could only be revealed by close magnification inspection. Numerous sherds from the *Capitana el Rubí* site that previously were thought not to contain glaze were later inspected with close magnification to reveal that there were remnants of glaze actually present. It has been determined that it is not always apparent whether or not glaze is present upon a sherd. It can not be stressed enough that immersion in seawater can have detrimental effects upon ceramic remains. The actions of waves and sand can cause abrasion. Chemical reactions caused by minerals in the seawater along with reactions caused by decomposing organic matter as well as reactions caused by deteriorating metal may also play a part in the degradation of glaze. The new flat-bottomed Olive Jar variety designation may have been confused with what Deagan (1987:36) referred to as Spanish Storage Jar type or to what more closely resembles a newly designated pottery type found at what is presumed to be the 1715 Plate Fleet salvage camp located at Higgs Beach, Florida. This newly designated pottery type has also been found on the *Capitana el Rubí* and the *San José y las Animas* sites. Examples of this previously unnamed type are identified in this study as Type C-1 and subsequently binomially classified as Higgs Green. Other examples can be found at FDHR collection, *San José y las Animas* site, number 93.613.124.1 and at the University of Florida Museum of Natural History collection, 1715 Plate Fleet site, oversize number 85-8-1. (see Figure 3) Numerous examples of this pottery type are part of the *Capitana el Rubí* and *San José y las Animas* site collections respectively. Though the Higgs Green type resembles Olive Jar paste in color, the Higgs Green paste is tempered with fine sand particles as opposed to medium particles inherent of Olive Jar paste. Seven sherds were archaeologically recovered from the *Capitana el Rubí* site of which all were form diagnostic, and a single complete base was a preexcavation example. Further studies of the 1622 *Nuestra Señora de Atocha* and 1627 *Santa Ana Maria* flat-bottomed coarse earthenware materials may help determine their final typological placement.

The ‘1733 Earthenware Pottery Attribute Types and Comparatives’ (see Appendix 3) chart lists five possible varieties of Olive Jar. The ‘classic’ Olive Jar can be glazed or unglazed has tan paste, medium temper, with a hardness of 3-4.5 on the Mohs’ scale. The under fired variety, Type E has a gray/black paste that may be attributed to be fired in a reducing environment or it may indeed be a separate and new variety of Olive Jar which if so will be classified as the gray variety. James (1988:56) refers to two vessels of Form IV shape that had black paste but he could not determine a reason for their deviation from the normal paste color. Originally Type I was classified as Type E, but there seems to be a definite difference in paste material composition between the two that is only apparent under close magnification inspection, thus creating a need for the separate types. Type E has a folded texture while Type I has a granular texture. Only with a larger sample size can it be determined if this phenomena is only a localized condition. Type F, glazed and unglazed has a red paste similar in all other attribute features to Olive Jar paste with the exception of the color and can be glazed or unglazed. The glazed variety has been archaeologically recovered from both the *Capitana el Rubí* and *San José y las Animas* sites. Only five of the glazed variety sherds have been found to date between the two sites. Two of the

sherds are large with one retaining a partial rim. (see Plate 2) Though no basal pieces have been recovered, contour and size estimates indicate that these are of Olive Jar form. The glazed variety has either a moderate brown or dark olive green glaze. The larger pieces discussed are completely glazed on both sides with the dark olive green glaze and are of a higher standard in manufacture compared to the classic Olive Jar variety. As such if future study reveals them not to be Olive Jar, than they would be reclassified as a distinct variety of the Spanish Storage Jar type.

Figure 3. Photograph of Higgs Green pottery from the University of Florida Museum of Natural History collection, 1715 Plate Fleet site, oversize collection number 85-8-1.

Two other types of pottery that are not represented nor identified in the literature have been named in this study. (see Plate 1) Both types have been found with sufficient quantities of sherds that have attributes enabling the identification of possible forms. Carredano and Jiménez (1993:296) indicate the existence of forms studied in Spain similar to Types A and B referring to them as “aparte de orzas posiblemente comerciales”, roughly translated to mean containers that were possibly used for commercial purposes. Type B, 1733 Black has possible forms of bacín and/or jar, while Type A, Capitana Gray has possible bowl, bacín, and/or jar forms. Both wares have paste that is tempered fine with a 2-2.5 Mohs’ hardness and is quite distinguishable from that of an Olive Jar paste. 1733 Black has an orange/red paste and is named for its black glaze commonly present on the inside, outside, or both surfaces, but does not necessarily cover the entire piece so unglazed sherds will be identifiable by only their paste attributes. The black glaze may also resemble gray, the discoloration most probably due to effects of seawater immersion. Destructive testing of a suspected piece by scratching the glaze will show the underlying black color. 1733 Black totaled 158 sherds of which 132 were form diagnostic pieces. Capitana Gray has a white to light gray paste that usually resembles a medium gray because of a surface discoloration attributed to immersion in seawater. The ware may have grayish to brownish glaze on the inside, outside, and/or both surfaces and has the same inherent adhesion problems as that

of Higgs Green and Olive Jar wares, so those sherds that do not have an apparent glaze are identified by paste attributes only. Capitana Gray totaled 114 sherds of which 84 were form diagnostic pieces. No complete vessels were reconstructed for either type, so form determination relayed upon rim/body/base/handle projections. Four other types of pottery that are not represented nor identified in the literature have been identified but not binomially named in this study as the sample size was considered too small and/or it was not possible to determine any possible vessel form. Types C-2, C-3, and C-5 (see Plate 3) had possible forms but were of a small sample size. Alfred J. Woods, Collection Manager for the Historic Archaeology Department at University of Florida, Florida Museum of Natural History indicated that these types were possibly of New World manufacture (personal communication May 6, 2001). Type C-6 was recovered in a greater sample size than the previous three types, but any indication of vessel form could not be accurately determined. Type C-6 (see Plate 3) is black glazed predominantly on both sides and has a hardness greater than 6 on the Mohs' scale making it close to the hardness of stoneware but is not attributed to the stoneware group. This type may be of Old World manufacture since firing temperatures would have been substantially higher to produce this ware than what one normally would attribute to New World manufacture.

Small quantities of other previously named types of coarse earthenware that were archaeologically recovered from the *Capitana el Rubí* site are as follows; Four pieces of Rey Ware (Type C-4), 17 pieces of El Morro consisting of three paste varieties (Type C-7,8,9), and two pieces of Black Lead-glazed. (see Plate 4) Those recovered being at present unnamed are as follows; eight pieces of Type I which has a gray/black paste of crude wheel manufacture similar to in temper and hardness to Olive Jar paste but definitively not such, five pieces of gray/black paste hand thrown Aboriginal and five pieces of tan paste hand thrown Aboriginal. (see Plate 5)

Majolica represents a minority for coarse earthenware archaeologically recovered from the *Capitana el Rubí* site so preexcavation samples were incorporated into the study. Thirteen of 26 sherds have been tentatively identified and divided into six types, Puebla Blue on White, San Agustín Blue on White, San Luís Polychrome, Playa Polychrome, Tumacacori Polychrome, and. Abó Polychrome. (see Plate 6) Seven of the remaining 13 unidentified sherds possess attributes that may help identify them in the future. (see Plate 7)

The 20 to 30 mm thick sized samples consisted of two varieties and were originally defined as Type G and H. Basic attributes were as follows; tan and gray paste colors, coarse temper, with a hardness of 3-4.5. The definition seemed plausible until samples were divided into three distinct slip color varieties, no slip, beige slip, and tan slip. A few samples were deemed as undeterminable because of excessive growth. Sample numbers 1539 and 141, both of gray paste color with a beige slip were subjected to fresh fracture testing in order to determine the firing core color. Sample number 141, of tan paste without evidence of slip was also subjected to fresh fracture testing as a comparative control. (see Figure 4)

> The firing atmosphere has a significant effect on the fabric of a fired vessel, most notably on its colour. The fired colour of a fabric depends principally on the iron compounds and carbon that the clay contains and the duration, temperature and atmosphere during firing. Most clays, but in particular sedimentary clays, contain a portion of organic matter. When heated in an oxidizing environment (where there is an excess of free oxygen) the carbon will burn and form carbon dioxide, which will attempt to escape from the fabric. In some cases the escaping gas causes bloating or bubbling. Where there is no excess of oxygen (a reducing environment), or the duration of the

> firing is insufficient, the carbon will not all burn out, but will be visible in the final fired fabric as a dark grey or black core. This core may be particularly marked where the vessel is thick . . . (Orton et. al., 1993:133).

