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Texas A&M University, 1990

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MANAGEMENT OF HISTORIC SHIP ARCHAEOLOGICAL SITES
IN THE CARIBBEAN

A Dissertation
by
JAMES MICHAEL PARRENT

Submitted to the Office of Graduate Studies of Texas A&M University
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

December 1990

Major Subject: Anthropology
MANAGEMENT OF HISTORIC SHIP ARCHAEOLOGICAL SITES
IN THE CARIBBEAN

A Dissertation
by
JAMES MICHAEL PARRENT

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(Chair of Committee)

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(Head of Department)

December 1990
ABSTRACT

Management of Historic Ship Archaeological Sites in the Caribbean. (December 1990)

James Michael Parrent, B.A., Wright State University;
M.A., Texas A&M University
Chair of Advisory Committee: Dr. David L. Carlson

For many years treasure hunters have considered the Caribbean region a prime target for their ventures. While some have chosen to seek contracts with island governments, others have chosen clandestine operations. Regardless of the methods used by treasure hunters, the results are the same—destruction of the region's cultural heritage.

Fortunately, Caribbean nations wanting to develop their cultural resources do not have to rely on treasure hunters. Governments can contract with universities and non-profit organizations that have expertise in dealing with historic shipwreck archaeological sites, thereby developing their resources while retaining ownership of recovered artifacts.

Nations contemplating cultural resource development should first enact legislation that clearly establishes ownership of historic ship archaeological sites and then they should design cultural resource management plans that include consideration for site preservation, ecological
impacts from site excavations, and artifact conservation, study and display.
DEDICATION

To Sharon, my wife and friend.
ACKNOWLEDGMENTS

First, my thanks to my committee members. Committee chairman Dr. David Carlson whose guidance through the system was appreciated. Dr. Vaughn Bryant, Jr., Head of Anthropology and the one who encouraged me to undertake this task. Dr. Michael Waters and Dr. Arnold Vedlitz whose comments and suggestions were greatly appreciated.

Second, Ms. Margaret Lynch who edited this manuscript. Her professionalism and candor made this a better product.

Third, Dr. D.L. Hamilton from whom I learned the conservation techniques contained herein.

Numerous others were helpful as data was collected for this manuscript. The persons mentioned below are acknowledged for their support and input. Mr. Bully, Caribbean Cultural Affairs Officer, UNESCO, Kingston, Jamaica. Ms. Lorna Smith who was the Permanent Secretary, Ministry of Natural Resources & Labour, Government of the British Virgin Islands (BVI) when I conducted my original research. His Excellency J. Mark A. Herdman, Governor of the British Virgin Islands. BVI government officials, the Honorable H. Lavity Stoutt, Chief Minister, and Honorable Ministers Omar Hodge, Oliver Cills, and Louis Walters.

Finally a special thanks to my wife and confidante Sharon who has persevered through it all.
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1. INTRODUCTION

1.1 Treasure Hunters in the Caribbean

Nations of the Caribbean are plagued by treasure hunters. The British Virgin Islands, Dominican Republic, Netherlands Antilles, Turks and Caicos Islands, Puerto Rico, Belize, Dominica, and Jamaica all have experienced problems with treasure hunters during the past few years. While the exploitation of cultural resources for profit is common worldwide, both on land and underwater, the problem seems especially acute in the Caribbean. The area has a high concentration of accessible shipwreck sites. Many of these sites are located in territorial waters of relatively poor nations whose governments find it difficult to ignore promises from treasure hunters of vast fortunes to be realized from shipwreck site salvage.

The plight of historic ship archaeological sites in the Caribbean was a major topic of discussion during the 1987 annual meeting of the Society for Historical Archaeology and the Conference on Historical and Underwater Archaeology held in Savannah, Georgia on January 7-11, 1987. Of particular interest were the problems described

This dissertation employs American Antiquity as a pattern for format and style.
by people directly responsible for historical sites in the Caribbean. Mr. Harriot W. Topsey, Archaeological Commissioner, Department of Archaeology, Belmonpan, Belize, came to the meeting seeking advice and help in dealing with treasure hunters attempting to exploit archaeological sites off the coast of Belize. There, treasure hunters are seeking government permits to work local sites, and they are using various pressure methods to accomplish their goals (Harriot Topsey, personal communication 1987). Dr. Wil Nagelkerken, Marine Biologist/Marine Archaeologist and Adjunct Associate Professor of Anthropology, Curacao, Netherlands Antilles, has noticed an increase in requests by treasure hunters to work wrecks in the Caribbean. He is retiring soon, and there may not be a qualified person to assume his duties. If that is the case, it is likely that treasure hunters will be able to obtain permits to work local wreck sites in the Netherlands Antilles (Wil Nagelkerken, personal communication 1987). Dr. John Luis Antonia de Passalacqua, professor of International Law, University of Puerto Rico, expressed concern about the increased activity of treasure hunters in the Caribbean. He also stated that it is becoming more difficult to convince some government officials that contracting with treasure hunters is not in the best interest of the people or the cultural resource base of Puerto Rico (John Luis Antonia de Passalacqua, personal communication 1987).
Walter A. Cardona Bonet (1989:11-12) discusses the problem of passing shipwreck legislation in Puerto Rico and states that several years (1981-1987) were spent debating the problem. He goes on to state: "However, the initial shipwreck legislation mesmerized until the government and press were overwhelmed by Mel Fisher's 'galleon' discoveries off Vieques Island in 1985 resulting in a treasure diving frenzy at Puerto Rico that has since continued." As a result of the pressure placed on Puerto Rico's marine cultural heritage, an underwater archaeological law (Law No. 10 of August 7, 1987) was passed.

In 1988 the government of the British Virgin Islands (BVI) sought help from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in dealing with the many treasure hunting groups wishing to exploit their submerged cultural resources. The BVI government, like many other island nations, does not have staff qualified to evaluate and analyze treasure hunting proposals. Often such countries fall victim to the slick, misleading and, quite often, false claims of treasure hunters.

Each year the government of Jamaica receives several requests and proposals from treasure hunters seeking permission to work historic ship archaeological sites on Pedro Bank, an area of cays, shoals and reefs within
Jamaica's territorial sea. Some groups claim that they have the support of certain ministers of Parliament but, to date, the government has not allowed treasure hunters access to such sites. Elsewhere in the Caribbean, "gold rush fever" is claiming more and more historic archaeological sites in the name of free enterprise. Publicity generated by the discovery of the Spanish galleon *Atocha* off the coast of Florida has enabled treasure hunters to acquire financial backing to pursue other historic ship sites, and they are actively doing so throughout the Caribbean.

In some areas of the Caribbean, activities reminiscent of the era of the privateers have been rekindled by the promise of gold. Treasure hunters form clandestine groups to plunder historic ship archaeological sites for valuable artifacts with complete disregard for the most elementary archaeological techniques. The fact that this is occurring in the Caribbean was poignantly demonstrated recently when a treasure salvor's vessel was observed anchored in Port Royal Harbor, Jamaica. That the boat was operated by treasure hunters was made obvious by the fact that two large "mailbox" prop-wash deflectors were mounted on the stern of the vessel. Conversations with the crew confirmed that they were seeking shipwreck sites and that they were not operating with the consent of any Caribbean government.

Other treasure hunters seek contracts with governments
to search for and excavate historic ship archaeological sites for profit. Such groups make a pretense of using proper archaeological techniques and terminology, hoping that archaeological jargon will lend credence to their destructive work; but pillaging a historic site within a 10 by 10 foot grid, using data points and photographic documentation, does not change the fact that the site is still being destroyed and that much valuable information is being lost.

1.2 Loss of Data

Why is the data being lost? It is a simple matter of economics. Excavating a historic shipwreck for profit requires the work to be accelerated to the point of inherent data loss. Also, profit is usually realized from intrinsic value artifacts, i.e., gold, silver and gems. These offer few clues to maritime history or shipboard life, while artifacts that would yield such information are often overlooked or discarded because they are not intrinsically valuable and, for that matter, are expensive to conserve, study, and preserve.

The purpose of this document is to discuss the specific problems facing Caribbean countries as they try to preserve and develop their national patrimony; to bring to light the various methods employed by treasure hunters as they seek historic shipwrecks; and to offer constructive
means of developing and protecting a nation's underwater cultural resources.

Herein, Jamaica and the British Virgin Islands (BVI) are used as examples in descriptions of the problems facing many governments as they attempt to deal with treasure hunters.
2. TREASURE HUNTERS

It is imperative that governments of the Caribbean be cognizant of treasure hunting activities that threaten their cultural resources. Various groups are actively seeking contracts to exploit Caribbean historic archaeological sites and informed officials are better equipped to protect their nation's interests.

2.1 Methods of Operation

Treasure salvors can make substantial profits without ever finding treasure. This is accomplished first and foremost by following the golden rule of treasure hunting, "never use your own money." Using investors' money in the quest for treasure minimizes the treasure hunters' personal financial risk and maximizes their profit potential. Therefore, attracting investors is the first priority of any treasure hunting scheme. In order to attract investors, treasure hunters must first obtain a contract with a government that allows them to search for and excavate a "treasure ship."

Most often a treasure hunting group will form a corporation for a specific venture. Corporations provide a means of selling shares and provide the principals with a certain amount of legal protection. One corporation may lease equipment at inflated rates from another corporation.
whose principal shareholders are the same. In this manner a portion of investors' money can be drained off as business expenses but be reflected as profit for the principals.

Treasure hunters can work for years claiming to search for real or imagined treasure ships while obtaining more and more of investors' money. Such a procedure will continue as long as new investors are available and the government involved is placated. If treasure is found it is a bonus to the operation. At the end of a particular operation, or any time that it is expedient, the corporation that signed the contract can file for bankruptcy and be absolved of most financial responsibilities. The losers in such cases are the investors and the people whose cultural resources are exploited.

Almost any island nation in the Caribbean can be targeted for exploitation because most have historic ship sites in their territorial waters. Actual knowledge of the location of a wreck site is not a prerequisite of treasure hunters since there were thousands of ships that disappeared in the Caribbean and anyone can claim they know the location of one of these "lost treasure wrecks." After a country has been targeted, the process of extracting a contract from the government commences. Usually treasure hunters tell government officials that a ship with hundreds of millions of dollars worth of treasure aboard sank in
their waters, and the salvors either know where it is or can find it. The government will receive a share of the treasure if it signs a contract awarding exclusive rights of search and excavation to the treasure hunting group. The urgency of acquiring a contract is stressed to the targeted government by statements such as these:

1. Other treasure hunters know where the wreck is, and they will plunder the site and not share the treasure with the government.
2. Investors are ready to invest now but may not be willing to wait long for a contract.
3. Certain equipment is now available free or at a reduced rate.
4. Sites are being destroyed by natural causes.
5. A major investor must invest before the end of the year for tax purposes.

2.2 Treasure Hunting Contract

Below is an actual contract between a Caribbean island nation and a treasure hunting concern. A similar contract was submitted to the BVI government but rejected. In the first part of this section, the contract is presented in total. Then the meaning and relevance of each paragraph is examined and certain key words and phrases are analyzed, questioned and discussed. The names of the parties have
been omitted and, for sake of clarity, misspelled words in the original contract have been corrected without note.

2.2.1 Contract

AN AGREEMENT made the ___ day of _____, 19___ BETWEEN THE RIGHT HONORABLE __________________, acting herein for and on behalf of the Government of ________ (hereinafter called "the Government") of the ONE PART AND ____________________, a company duly registered under the __________________, laws of ________, (hereinafter called "the Salvor") of the OTHER PART.

WHEREBY IT IS MUTUALLY AGREED as follows:

1. This Agreement shall relate to maritime salvage of ancient shipwrecks more than 100 years old to be conducted on or under the navigable waters within the territorial limits of ________ for the purpose of recovering items of salvage from wrecked and abandoned vessels which salvage include tackle, apparel, armament and cargo.

2. The Government hereby grants to the Salvor and the Salvor hereby takes the exclusive right and licence during the period of this Agreement and any renewals hereof to search for and salvage shipwrecks more than 100 years old which are located on or under the navigable waters within the territorial limits of ________. The Government reserves the right upon
giving notice in advance to the Salvor to enter into agreements with other parties for the salvage of shipwrecks less than 100 years old.

3. The Government hereby undertakes that it will not at any time during the continuance in force of the Agreement enter into any other Agreement with any third party on terms in conflict with this Agreement for salvage operations in the territorial waters within the limits of ________.

4. This Agreement shall subsist for the period of fifteen (15) years from the date hereof and shall be subject to renewal annually at the option of the Salvor and with approval of the Government upon payment of the renewal fee of U.S. $1.00.

5. The Salvor shall commence and diligently pursue its salvage operations in accordance with this Agreement and in this regard the term "diligence" shall mean a fair, proper and reasonable degree of salvage activity upon a site measured with reference to the particular circumstances surrounding the salving of a submerged shipwreck to include, but not be limited to, weather, water conditions, time of day, day of week. In the event that the Salvor does not perform any salvage activities for a continuous period of two (2) years during the initial fifteen (15) year period then the Government may at any time after such period of Two
years by notice in writing to the Salvor terminate this Agreement forthwith but shall then allow the Salvor a period of three (3) months for the sole purpose of winding up its salvage operations.

6. The Salvor shall at all times in the conduct of its salvage operations observe and comply with the Archaeological Guidelines appended hereto as Appendix A and deemed to be incorporated herein. In the event that the Salvor at any time fails to comply with the said Archaeological Guidelines the Government may serve on the Salvor a notice of such noncompliance and the Salvor shall forthwith comply. Any dispute as to whether the Salvor has complied with the Archaeological Guidelines shall be submitted to Arbitration as hereinafter set out.

7. This Agreement shall relate to the salvage of certain unidentified wrecked and abandoned sailing vessels whose wreck sites are wholly and partly encompassed within the area of navigable water and submerged lands within the territorial limits of ________.

8. The Salvor shall be solely responsible for the conduct of all salvage operations and the Salvor hereby undertakes and agrees to be responsible for and to indemnify the Government and hold it harmless against all claims, demands, liabilities and suits of any nature whatsoever for damage to property or injury to
or death of its servants, agents, licensees and all other persons and its subcontractors due to any act occurrence or default by the Salvor, its servants or agents arising from the salvage operations conducted hereunder.

9. The Salvor shall not except with the prior consent in writing of the Government transfer or assign the benefit of this Agreement and in the case of any such transfer or assignment the transferee or assignee shall be bound to observe and comply with the terms of this Agreement.

10. Notwithstanding the provisions of Paragraph 9 hereof the Salvor shall be at liberty without the consent of the Government to enter into subcontracts with other salvage companies for the conduct of salvage operations subject to full compliance by all such subcontractors with the terms and conditions of this Agreement. A copy of every subcontract shall be delivered to the Government as soon as reasonably practicable after the signing thereof.

11. The Salvor undertakes to cooperate with the Government in the salvage operations to permit the Government to participate in the salvage operations at no cost to the Salvor such participation to include but need not be limited to the placement of a Government representative on the primary salvage vessel, the
preparation of surveys, maps and site studies, access to and inspection of all salvaged objects, data, logs, record and materials relating to the salvage operations.

12. All information, written or oral, exchanged between the parties to this Agreement shall be deemed to be confidential and treated as such and shall be used solely for the furtherance of this Agreement.

13. The Salvor undertakes to provide the government with a full description of all vessels to be used in the salvage operations and to provide the Government with the names of the captain and crew and other persons on board each vessel involved in the salvage operations and to make application for and obtain work permits for all such persons.

14. The Salvor undertakes to conduct the salvage operations in a manner which will ensure the stabilization or preservation and protection of historic archaeological sites and materials by utilizing means that will not destroy such sites or materials. The Salvor also undertakes not to use any explosives, drag lines, cutter head dredges and that upon completion of the salvage operations the salvage site shall not be left in jeopardy through exposure to destructive agents, either natural or artificial.
15. The Government shall have the right to temporarily interrupt the salvage operations at a particular spot within the wreck site area if the Government should determine that certain archaeological features or artifacts discovered or uncovered during the salvage operations are of sufficient scientific, historical or prehistoric importance to the public to warrant special handling or protection. Such temporary interruption of the salvage operations in that particular area shall remain in effect for a reasonable time. The Government and the Salvor shall determine the proper techniques and employ special operational procedures or the Government may authorize the return to normal salvage operations in the particular area. Such temporary interruption shall not preclude the salvage operations by the Salvor elsewhere in the wreck sites area so long as such salvage operations do not endanger the artifacts or features being protected.

16. The Salvor undertakes that spinning propeller shafts, high vacuum suction intakes and propellers shall be caged while divers are in the water, that dive flags shall be displayed, and that standard dive safety precautions shall be followed.

17. The Salvor undertakes that all artifacts and materials recovered in the salvage operations shall remain in
the possession of the Salvor and the Salvor shall be solely responsible for the stabilization, maintenance, storage and security of all artifacts and materials.

18. The Salvor undertakes to deposit unique and precious objects in a bank or other secure repository at the option of the Salvor, and to provide the Government with the name and address of such bank or repository and an inventory of all salvaged items so deposited at the end of each calendar year.

19. The Salvor undertakes to tag, handle, process, stabilize or conserve, store and maintain all artifacts and materials in the manner prescribed in the Archaeological Guidelines.

20. In the interest of the people of _________ and their heritage and history the Salvor shall endeavour to cause to be donated to the Government as its own property and in lieu of all taxes, levies, customs duties and consumption taxes that would otherwise be payable by the Salvor a cross-sectional representation of all salvaged artifacts recovered from the contract site during the annual salvage operations. It is understood by the parties that the donation of the cross-sectional representation of the salvaged artifacts shall represent one-fifth (1/5) in value of the artifacts salvaged. In no event shall the Government be entitled to more than one-fifth in value
of the artifacts salvaged. The Salvor shall have the unrestricted use of its portion of the salvaged artifacts and shall be entitled to remove such artifacts from _______ without the imposition of any taxes, duties or other levies whatsoever.

21. In the event that the Salvor is unable to cause the donation of an adequate cross-sectional representation of the salvaged artifacts then the Government may assert a claim in appropriate form in unique artifacts which it feels are essential to the preservation of the peoples' heritage.

22. The Salvor undertakes to use its best endeavors to make a physical distribution of the donated salvaged materials within a reasonable period of time after the Salvor prepares the inventories, cleans, preserves and certifies the authenticity of the items. Artifacts salvaged during one calendar year shall be distributed during the ensuing calendar year. The Salvor shall use its best endeavors to provide the government on the 2nd of January of each year with a written list of the artifacts salvaged during the previous calendar year. In the event of large recoveries during the month of November or December of such previous year then such list may be provided up to the 1st of February. The decision on the distribution of the salvaged artifacts between the Salvor and the
Government shall be made within 30 days after provision of the written list of the Government. In the event that the parties are unable to agree upon equitable distribution within the time stated then the distribution shall be made by computer on a random basis and such distribution shall be binding upon the parties.

23. The Salvor intends to have a Treasure Museum Tourist attraction in _________ and shall use its best endeavors to establish the museum within four (4) years of the signing of this Agreement.

24. The Salvor undertakes to set up an archaeological work study programme in order to teach citizens of _________ how to use Remote Sensing Equipment and preservation of artifacts and museum curation. The Salvor shall as far as reasonably practicable employ citizens of _________ in its efforts to set up the archaeological work study program.

25. The Salvor and the Government intend to exchange information concerning analysis, interpretation and authentication of artifacts, archaeological provenience data and historical research and agree to cooperate in the development of exhibitions and publications relating to the salvaged artifacts and research data.
26. The Salvor and/or the Salvor's investors may donate other artifacts to the Government subject to acceptance by the Government.

27. Every vessel engaged in the salvage operations shall be liable to search by the Government police force and by the duly authorized representatives of the customs and immigration departments. In the event that any such vessel is found by a court of competent jurisdiction to be engaged in the smuggling of goods or in trafficking in any prohibited drug then the Government shall be entitled to terminate this Agreement forthwith but shall then allow the Salvor a period of three months for the sole purpose of winding-up its salvage operations.

28. The Government hereby undertakes and agrees with the Salvor that so long as the Salvor observes all the conditions and performs all its obligations under this Agreement the Government will not at any time during the period of this Agreement and any renewals hereof initiate any measure applicable to the salvage operations or do or cause to be done any act or thing calculated or likely to affect adversely the rights of the Salvor hereunder or the salvage operations of the Salvor or the benefits to be derived by the Salvor and its investors from the salvage operations contemplated by this Agreement. It is appreciated by the parties
hereto that very substantial sums of money will be 
invested at risk on the salvage operations.

29. All disputes or differences whatsoever which shall at 
any time hereafter whether during the continuance in 
effect of this Agreement or upon or after its 
determination arise between the parties hereto 
touching or concerning this Agreement or its 
construction or effect or as to the rights, duties and 
liabilities of the parties hereto or either of them 
under or by virtue of this Agreement or otherwise as 
to any other matter in any way connected with or 
arising out of or in relation to the subject matter of 
this Agreement shall be referred to arbitration 
pursuant to the provisions of the Arbitration Act for 
the time being of ________.

30. This Agreement and the rights and obligations of the 
parties hereunder shall be construed and have effect 
in accordance with the Laws of the ________.

   IN WITNESS WHEREOF the parties hereto have hereunto 
set their hands respectively the day and year first above 
written.

   SIGNED by__________________ On behalf of the Government

   SIGNED by__________________ On behalf of the Salvor .
2.2.2 Contract Analysis

Here the meaning of each section of the contract is discussed. The true meaning of each section has important implications to the government, the people, and the cultural resources of the nation involved.

1. This Agreement shall relate to maritime salvage of ancient shipwrecks more than 100 years old to be conducted on or under the navigable waters within the territorial limits of ________ for the purpose of recovering items of salvage from wrecked and abandoned vessels which salvage include tackle, apparel, armament and cargo.

Discussion

Section one sets forth which wrecks will be salvaged; it must be assumed that the age of 100 years is determined from the date of signing the contract.

2. The Government hereby grants to the Salvor and the Salvor hereby takes the exclusive right and licence during the period of this Agreement and any renewals hereof to search for and salvage shipwrecks more than 100 years old which are located on or under the navigable waters within the territorial limits of ________. The Government reserves the right upon giving notice in advance to the Salvor to enter into agreements with other parties for the salvage of shipwrecks less than 100 years old.
Discussion

This clause prevents the government from awarding any other contracts concerning shipwrecks older than 100 years. It thereby hands control of all such wrecks over to the treasure salvors who in turn can negotiate contracts with sub-contractors. It would be prudent of governments to restrict the salvors' activities to certain sites they claim to know about or have locations for.

3. The Government hereby undertakes that it will not at any time during the continuance in force of the Agreement enter into any other Agreement with any third party on terms in conflict with this Agreement for salvage operations in the territorial waters within the limits of ________.

Discussion

This section further restricts the government and seems to be designed to give salvors full control of all historic wrecks within the country's territorial waters. What would happen if a wreck of great historical significance, but little intrinsic value, was discovered by another party? Could the government have it excavated by a professional archaeological group in order to create a museum and promote the history of the nation, or would the government be required to wait on the pleasure of the salvors?
4. This Agreement shall subsist for the period of fifteen (15) years from the date hereof and shall be subject to renewal annually at the option of the Salvor and with approval of the Government upon payment of the renewal fee of U.S. $1.00.

Discussion

Section four, along with previous sections, gives the salvor complete control of the country's marine cultural heritage for at least 15 years from the date of signing.

5. The Salvor shall commence and diligently pursue its salvage operations in accordance with this Agreement and in this regard the term "diligence" shall mean a fair, proper and reasonable degree of salvage activity upon a site measured with reference to the particular circumstances surrounding the salving of a submerged shipwreck to include, but not be limited to, weather, water conditions, time of day, day of week. In the event that the Salvor does not perform any salvage activities for a continuous period of two (2) years during the initial fifteen (15) year period then the Government may at any time after such period of Two years by notice in writing to the Salvor terminate this Agreement forthwith but shall then allow the Salvor a period of three (3) months for the sole purpose of winding up its salvage operations.
Discussion

This section has very little meaning because it is vague. It is mostly verbiage, to give the appearance that the government has some control or rights. Also, if a salvor has not done any work for two continuous years, why does he need three months to wind-up operations?

6. The Salvor shall at all times in the conduct of its salvage operations observe and comply with the Archaeological Guidelines appended hereto as Appendix A and deemed to be incorporated herein. In the event that the Salvor at any time fails to comply with the said Archaeological Guidelines the Government may serve on the Salvor a notice of such noncompliance and the Salvor shall forthwith comply. Any dispute as to whether the Salvor has complied with the Archaeological Guidelines shall be submitted to Arbitration as hereinafter set out.

Discussion

The guidelines mentioned are those drawn up by the salvors, so it seems reasonable to assume they would be able to follow them. Also, at any particular time the government may not have anyone qualified to judge if the salvor is or is not following the guidelines. If for some reason a dispute has to go to arbitration, who sets the standards for arbitration and who selects
the arbitrator? This section is another attempt to give the impression that the government has some control. In addition, proper archaeological techniques often require a great deal of time, skill and delicacy. These requirements are in direct conflict with a salvor's desire and need (especially if he has investors to satisfy) to make a profit. It is not difficult to hide deliberate damage to monetarily valueless artifacts that may stand in the way of speedily collecting treasure. Even carelessly moving a few encrustations about on the site, or shifting the odd ship timber, can irrevocably destroy information that trained archaeologists might have recorded. (Please note that the appendix cited above is not the one that appears at the end of this manuscript.)

7. This Agreement shall relate to the salvage of certain unidentified wrecked and abandoned sailing vessels whose wreck sites are wholly and partly encompassed within the area of navigable water and submerged lands within the territorial limits of ________.

Discussion

Section seven appears to broaden the scope of section two and includes those wrecks only partly within the territorial limits of the country.
8. The Salvor shall be solely responsible for the conduct of all salvage operations and the Salvor hereby undertakes and agrees to be responsible for and to indemnify the Government and hold it harmless against all claims, demands, liabilities and suits of any nature whatsoever for damage to property or injury to or death of its servants, agents, licensees and all other persons and its subcontractors due to any act occurrence or default by the Salvor, its servants or agents arising from the salvage operations conducted hereunder.

Discussion

This section, while it may have some use in court proceedings, does not absolve the government from liabilities and suits that may arise from negligence or misconduct on the part of the salvor while the salvor or the salvor's subcontractors are working under contract with the government.

9. The Salvor shall not except with the prior consent in writing of the Government transfer or assign the benefit of this Agreement and in the case of any such transfer or assignment the transferee or assignee shall be bound to observe and comply with the terms of this Agreement.
Discussion

The appearance of some government control in section nine is offset by section 10 below.

10. Notwithstanding the provisions of Paragraph 9 hereof the Salvor shall be at liberty without the consent of the Government to enter into subcontracts with other salvage companies for the conduct of salvage operations subject to full compliance by all such subcontractors with the terms and conditions of this Agreement. A copy of every subcontract shall be delivered to the Government as soon as reasonably practicable after the signing thereof.

Discussion

Section 10, in essence, gives the salvor the right to subcontract any or all of the salvage operations to a third party. Since previous sections gave the salvor all rights to historic wreck sites less than 100 years old the salvor, through subcontracts, could have sites worked by others who may not have been able to secure a contract with the government in the first place. It must be noted that the government has no right under this section to disallow a subcontractor from working wreck sites.

11. The Salvor undertakes to cooperate with the Government in the salvage operations to permit the Government to participate in the salvage operations at no cost to
the Salvor such participation to include but need not be limited to the placement of a Government representative on the primary salvage vessel, the preparation of surveys, maps and site studies, access to and inspection of all salvaged objects, data, logs, record and materials relating to the salvage operations.

Discussion

This section only states that the salvor will attempt (undertake) to cooperate in the matters described, when it should be made clear that the government maintains rights of monitoring and inspection at all times.

12. All information, written or oral, exchanged between the parties to this Agreement shall be deemed to be confidential and treated as such and shall be used solely for the furtherance of this Agreement.

Discussion

Does this include all historic and archaeological data that may be generated by the operation? Does this also prevent the government from publicizing displeasure or pleasure with the group's performance? Does this limit the government's ability to use the information to enhance tourism?

13. The Salvor undertakes to provide the government with a full description of all vessels to be used in the
salvage operations and to provide the Government with the names of the captain and crew and other persons on board each vessel involved in the salvage operations and to make application for and obtain work permits for all such persons.

Discussion

This section may be redundant since customs and immigration laws would require such information to be provided anyway. Moreover, the word "undertakes" only implies an attempt at compliance by the salvor.

14. The Salvor undertakes to conduct the salvage operations in a manner which will ensure the stabilization or preservation and protection of historic archaeological sites and materials by utilizing means that will not destroy such sites or materials. The Salvor also undertakes not to use any explosives, drag lines, cutter head dredges and that upon completion of the salvage operations the salvage site shall not be left in jeopardy through exposure to destructive agents, either natural or artificial.

Discussion

Again, as previously noted, the salvor dictates the standard for preservation and protection of historical archaeological sites, and, furthermore, the government may not have personnel qualified to judge compliance.
Also, this section only indicates that the salvor will attempt to do as stated.

15. The Government shall have the right to temporarily interrupt the salvage operations at a particular spot within the wreck site area if the Government should determine that certain archaeological features or artifacts discovered or uncovered during the salvage operations are of sufficient scientific, historical or prehistoric importance to the public to warrant special handling or protection. Such temporary interruption of the salvage operations in that particular area shall remain in effect for a reasonable time. The Government and the Salvor shall determine the proper techniques and employ special operational procedures or the Government may authorize the return to normal salvage operations in the particular area. Such temporary interruption shall not preclude the salvage operations by the Salvor elsewhere in the wreck sites area so long as such salvage operations do not endanger the artifacts or features being protected.

Discussion

The government that signed the contract here did not have the expertise to exercise the option of section 15. If a government inadvisably signs a contract like this one, it should at the very least be sure that it
has archaeological expertise at its disposal, otherwise it has left the nation's underwater resources with no protection to speak of.

16. The Salvor undertakes that spinning propeller shafts, high vacuum suction intakes and propellers shall be caged while divers are in the water, that dive flags shall be displayed, and that standard dive safety precautions shall be followed.

Discussion

The use of the word "undertakes" only implies that the salvor will attempt to protect his own personnel from the listed hazards. Note the use of "shall" in association with dive safety. Throughout this contract the word "undertakes" is used instead of "shall" or "will" when it is beneficial to the salvor.

17. The Salvor undertakes that all artifacts and materials recovered in the salvage operations shall remain in the possession of the Salvor and the Salvor shall be solely responsible for the stabilization, maintenance, storage and security of all artifacts and materials.

Discussion

This is a vague reference to ownership but a strong statement that the salvor has control of the artifacts.

18. The Salvor undertakes to deposit unique and precious objects in a bank or other secure repository at the
option of the Salvor, and to provide the Government with the name and address of such bank or repository and an inventory of all salvaged items so deposited at the end of each calendar year.

Discussion

Section 18 further strengthens the salvor's control of the artifacts, but while the salvor must endeavor to secure the artifacts, he is not asked to guarantee that they will indeed be deposited in a secure repository.

19. The Salvor undertakes to tag, handle, process, stabilize or conserve, store and maintain all artifacts and materials in the manner prescribed in the Archaeological Guidelines.

Discussion

This section simply states that the salvor will attempt to follow his own conservation guidelines.

20. In the interest of the people of _______ and their heritage and history the Salvor shall endeavour to cause to be donated to the Government as its own property and in lieu of all taxes, levies, customs duties and consumption taxes that would otherwise be payable by the Salvor a cross-sectional representation of all salvaged artifacts recovered from the contract site during the annual salvage operations. It is understood by the parties that the donation of the
cross-sectional representation of the salvaged artifacts shall represent one-fifth (1/5) in value of the artifacts salvaged. In no event shall the Government be entitled to more than one-fifth in value of the artifacts salvaged. The Salvor shall have the unrestricted use of its portion of the salvaged artifacts and shall be entitled to remove such artifacts from _______ without the imposition of any taxes, duties or other levies whatsoever.

Discussion

Section 20 states that the salvor will try to have artifacts donated to the government and restricts the government from receiving more than twenty percent of the total value of the recovered artifacts. It is not clear if the government is even guaranteed twenty percent of the artifacts. The clause raises several questions. Does the government already own artifacts found in its territorial waters? Is signing this contract an admission by the government that it does not own artifacts found in territorial waters? Could treasure hunters find wrecks under this contract and then sue for ownership under admiralty law? With such questions in mind, it is strongly recommended that governments enact legislation that will clearly establish its ownership of its submerged cultural
resources prior to entering into any agreement with treasure hunters.