Figure 4. Photograph of fresh fracture testing of Type G/H (Spanish Tinaja) in order to determine paste and firing core colors. A- 141 gray / B- 1539 gray / C- 141 tan.

The fresh fracture results for the two samples that showed evidence of slip were not consistent with what one expected to find. It was evident by the brownish red color that the core of the fabric had been completely oxidized, but the margins were gray in color indicating a reducing environment. Normally one would expect that if the core was fully oxidized than the margins would also be. Even if deliberate reduction was achieved during the final stages of firing by throwing green timber onto the fire than only the surfaces should be gray in color (Orton et. al., 1993:69). The problem was solved upon closer inspection of all edges and sides of samples that seemed to have a beige or tan colored slip. This indication of color was upon all surfaces of the samples and not upon only the inner and outer surfaces where it would logically be found if the coloration was indeed slip. The coloration of the fresh fractures specimens was also reevaluated and the gray coloring formed a halo effect surrounding the brownish red color of the core. Sample number 141 showed only a very minor discoloration halo effect at the extreme outer edges of the sample, but was not obvious unless looked for. At this point, other samples of various thicknesses were inspected visually for indications of slip being present upon all surfaces of the sample. This phenomenon seemed only to affect those samples in the 20 to 30 mm thickness range. Samples in the 10 to 15 mm thickness range that showed the presence of slip had the slip contained only upon the inner and/or outer surfaces of the samples.

A quick field test was instituted to determine whether or not slip was actually present upon a sherd. If the coloration could be scratched off with the moderate pressure of a fingernail than the perceived slip was only a discoloration of the sample. If the slip could not be defaced with the same test than the slip had been applied in antiquity. It is apparent that seawater and/or localized

conditions such as organic matter and/or metal may have played a part in the discoloration of the samples. At present no other explanation has been proposed by any of the various persons who have inspected the samples. The detection of this problem actually helped simplify the classification of the Spanish utilitarian storage jar samples by eliminating the need for multiple varieties within the type. Type H was dropped leaving Type G as the designation. Accordingly the problem opens up new avenues for those researchers interested in compositional fabric analysis and post depositional studies.

Marken (1994:181) refers to what this study has called Type G, renamed Spanish *Tinaja* (see Plate 8) as a *tinaja*. He indicated that two intact and one reconstructed vessel were recovered from the 1622 *Nuestra Señora de Atocha* shipwreck. Lister and Lister (1976:85) defines a *tinaja* as a "large earthenware jar; a liquid measurement of about 12 ⅔ gallons" and indicates that because of their function as a storage vessel, they have sometimes been misidentified as an Olive Jar. Three distinct temporal ranges are listed for New World assemblages, 1493 to 1575, 1575 to 1700, and 1700 to 1830, but descriptive attribute information is not indicated. The term Spanish Tinaja has been proposed by this study to differentiate this more massive form of storage container from both the classic Olive Jar and other smaller named and unnamed type of Spanish coarse earthenware utilitarian storage containers. Of the 56 sherds available for the study, only four were preexcavation specimens, the bulk being archaeologically recovered from the *Capitana el Rubí* site. A single heavily abraded flat bottomed partial base sherd with an estimated outside base diameter of between 195 and 215 mm was recovered from the *Chaves*. Body sherds indicate an estimated maximum body diameter of 770 mm, while the single archaeologically recovered possible rim sherd from the *Capitana el Rubí* site would indicate an outside rim diameter of approximately 485 to 510 mm and the single archaeologically recovered definitive rim sherd from the *San José y las Animas* site indicates an outside rim diameter of approximately 660 mm. If the *Capitana el Rubí* piece is a base foot ring rather than a rim sherd than the vessel would be massive compared to the 1622 *Nuestra Señora de Atocha* shipwreck recovered vessels. The 1622 *Nuestra Señora de Atocha* shipwreck vessels have an outside base diameter of 165 mm, maximum body diameter of 665 mm, outside rim diameter of 350 mm, and are 750 mm tall. If the 1733 sample measurements are compared to The 1622 *Nuestra Señora de Atocha* shipwreck vessels, the 1733 samples are slightly larger and may represent the third temporal range for the vessel type but a definitive conclusion will not be proposed by this study because the small sample size of the data.

Guadalajara wares (see Plate 9) were perhaps the simplest to identify in this study because the available literature supplied relative descriptions and photographs (Fairbanks, 1972; Logan, 1977; Pearson and Hoffman, 1985; Deagan, 1987). Form attributes and sherd counts for Guadalajara wares are included within the '1733 Ceramic Table' database found in appendix 3. Guadalajara paste is light gray in color, Munsell color designation N7, no temper, with a hardness of > 2. Sherd body thickness averages 3 to 5 mm. Surface treatment for the Polychrome variety consists of a light gray, 10YR/7/1, a very pale brown, 10YR/7/3, or a dark grayish brown, 10YR/4/3, slip painted with geometric and floral designs ranging from reddish gray, reddish brown, to reddish yellow, 5YR/3-7/2-6. The Blackware variety is covered in a black to grayish black slip, N 1-2, with no evidence of painted designs for the samples studied. This ceramic ware has been previously referred to as *Tonalá ware* and *Aztec IV*, but the term Guadalajara ware was utilized in following with nomenclature designated by Deagan (1987:44-45). Though Guadalajara wares were easily identifiable, the exacting types of Polychrome and Blackware were sometimes indistinguishable. Immersion in seawater has the most adverse affect on

Guadalajara paste than of any of the other types studied thus far. Regardless of various conservation methods, variations in drying times and humidity controls, the paste becomes brittle and many specimens can literally crumble to dust even under careful handling considerations. One possible reason that the paste is susceptible to disintegration lies with the original firing techniques. Firing transforms the clay minerals into a new mineral ceramic at approximately 550 to 600° C and pottery that does not reach correct firing temperature will eventually disintegrate when immersed in water (Orton et. al, 1993:126). Because of this problem, the Capitana Project has included a variety referred to as Guadalajara Undefined to designate those specimens that are of Guadalajara type paste, but for which identification of the surface treatment has become impossible due to the detrimental affect that immersion in seawater has had upon the sample. Some success has been had by using a very high molecular weight of polyvinyl acetate homopolymer emulsion, trade name CM Bound M-1, in various percentage compositions during conservation. Positive results are that the artifact may remain more stable and less apt to disintegrate, but the negative effects are that the sample may exhibit an unnatural sheen if care is not exercised during application and reversibility is nearly impossible without destruction of the piece. The technique is only advisable for those specimens that are unique and may be lost completely without treatment, or for spot repairs to those pieces that have already undergone drying and require further treatment in order to control further deterioration of the piece. Ron Molinari (1994:49) has also had some success by consolidating the artifact with Elmer's Glue-All during the drying period of the conservation attempt.