21. In the event that the Salvor is unable to cause the donation of an adequate cross-sectional representation of the salvaged artifacts then the Government may assert a claim in appropriate form in unique artifacts which it feels are essential to the preservation of the peoples' heritage.

Discussion

It is not clear what the proper form of claiming an adequate and representative cross section of salvaged artifacts would be. Also, there is no guarantee of the success of the claim.

22. The Salvor undertakes to use its best endeavors to make a physical distribution of the donated salvaged materials within a reasonable period of time after the Salvor prepares the inventories, cleans, preserves and certifies the authenticity of the items. Artifacts salvaged during one calendar year shall be distributed during the ensuing calendar year. The Salvor shall use its best endeavors to provide the government on the 2nd of January of each year with a written list of the artifacts salvaged during the previous calendar year. In the event of large recoveries during the month of November or December of such previous year then such list may be provided up to the 1st of
February. The decision on the distribution of the salvaged artifacts between the Salvor and the Government shall be made within 30 days after provision of the written list of the Government. In the event that the parties are unable to agree upon equitable distribution within the time stated then the distribution shall be made by computer on a random basis and such distribution shall be binding upon the parties.

Discussion

Distribution of recovered artifacts in such a short period is an admission by the treasure hunters that little time will be spent studying the collection before it is distributed. Much data may be lost by such a short-sighted policy, and the random distribution of the nation's cultural heritage is not in the best interest of the people. Also, what portion of the artifacts is the government guaranteed by this contract?

23. The Salvor intends to have a Treasure Museum Tourist attraction in _________ and shall use its best endeavors to establish the museum within four (4) years of the signing of this Agreement.
Discussion

The words "intends" and "endeavors" are not binding as their definitions indicate that the salvor will only try to accomplish the actions listed.

24. The Salvor undertakes to set up an archaeological work study programme in order to teach citizens of _________ how to use Remote Sensing Equipment and preservation of artifacts and museum curation. The Salvor shall as far as reasonably practicable employ citizens of _________ in its efforts to set up the archaeological work study program.

Discussion

The word "undertakes" only indicates that the salvor will try to set up a training program. The contract does not stipulate that the program has to be established or, once established, continued for the length of the contract. Nor is it clear that the training in preservation and curatorial methods will be conducted by professionals.

25. The Salvor and the Government intend to exchange information concerning analysis, interpretation and authentication of artifacts, archaeological provenience data and historical research and agree to cooperate in the development of exhibitions and publications relating to the salvaged artifacts and research data.
Discussion

Only an intention to accomplish the actions is indicated.

26. The Salvor and/or the Salvor's investors may donate other artifacts to the Government subject to acceptance by the Government.

Discussion

This appears to be mere verbiage since what investors choose to do with their artifacts cannot be governed by this contract.

27. Every vessel engaged in the salvage operations shall be liable to search by the Government police force and by the duly authorized representatives of the customs and immigration departments. In the event that any such vessel is found by a court of competent jurisdiction to be engaged in the smuggling of goods or in trafficking in any prohibited drug then the Government shall be entitled to terminate this Agreement forthwith but shall then allow the Salvor a period of three months for the sole purpose of winding-up its salvage operations.

Discussion

Allowing drug runners or smugglers to continue operations for three months seems contrary to the best interests of the country.
28. The Government hereby undertakes and agrees with the Salvor that so long as the Salvor observes all the conditions and performs all its obligations under this Agreement the Government will not at any time during the period of this Agreement and any renewals hereof initiate any measure applicable to the salvage operations or do or cause to be done any act or thing calculated or likely to affect adversely the rights of the Salvor hereunder or the salvage operations of the Salvor or the benefits to be derived by the Salvor and its investors from the salvage operations contemplated by this Agreement. It is appreciated by the parties hereto that very substantial sums of money will be invested at risk on the salvage operations.

Discussion

This clause stipulates that the government "will not" undertake the actions described against the salvor. If one follows the logic of word selection in the previous sections then the term should be "will endeavor" not to undertake the actions specified. The use of vague terms throughout the contract always favors the salvor. It is clear that the contract is designed for the protection of the salvors and to enhance their ability to attract investors.

29. All disputes or differences whatsoever which shall at any time hereafter whether during the continuance in
effect of this Agreement or upon or after its
determination arise between the parties hereto
touching or concerning this Agreement or its
construction or effect or as to the rights, duties and
liabilities of the parties hereto or either of them
under or by virtue of this Agreement or otherwise as
to any other matter in any way connected with or
arising out of or in relation to the subject matter of
this Agreement shall be referred to arbitration
pursuant to the provisions of the Arbitration Act for
the time being of ________.

Discussion

As it stands this section is appropriate, but since
most of the actions of the salvor are based on the
salvor only attempting or trying to accomplish the
actions described in the previous sections, I am not
sure of its relevance in governing the actions of the
salvor; however, this section could be used to force
governments to comply with sections where words such
as "will" or "shall" are used to describe actions
required of the government.

30. This Agreement and the rights and obligations of the
parties hereunder shall be construed and have effect
in accordance with the Laws of the ________. 
Discussion

This final section is standard legal practice and requires no discussion here.

As written, the above contract is totally inadequate. It offers little if any protection to the government or to its cultural resources. A country would be better off selling the rights to its archaeological sites outright than entering into such an agreement.

2.3 Investors in Treasure Hunting Schemes

Once a contract is secured the process of attracting investors commences. Investors are shown the contract and told that a wreck or wrecks worth hundreds of millions of dollars will be found and that the investors will be given a share of the spoils. Publicity about the Atocha treasure find made it easy to attract investors for a while, but recent allegations by investors of unfulfilled promises and possible fraud on the part of the treasure hunters has made potential investors wary. A lengthy article in The Miami Herald ("Fisher's Atocha discovery is not all glitter," 19 July 1987) discusses various aspects, accusations and law suits concerning the Atocha venture.

Some investors participate in hopes of a get-rich-quick return on a small investment, while others invest for the thrill of being part of a treasure hunt. Another type
of investor is involved for the first two reasons but also has a tax scheme in mind. This latter investor is probably the shrewdest type because it is difficult for him to lose. Such a person must belong to a tax bracket in which a business loss can be beneficial for tax purposes, or in which a sizable donation to a university or museum will result in a tax reduction for the investor. The investor contributes to a treasure hunting venture for a percentage of the salvaged treasure. If treasure is found the investor may realize a substantial profit. If no treasure is found he can write-off the amount invested as a tax-deductible business loss, or, if artifacts are found, the investor may be given miscellaneous artifacts that have been valued far above their true monetary value. The investor can donate these to a university or museum and take a tax deduction in the amount of the inflated appraisal. Recently there has been a move on the part of some museums to refuse donations of artifacts that come from dubious ventures.

Of course, there are many variations in the methods of treasure hunters and in the contracts they offer targeted countries. The above is meant only to be an example. Some groups are less scrupulous than others, but all have one thing in common: they destroy our marine heritage for the sake of personal gain.
3. ALTERNATIVES TO TREASURE HUNTERS

What are the alternatives to contracting with treasure hunters? Fortunately there are several options. First, however, government planners and regulators, who do not have the assistance of professional archaeologists, need to know basic archaeological concepts and techniques in order to evaluate archaeological proposals from all sources. Basic concepts are presented below, followed by discussions of alternatives to treasure hunters. It is recommended that additional sources concerning proper archaeological techniques, such as UNESCO (1972, 1981), be consulted.

3.1 Archaeology

Archaeology is the systematic study of past human cultures by locating and interpreting the cultural products (artifacts) of past cultures. In order for archaeologists to relate the recovered artifacts to the culture they represent, the artifacts must by studied in relationship to one another, and each artifact's precise location on the site—its provenience—must be known. Casually collected or looted artifacts are not suitable for the study of past cultures and, from a scientific point of view, are little more than curiosities.

In Archaeology: Discovering Our Past, the authors list three principal goals in studying the past.
The first is to reveal the **form** of the past: the description and classification of the physical evidence that is recovered. Analysis of form allows archaeologists to outline the distribution of remains of ancient societies in both time and space. The second goal is to discover **function**: by analyzing the form and interrelationships of recovered evidence, to determine the ancient behavior represented by the physical remains. Finally, the archaeologist attempts to understand cultural **processes**: by using the remains of ancient cultures, to explain how and why they changed through time [Sharer and Ashmore 1987:10-11].

3.2 The Archaeologist

An archaeologist is a person who has invested the time and money to study the discipline of archaeology, and a person who adheres to certain professional standards and concepts. These guiding principles are described in the "Code of Ethics and Standards of Research Performance" set forth by the Society of Professional Archeologists (SOPA). The code of ethics states: "Archeology is a profession, and the privilege of professional practice requires professional morality and professional responsibility, as well as professional competence, on the part of each
practitioner" (SOPA 1988:5). The complete code can be found in the appendix.

An archaeologist is motivated by the desire for information that contributes to our understanding of the human past. Such information furnishes insights into modern societies and provides mankind with a sense of continuity over time.

3.3 Recognizing Proper Archaeological Techniques

3.3.1 Research Design

Any person who contemplates investigating an archaeological site must have a plan of action, i.e., research design. Such a plan should consider all aspects of the proposed project and should be so constructed as to allow investigators the greatest flexibility as the project progresses. A research design is a means of formalizing the investigator's thoughts, ideas, and questions concerning the project. It also allows formal presentation of the researcher's plan of work to all concerned parties. A properly constructed research design is not in any way restrictive. On the contrary, it should anticipate problems and facilitate the smooth handling of unexpected events. A comprehensive research design will include the following stages: (1) formulation; (2) implementation; (3) data acquisition; (4) data processing; (5) analysis; (6)
interpretation; and (7) publication (Sharer and Ashmore 1987:100-133).

The first stage, formulation, consists of defining research problems and goals and conducting background investigations, e.g., archival research, literature searches, review of previous work. It also includes conducting feasibility studies to insure that the project can proceed within existing conditions (political, economic, environmental). This stage is followed by implementation, which involves finances, permits and logistics.

Stage three, data acquisition, is concerned with the initial aspects of fieldwork and includes reconnaissance to locate sites; survey to delineate and gather preliminary information; and excavation to reveal subsurface information.

The fourth stage, data processing, is the recording of artifacts and features. Recording includes labeling, cataloging, drawing, photographing, video-taping and notes. This stage is crucial to the success of a project because as artifacts and features are disturbed by the excavators the information contained in their relationship to one another is destroyed and can only be retrieved from the excavation records.

Stage five is the analysis of collected data. Recovered material is examined and classified by form or
style. Artifacts are examined to determine their age, what raw materials were used in their construction, how they were made, and their function.

Interpretation of data, the sixth stage of the research design, involves the synthesis of all results of data collection, processing, and analysis. Interpretation of data should provide answers to original research questions formulated in stage one.

Publication of results is the final stage of the research design and often separates successful professional archaeologists from others. Publication of data, data analysis and interpretation is the means by which archaeologists pass on information to colleagues, students and interested persons. No site should be excavated unless provisions are made for the publication of the retrieved data.

3.3.2 Site Location

Locating submerged archaeological sites presents a unique problem to archaeologists. Covered sites on land can often be detected through the observance of vegetation growth patterns (due to the variation in groundwater retention potential or soil compaction) or through the use of various remote-sensing technologies such as ground-penetrating radar, color infra-red photography, heat-detecting infra-red scanners (Lightfoot and Lightfoot
1989), and by the measurement of soil resistivity; however, due to the nature of sites covered with water or in saturated soils, none of these techniques have yet proven effective in detecting submerged sites.

Most underwater site discoveries are fortuitous, found by sport divers or fishermen, or during construction activities. Archaeologists, to aid themselves in detecting underwater archaeological sites, have adapted three types of electronic equipment: magnetometers, side-scan sonar and subbottom profilers. Originally the side-scan sonar and the magnetometer were developed for military use, whereas the subbottom profiler was developed for off-shore oil exploration. All three devices consist of control and recording devices and a towed sensor.

Normally for marine surveys, a proton precession magnetometer is employed (Breiner 1973). The towed sensor detects changes in the earth's magnetic field caused by material that exhibits magnetic properties, like magnetite, or ferrous material (cannons, boat motors, parts of automobiles). Magnetic changes are relayed to the recorder and are indicated as digital and printed readouts. These are interpreted by the operator. When the recorded magnetic changes suggest a site location, then divers enter the water to investigate.

For the most part, magnetometers will only detect sites that contain a quantity of ferrous material that
presents a magnetic signature large enough to be detected above the naturally occurring magnetic background noise. Experience has shown that many sites are missed because of the angle of approach by the survey vessel (the magnetic signature of a site varies in intensity around its perimeter) and the horizontal or vertical distance from the sensor head to the target (the greater the distance, the smaller the signature). In some cases a magnetometer may detect a ballast pile if the ballast stones represent a substantial change or difference from the surrounding terrain. For example, if a ballast pile is located among locally occurring rock deposits it would be very difficult to detect. But if the ballast pile is located in or on a sandy sea bottom it would present a magnetic difference that might be detected by a magnetometer (Breiner 1973).

A major limiting factor of magnetometers is their tendency to record all changes in the earth’s magnetic field, whether caused by natural, modern or historic material. Modern debris can mask a site and render it impossible to find if one relies solely on a magnetometer.

Side-scan sonar is useful in detecting objects that are exposed on the sea floor (Mudie et al. 1970). The towed sensor is electronically pulsed and sends out a high frequency signal (approximately 105 khz) that is reflected back to the sensor by the sea floor and any exposed objects. The reflected signal is received by the sensor
and recorded as a visual image, much like a photograph, by the recorder. Side-scan sonar, while very useful for detecting objects above the sea floor, will not penetrate the sea floor to reveal buried sites because of the high frequency used. It may, however, indicate the presence of a buried object by detecting changes in the sea floor, e.g., sand mounding over a site. The relationship of frequency to penetration is presented in more detail in the subbottom profiler discussion below.

A subbottom profiler projects sound pulses from a towed sensor into the sea floor and records returned sound waves that have been reflected by changes in seabed continuity, e.g., relic river beds, submerged coral reefs or historic sites. In the case of a historic ship site, sound waves are reflected by the remains of the vessel, e.g., ballast stones, ships' timbers, cannon and anchors.

As mentioned above, the subbottom profiler was developed for use by the oil and gas industry and is used to detect sub-surface stratigraphic profiles. Detection is accomplished through the use of a sound generator and a sound receiver that detects variations in reflected sound intensities. Depth of penetration is controlled by the transmitted pulse rate and the frequency of the sound source.

Sound travels about five times faster in water (approximately 1500 meters per second) than in air
(approximately 300 meters per second). The speed of sound in water is affected by pressure, temperature, chemical constitution, and other factors, but from a practical standpoint such variations from 1500 meters per second can be ignored (Edgerton 1986:5). Distance from the sound source to the object reflecting the sound waves is calculated using the equation:

\[ D = \frac{ct}{2} \]

where \( D \) equals the distance in meters, \( c \) equals the velocity of sound in water (or 1500 meters per second), and \( t \) is the time interval, in seconds, between generation and reception of the sound pulse.

The frequency determines how deep into the sea-bottom the sound will penetrate and determines the resolution of the reflected signal. Both these phenomena are a function of wavelength which, as can be seen by the following formula, is a function of frequency:

\[ W = \frac{c}{f} \]

where \( W \) is wavelength at a given frequency, \( c \) is velocity in meters per second (about 1500 meters per second in water), and \( f \) is frequency in hertz (Hz). If, for example, an object is larger than the sound pulse wavelength, then a maximum amount of sound energy will be reflected by the object to the receiving device. But if the object is smaller than the sound pulse wavelength only a portion of
the sound energy will be reflected. Perhaps this can best be shown by the following formula:

\[ R = \frac{S}{W} \]

where \( R \) is the reflected energy, \( S \) equals the size of object and \( W \) equals the wavelength. For a given sized object, if the frequency of the sound pulse is increased the wavelength decreases; therefore, the amount of energy reflected is increased. At the receiving device, the increase in reflected energy results in better resolution of the object. How this relates to depth of penetration can be understood easily by using the extreme example of all energy being reflected by an object and thus not penetrating beyond that object. This is actually what happens with side-scan sonar, where no sound penetrates the sea floor because of the relatively high frequencies used (Belderson et al. 1972).

Another factor contributing to the resolution and depth of penetration is the sound pulse beam width. Beam width is a function of equipment design. A narrow beam width is desirable because it concentrates the sound pulse, reducing unwanted side reflections and increasing the depth of penetration and the amount of energy reflected.

The tuned transducer acoustic subbottom profiler, with a 10 kw booster amplifier, is perhaps the best suited for archaeological purposes. Its penetration depth is to 30 m, which should be sufficient to detect historic or
prehistoric sites buried beneath the sea floor. In addition, it can be tuned over a range of 3.5 to 7 kHz, allowing for variation in depth and resolution (Sieck and Self 1977).

A new swept-FM, digital subbottom profiler, the chirp sonar system, may surpass all previously available subbottom profiler equipment used to detect archaeological sites. The system, available from Datasonics, Cataumet, MA, utilizes modern digital signal processing algorithms and hardware to generate high-resolution images (Schock and LeBlanc 1990).

The Columbus Caravels Archaeological Project at St. Ann's Bay, Jamaica, uses all three pieces of remote-sensing equipment. Project strategy calls for use of the new chirp subbottom profiler in conjunction with a side-scan sonar and a magnetometer to search for the remains of the two ships left in St. Ann's Bay by Columbus in 1504 (Morison 1983). The two ships were purposely run aground, so, although the wooden superstructures would have decayed over time, the integrity of the ballast and lower ships' hulls under the ballast stones should be intact. Also, since the ships were not wrecked, and Columbus and his men were rescued, it is not expected that cannons, anchors or other large metal objects were left behind. Such a scenario reduces the likelihood that a magnetometer will detect the site. The probable nature of the site indicates that the
best chance for detecting the ships' remains may be offered by a subbottom profiler.

Historic records indicate that the ships left in St. Ann's Bay were approximately 23 m long and 7 m wide. Therefore, since the vessels were run aground side-by-side, the expected target size is about 46 m by 14 m. With the smallest dimension of the target expected to be about 14 m, a box-grid survey will be run using 10 m center lines.

The signature of the site should be diagnostic because the target area is represented by two ballast piles positioned side-by-side. It is expected that the site will be represented by two distinct mound-like structures approximately in line with one another and about 4 m apart. Once such a target is located it will be tested by limited excavation or coring to determine its potential for being the Columbus Caravels site.

3.3.3 Excavation

Assuming that conservation facilities, as discussed on pages 157-163, are in place, preparations for excavation can commence once the site is found. First the visible portions of the site should be photographed, recorded by video camera and mapped (site recording cannot be over-emphasized) using a prime datum point positioned far enough off site so that it will not be disturbed during excavation. The prime datum point is permanent and all
subsequent data points will be referenced to it. Next, remote-sensing equipment should be used to delineate portions of the site that are buried. Coring--taking samples of soil with a drilling device--may also be used for determining a site's parameters. Secondary data points, positioned at convenient locations, should be established so that any part of the site can be measured from at least three points (four is preferable). This will allow measurements to reflect the spacial location of measured artifacts (both vertical and horizontal). The shorter the distance between artifacts to be plotted and the data points used, the better; often measuring tapes are pulled and pushed by ocean currents, which distorts measured distances. If applicable, a grid system of excavation control should be used. Often this is not practical due to ocean currents and wave surge, which displace the grid.

Overburden of coral, sand and sediments can be removed by the use of water or air dredges. Care must be used to prevent the accidental movement of small artifacts. As artifacts are uncovered they must be plotted, mapped, photographed and tagged in place, and then carefully removed and delivered to the conservation facility.

Why be so careful and meticulous? Because the artifacts and their relationships to one another tell the story. For example, a seemingly random group of small lead
weights, when plotted on a map, may outline what was once a fishing net. A scatter of pottery and miscellaneous metal pots, when plotted, may reveal the location of the ship's galley. A grouping of expensive ceramics versus a grouping of less expensive eating-ware may indicate separation of dining facilities for officers and crew.

Artifacts submerged in the sea for many years can become extremely fragile. Upon exposure, delicate objects can be damaged by ocean currents if left in place for an extended time. Often it is necessary to place sand bags over exposed ship's timbers to prevent damage from excavation activities and ocean currents.

Excavators frequently come upon fragile artifacts, e.g., vegetable matter, cloth or rope, that can withstand little handling. Small collection bags and various sizes of plastic containers must be present on site to facilitate the removal of such items.

Artifacts such as olive jars should be kept upright and full of water when removed from the site. Only at the conservation lab should the water be carefully removed and screened in order to recover pollen, seeds, pits, or other organic material that may indicate what had been stored in the containers. A special laboratory washing procedure can even recover pollen that has adhered to the surface of pottery.
Samples of sediment at all discernable layers of the site should be collected for later laboratory analysis. Often seeds, pollen, charcoal and other types of organic material can be recovered. Particular attention must be paid to collecting sediment samples found in the bilge of ships. Sediments can contain organic material representative of cargos, pests, foods consumed on board and ports of call. Stressed here, and discussed in detail in the conservation section (pages 155-228), is the importance of keeping all recovered artifacts wet at all times.

A master log that records the progress of the project and the daily assignments and activities of all project personnel must be maintained. A master photographic log and a master artifact log also must be maintained. In addition, each member of the excavating team must keep a daily personal journal. In this journal each person records his daily excavation activities, including descriptions and drawings of where the person was working; artifacts he encountered; and sediment types found. Personal journals also should record general and intuitive impressions of the site. The journal should contain references to all artifacts tagged (including number, map reference, coordinates) and references to photographs taken.
At the end of a field season or the end of the project, the site should be sealed to prevent damage from currents, storms or inquisitive divers. A good method is to fill bags with sand and place these around and over the areas excavated. The bags, along with all exposed areas, are then covered with sand and sediments. This can be done easily using air or water dredges.

3.4 Contracts with Nonprofit Organizations and Universities

Governments can contract with accredited universities or institutions to conduct research using the host nation's cultural resource as a data base. This method allows for the orderly investigation, recording and reporting of archaeological sites, while the nation retains ownership of all recovered material. Such a method has been used successfully in Jamaica (Hoyt 1984; Parrent 1989), the Cayman Islands (Smith 1979), Bahamas (Smith et al. 1985), and Turks and Caicos Islands (Keith et al. 1984).

Nations also can allow accredited universities to conduct field schools at archaeological sites. Here again, the site is excavated carefully, and the host country retains all recovered artifacts. In addition, the host country can use the visitors' field schools to gain training for its own citizens. Field schools have been used successfully in the United States (Broadwater 1986;
Steffy et al. 1981), Bermuda (Watts 1989), and Jamaica (Hamilton 1986).

Agreements between universities, institutions or nonprofit organizations and countries with archaeological sites are not uncommon. For instance, Turkey, which has long protected its ancient sites, has allowed archaeologists from all over the world to excavate its cultural properties while retaining strict control and ownership of those properties. For over 25 years, the Institute of Nautical Archaeology (INA), led by Dr. George Bass, founder and archaeological director of INA, and professor of Nautical Archaeology at Texas A&M University, has conducted research and shipwreck excavations along the coast of Turkey (Bass 1987: 693-732) to the mutual benefit of both Turkey and INA. The wrecks discovered in Turkey's waters by Dr. Bass's teams are some of the oldest known shipwrecks and are providing researchers with a wealth of new information about the Bronze Age, while contributing to a tourist boom in Turkey, to a deep sense of national pride among Turks in their magnificent sites and museums, and to promoting the world's positive image of the country.

Bermuda, though not a Caribbean country, is an island that shares many maritime traditions with nations of the Caribbean, and it has successfully used field schools from Brown University and East Carolina State University to explore and excavate some of Bermuda's historic ship
archaeological sites. In the Caribbean, the Institute of Nautical Archaeology has had contracts with Jamaica, the Cayman Islands and Turks and Caicos Islands.

Presented next are actual working contracts between the government of Jamaica and organizations known by the government to be reliable and trustworthy. Unlike the contract discussed in Section 2 (pages 9-40), these contracts insure that the government retains ownership of all recovered artifacts. While these contracts are a great improvement over treasure hunting contracts it is pointed out that such contracts should not be negotiated between governments and organizations whose background or integrity may be unknown or in question. More rigidly constructed contracts may be warranted in cases not involving universities or organizations with a proven background in marine archaeological endeavors.

3.5 Contracts Between INA and Jamaica

3.5.1 Port Royal Excavation and Field School

A version of the following contract for archaeological investigation of the sunken city of Port Royal, Jamaica, was first instituted in 1981 between the government of Jamaica, Texas A&M University and INA; a similar contract exists today. Copies of the contract are on file at INA headquarters in College Station, Texas. The project is conducted as a Texas A&M University field school, with the
support of INA. Jamaican personnel have received valuable training in all aspects of associated archaeology at the field school, and Jamaica keeps all artifacts recovered from the site.

3.5.2 Port Royal Contract

HEADS OF AGREEMENT BETWEEN GOVERNMENT OF JAMAICA
AND INSTITUTE OF NAUTICAL ARCHAEOLOGY

WHEREAS the Government of Jamaica (GOJ) wishes to carry out underwater archaeological excavations and surveys at Port Royal, Jamaica for the purpose of developing a cultural resource management plan to scientifically research, as well as protect and preserve the archaeological and historical resources of the submerged sections of Port Royal in Kingston Harbour and to locate and recover such artifacts and material of archaeological and historical significance, and to develop expertise within Jamaica in order to continue and extend these activities.

AND WHEREAS the Government of Jamaica has requested the Institute of Nautical Archaeology and the Department of Anthropology of Texas A&M University, College Station, Texas, U.S.A. (hereafter referred to as "the Permittee") to afford certain assistance with this research during the period 31st March 1986 to 31st March 1987 and the Permittee has agreed to undertake during the period 31st March 1986
to 31st March 1987 in association with the GOJ, a research program to identify and excavate, to the highest archaeological standards, the archaeologically and historically significant sites that may be located at Port Royal submerged in Kingston Harbour, the parties hereto have set out here under the following principle:

1. This agreement will end on the 31st March 1987.

2. The GOJ agrees that no other licenses or permits for the exploration for or excavation of historic submerged sites at Port Royal will be granted during the period of this agreement.

3. All publications and film rights arising from these operations will vest in the Permittee, provided, however, that credit is acknowledged to Jamaican contributors and that drafts of all material to be published are submitted for vetting by the GOJ and that a suitable number of copies is made available to the GOJ post publication; and every effort will be made by the Permittee to obtain proper publicity to promote tourism and enhance the image of Jamaica. The GOJ will make every effort to coordinate with the Permittee the dissemination of local and international media coverage, the Permittee will ensure that copies of all important and relevant data on each excavation season is submitted to the GOJ as well as interim
reports prior to the commencement of the following season.

4. All materials recovered during the operations will be the property of the GOJ and the Permittee will not remove from the jurisdiction of the GOJ or utilize any such artifacts or materials without first obtaining written permission from the GOJ, such permission being used solely for the maximum benefit to Jamaica to further her educational, historical and cultural heritage and not for any other intrinsic value which could be derived therefrom.

5. The Permittee will:
   a) Employ at no cost to the GOJ, other than those identified below, the necessary state of the art technology, and training for Jamaican personnel in the use of the same, for the purpose of conducting in the waters of Jamaica underwater archaeological surveys, locating and recording submerged sites, exploring and establishing the extent and nature of such submerged sites, as well as excavating and preserving for later detailed examination such artifacts as may be discovered during the survey.
   b) Strive to raise outside monies and support by submitting research proposals to U.S. federal, international and private funding agencies to conduct the archaeological research and to develop
the conservation and support facilities of the Archaeological Division of the National Trust Commission at the Old Naval Hospital in Port Royal.

c) Conduct the archaeological operations expeditiously and in a diligent and professional manner, utilizing properly qualified personnel in accordance with the highest archaeological standards and the highest safety standards.

d) Exercise every effort to preserve the environment and natural ecology of the research areas.

e) Use its best endeavors to insure the effective imparting of technological skills to Jamaican personnel, and to utilize as far as is practical, Jamaican personnel in the conduct of operations.

f) Ensure that the Jamaican Defense Force Coast Guard (JDFCG) shall have inspection access at all times to the marine craft used by the Permittee. The GOJ will ensure that the JDFCG will provide any reasonable assistance requested by the Permittee which is within their capability.

g) Do every thing possible to provide assistance to a qualified Jamaican who passes the academic qualifications for admission to the Graduate Program in Nautical Archaeology in the Department of Anthropology at Texas A&M University.
6. The GOJ will:

a) Provide the Permittee with such licenses and/or permits as it may require under the Wreck and Salvage Law and any other appropriate legislation.

b) Provide the approved personnel of the project with work permits.

c) Exempt the Permittee's equipment from all local tariffs, customs, import, and stamp duties by providing the Permittee with an Open (Import) Permit or other exemptions to import all necessary diving, excavation, photographic, laboratory, conservation, and computer equipment, supplies, and materials. This is to include repair or replacement parts required to repair and equipment imported to Jamaica under the terms of this agreement.

d) Provide the Permittee with the permits, waivers, and licenses necessary to import, free of all duties, taxes, and fees, an approved motor vehicle to facilitate carrying out the obligations and business of the project.

e) Allow the Permittee to import duty free, the canned, dry and other food products necessary to feed the project personnel, as approved by the Prime Minister in a letter dated July 7, 1985 on
file as C126/117 with the Collector of Customs in Kingston.

f) Provide security for all the Permittee's equipment in use and storage in Jamaica.

g) Provide trucks and assistance in delivering the equipment shipped from Texas, via Kaiser Aluminum Co., Discovery Bay, to the project headquarters in Port Royal and from Port Royal back to Discovery Bay.

h) Assist the Permittee's historian in getting access and permission to copy or microfilm, at the Permittee's expense, all relevant documents and archives housed in the Island Record Office and Public Archives in Spanish Town and the West Indies Reference Library at the Institute of Jamaica in Kingston. Copies or microfilms of all duplicated records will be made available to the Archaeological Division of the National Trust Commission to facilitate 17th and 18th century historical research of Port Royal. Where possible existing microfilm service will be used.

i) In the event that artifacts and materials are discovered, the GOJ undertakes to provide the requisite storage and environmental conditions, for the proper preservation of all such artifacts
and materials as determined and recommended by the
Permittee and approved by the GOJ.
j) Coordinate the activities to carry out the terms
of section 4-a through 4-j with relevant
Government Agencies, Offices and Institutions.

7. On a yearly basis, either party of this agreement may
conclude arrangements for the revision or extension of
this agreement on terms to be agreed.

Dated this ____________ day of ____________19__

3.5.3 Columbus Caravels Archaeological Project, St.
Ann's Bay, Jamaica

The contract presented below (for the search and
excavation of Columbus's two caravels left in St. Ann's
Bay, Jamaica by Columbus in 1504) was signed by the GOJ and
INA recently. Copies of the contract are on file at INA
headquarters in College Station, Texas. The project has
commenced with funds provided by INA and Texas A&M
University.

3.5.4 Contract for St. Ann's Bay

AGREEMENT

This Agreement is made between the JAMAICA NATIONAL
HERITAGE TRUST a body corporate established and existing
under and by virtue of the Jamaica National Heritage Trust
Act with offices at 79 Duke Street in the city and parish
of Kingston (hereinafter called "the Trust") of the FIRST PART AND the INSTITUTE OF NAUTICAL ARCHAEOLOGY, Texas A&M University, College Station, Texas 77841, United States of America (hereinafter called "the Permittee") of the SECOND PART.

WHEREAS the Trust wishes to carry out under water archaeological surveys and excavations within Saint Ann's Bay (in the area more particularly described in the Schedule herein) for the purpose of locating and excavating the remains of two caravels beached and abandoned by Christopher Columbus in 1504 and to scientifically research, as well as protect and preserve the archaeological and historical resources of Saint Ann's Bay, and to locate and recover such artifacts and materials of archaeological and historical significance and to develop expertise within Jamaica in order to continue and extend these activities.

AND WHEREAS the Trust has requested the Permittee to assist with this research during the period January, 15, 1990 to December 31, 1994 and the Permittee HEREBY AGREES to undertake in association with the Trust, a research programme to survey and identify and excavate to the highest archaeological standards, the archaeological and historical site located at Saint Ann's Bay and described in the Schedule herein.