With Guadalajara Polychrome and Blackware being distinct types and Guadalajara Undefined being a variety of either Polychrome and/or Blackware designated to help categorize shipwreck recovered material for which an exact determination can not be made between Guadalajara Polychrome or Blackware, another variety of both Polychrome and Blackware has been defined. The term *Tonalá ware* may have been coined by Carl Clausen in the 1960's while working on the *1715 Plate Fleet* shipwrecks though this researcher has not been able to document the source. *Tonalá ware* has been utilized to refer to the miniature clay figurines and pottery vessels that are composed of the same paste type as Guadalajara ware which were recovered from the 1715 Plate Fleet shipwrecks and to a greater extent on the 1733 Plate Fleet shipwrecks. They have also been reported on the 1766 *El Nuevo Constante* recovered off the coast of Louisiana. Accordingly Guadalajara wares can be designated as tableware use or as miniatures. Table 6 shows comparative dimensions. The miniature designation seems to be predominant for the Blackware type but evidence for polychrome miniatures exist. Use of the term miniature was decided upon to define Guadalajara wares seemingly manufactured as gifts, novelties, toys, and/or souvenirs. Dr. Ron Molinari (1994:49) wrote, "If you traveled to Mexico today, to the small Mexican markets, especially those in the boarder towns catering to American tourists, low and behold you find these same figurines. I had found a clay miniature of a pitcher on the San Jose in 1990 and couldn't believe my eyes, when in a small shop in Nueva Laredo, Mexico last year, there was the almost identical miniature". (see Figure 5)

1733 San José y las Animas **1993 Mexico**

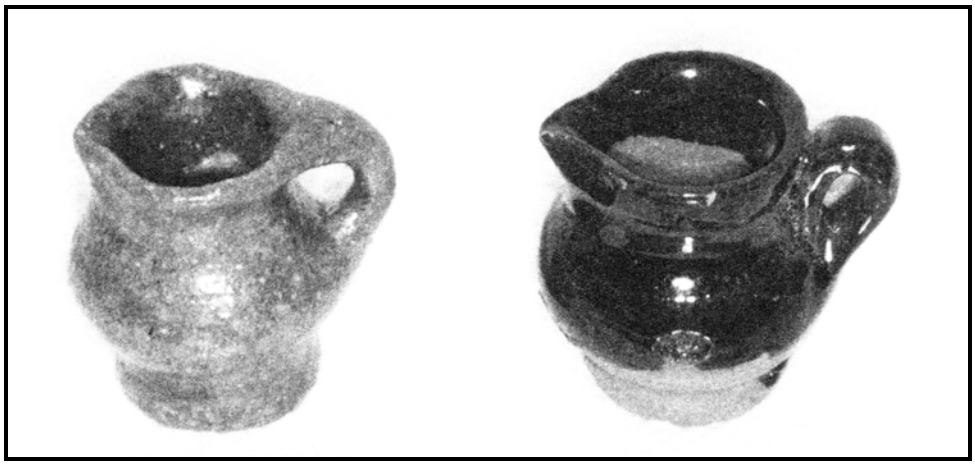


Figure 5. Comparison of 1733 and modern *Tonalá ware* clay miniatures. Shown one and one half times larger than actual. (photo by Ron Molinari)

	Rim dia.	Rim dia. Miniature	Base dia.	Base dia. Miniature	Handle	Handle Miniature
Polychrome	125-170 mm	25 mm	40-50 mm	NA	10 x 28 mm	NA
Blackware	125 mm	NA	65-85 mm	10-30 mm	10 x 30 mm	5 x 15 mm
Undefined	125 mm	NA	50-65 mm	25-35 mm	NA	NA

Table 6. Guadalajara Comparative Dimensions

Three pieces of presumably Rhenish brown salt glazed stoneware are among the 1733 collection which are similar in paste attribute to what is described by Hume (2001:113,120). A single piece was archaeologically recovered from the *Capitana el Rubí* site and the remaining two are preexcavation samples. (see Plate 10)

The final ceramic group to be discussed is the porcelain group. Twenty five sherds were archaeologically recovered from the *Capitana el Rubí* site while eleven sherds were included in the study from preexcavation samples. (see Appendix 5 and Plate 11) A majority, 53% of the sherds was small fragments and a definitive vessel form could not be determined. For the 47% of sherds that vessel form was indicated less than one half is to be considered certain as cup and bowl forms can be confused due to similarities in thickness and curvature when working with fragmentary samples. Samples having a higher probability for definitive vessel form were those sherds whose attributes such as size or the existence of partial bases enabled a more positive determination. 50% of the sherds were under glazed blue and white incorporating a floral design pattern and/or parallel lines, 39% were under glazed blue, while 11% were under glazed white only. Because of the small physical size of the sherds, the white only under glaze variety may actually represent fragments of the under glazed blue and white variety. 42% of the sherds had some evidence of a gilded floral design on the surface of the under glaze. The pattern shows

itself as the piece is tilted at a light source and does not readily take to photographs. The 1733 porcelain collection is in all probability Chinese export material from the Kang Hsi, 1662-1723, and/or the Yong Cheng, 1723-1736, Qing dynasty periods. One piece, tag number 483 may be of Japanese origin because of its differing design motif.

Brick Analysis

Because brick remains are similar in size to Spanish *Tinaja* sherds it was necessary to define an attribute system specific for brick. The attributes are as follows; flat on at least two sides, rectangular in shape, sharp 90° angles, 35 to 50 mm thick, and 2-2.5 hardness on the Mohs' scale. Originally there seemed to be four different paste colors, red, gray, beige, and white, but as with previously discussed ceramics, immersion in seawater has had an effect upon the surface of the material leaving various shades of oxidation. Closer visual inspection and destructive scratch testing revealed two varieties of brick. Red was defined as Munsell color 2.5YR/5/6 red and gray as 5Y/7-8/2-3 light gray to pale yellow or gray to light gray in color. It was hoped that the brick group could be utilized to determine food preparation activity area of the vessel but no distinct pattern has emerged from the artifact feature map. (see Map 7) The brick is scattered in a seemingly random pattern with no associated identifiable iron and/or copper food preparation related items present. (see Appendix 6)

Glassware Analysis

At first there seemed to be three different varieties of green glass; blue-green, olive-green, and dark-green, but upon closer inspection revealed otherwise. The dark-green specimens are darker in color than the olive-green specimens but are in actuality colored olive-green. They resemble dark-green because of two reasons. First, the dark green pieces are thicker causing the color to look darker. Secondly, pieces that are disintegrated cause the specimen to also look darker in color. If the specimen is held up to a bright light source, the examiner is able to discern the true olive-green color verses the erroneous dark-green color provided that the sample is not disintegrated beyond its ability to allow light to penetrate through it. Case gin, onion bottle, window pane, and ornamental glass types are represented by the assemblage. Artifact 8011 is part of a glass stem from a drinking glass. Artifact 361 is the bottom of a medicine vial. Artifact 8013 are fragments of leaded window pane glass with an average thickness of 3 to 5 mm. Number 1506, 1517, and 8014 represent onion bottle neck remains. Case gin bottles are represented by 8012 for base pieces and 352 as neck fragments. (see Appendix 7 and Plate 12)

Faunal Analysis

From the identifiable bones the minimum number of individuals (MNI) in quantities of one is: a cougar, pig, chicken, cow, fish, shark, and turtle. (see Plate 13) Unidentifiable bones (UID) were not included in the MNI. (see Appendix 8) Even though a dolphin tooth was found, it is doubtful it was on the ship, as they probably lose their teeth often like sharks. The presence of the cougar is intriguing. The bones, a first and third phalanx, were identified with the use of cougar/mountain lion comparative skeletal material. No jaguar comparative skeleton was available. Whether they were transporting a live cougar is questionable. The first phalanx has cut marks, more like hack marks, and may be indicative of the presence of a pelt instead of a live animal. This faunal material was identified in the University of Georgia Zooarchaeology Laboratory, directed by Dr. Elizabeth Reitz. Dr. Barnet Pavao-Zuckerman and Greg Lucas also assisted in identification. (Weaver, 2002)

Ballast Analysis

The site of the *Capitana el Rubí* is disarticulated and completely covered by sediment so no attempt could be made to approximate the volume and dimensions of the ballast remains. Ballast rock was studied to determine those attributes that will aid in the continuing development of a diver training system and typological classification system. The aim for establishing a ballast typology is to allow divers not trained in geology to identify ballast rocks underwater without having to bring large quantities of samples to the surface. The typological study was based on similar study performed on the 1824 U.S.S. Alligator site (Benson 1996).The formulation of ballast modal types utilizes the criteria of shape, size, texture, grain size, and color. Since the ballast assemblage is disarticulated and completely covered by sediment stratified random sampling was not employed. Accordingly only cluster sampling and opportunistic sampling methods were utilized. All samples were archaeologically excavated with the exception of numbers 112 and 123 which were preexcavation samples from the *Capitana el Rubí* site. All cluster samples were recovered from the area of hole numbers 114-119 in July of 1995. Opportunistic sample locations can be referenced by artifact tag number.

Identification of rock samples was accomplished by fresh fracture hand lens magnification inspection. Seawater immersion of rock results in problems similar to that of seawater immersed ceramics in that coral, other marine growth, and/or localized chemical reactions can distort the actual color and texture of a sample. River rock, which is what the majority of these samples consist of, as apposed to quarried rock, also present their own unique identification problems. The surfaces of river rock have been abraded and polished causing the surfaces to lose their texture features and are usually much lighter in color than in actuality. As such there was the necessity to fresh fracture samples. Not all samples required fresh fracture for identification as the samples were sorted into similar visual attribute types and than a representative sample was utilized for fresh fracture analysis. Those samples subjected to fresh fracture are colored red in appendix 9. The majority, 87%, of the ballast samples were determined to be extrusive igneous rocks. 93% of the extrusive igneous samples are intermediate and basic rock comprised of andesite, trachyte, and porphyritic basalt. Most are high in ferro-magnesian and/or magnetite mineral content. The remaining 7% of the extrusive igneous samples were identified as basalt. Sedimentary rock comprised 10%, metamorphic rock 7.25%, and a single mineral sample, hematite (iron ore), 0.75% of the assemblage. If the samples were viewed by mass in lieu of quantity percentile, sedimentary rock samples would comprise only 0.38% of the assemblage. Sedimentary samples identified included conglomerate, sandstone, and chert. Metamorphic samples identified included metaquartzite and quartzite. (see Appendix 9)

MAPPING INFORMATION

By Robert J Benson

There were no significant or readily exposed artifacts or site features located prior to excavation on the *Capitana el Rubí* site so a preexcavation map was not warranted. Site mapping was accomplished with ArcView version 3.2 geographic information system (GIS) software. An individual single page sized map showing detailed features was not possible due to the extensive size of the excavated area which covered approximately 252,000 square meters. This would equate to a 1:6000 scale map. This also was true of the primary excavation area which encompasses approximately 32,400 square meters which equates to a 1:1400 scale map. With these limitations in mind a variety of large scale feature oriented maps were designed that

presented pertinent data in a viewable format. The *Capitana el Rubí* site, due to the fact that the timber and ballast remains are scattered and disarticulated over such a large area did not lend itself to side/profile and/or frontal/sectional views, so only overhead/plan views were created. The ArcView created maps supplied within this report are X/Y coordinate pin-point maps and should not be confused with graphically drawn representation maps. (see Appendix 11)

1. NOAA chart depicting site in relation to submerged features and nearest land mass.
2. Admiralty area map depicting Admiralty area radius, excavated area, site datums, and the nearest permanently fixed geographic datum, Davis Reef light tower.
3. Excavation area map depicting site datums and all excavation holes.
4. Bottom typography map of the main ballast area depicting ballast, ballast with timbers, coral, sand, and timber locations.
5. Recovered depth map of the main ballast area depicting graduated color values for the final depth of excavation holes.
6. Timber map of the main ballast area depicting the location of timber remains.
7. Ceramics map of the main ballast area depicting the location of brick, porcelain, and coarse earthenware pottery.
8. Artifact map of the main ballast area depicting the location of bone, glass, ivory, lithic, and organic materials.
9. Metal map of the main ballast area depicting the location of copper alloyed, gold, iron, lead, pewter, and silver materials.
10. Salvage vessel map depicting the areas worked by the various salvors.

PROJECT ASSESSMENT

The Capitana Project was intended to provide a synthesis of descriptive information for the dating, cultural origins, and functions of Spanish 18th century maritime culture. A considerable amount of viable archaeological data has been acquired from this previously disturbed site even though excavation time on the site was very limited. The *Capitana el Rubí* site has been able to provide excellent typological data despite the lack of shipboard activity and wrecking process data that the project had hoped to uncover. The Capitana Project ceramic study has proposed the addition of two previously unnamed ceramic types that will expand the present knowledge of the coarse earthenware utilitarian group. Continuing comparative study may yield even more unnamed types. The ceramic study has also proposed clarification for Guadalajara wares which can be designated as tableware use or as miniatures. The project archaeologist recommends that a sub-bottom profile of the site could yield a more exact scatter pattern for ballast and timbers remains and help determine if any part of the site has not been completely disarticulated. Because of the deep overburden the current excavation methods can only supply a limited picture of these features.