AND WHEREAS the parties agree as follows:
1. This agreement shall commence on January 15, 1990 and end December 31, 1994. The parties to this Agreement will review this contract annually and if necessary, make arrangements for the revision and/or extension of this Agreement on terms to be agreed.

2. The trust hereby agrees that no other licenses or permits for the exploration of, or excavation of historic submerged sites at Saint Ann’s Bay as set out in the Schedule herein, will be granted during the period of this Agreement.

3. All exclusive rights to research data shall vest in the Permittee for a period ending two years after the termination of the contract/project.

4. Save where the Permittee gives permission to another author to use the information, all publications rights arising from these operations will vest in the Permittee, provided, however, that proper credit is acknowledged to Jamaican contributors and the drafts of all materials to be published, is submitted for vetting by the Trust in order to verify the accuracy of the contents therein, and that proper credits have been acknowledged and further that:
   a) A suitable number of copies of all publications are made available to the Trust.
   b) Every effort will be made by the Permittee to obtain proper publicity, to promote tourism and
enhance the image of Jamaica, and to co-operate with Jamaica in its promotion of the Columbus Quincentennial.

c) The Trust will make every effort to coordinate with the Permittee, the dissemination of local and international media coverage.

d) The Permittee will ensure that copies of all important and relevant details such as maps, diagrams, logs, diaries, artifacts lists, slides, videos and any other information and interim reports are submitted to the Trust on the 31st of January commencing January 1991. A yearly research article will also be produced by the Permittee.

e) All materials recovered during the operations will be the property of the Trust and the Permittee will not remove any such material from the jurisdiction of Jamaica, or utilize any such artifacts or materials without first obtaining the written permission of the Trust; such permission being solely for the maximum benefit of Jamaica, and to further her educational, historical and cultural heritage, and not for any other intrinsic value which could be derived therefrom.

5. a) Film Rights arising from these operations shall vest in the Permittee and the Trust jointly, save
and except for those productions done for use locally and within the Caribbean region, for the benefit of Jamaica and the enhancement of its tourism and education, which shall vest solely in the Trust.

b) The Permittee shall enter into any negotiations with third parties concerning film rights and shall sign any contracts thereon for and on behalf of itself and the Trust.

c) The Permittee shall ensure that a suitable number of any film productions arising from these operations are made available to the Trust.

6. Any revenue accruing to the Permittee as a result of publications whether of a technical or popular nature and film productions that exceeds the cost of the project shall be shared equally with the Trust.

7. The Permittee will:

a) Indemnify the Government against all claims of public liability and/or (personal) liability, to its staff and workers, arising from the execution of excavatory works under the contract.

b) Provide at no cost to the Trust, the necessary state of the art technology and training for Jamaican personnel in the use of the same, for the purpose of conducting in the waters of Jamaica, underwater archaeological surveys, locating and
recording submerged sites, exploring and establishing the extent and nature of such submerged sites, as well as excavating and preserving artifacts.

c) Be responsible for the conservation of all salvaged material and to this end they shall ensure, in consultation with the Trust, the efficiency of the conservation programme and provide resources, material and technical assistance for the said conservation programme.

d) Inform the Trust annually of contributions received by the Institute of Nautical Archaeology, in support of the project.

e) Conduct all archaeology operations expeditiously, and in a diligent manner, in accordance with the approved standards of the Trust, utilizing properly qualified personnel in accordance with the highest archaeological safety standards.

f) Ensure the effective imparting of technological skills to Jamaican personnel, and to utilize as far as practicable, Jamaican personnel in the conduct of operations.

g) Ensure that the Trust's counter-part has access at all times, to the excavation sites, record and finds related to this project.
h) Ensure that the Jamaica Defence Force Coast Guard (JDFCG) shall have inspection access at all times, to the marine craft used by the Permittee.

i) Provide five (5) copies of the final field report on this project within two years of the expiration of this contract.

8. The Trust will:

   a) Assign a counter-part to INA's senior representative on this project.

   b) Use its best endeavors to:

      i) Provide such licenses and permits as the Permittee may require for excavation under the Jamaica National Heritage Trust Act, the Wrecks and Salvage Act, or any other appropriate legislation.

      ii) Assist approved personnel for the project in obtaining work permits.

   iii) Assist the Permittee in obtaining an Open (Import) Permit or other exemptions to import for their use, for the duration of the project, all necessary diving, excavation, photographic, laboratory, conservation, and computer replacement parts required to repair any equipment imported into Jamaica under the terms of the Agreement and on completion of the project.
to obtain the necessary permits to return the
said equipment to the United States of America.

iv) Assist the Permittee to import duty-free, donated
canned, dry and other food products required to
feed the project personnel.

v) Assist the Permittee to obtain the necessary
permits, waivers, and licenses necessary to
import free of all duties, taxes, and fees one
(1) motor car and one (1) commercial vehicle to
facilitate effective execution of the obligations
and business of the project at the end of which
the said vehicles are to be returned to the
United States of America.

vi) Provide a suitable small boat for use as a work
boat over the excavation site, fuel and upkeep
for the boat is to be provided by the Permittee.

c) Provide security as far as practicable, for all
the Permittee's equipment in use and storage in
Jamaica.

d) Provide trucks and assistance in delivering the
equipment shipped from Texas via Kaiser Aluminum
Company, Discovery Bay, to the project
headquarters in Saint Ann's Bay, and from Saint
Ann's Bay back to Discovery Bay.

e) Seek the co-operation of the Jamaica Defence Force
Coast Guard in providing reasonable assistance,
requested by the Permittee when it is within their capacity.

f) Provide the requisite storage and environmental conditions, as recommended by the Permittee, and approved by the Trust for the proper preservation of all such artifacts and materials recovered by the Permittee.

g) Provide suitable accommodations for project personnel.

h) Coordinate the activities necessary for carrying out the terms of Clause 8(b); (i)-(vi) herein with the relevant government agencies, offices and institutions.

9. The Trust reserves the right to terminate this contract before 1994 under the following circumstances:

i) If the Permittee fails to perform any of the obligations agreed to under clauses 4 thru 7 inclusive.

ii) For any criminal conduct engaged in by the Permittee or by any of its servants and/or agents.

Provided in any event that the period of notice shall be 60 days.
SCHEDULE

The excavation area can be defined as the closed waters known as Saint Ann's Bay, as defined by Nautical Charts currently used by the Jamaica Defence Force Coast Guard and which includes the Relic Beach of 1504 and is enclosed within the following coordinates: 1) 18 25' 55" N; 2) 18 25' 23" N; 3) 77 13' 40" W; 4) 77 11' 40" W.

Dated this ____________ day of ____________19__

3.6 Contract Between Tryall Associates Ltd. and Jamaica

The government of Jamaica signed a contract with Tryall Associates Ltd., a nonprofit organization, to survey and excavate historic ship archaeological sites in Jamaican coastal waters. A copy of Tryall's contract is included below. The original contract is own file with the Jamaica National Heritage Trust in Kingston, Jamaica.

3.6.1 Tryall Contract

AGREEMENT dated this 21st day of November 1986, between the Government of Jamaica (hereinafter referred to as "the GOJ") and TRYALL ASSOCIATES, LTD. a company duly incorporated under the laws of the Cayman Islands and having offices located at 666 Fifth Avenue, 21st Floor, New York, New York 10103, U.S.A. (hereinafter referred to as "the Permittee").
WHEREAS the GOJ wishes to carry out underwater archaeological excavations and surveys at Pedro Bank, Jamaica for the purpose of developing a cultural resource management plan to scientifically research, as well as protect and preserve the archaeological and historical resources of Pedro Bank and to locate and recover artifacts and material of archaeological and historical significance within the geographic co-ordinates:

<table>
<thead>
<tr>
<th>Longitude West</th>
<th>Latitude North</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 78 12' 45&quot;</td>
<td>16 45' 10&quot;</td>
</tr>
<tr>
<td>B. 78 14' 48&quot;</td>
<td>17 09' 20&quot;</td>
</tr>
<tr>
<td>C. 77 30' 15&quot;</td>
<td>17 18' 10&quot;</td>
</tr>
<tr>
<td>D. 77 30' 25&quot;</td>
<td>17 18' 48&quot;</td>
</tr>
</tbody>
</table>

(hereinafter called "the designated area");

AND WHEREAS the GOJ has requested the Permittee to afford certain assistance with this research for a period of two years commencing from the date hereof and the Permittee has agreed to undertake during such period in association with the GOJ, a research program to survey, explore, and identify where possible, all shipwreck sites of vessels wrecked prior to 1800 on Pedro Bank and to salvage such parts of the wrecked vessels within the designated area and articles carried in or pertaining to such vessels including cargo, crew possessions, equipment and fittings as the GOJ shall direct after consultation
with the Permittee and in particular its archaeological director;

NOW THIS AGREEMENT WITNESSETH:

1. The period of the contract with the GOJ will be for two years from the date hereof, renewable on the application of the Permittee if, in the GOJ's opinion, the results of the exploration and salvage operations in the initial two years warrant further operations. During the continuance of the arrangement the GOJ will not contract with any other entity for the carrying out of any search or salvage activity within the designated area for vessels wrecked, stranded or derelict prior to 1800.

2. All publications and film rights arising from these operations will vest in the Permittee, provided, however, that credit is acknowledged to Jamaican contributors and that drafts of all material to be published are submitted for vetting by the GOJ and that a suitable number of copies is made available to the GOJ post publication; and every effort will be made by the Permittee to obtain proper publicity to promote tourism and enhance the image of Jamaica. The GOJ will make every effort to coordinate with the Permittee the dissemination of local and
international media coverage and the Permittee will ensure that copies of all important and relevant data on each survey and excavation are submitted to the GOJ in an expeditious manner.

3. All materials recovered during the operations will be the property of the GOJ and the Permittee will not remove from the jurisdiction of the GOJ or utilize any such artifacts or materials without first obtaining written permission from the GOJ, such permission being used solely for the maximum benefit to Jamaica to further her educational, historical and cultural heritage and not for any other intrinsic value which could be derived therefrom.

4. The Permittee will:

a) Finance the cost of the salvage operation. However, the GOJ will provide the use of GOJ facilities for housing, docking and storage of equipment and will use its best endeavour to secure financing from international institutions to assist in defraying the cost of the salvage operations.

b) Conduct the archaeological operations at Pedro Bank expeditiously and in a diligent and professional manner, utilizing properly qualified
personnel in accordance with acceptable archaeological standards.

c) Exercise every effort to preserve the environment and natural ecology of the research areas.

d) Use its best endeavors to insure the effective imparting of technological skills to Jamaican personnel, and to utilize as far as is practical, Jamaican personnel in the conduct of operations.

e) Ensure that the Jamaican Defense Force Coast Guard (JDFCG) shall have inspection access at all times to the marine craft used by the Permittee.

f) Provide space aboard the research vessel for a GOJ designated inspector.

5. The GOJ will:

a) Provide the Permittee with such licenses and/or permits as it may require under the Wreck and Salvage Law and any other appropriate legislation.

b) Provide the approved personnel of the project with work permits.

c) Exempt the Permittee's equipment from all local tariffs, customs, import, and stamp duties by providing the Permittee with an Open (Import) Permit or other exemptions to import all necessary diving, excavation, photographic, laboratory, conservation, and computer equipment, supplies, and materials. This is to include repair or
replacement parts required to repair any equipment imported to Jamaica under the terms of this agreement.

d) Provide the Permittee with the permits, waivers, and licenses necessary to import, free of all duties, taxes, and fees, an approved motor vehicle to facilitate carrying out the obligations and business of the project.

e) Allow the Permittee to import duty free, the canned, dry and other food products necessary to feed the project personnel.

f) Provide suitable accommodations at Admiralty House in Port Royal for the personnel of the project.

g) Provide security for all the Permittee's equipment in use and storage in Jamaica.

h) Ensure that the JDFCG will provide reasonable assistance requested by the Permittee when it is within their capability.

i) Provide trucks and assistance in delivering the equipment shipped from Texas, via Kaiser Aluminum Co., Discovery Bay, to the project headquarters in Port Royal and from Port Royal back to Discovery Bay.

j) Provide a suitable small boat for use as a work boat over the excavation site. Fuel and upkeep
for the boat will be provided for by the Permittee.

6. The GOJ will be responsible for the conservation of the salvaged material. However, the Permittee will cooperate with the GOJ to ensure the efficiency of the conservation programme and will use its best endeavour to provide, or identify sources of, material and technical assistance to the conservation programme instituted by the GOJ.

7. In the event that articles of intrinsic value are salvaged then, in order to defray the direct costs of the Permittee's operations, the GOJ will reimburse the Permittee the equivalent of 25% of the appraised value of the artifacts with intrinsic value, or the direct costs of operations which have not otherwise been defrayed by GOJ contributions, whichever is the lower.

8. This Agreement represents the entire Agreement between the parties hereto and supersedes all previous understandings, arrangements and agreements on the subject.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed by their duly authorized representatives the day and year first above written.

Dated this ______________ day of ____________19__
3.7 Developing Local Skills

A government can assist its own citizens in acquiring appropriate training in anthropology, archaeology and conservation and thereby develop its own cultural resources for the benefit of the people. Training may be obtained from various universities in the United States, e.g., Texas A&M University at College Station, Texas, or East Carolina University at Greenville, North Carolina. Also, the University of the West Indies, Kingston, Jamaica has recently employed an archaeologist and is now offering courses in anthropology and archaeology. Funds for training can be obtained through such bodies as the Organization of American States and UNESCO. Developing local expertise is the best method for studying and protecting each country's cultural resource base.

Regardless of the method chosen to deal with cultural resources, it is imperative that governments develop a cultural resource management plan.
4. CULTURAL RESOURCE MANAGEMENT

4.1 Cultural Resource Management Defined

Cultural resource management is defined here as the development and maintenance of programs designed to protect, preserve, scientifically study and otherwise manage cultural resources for the benefit of the people whose ancestry is represented by the resource. This includes prehistoric and historic sites.

4.2 Necessity For Cultural Resource Management

Cultural resources are part of a country's history and prehistory, and as such they are a valuable, but finite, non-renewable asset. A nation's cultural resource base must be properly managed if maximum benefit for the country's people is to be realized. A haphazard, unplanned management approach will lead to confusion and will increase chances of outside manipulation, resulting in the loss of an irreplaceable resource base. Countries without a firm plan to protect and develop their cultural resources are more likely to fall prey to unscrupulous treasure hunters than those with a well thought out management plan. In addition to protecting cultural heritage, a cultural resource management plan, if properly implemented, can be a boon to the local economy by increasing tourism, and can be
a stimulating factor in education by bringing recognition to local historic events.

Additional information concerning cultural resource management can be found by referring to King et al. (1977), McGimsey and Davis (1977), Schiffer and Gumerman (1977), Towle (1985) and UNESCO (1981, 1979).

4.3 Predictive Models

An important component of a cultural resource management plan (CRMP) is the development of a predictive model for identifying areas that have a high potential for containing archaeological sites. Obviously, areas likely to contain historic sites require more intensive monitoring than areas with little potential for containing such sites. For historic ship archaeological sites, "loss traps," (Schiffer 1975) where vessels were likely to sink due to natural phenomena, such as storms, reefs, shoals, etc., are not the only factors defining where underwater sites might be found. Figures 1 and 2 illustrate the many varied elements to be considered when developing predictive models for historic ship archaeological sites in the Caribbean. Cultural system criteria, e.g., safe harbors, availability of fresh water and exploitable flora and fauna (Trubowitz 1977:146), for site location will be conditioned by variable parameters, ranging from vessel age to incidence of warfare. Variables such as seaworthiness or warfare
SHIP CONCENTRATION CRITERIA

PERIOD SAILING ROUTES

Arrives Destination Safely

Comes To Grief

Sinks in Shallow Water

Runs Aground
reefs, shoals, sand bars, barrier islands

Sinks at Sea (deep water)

(Cause)

Abandon

War

Fire

Seamanship

Storm

(Cause)

Economics

Condition of Ship

War

Squall

Hurricane

Harbor

Channel

Anchorage

Coastal

Waterways

Storms

Condition of Ship

Seamanship

Navigation

Purposely

(Type)

Overuse

One-Way

Condition of Ship

War

Political

Economics

Squall

Hurricanes

Great Hurricanes

Minimum Ship Loss

Some Ships Sink

Large Number of Ships Sink

Figure 1. Ship Concentration Criteria
Figure 2. Ship Preservation Factors
will interact with the natural environment to create conditions favorable for the occurrence, location and preservation of historic ship archaeological sites.

Environmental factors influencing site preservation will vary from region to region (see Figure 2, page 86). Ships that sink to a hard sea floor are exposed to the ravages of teredo worms, microbiological agents and ocean currents. Microbiological agents require oxygen to survive; consequently buried organic material is protected. Teredo worms cannot live in wood covered by sediments. Therefore, wrecks sinking in areas with bottoms of sand or clastic sediments will suffer less destruction than those coming to rest on a hard sea floor. Wreck remains covered with sand are protected from the destructive forces mentioned above, but sand is transient, and what is covered today may not be covered tomorrow. Clastic sediments, such as mud and clay, offer the best protection for wreck sites. Once ship remains are buried in clastic sediments they are protected from damage by teredo worms, microbiological agents, and wave and current actions.

Several obvious geographical features may be used to predict the locations of historic ship archaeological sites. Included are the locations of deep harbors, shoals, reefs, sandbars and barrier islands; however, the role of these obstacles to navigation, as well as the role of deep water and safe harbors, must be considered only along with
the knowledge that the shape, size, depth and location of geographic features can change dramatically over time. What was once an open channel may now be a sand bar, and today's shallow marsh may have been a deep harbor in the not-too-distant past (Kraft et al. 1975, 1980; Mitchell and Keegan 1987). Historic maps, sailing charts and literary research will yield much information on the subject and will indicate areas currently disguised but likely to contain historic ship archaeological sites.

Planners should also keep in mind that ship remains can be found almost anywhere underwater because some vessels sank without having struck a shoal, reef or sandbar. Ships that set sail from Spain to the New World were often in poor condition (were intended to sail one-way) and overloaded with cargo. The condition of the ships is best illustrated by a letter dated April 19, 1553 to the Crown from Bishop Perpetuo which states in part:

During this time four French ships attacked the armada and approached close enough to fire at us. They could maneuver easily, while our ships were so heavily loaded that we could neither fight nor navigate. Thus, it is very important to the service of His majesty that Your Highness advise and order the greatest solicitude and vigilance in the inspection of the ships that sail from
Spain so as to avoid the lies and treachery that occur during the inspections that allow these rotten ships, leaking like sieves, to sail from these ports so heavily loaded with merchandise and people that in no manner can they navigate or be valorous. And, because the owners of the ships have their vessels insured, along with their merchandise and wealth, they can let the ships flounder at sea and sink, saving themselves in the lifeboats while the passengers lose their lives and wealth. And what is worse is that if the merchandise is worth 500 and the ship 1,000 they insure at double the value. This is understood by the experience of this armada—that they could have brought a ship to port to be saved, along with its merchandise but, because they say the insurer has no obligation in port, they wanted to let it go to the bottom [McDonald and Arnold 1979].

Special attention should be given to areas likely to contain historic sites whenever government agencies plan or approve developments or projects that will effect the area. A CRMP should also identify specific archaeological sites that are threatened by development or exploitation, and
investigate, protect and, where warranted, excavate the threatened sites.

4.4 Site Preservation

An important part of a CRMP is the preservation of historic ship sites. Not all sites warrant excavation, on the contrary, one should have a valid scientific reason to excavate any archaeological site. A properly designed CRMP takes into consideration the preservation of some sites for posterity. This not only allows for future educational and economic benefits, which come from actively dealing with historic sites, but will preserve sites that may be more beneficially examined through some yet unknown research method and will allow future researchers to examine new questions concerning the past.

4.5 Ecological Impacts

A CRMP must consider all aspects of a planned action. A CRMP is concerned not only with protecting archaeological sites but also with potential negative ecological effects from historic ship excavations and excavation methods. Such considerations are especially important for such areas as the reef system around the island of Anegada in the BVI. Research indicates that there are hundreds of shipwrecks of various ages scattered about the reef of this small coral atoll in the BVI group of islands. Treasure hunters
consider these wrecks to be prime targets for their activities. Several treasure hunting groups have proposed contractual arrangements with the BVI government to work sites around Anegada; but, in light of problems experienced with treasure hunters in the past, the BVI government is taking a cautious approach to future contracts concerning historic ship archaeological sites in their territorial waters.

Anegada's importance to archaeology may be surpassed by its importance to regional marine ecology. Anegada, the only coral island in the Virgin Islands, is the northernmost island in the chain and, in regard to prevailing wind and current, is up current from the rest of the islands. Coral polyps, spawned on Anegada's reef system, float with the current, rejuvenating, as well as establishing, coral formations throughout the island group. The reef may also furnish a protected spawning environment for many local fishes. Damage caused by extensive excavations on Anegada's reef could have far-reaching effects on the marine ecology of the Virgin Islands.

In 1982 Mr. Bert Kilbride, a BVI businessman interested in working local historic shipwreck sites, obtained a letter from Mr. E. A. Shinn, from the United States Department of the Interior, Geological Survey Energy Resources Division, addressing the issue of coral damage resulting from sediment suspension and subsequent
settlement on corals. In his letter Mr. Shinn discussed suspended sediments from two hurricanes on the Florida reef tract and the apparent negligible effects that the suspended sediments had on local corals. He also discussed his experience with sedimentation suspension caused by oil well drilling and its lack of damage to nearby corals.

Drawing parallels between a vast coral ecosystem such as Florida's and the small coral reef of Anegada is ill-advisable at best. The difference between the two is apparent when one realizes that, where the reef system along Florida's coast is measured in hundreds of miles, the reef around Anegada is measured in feet. Extrapolations such as those proposed by Mr. Shinn are only valid between similar systems. Small isolated ecosystems such as the reef around Anegada are much more sensitive to disturbances than are larger more versatile systems. Loss of a few hundred yards of coral formation along the Florida coast would have little long-term effect overall; the same loss around Anegada could be devastating to the marine ecosystem of the Virgin Island group.

In his letter Mr. Shinn states:

...it is my opinion that unless corals are physically buried, high sedimentation of sand and silt for the length of time required to dig into a sunken ship will have negligible effect. If,
however, the excavating is done right on a reef where there are living corals within 50-75 ft then there is a likelihood of their being buried and killed [Shinn 1982, letter on file with BVI Minister of Culture].

It is important to point out that the archaeological sites being considered for excavation are on the living coral reef around Anegada and that certain methods used in excavations will cause damage to nearby coral structures.

Figures 3 and 4 are aerial photographs of treasure hunters working along the coast of Florida. These photographs graphically depict the amount of suspended matter and extensive bottom damage caused by "mail box" sand blasters, a favorite tool of treasure hunters. In Figure 3 note the numerous holes blasted into the sea floor. Figure 4 shows a large sediment plume extending down current from the treasure hunters' work boat. It is obvious that nearby coral would be buried by sand blasted from the holes shown in Figure 3.

Nations contemplating excavations near reef systems should consult a local reef management specialist. For example, while visiting the Virgin Islands I traveled to St. Croix where I discussed the problem of suspended sediments and coral damage with marine biologists at the West Indies Laboratory of Fairleigh Dickinson University.
Figure 3: Treasure hunter's boat equipped with "mail box" sand blasters working off the coast of Florida. The round circles (depressions) in the foreground are holes blasted into the sea bottom.

Figure 4: Photograph of long silt plume extending down-current from treasure hunter's boat.
They expressed concern about damage to the Anegada ecosystem from treasure hunting activities and are willing to discuss the problem with BVI officials. It is highly recommended that scientists who are well-versed in regional ecologies be contacted for information concerning activities that might damage local ecosystems.

4.6 Economic Considerations

The potential economic benefits of archaeological resources must be considered in a CRMP. Many countries successfully use their cultural resources as tourist attractions. In a paper presented at the 1990 Society for Historical Archaeology Conference on Historical and Underwater Archaeology, Peter Throckmorton reported that a recent study of the economic impact of the arts, including museums, in Britain shows that 27% of earnings from tourism are attributable to cultural attractions. In Sweden, according to the Swedish tourist board, one million tourists spend an extra day in Stockholm to view the Vasa, a 1628 warship salvaged intact from Stockholm Harbor in 1961. The Swedish government estimates that this translates to an extra $300.00 per day per tourist, amounting to several hundred million dollars per year added to Sweden's economy (Throckmorton 1990:1-6). Throckmorton also states:
Traditional sources of income for many Caribbean islands have declined in the past ten years. Value of sugar exports from the Dominican Republic in 1987 were a third of what they had been in 1977, and in the smaller islands, Jamaica's bauxite exports are down by over one half in the same period. In contrast, tourism, two-thirds of it North American, has increased in all the islands. In Jamaica, the Dominican Republic, St. Kitts and Nevis, St. Lucia, Antigua, and the Cayman Islands it has doubled since 1980. In St. Martin is has tripled. Today, tourism is rapidly becoming the treasure of the Caribbean [Throckmorton 1990:2].

Dr. Bass, INA's director of Archaeology, on many occasions has pointed out the beneficial aspects of museums. The following comments are his:

The 16th-century warship Vasa, raised from Stockholm Harbor, is the greatest tourist attraction in the entire country of Sweden. It generates many millions of dollars annually - not by museum ticket sales, but by the money visitors to the Vasa Museum spend on train and plane
tickets, taxis, restaurants, hotels, souvenirs, etc., inside Sweden.

In 1960 I saw only one tourist enter the town of Bodrum, Turkey (pop. 5,000): a German hitch-hiker. That year we started a museum in the town's Crusader castle (the museum since then has been totally funded and run by the Turkish government). We had just excavated a Bronze Age shipwreck, and artifacts from it formed the basis for the museum.

Today Bodrum is one of the major tourist centers of Turkey, surrounded by holiday villages. Its vast marina is filled with yachts of all nations, many for the winter. I have been told that 150,000 tourists come through on a single weekend. And Bodrum is said (for better or worse!) to have one of the ten finest discotheques in the world. Last year tourists ranging from Prince Charles to David Rockefeller visited the Bodrum Museum of Underwater Archaeology [George F. Bass, personal communication 1990].

Historic shipwrecks left in place on the ocean floor are superb tourist attractions for scuba divers, and such use is compatible with the preservation of most sites. For
example, the BVI underwater site of the RMS Rhone is a very popular attraction for scuba divers, and scuba divers are a great source of revenue. It is estimated that in the United States alone there are more than three million certified divers. As a group, scuba divers spend large sums of money traveling to dive sites, and few divers would turn down the opportunity to dive on a well-preserved historic ship site. Most sport divers are well-educated, reasonable people who would not tamper with or otherwise disturb an underwater site. As a safeguard against damage, dive operators should be licensed, as discussed in Section 6 (pages 140-143), to conduct dive trips on archaeological sites. They should be well-informed about the importance of monitoring their patrons' activities. In addition to being profitable, the opening of sites to tourists is an excellent way to dispense information about archaeological sites to the public, an often-stated goal of archaeology.

Development of historic resources for economic benefit is not restricted to shipwreck sites, as is demonstrated by the development of Nelson's Dockyard at English Harbor in Antigua. The following figures were cited by George F. Tyson (1985:17-18) and attributed to E. C. Stevens, supervisor of Nelson's Dockyard:
1. approximately 15,000 yachtsmen and 50-60,000 additional tourists visit the English Harbor area each year;

2. between 1971-1980 gate receipts have risen annually from EC$22,000 to EC$151,000; profits from various retail outlets located in the complex rose from EC$3,000 to EC$48,000; income from rentals rose from EC$25,000 to EC$53,000; total earnings from the English Harbor project rose from EC$80,000 to EC$364,000 and net earnings increased from EC$10,000 to EC$61,000;

3. approximately 20 revenue generating businesses operate within the complex, employing 200 persons on a full-time basis (many are being taught new skills in a revival of traditional craft activities);

4. a "spill-over" effect into the immediately surrounding community has created a variety of small business activities [Tyson 1985:17-18].

Positive economic considerations discussed above are not the only economic factors to be considered in a CRMP. The potential expense in actively dealing with the resource base, i.e., excavating sites and conserving and displaying artifacts, must be understood. Such expenses can be great,
and concern about them is often set against the claims of
treasure hunters that hundreds of millions of dollars worth
of treasure is lying about the seabed waiting to be
collected. Such claims would be seductive to any
government—especially to the government of a developing
nation, which cannot ignore what the possible financial
windfalls could do for its country's economy.

It is herein agreed that the physical needs of people
can outweigh the importance of protecting archaeological
sites; however, the two options seldom come into conflict.
In most cases treasure hunters' claims of large treasure
troves are unsubstantiated and only made as a ploy to gain
contracts. If on the other hand, the claim of millions of
dollars worth of treasure is true, it would be imperative
for a government to have a well-orchestrated CRMP in place
before negotiating a contract with treasure hunters, or
with anyone for that matter. Not being properly prepared
with a CRMP would be analogous to the government allowing
someone into the national treasury unattended.

It must be stressed again that treasure hunters do not
have to find treasure in order to make substantial personal
profits. Treasure hunters can search for years using
investors' money, resulting in substantial gains for the
treasure hunters but no gain for investors or for the
countries whose cultural resources they are exploiting.
But, in order to attract investors, treasure hunters must
first obtain a government contract that allows them to work a historic ship archaeological site.

4.7 Artifact Conservation

A nation's financial ability to properly conserve, display and support research on the recovered artifacts must be a major consideration in a well-developed CRMP. If the artifacts raised from an underwater site are not properly conserved, they will deteriorate and become worthless as specimens for study or museum display.

Since it is the artifacts and their relationship with one another that contain the information about man's past, the artifacts must be accurately recorded, conserved and studied. Never should more artifacts be recovered than can be cared for properly. There is no justification for excavating any archaeological site if the knowledge to be gained is lost as the artifacts perish from lack of proper and timely conservation. Conservation is always the responsibility of the excavator.

The fact that conservation of artifacts recovered from a marine site is the most costly and time-consuming phase of the project cannot be stressed too much. Experience has demonstrated that the artifacts recovered during a three month excavation can require from two to five years to conserve (Hamilton 1983). The failure of planners to consider the cost of conservation has caused many projects
to flounder and much historically important data to be lost forever. Basic information on artifact conservation is presented in Section 7 (pages 157-163). Detailed conservation techniques about specific types of material, e.g., iron, ceramics, wood, etc., are discussed in Section 7 (pages 163-228).

4.8 Educational Benefits

Maximizing the educational potential of the nation's cultural resource base is an additional concern in a CRMP. A major benefit of studying archaeological sites is knowledge gained about people who are rarely mentioned in historic records. History contains much information about the elite, i.e., kings, queens, ships' captains, etc., but comparatively little is recorded of the common man. In spite of their importance, the carpenter, potter, metal worker, seaman, etc., were, for the most part, left out of the written historic record. The study of artifacts from properly excavated archaeological sites can reveal much about the past lives of these unsung people. Their skills in woodworking, pottery, metallurgy, building and so forth are recorded in the artifacts they left behind. In the case of prehistoric man the archaeological record is even more important, since it is the only record available for study.
Catastrophic sites such as shipwrecks are unique in that they are depositories of information relating to a particular moment in history. Study of this type of archaeological site affords archaeologists the opportunity to discover much about peoples' activities at the time of the catastrophe.

Historic ship archaeological sites located in the Caribbean represent, much like a history book, the maritime history of the New World. Each site is a chapter that can be deciphered by qualified archaeologists and presented to the public. It is not important or advisable to excavate all of the sites immediately. As long as the sites remain intact, future generations of archaeologists can study them and write their own chapters in the book. What is important is that the present caretakers of this historic reference material, the elected officials of the various Caribbean countries, prevent its destruction through neglect, unscrupulous use, or ignorance of its significance.

An often overlooked, but very important, aspect of scientifically studying cultural resources is the sense of ancestral continuity provided for a nation's people. Such a feeling often contributes to a people's sense of security, community and national pride. This is especially true for children and young adults. Compare this with treasure hunting, which sets the example of destruction of
cultural property for personal gain. Surely the former is far more beneficial for a country.