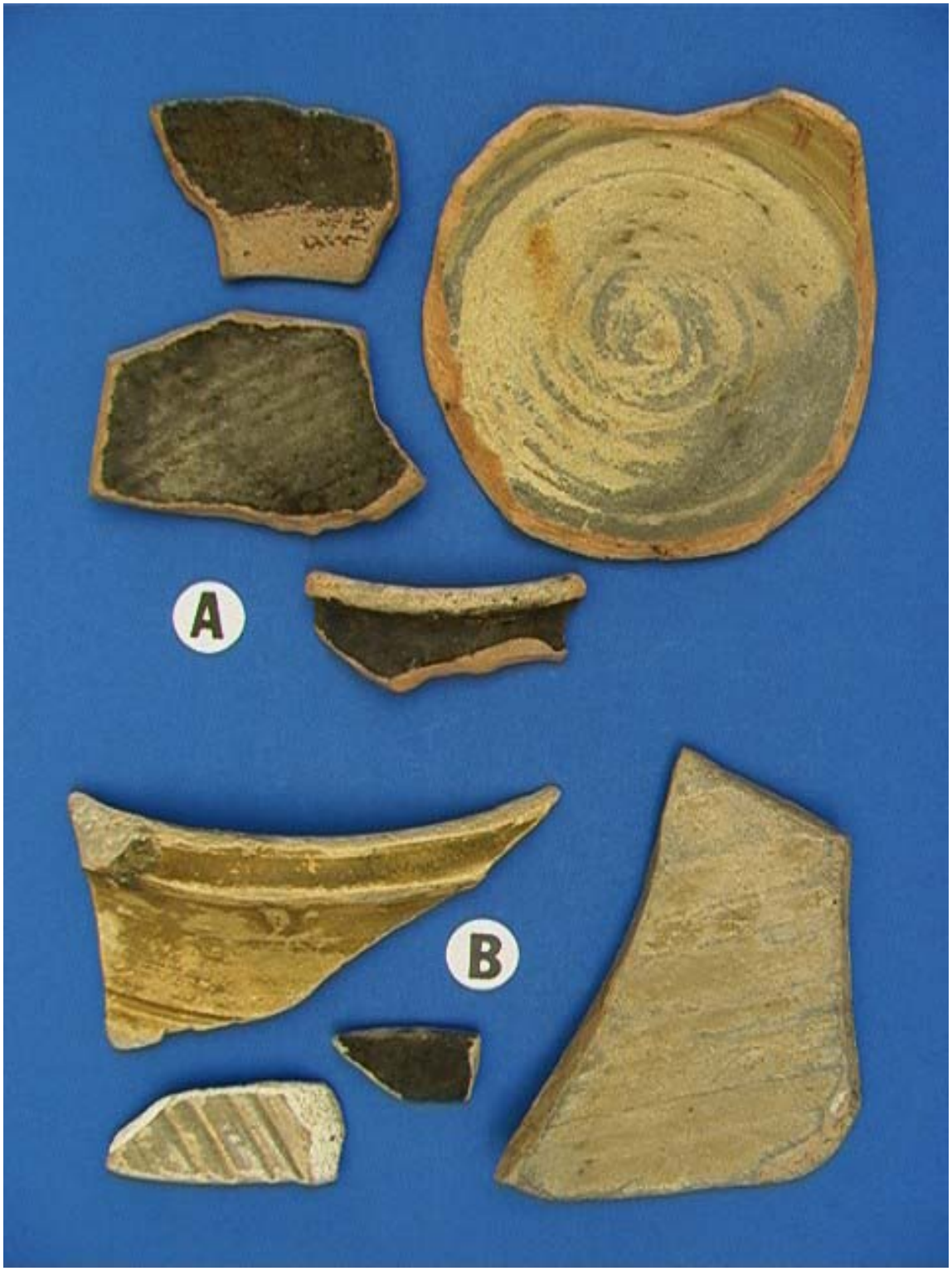


Plate 1

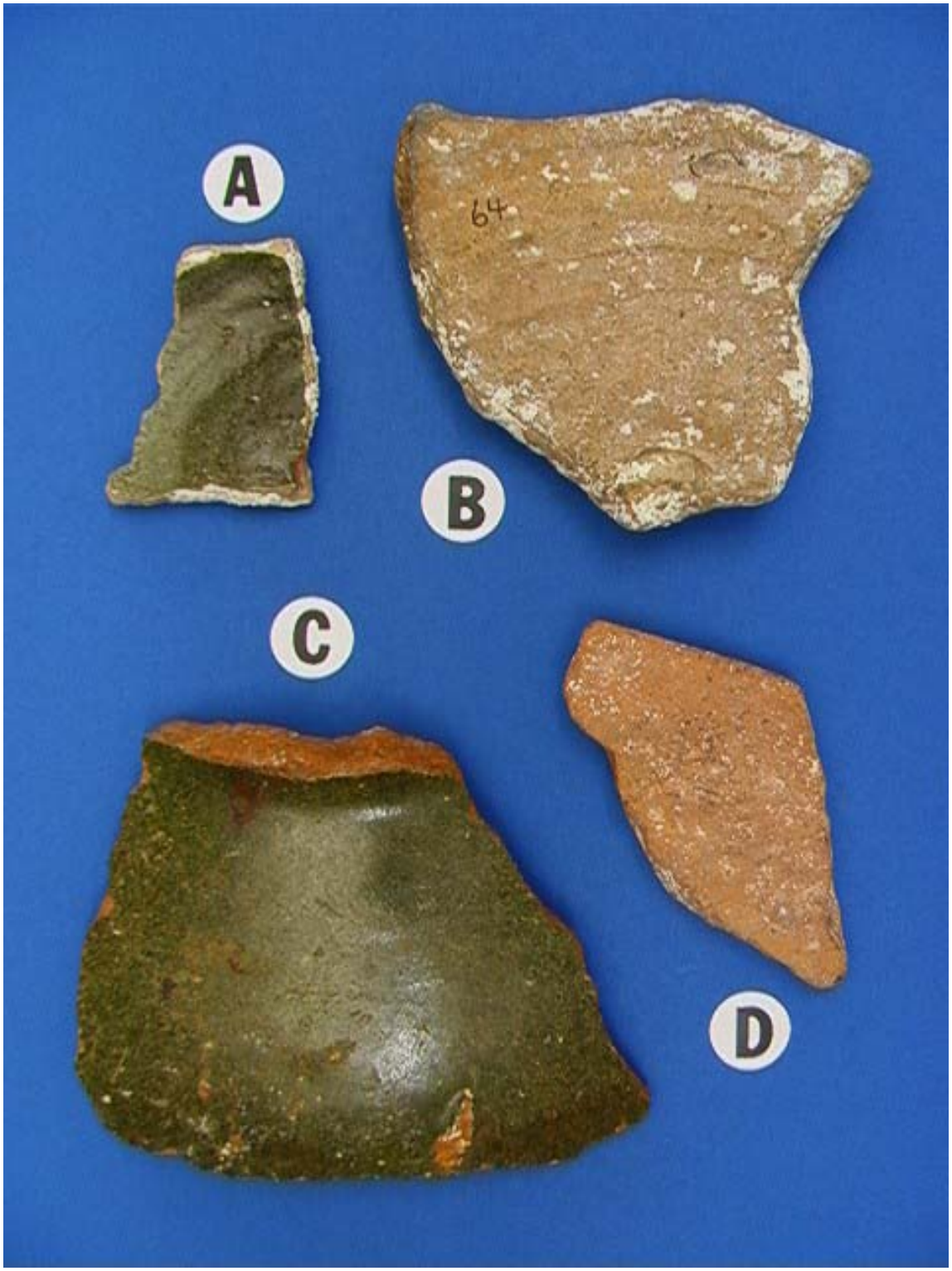


Plate 2