4.9 Cultural Resource Management Summary

A CRMP is used by those persons who license and permit development projects that may affect cultural resources. Properly implemented it will allow for an equitable balance between development, economic growth and cultural resource protection. A CRMP is a valuable tool for government as it strives to improve the economic, educational and national spirit of the country.
5. HISTORIC SHIP ARCHAEOLOGICAL SITES IN THE CARIBBEAN

5.1 Interest in Caribbean Historic Ship Archaeological Sites

As previously mentioned, the publicity associated with the Atocha treasure has stimulated an inordinate amount of interest in historic ship sites in the Caribbean. From an archaeological point of view, the publicity is having both negative and positive effects on the region's submerged cultural resources. A pronounced increase in activities of treasure salvors seeking new sites to plunder, an increased willingness among private investors to finance treasure hunting activities, and an acquiescent mood among many government officials who see treasure windfalls as solutions to socioeconomic problems have resulted on the one hand. At the same time, publicity of the treasure hunters' victory in court [State of Florida, Department of State v. Treasure Salvors, Inc., 621 F.2d 1340 (5th Cir. 1980)] over the state of Florida has demonstrated to many governments that their submerged cultural resources are vulnerable to outside exploitation and has explicitly shown them the need for legislation designed to protect historic ship archaeological sites from unwanted salvage attempts. Numerous other litigations between states and treasure salvors concerning shipwrecks and states' rights to manage them led to the passage in the United States of Public Law
100-298--April 28, 1988 (Abandoned Shipwreck Act of 1987). This federal law clearly removes historic shipwrecks located in American territorial waters from admiralty court jurisdiction, the traditional source of laws concerning shipwrecks throughout much of the world, including the United States and the Caribbean.

5.2 Historic Ship Archaeological Sites and Admiralty Law

Admiralty law, in particular the law of salvage, has been the most successful tool used by treasure salvors to legitimize their claims on historic ship archaeological sites. Admiralty law, also known as maritime law, is the set of legal rules, partly procedural, partly substantive, which has grown up around the maritime shipping industry and which may date back to the thirteenth and fourteenth centuries.

In England, during the sixteenth and seventeenth centuries, the role of admiralty law diminished and was not revived until the reorganization of the English court system in the nineteenth century. At this time a court of admiralty law, with extensive, though incomplete, jurisdiction over the problems peculiar to the shipping industry, was established by statute. Over time, as maritime traditions changed, admiralty law adjusted to meet the changes. Countries whose legal systems derive from that of England were affected by the changes in England's
laws. Today, many Caribbean countries with an English tradition of law share almost identical salvage laws. Most of these countries have not enacted laws that establish clear ownership of shipwreck sites in their territorial waters. Therefore, treasure hunters who located such sites could claim salvage rights to them.

In a review of events concerning the federal court ruling in favor of salvors in the Atocha case, an attorney, Albert D. Alberi, stated:

One of the remarkable things about admiralty law is that nations with radically different cultures and legal systems accept many of the same principles of substantive admiralty law. In the United States, the Constitution and the Judiciary Act of 1789 gave the responsibility for cases in admiralty to the federal courts. Although the Congress has made changes in admiralty law over the years, many recognized principles of admiralty law cited in modern cases are over a hundred years old. Given some of the sweeping changes in constitutional law made in the last three decades such as civil rights, the enduring quality of admiralty case law is even more noteworthy [Alberi 1981:305].
Salvage, as referred to in admiralty law, is a term used to describe the act of rescuing life and property from peril on the water which, without the salvor's assistance, would result in loss of life or property. "Salvage" also describes the reward to which the rescuers, known as salvors, are entitled for having rescued a vessel in distress.

Maritime law requires that people in the vicinity of a seaworn vessel in distress assist in saving the lives and property of those in trouble, a requirement not shared by witnesses of an accident or catastrophe on land but one which responds to the special circumstances of seafaring. Often, for instance, in the early years of New World settlement, inbound cargos were vital to the survival of colonies and the law of salvage was a method used to encourage others to come to the aid of a waterborne vessel in distress for the purpose of rescuing life and property. Admiralty courts recognized the fact that people were not likely to risk their own ships and lives to rescue the property of others without the added incentive of compensation for such an act, and the law of salvage provides that incentive.

The reason for the seemingly lack of concern or courage on the part of seafarers is not because seamen are less humane than their brothers on shore, but because conditions of rescue at sea are often very dangerous; the
rescuing vessel usually has to place itself in jeopardy during a rescue. Many attempted rescues take place during storms, and near dangerous shoals, treacherous reefs and other sea hazards. Even a high following sea can easily swamp a vessel whose maneuverability is reduced during a rescue attempt. Thus the spirit of the law is to encourage others to come to the aid of an endangered vessel, its cargo and personnel, while the intention of the law is to reward the salvors for their valiant efforts.

How the law of salvage came to be bent and twisted into a tool for the destruction of historic maritime sites is a mystery whose answer may lie in semantics. The use of "shipwreck" to define a historic ship archaeological site is at the root of the problem. Before salvors can claim salvage rights or compensation for salvage of a historic ship, the site must be referred to as a shipwreck, be abandoned and in peril. The first condition is met easily: one only has to refer to all such historic sites as "shipwrecks," and, of course, one could logically argue that the remains of a vessel that has lain on the sea bed for any amount of time fits the criteria of an abandoned vessel, if in truth, it still is a vessel or "shipwreck". The next point, that of the site being in peril, is a little more difficult to establish. Treasure salvors often claim that a "shipwreck" is in peril from the sea because of currents, storms, corrosion, etc., and that they are
entitled to its remains or to compensation for rescuing the artifacts on or about the "wreck". But the peril at sea in the case of old wrecks usually comes from the activities of treasure salvors as they disturb the equilibrium that the site has reached with its environment.

5.3 Historic Ship Archaeological Sites and Their Environment

Objects that come to rest on the sea floor initially start to deteriorate while at the same time becoming covered with concretions (corrosion products, sand and marine organisms). Eventually this concretion forms a protective barrier, greatly reducing further deterioration. Once the artifacts have adjusted to their underwater environment they are almost impervious to currents, tides and most storms. Any wooden sailing vessel that has lain on the sea bed for a few hundred years has long since reached a stage of equilibrium with its environment, and it has the potential to remain preserved for hundreds if not thousands of years. Site surveys and site excavations by leading scholars in the field of marine archaeology have conclusively demonstrated this fact (Bass 1975, 1987, 1988; Lenihan 1987; Throckmorton 1987); however, the remains of a historic ship can deteriorate quickly once the site is disturbed by treasure salvors or archaeologists. Objects of immense historic value can be destroyed in a matter of
hours or days if proper conservation procedures (discussed below on pages 155-228) are not immediately implemented.

5.4 Shipwreck or Archaeological Site

In light of admiralty court rulings favorable to treasure salvors, the importance of discriminating between a shipwreck and a historic archaeological site is apparent. Governments should examine their laws concerning ship sites with such court rulings in mind. Often archaeological sites are classified as shipwrecks with no special provisions for protection. Such circumstances raise the question, "When is a shipwreck not a shipwreck?" It is not a difficult question to answer, but the question's answer requires some background information and a measure of common sense.

First, what thoughts come to mind when the word "shipwreck" is heard or read? Some people would imagine a tragedy, such as the sinking of the Titanic with all its associated human suffering and loss. For others the word "shipwreck" stimulates dreams of diving adventure, romantic images of pirates and chests of gold, silver and jewels. A common vision is of an intact treasure galleon sitting upright on the ocean floor. Such fanciful ideas are often supported by movie and television productions that are intended solely for audience entertainment and not meant to represent factual data.
In reality the visible remains of a sunken historic ship are far less exciting than those imagined. After a few decades underwater, most wrecks of wooden ships are reduced to large piles of coral-covered ballast stones (stones used to stabilize a ship), scattered timbers and some associated iron concretions of cannons, anchors and ships' fittings. Mixed in with these ship remains are artifacts representing period commerce, exploration, and everyday life. The artifacts are of immense value, not in dollars, but in their potential for providing new information and insights into socioeconomic factors of New World exploration and settlement, and of later historic periods.

Gradually over time the remains of what was once a shipwreck slip into the realm of history and the laws intended to settle matters between its unfortunate owners and any possible salvors have ceased to be relevant. No person is in danger and no property is any longer in peril. Any remaining monetary value in the ship and its contents has been overtaken by the historical value of the wreck site and historical property generally belongs to the people of the area in which it is found. This is a widely accepted principle on land and most societies do not condone the plundering of ancient and historic sites for individual gain. There is no rational reason why it should not be the guiding principle for underwater sites as well.
Artifacts recovered from the sites of historic wrecks enable historians and archaeologists to learn much about the people and ships involved in New World exploration and maritime trade. New knowledge obtained from this research is passed on to colleagues, students and the general public through lectures, magazine articles, professional papers, books, TV specials and museum displays. The question, "When is a shipwreck not a shipwreck?", is answered with the recognition that a shipwreck is not a shipwreck when it is a historic ship archaeological site.

Scholars debate about how old a shipwreck should be before it is classified as historic. This same argument is valid for other historic sites. It is generally accepted that a vessel over 50 years old is historic. The cut-off point is necessarily an arbitrary one, but it seems a reasonable period to allow for salvage rights while still protecting historical sites; however a vessel involved in some event of importance that is less than 50 years old may also be considered historic. For example, few would argue about the historical significance of the site of the U.S.S. Arizona sunk during the attack on Pearl Harbor in 1941 and now a war memorial. The same can be said for the German battleship Bismarck and the British battlecruiser H.M.S. Hood. Both were sunk during a naval engagement in 1941.
5.5 Historic Ship Archaeological Sites and Legislation

When the remains of a shipwreck have become more properly a historic archaeological site, and the site is not in peril, how can the site come under the scrutiny of the law of salvage? The fate of our maritime heritage should not fall under a law written with the intent of saving lives and property from the perils of sea travel. Logic suggests that the management of historic ship archaeological sites should not be dictated in admiralty court under provisions of the law of salvage; however, since logic and law are often at odds, individual governments must take steps to protect the sites in question.

Governments can protect their historic ship archaeological sites by legislative action. First, logical criteria (such as the age of the ship or its historic importance) should be used to discriminate between shipwrecks and historic ship archaeological sites to insure clarity of distinction. Second, specific laws should be written so that historic sites are protected from exploitation without prior government approval. Third, significant penalties, such as the forfeiture of vessels and equipment, as well as fines and imprisonment for individuals and heads of organizations who unlawfully disturb historic sites, should be established as a deterrent. Fourth, provisions should be made for
governments to employ archaeologists to represent their interests before any agreement is signed that will result in historic site excavations. It is imperative that the employed archaeologist's salary be paid by or through the government, regardless of the funding source for the salary, in order to define clearly the archaeologist's lines of loyalty and responsibility.
6. PROPOSED CHANGES IN THE LAWS AND REGULATIONS REGARDING
HISTORIC SHIP ARCHAEOLOGY SITES IN THE CARIBBEAN

6.1 Legislative Need

A government may decide to exploit cultural resources for a number of reasons, but the decision should be its own and not one thrust upon it by outside forces taking advantage of outmoded laws or lack of protective legislation.

Here the laws of the BVI, which are basically the same as those of several other island nations in the Caribbean, are examined and discussed as an example. The legislative changes proposed are derived from reviews of the laws or proposed laws of other countries that have a similar maritime tradition--in particular the Maritime Archaeology Act, 1973 of Western Australia and the proposed legislative changes, new legislation and regulations for Bermuda drafted by Dr. Edward Harris, Ms. Cathy Hoyt and Mr. Steven Hoyt (Harris et al. 1986a, 1986b, 1986c). For the most part, the recommendations that follow come directly from reviewed laws, however, in some cases, changes have been introduced that more clearly establish a government's exclusive right to ownership of artifacts recovered from historic ship archaeological sites. If adopted by Caribbean countries, the laws outlined below will greatly
increase each country's ability to protect and manage historic ship archaeological sites.

6.2 Existing Law and Proposed Legislative Changes

6.2.1 General Changes

Currently the law governing historic ship archaeological sites in the BVI is based on the law of salvage. The proposed legislative changes would remove these sites from salvage law and place them under the mandate of the Minister of Culture.

An Archaeological Advisory Board, herein referred to as the Advisory Board, should be appointed to assist the Ministry of Culture or other appropriate body in managing the nation's cultural resources. Members of the Advisory Board should be knowledgeable in the areas of history, archaeology or other fields related to cultural heritage and cultural resources.

6.2.2 Specific Changes

It is proposed here that the current BVI law concerning historic ships be changed from the Receivers of Wreck Act (Amendment) Ordinance, 1968, to the Historic Ship Archaeological Sites and National Collection Act, 19__. Below, sections of the current law are quoted, followed by proposed changes, and then by an explanation for the recommended changes.
Present Law

28C.(1) In this section and in sections 28D, 28E and 28F

(i) The expression "historic wreck" means a wreck, and all the contents and appurtenances thereof, which is not less than twenty-five years old, or has been abandoned by the owner thereof, and is of historic interest or value;

Proposed Changes

28C.(1) (i) The expression "historic wreck" means the remains of any ship, boat or vessel, found in or on the shores of the sea or any tidal water, which is more than 50 years old or which is designated as a historic wreck by the Minister of Culture. This age to be determined from the current year; e.g., in the year 2000, wrecks before 1950 are considered historical wrecks.

Explanation

Any wreck, part of a wreck, or contents of a wreck or any isolated find (i.e., a single cannon) which is more than fifty years old is of historic interest and must be protected. The fifty year criteria is arbitrary, but such criteria is generally excepted as valid within the archaeological community. However, a country may wish to
designate younger sites as protected, i.e., 25 years old, or a government may wish to designate any vessel, regardless of age, as a historic wreck for one reason or another.

Present Law

28C.(1) (ii) The expression "unprotected wreck" means any historic wreck declared by the Receiver by notice published in the Gazette to be an unprotected wreck.

Proposed Changes

Delete

Explanation

Any wreck more than fifty years old is of historic value and should be protected. Therefore, there should be no unprotected historic wrecks. This follows the explanation of 28C.(1) above.

Present Law

28C.(1) (iii) In any proceeding under this Act, a certificate purporting to be under the hand of the Receiver declaring that a wreck is or is not a historic wreck or as the case may be shall be receivable in evidence and shall be prima facie evidence of that fact.

Proposed Changes

Delete
Explanation

Deletion follows from the deletion of number 28C.(1) (ii) above.

Present Law

28C.(2) Notwithstanding the provisions of section 25 every historic wreck at any place or in the territorial or tidal waters of the Virgin Islands shall vest in the Crown absolutely and shall be deemed to pass into the possession of the Receiver.

Proposed Changes

28C.(2) Every historic wreck at any place on the shores or in the territorial or tidal waters of these Islands shall vest in the Crown absolutely and shall be deemed to pass into the possession of the Minister of Culture (hereinafter referred to as "the Minister").

Explanation

The reference to section 25 is removed as it applies strictly to salvage of recent shipwrecks. Throughout this document, references to the Receiver of Wreck have been changed to the Minister of Culture as recommended in the general changes above.

Present Law

28D.(1) The Receiver may in his discretion grant to any person whom he is satisfied is a fit and
proper person a license to explore or remove
or conduct research on any particular
historic wreck or historic wrecks generally.

Proposed Changes

28D.(1) The Minister, based upon the recommendations
of the Archaeological Advisory Board, may
grant a license to explore historic wrecks
generally or for the purpose of conducting
research on a particular historic wreck.

Explanation

An Archaeological Advisory Board would review all
applications for licenses to determine the qualifications
of persons or institutions applying for a license. The
review may involve authorities from outside the country.
The Advisory Board would make recommendations to the
Minister based on its review.

Present Law

28D.(2) The Receiver may attach to any license
issued under this section such terms and
conditions as he may consider expedient.

Proposed Changes

28D.(2) The Minister may attach to any license
issued under this section such terms and
conditions as may be considered appropriate
or necessary.
Explanation

Such terms and conditions should be imposed at the recommendation of the Advisory Board.

Present Law

28D.(3) No person shall dive within the vicinity of a historic wreck or mark, mutilate, destroy, remove or otherwise interfere with or deal in or possess any such wreck or any part thereof or articles in the vicinity thereof unless authorized so to do by license issued by the Receiver or otherwise than in accordance with license so issued to him.

Proposed Changes

28D.(3) No person shall mark, mutilate, destroy, remove or otherwise interfere with or deal in or possess any historic wreck or any part thereof or articles in the vicinity thereof unless authorized so to do by license issued by the Minister or otherwise than in accordance with a license so issued to him.

Explanation

The reference to diving has been removed since sightseeing on historic wrecks is of considerable interest to tourist divers and locals alike. One reason for protecting these wrecks is to make them available to the public. Therefore, while diving should be permitted on
historic wrecks, a look-but-don't-touch policy must be established. Such a policy is in the interest of all divers, particularly commercial dive tour operators, as it preserves the wrecks for future dives.