Plate 3

Plate 4

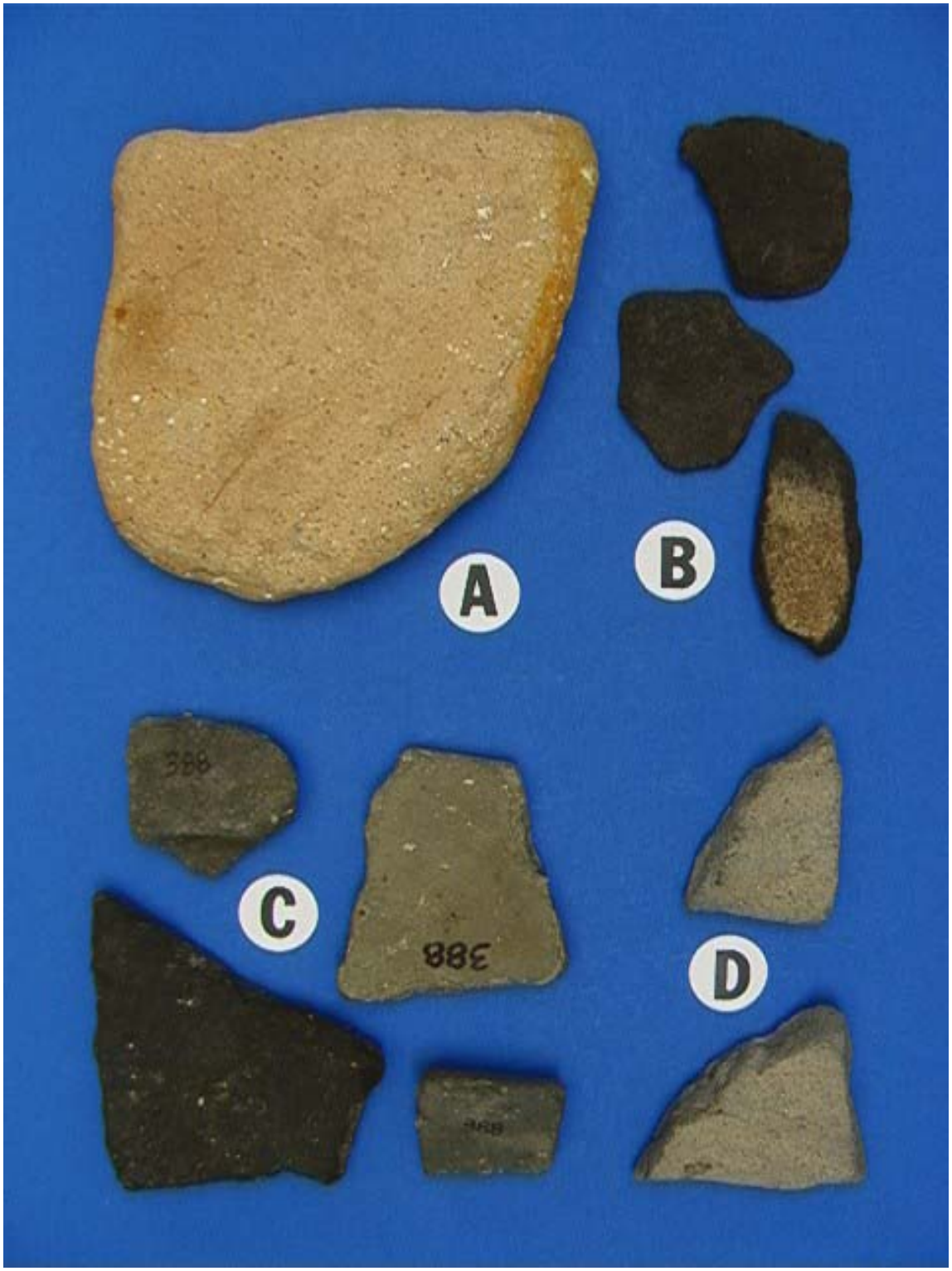
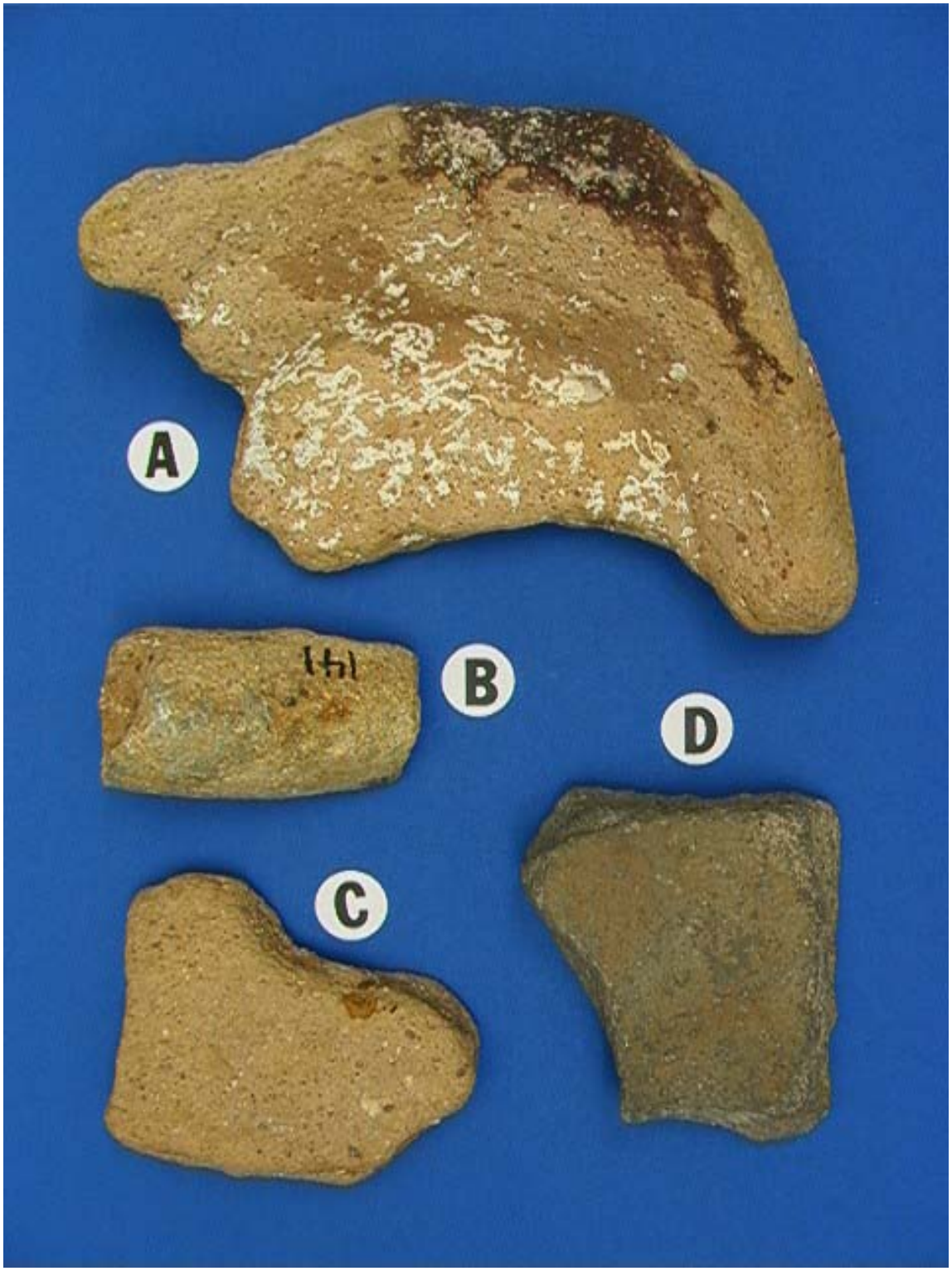


Plate 5

Plate 6

Plate 7



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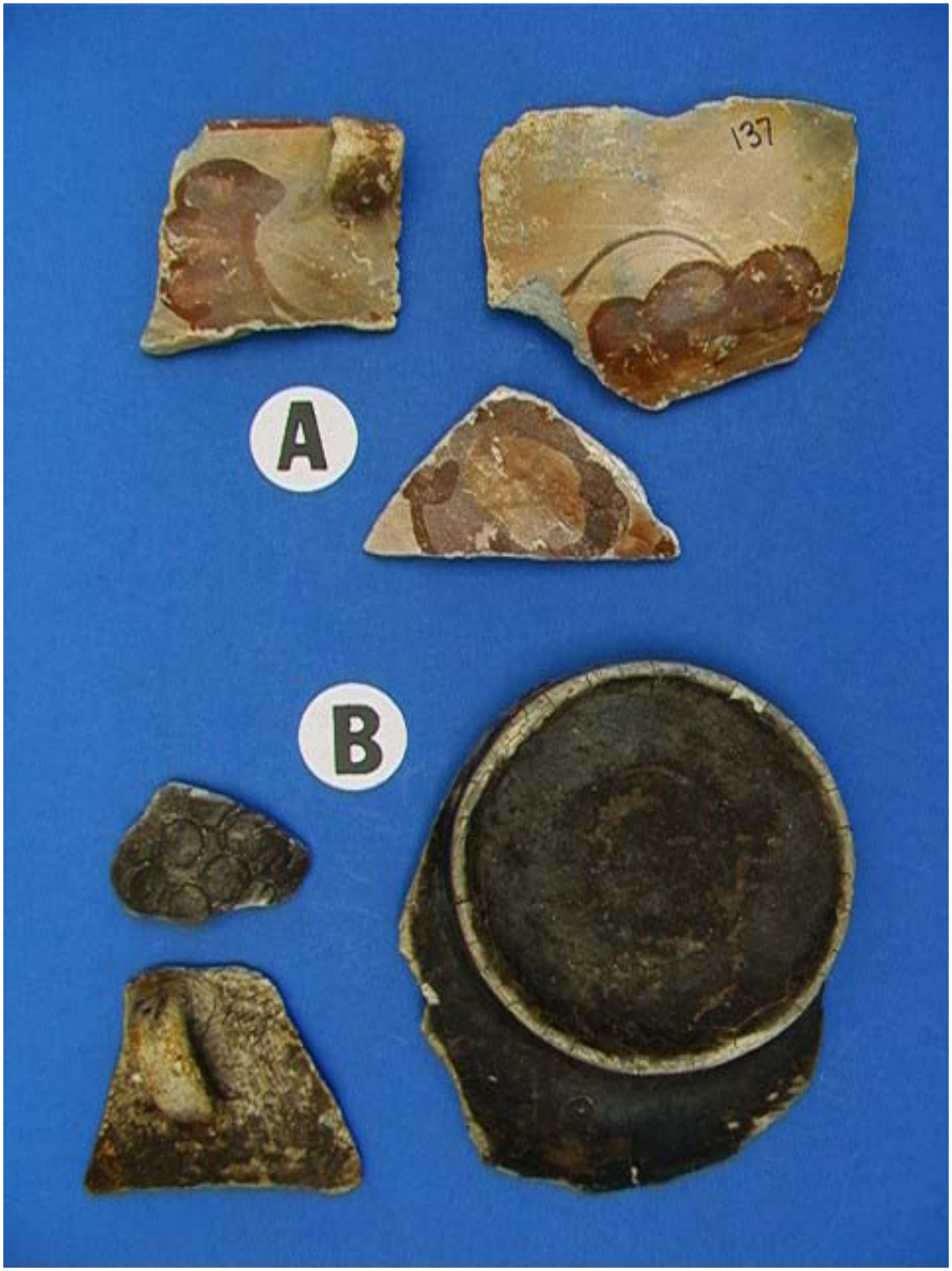

Plate 9

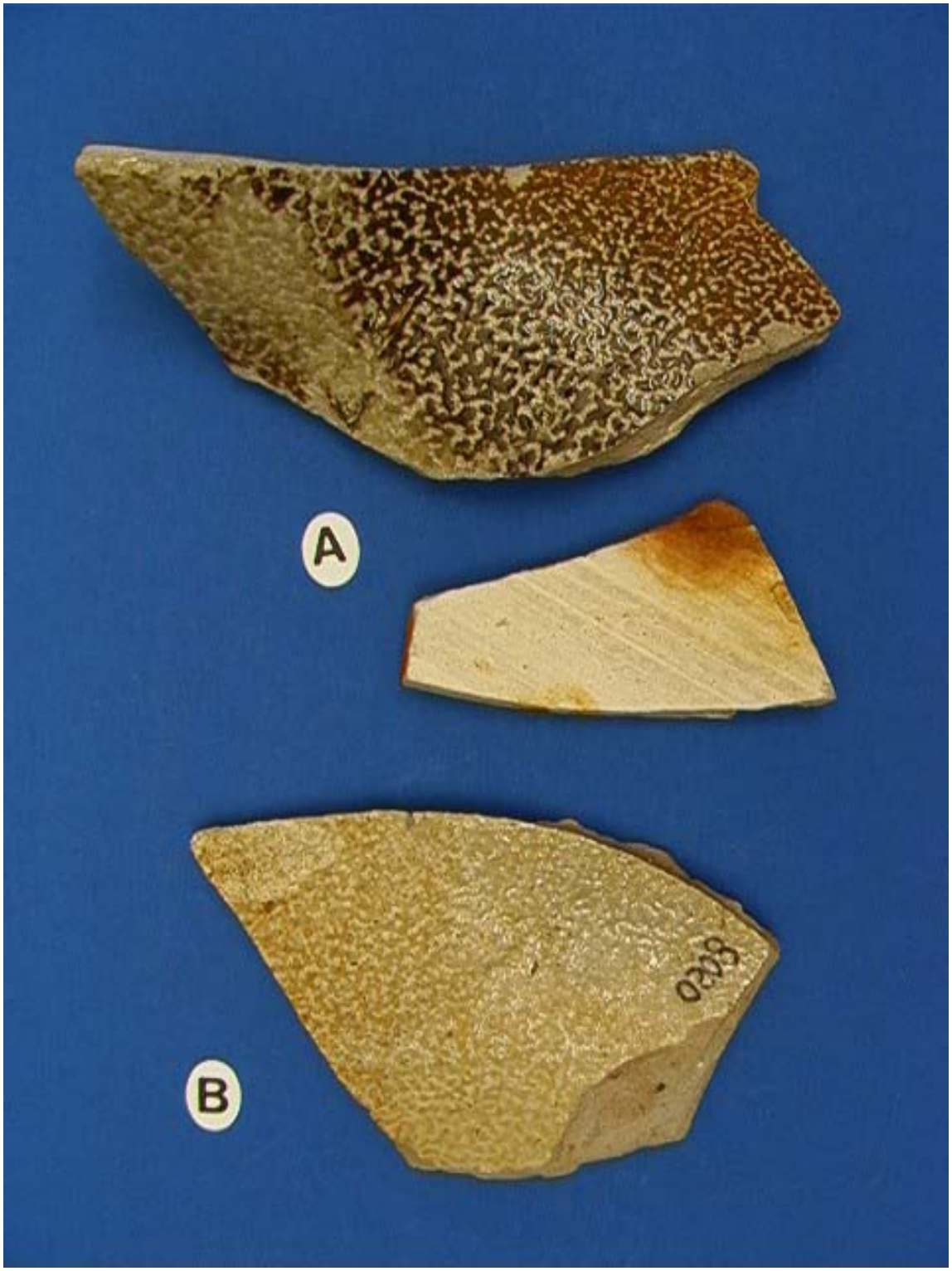

Plate 10

Plate 11

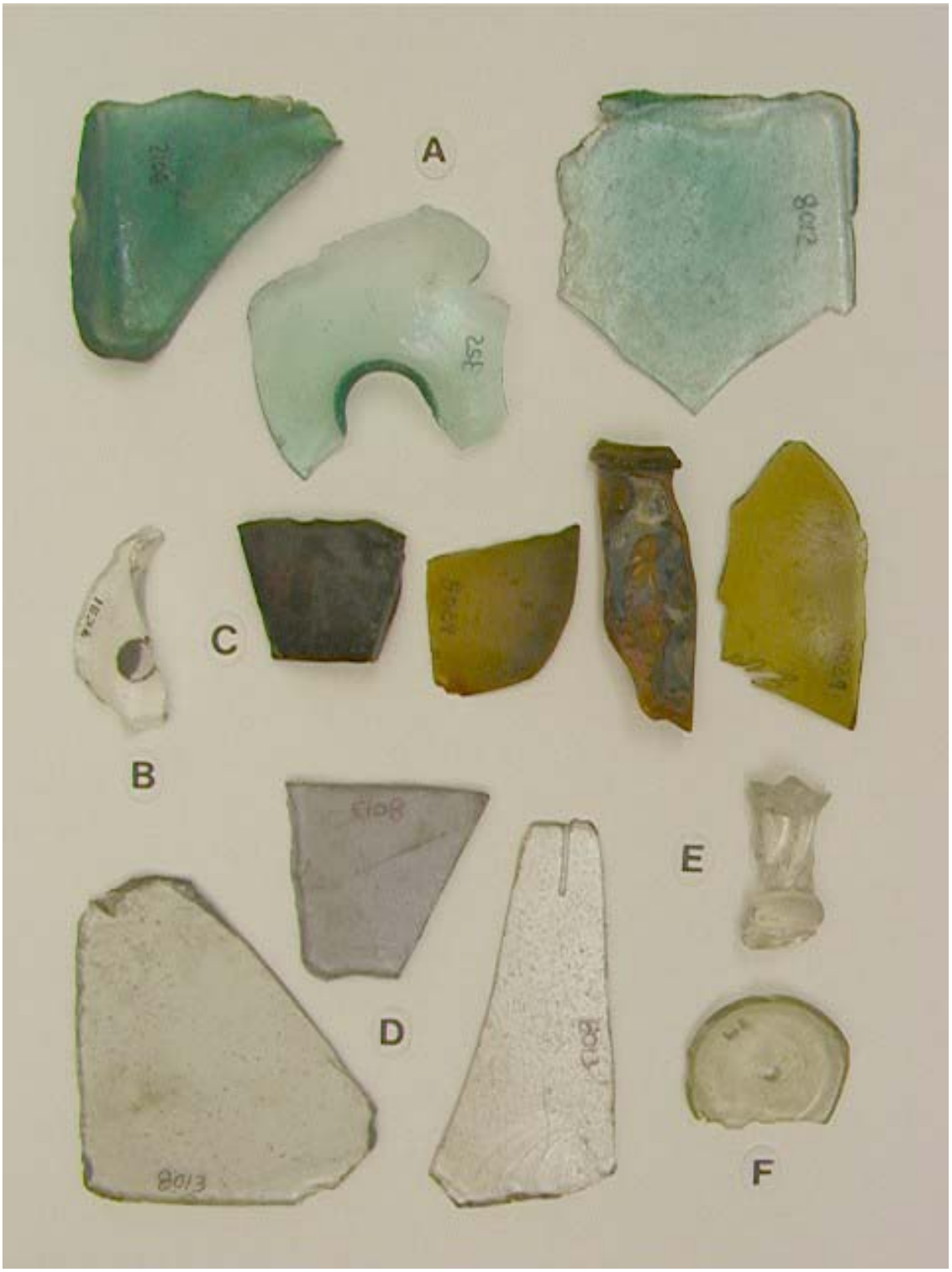

Plate 12

Plate 13

Color Plate Key

Note: All artifacts were archaeologically recovered from the *Capitana el Rubí* site unless otherwise indicated. All artifacts are located in the CSRI research collection.

Plate 1. Recently identified wares: (A) 1733 Black, body sherds, 99 and 142, rim sherd 195, base sherd, preexcavation 1733, 8006; (B) Capitana Gray, rim sherd with green glaze, 1507, rim sherd with black glaze, 142, body sherd with gray glaze, 388 and 1549.

Plate 2. Spanish Olive Jar varieties: (A) Type D, tan paste, base sherd, inside green glazed, 194, (B) Type D tan paste, unglazed base sherd, 64, (C) Type F, red paste, dark olive green glazed on both surfaces, preexcavation 1733, 8023, (D) red paste, moderate brown glaze on one surface, 64.

Plate 3. Unidentified types: (A) Type C-5, body with handle, 170, (B) Type C-2, bowl, preexcavation 1733, 1642, (C) Type C-6, body sherd, black glazed on inside surface, 141, (D) Type C-3, bowl, 125.

Plate 4. Identified glazed coarse earthenware: A-C El Morro. (A) Type C-8, body sherd, red paste with greenish brown glaze, preexcavation 1733, 1307, (B) Type C-7, base sherd, orange paste with orange glaze, preexcavation *San José y las Animas*, 1406-11b, (C) Type C-9, body sherds, dark gray paste with yellow brown glaze, 412 and 1549; (D) Black Lead-glazed, body sherds, 142; (E) Rey Ware, Type C-4, rim sherd, brown and green glazed, preexcavation 1733, 8021, body sherds, dark olive green glazed, 92 and 106, handle, dark olive green glazed, 1498.

Plate 5. Aboriginal and unidentified types: A-B Aboriginal. (A) body sherd, tan paste, 141, (B) body sherds, black paste, 92, (C) Type I, body sherds, 99 and 388, rims sherds, 388, (D) Type E, body sherds, 70, 388.

Plate 6. Mexican majolica: (A) Playa Polychrome, body sherd, 301, (B) Puebla Blue on White, body sherds, preexcavation *San José y las Animas*, 1406-6b, preexcavation 1733, 8018, (C) Tumacacori Polychrome, body sherd, preexcavation 1733, 8018, (D) San Luís Polychrome, body sherd, 303, plato base, 002, (E) Abó Polychrome, handle, preexcavation *San José y las Animas*, 1406-6b, body sherds, preexcavation *San José y las Animas*, 1406-6b.

Plate 7. Unidentified majolica: (A) body sherds, similar to Tumacacori Polychrome with whiter glaze, preexcavation *San José y las Animas*, 1406-6b, (B) plato base, preexcavation 1733, 8018, (C) sherd, cream/gray glazed, 1509, (D) sherd, green glazed with partial pattern, 144, (E) base sherd, gray glazed, preexcavation *San José y las Animas*, 1406-11c, (F) body sherd, blue/gray parallel lines, 1509, (G) body sherd, green/gray glazed, 106, (H) sherd, green and gray glazed, 202.

Plate 8. Spanish Tinaja: (A) base sherd, 1203, (B) rim sherd, 141, body sherds, 141 and 1499.

Plate 9. Guadalajara varieties: (A) Polychrome, handle, 137, body sherds, 218, 137, (B) Blackware, body sherd with embossed pattern, 230, handle, preexcavation *San José y las Animas*, 1404-19, plato base, 1554.

Plate 10. Rhenish brown salt glazed stoneware: body sherd, preexcavation 1733, 8019, body sherd (inside view), 70, body sherd, (cream colored glaze variation or seawater disintegration), preexcavation 1733, 8020.

Plate 11. Oriental porcelain: (A) dark powder blue, rim sherds, 1538,1576, 233 (inside view), base sherd, 316, (B) white on white, base sherd, 186, body sherd with partially unglazed, 187, rim sherd, preexcavation *San José y las Animas*, 1406-6a, (C) blue on white, rim sherds, 1623, preexcavation *San José y las Animas*, 1406-6a, 362, and 362, base sherd, preexcavation *Capitana el Rubí*, 8016, rim sherd, preexcavation *San José y las Animas*, 1406-6a, (D) case bottle body sherd, preexcavation *San José y las Animas*, 1406-6a.

Plate 12. Glassware: (A) blue/green case bottle, base shards, preexcavation *Capitana el Rubí*, 8012, base of neck, 325, (B) clear shard, 1536, (C) olive green bottle, shards, 388, preexcavation 1733, 8029, partial neck, 1517, (D) leaded window pane shards, preexcavation *Capitana el Rubí*, 8013, (E) clear ornamental drinking glass stem, preexcavation *Capitana el Rubí*, 8011, (F) base of clear medicine bottle, 361.

Plate 13. Faunal: A-B, *Felis concolor*-cougar, (A) 1st phalanx (with cut marks), 381, (B) 3rd phalanx (claw), 392, (C) *Bos tauras*-cow, vertebra fragment, 8029, D-F, *Gallus gallus*-chicken, (D) distal tibia, (E) right distal femur, (F) synsacrum, G-K, *Sus scrofa*-pig, (G) vertebra fragment, (H) 2nd phalanx, (I) dorsal vertebra epiphysis, (J) juvenile, fibula, (K) juvenile, left ulna.

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