Present Law

28D.(4) Any person who contravenes the provisions of this section shall be guilty of an offense and shall on conviction by a court of summary jurisdiction be liable to a fine not exceeding one thousand dollars or to imprisonment for a term not exceeding six months or to both such fine and imprisonment.

Proposed Changes

28D.(4) Any person who contravenes the provisions of this section shall on conviction by a court of summary jurisdiction be liable to a fine not less than one thousand dollars and not exceeding fifteen thousand dollars or to imprisonment for a term not exceeding six months or to both such fine and imprisonment.

Explanation

Fines should be substantial in order to deter pillaging of historic wrecks. The cost of small fines can be recovered quickly by selling valuable artifacts taken
from a wreck in a single day, particularly as historic sites are not patrolled regularly.

Present Law

28D.(5) For the purposes of this section the expression "historic wreck" shall not include an unprotected wreck.

Proposed Changes

Delete

Explanation

Deletion follows from the deletion of number 28C.(1)(ii) above.

Present Law

No provision

Proposed Changes (new clauses)

--.(-) When, on the arrest of a person on a charge of an offense under section 28D.(3) or section 28D.(4)

(i) the property in respect of which the offense is alleged to be committed; or

(ii) any vessel, vehicle, equipment, or other thing alleged to have been used in the commission of the offense, is found in his possession or under his control the person arresting him may seize such property or thing and take the same forthwith before a Justice to be dealt with according to law.
Where any property or thing is brought before a Justice under the provisions of this section he shall dispose of it as though it had been a thing seized or taken under the provisions of the Criminal Code.

A court convicting a person of an offense against section 28D.(3) or section 28D.(4) may, in addition to imposing a penalty, order the forfeiture to the Crown of any vessel, vehicle, or other specified equipment or thing, used in the commission of the offense, and any order so made has effect according to its tenor.

The court may, before making an order under this section, require notice to be given to, and hear, such persons as the court deems fit.

Goods in respect of which an order is made under this section shall be dealt with as the Attorney General directs and, pending his direction, may be detained in such custody as the court directs.

A court convicting a person of an offense against this Act may, in addition to imposing a penalty, order the person to pay to the Trustees the full amount of the
antiquarian value of the property damaged, mutilated, destroyed or removed, as the case may be, and the amount so ordered to be paid may be recovered as if it were part of the penalty imposed, notwithstanding that the total of the penalty and the amount exceeds the maximum penalty that may be imposed.

Explanation

The penalty imposed for violations of this Act must be such as to discourage unlawful exploitation of archaeological sites. Many who would violate this law believe that great wealth is obtainable and that small fines are a business expense. Substantial penalties will dispel such beliefs.

Present Law

No provision

Proposed Changes (new clause)

There shall be established a collection of artifacts from historic wrecks at which shall be called the National Collection, such collection being placed in the custody of an appropriate institution, as designated by the Minister, for preservation and exhibit.
Explanation

Unless a National Collection is established and an appropriate repository specified to house that collection and all records appertaining to that collection, artifacts will be lost to the public domain or may be scattered among several institutions rather than held as a cohesive body of artifacts. The cohesiveness of the collection contributes significantly to the historical value of the collection.

Present Law

28E.(1) Where any historic wreck is reported to the Receiver and the right of release, referred to in subsection (2) is not, in the first instance, exercised then the Receiver shall pay to the finder of such wreck such compensation in respect of such wreck, or any articles recovered therefrom, as may be agreed between them or, in default of such agreement, such compensation as may be determined by a sole arbitrator, or arbitrators, appointed by the Administrator: Provided that in any such case the Administrator shall have power to direct, in the alternative to paying any sum awarded by such arbitrator, or arbitrators, that such wreck or articles shall be released to the finder thereof.
Proposed Changes

28E.(1) The Minister shall be entitled to the possession of all finds, artifacts, and other appurtenances without compensation as are recovered from a historic wreck, such recovery being made under terms of the license issued. Such recovered material shall be deemed absolutely into the possession of the Crown as a part of the National Collection of marine artifacts.

Explanations

Past experience has shown that governments are often unable or unwilling to purchase artifact collections when ownership of such artifacts is in question due to the lack of antiquities laws or in cases where the fate of recovered artifacts is determined by admiralty law. Therefore, the only way to bring these items into the public domain is by maintaining government ownership, established in section 28C.(2) above, without compensation to the licensee and for the government to physically take possession of these items. This is a common feature in the legislation of many nations that maintain ownership and possession of all artifacts without compensation, which, in the interest of maintaining a nation's cultural heritage, is the best course of action.
Present Law

28E.(2) Notwithstanding the provisions of section 28D(2) and of any law relating to the disposal of Crown property it shall be lawful for the Receiver, with the approval of the Administrator, to release, to the finder of a historic wreck, such wreck or any articles found therein or appurtenant thereto and in such case and upon such release the title of such articles shall pass to such finder.

Proposed Changes

Delete

Explanation

Deletion follows changes in 28 E.(1) above.

Present Law

28E(3) It shall be lawful for the Receiver by notice published in the Gazette to declare that, in relation to any unprotected wreck specified in the notice, the provisions of subsection (2) shall have effect with respect to the release to the finder of articles found therein without prior reference to the Receiver or to the Administrator.
Proposed Changes
Delete
Explanation
Deletion follows from the deletion of section 28C.(1)(ii) above.
Present Law
No provision
Proposed Changes (new clause)

--.(-) Notwithstanding the above, all of the artifacts from a historic wreck as removed under the terms of the license and all work done under the terms of the license shall be recorded by archaeological methods and all such records shall pass into the possession of the Crown as a part of the National Collection to remain with the artifacts and to be stored at the appropriate institution as designated by the Minister.

Explanation
What is important to the archaeologist is the information such objects can provide, and maximum information can be obtained by following standard archaeological methods of recovery. The objects themselves, once removed from their context within the site, lose much of their information value. Therefore, the archaeological records prepared using currently acceptable
archaeological methods are vitally important to analyzing and understanding any historic wreck site. These records, including detailed maps, measurements, operational logs and photographs must remain within the public domain as part of the National Collection.

Present Law

No provision

Proposed Changes (new clause)

---(-) Any artifacts removed from a historic wreck after the date of this legislation and found in the possession of any person who contravenes the provisions of this legislation shall be confiscated and shall be deemed to pass into the possession of the Minister and shall be placed in the National Collection without regard to compensation.

Explanation

Punishment for such theft is provided by section 28D.(4). This section guarantees that any stolen artifacts pass into the possession of the Crown without compensation.

Present Law

28F. Any person who, whether or not in possession of a license referred to in section 28C, without the express permission in writing of the Receiver uses, or causes to be used, any explosives or pressure air-hose, water-hose or vacuum-hose upon
or in the vicinity of, a historic wreck shall be guilty of an offense and shall on conviction by a court of summary jurisdiction be liable to a fine not exceeding two hundred and forty dollars or to imprisonment for a term not exceeding six months or to both fine and imprisonment.

Proposed Changes

Delete

Explanation

This section is redundant to section 28D. Section 28D provides punishment for damaging or destroying a wreck. The procedures and equipment allowed under any license should be established in the regulations to be formulated by the Advisory Board.

Present Law

No provision

Proposed Changes (new clause)

--.(-) There shall be established a body of persons to be called the Archaeological Advisory Board (hereinafter referred to as "the Advisory Board") with a common seal and perpetual succession and power to sue and liability to be sued.

--.(-) The Advisory Board shall consist of a Chairman and such other members as may be appointed by the governor, such members
being drawn from the fields of history, archaeology, education and other related professions, acting on the advice of the Minister responsible for culture and related matters. If available, at least one member should be a professional archaeologist.

Explanation

The Minister's ability to manage the nation's cultural resources will be greatly enhanced by an advisory board consisting of individuals with the recommended backgrounds. Furthermore, in order to properly evaluate applications to work on historic wrecks, the Advisory Board should consist of members knowledgeable in fields related to the nation's cultural heritage and cultural resources.

Present Law

33. The Administrator shall have power to make regulations for the carrying into operation of the provisions of this Act and in particular, without derogating from the generality of such power shall have power to make regulations providing for the forms and procedure to be employed in the granting of licenses under this Act and the fees to be paid therefor.

Proposed Changes

33. The Minister shall have power to make regulations on the advice of the Advisory Board for the
carrying into operation of the provisions of this Act and in particular without derogating from the generality of such power, shall have power to make regulations providing for the forms and procedure to be employed in the granting of licenses under this Act and the fees to be paid therefor.

Explanation

This change insures that the Minister and the Advisory Board work closely to regulate historic wrecks to the advantage of the nation's people.

The changes discussed above are integrated as proposed new legislation discussed below.

6.3 Proposed New Legislation

The changes discussed above are presented as a whole here. Such a law will provide protection for historic ship sites.

THE HISTORIC SHIP ARCHAEOLOGICAL SITE AND NATIONAL COLLECTION ACT, 19__

1. The expression "historic wreck" means the remains of any ship, boat or vessel found in or on the shores of the sea or any tidal water, which is more than 50 years old. This age to be determined from the current
year; e.g., in the year 2000, wrecks before 1950 are considered historical wrecks.

2. Every historic wreck at any place on the shores or in the territorial or tidal waters of these Islands shall vest in the Government absolutely and shall be deemed to pass into the possession of the Minister of Culture (hereinafter referred to as "the Minister").

3. (1) The Minister, based upon the recommendations of the Archaeological Advisory Board, may grant a license to explore historic wrecks generally or for the purpose of conducting research on a particular historic wreck.

3. (2) The Minister may attach to any license issued under this section such terms and conditions as may be considered appropriate or necessary.

3. (3) No person shall mark, mutilate, destroy, remove or otherwise interfere with or deal in or possess any historic wreck or any part thereof or articles in the vicinity thereof unless authorized so to do by license issued by the Minister or otherwise than in accordance with a license so issued to him.

3. (4) Any person who contravenes the provisions of this section shall on conviction by a court of summary jurisdiction be liable to a fine not less than one thousand dollars and not exceeding fifteen thousand
dollars or to imprisonment for a term not exceeding six months or to both such fine and imprisonment.

3. (5) When, on the arrest of a person on a charge of an offense under section 3.(3) or section 3.(4)—
(a) the property in respect of which the offense is alleged to be committed; or
(b) any vessel, vehicle, equipment, or other thing alleged to have been used in the commission of the offense, is found in his possession or under his control the person arresting him may seize such property or thing and take the same forthwith before a Justice to be dealt with according to law.

3. (6) Where any property or thing is brought before a Justice under the provisions of this section he shall dispose of it as though it had been a thing seized or taken under the provisions of the Criminal Code.

3. (7) A court convicting a person of an offense against section 3.(3) or section 3.(4) may, in addition to imposing a penalty, order the forfeiture to the Government of any vessel, vehicle, or other specified equipment or thing, used in the commission of the offense, and any order so made has effect according to its tenor.
3. (8) The court may, before making an order under this section, require notice to be given to, and hear, such persons as the court thinks fit.

3. (9) Goods in respect of which an order is made under this section shall be dealt with as the Attorney General directs and, pending his direction, may be detained in such custody as the court directs.

3. (10) A court convicting a person of an offense against this Act may, in addition to imposing a penalty, order the person to pay the full amount of the antiquarian value of the property damaged, mutilated, destroyed or removed, as the case may be, and the amount so ordered to be paid may be recovered as if it were part of the penalty imposed, notwithstanding that the total of the penalty and the amount exceeds the maximum penalty that may be imposed.

4. There shall be established a collection of artifacts from historic wrecks at _______ which shall be called the National Collection, such collection being placed in the custody of an appropriate institution, as designated by the Minister, for preservation and exhibit.

5. (1) The Minister shall be entitled to the possession of all finds, artifacts, and other appurtenances without compensation as are recovered from a historic
wreck, such recovery being made under terms of the license issued. All recovered material shall be deemed absolutely into the possession of the Government as a part of the National Collection of marine artifacts.

5. (2) Notwithstanding the above, all of the artifacts from a historic wreck as removed under the terms of the license and all work done under the terms of the license shall be recorded by archaeological methods and all such records shall pass into the possession of the Government as a part of the National Collection to remain with the artifacts and to be stored at the appropriate institution as designated by the Minister.

5. (3) Any artifacts removed from a historic wreck after the date of this legislation and found in the possession of any person who contravenes the provisions of this legislation shall be confiscated and shall be deemed to pass into the possession of the Minister and shall be placed in the National Collection without regard to compensation.

6. (1) There shall be established a body of persons to be called the __________________Archaeological Advisory Board (hereinafter referred to as "the Advisory Board") with a common seal and perpetual succession and power to sue and liability to be sued.
6. (2) The Advisory Board shall consist of a Chairman and such other members as may be appointed by the governor, such members being drawn from the fields of history, archaeology, education and other related professions, acting on the advice of the Minister responsible for culture and related matters.

7. The Minister shall have power to make regulations on the advice of the Advisory Board for the carrying into operation of the provisions of this Act and in particular without derogating from the generality of such power, shall have power to make regulations providing for the forms and procedure to be employed in the granting of licenses under this Act and the fees to be paid therefor.

6.4 Proposed Regulations Regarding Historic Ship Archaeological Sites

The nation's Minister of Culture or other appropriate body, with the assistance of the Archaeological Advisory Board, should formulate regulations to further define and amplify the more general provisions of the legislation, as well as provide for enforcement of the legislation in a general sense, i.e., provide rules that can be enforced by the appropriate authority. The following proposed regulations are offered as guidelines and are typical of jurisdictions which have realized the necessity for
protecting their underwater cultural heritage. The suggested regulations and licensing requirements have been adapted from those proposed to the government of Bermuda by Dr. Edward Harris, Ms. Cathy Hoyt and Mr. Steven Hoyt (1986c).

6.4.1 General Information on Regulations

In order to protect historic wrecks, human activity on any given site must be regulated. The most effective means to accomplish this is through the issuance of licenses for such activity, as required by the proposed legislation.

Two basic categories of licenses with appropriate subcategories are recommended:

1. Dive Tour Operator's License
2. Underwater Research License
   A. Survey
   B. Excavation
      1) Limited Excavation
      2) Full Excavation

Each is discussed in detail below.

6.4.2 Dive Tour Operator's License

The Dive Tour Operator's License is not meant to restrict supervised dives by commercial diving tour operators on historic wrecks except such wrecks as may be covered under an Underwater Research License - Excavation
(discussed below). The intent of the Dive Tour Operator's License is to provide a means to regulate and enforce the activities of such operators in order to prevent the disturbance or removal of artifacts from a historic wreck.

It is common knowledge that some tour operators allow or even encourage divers under their supervision to remove artifacts from historic ship archaeological sites to keep as souvenirs. Not only is this detrimental to historic ship archaeological sites but in the long run is also detrimental to all tour operators and the tourist industry in general. The more wrecks that are picked apart, historic or otherwise, the less the attraction is for future dives. Dive tour operators who allow or encourage such activity must be considered hit-and-run artists, as they are obviously making their profits now at the future expense of the tourist industry and the cultural heritage of the nation's people.

Perhaps one of the requirements for issuing a licenses would be a requirement for applicants to read relevant literature about the importance of maintaining the integrity of a site. Usually persons that understand the reasons behind restrictions are more apt to abide by them.

The Dive Tour Operator's License should be required of all commercial dive tour operators and diving instructors, in addition to any now required licenses, as a means for
the government to police activities concerning historic ship archaeological sites.

Holding a valid Dive Tour Operator's License, in conjunction with any other required licenses, gives the licensee the privilege to conduct supervised tours of historic ship archaeological sites with the express understanding that no historic site, nor any loose object on or in the vicinity of a historic site shall be tampered with or removed. Simply lifting an object and reversing its orientation can destroy potentially important archaeological associations and should not be allowed. In addition, isolated objects of historical interest not necessarily associated with a historic ship archaeological site should not be disturbed or removed from the sea floor.

Any establishment, institution or individual holding a Dive Tour Operator's License and found violating the terms of that license or the legislation regarding historic ship archaeological sites shall have that Dive Tour Operator's License suspended or revoked. Suspension or revocation of the license will be in addition to any punishment, fines or imprisonment imposed under the proposed Historic Ship Archaeological Sites and National Collection Act. If a Dive Tour Operator's License is suspended or revoked, the licensee shall no longer be allowed to conduct dives on historic ship archaeological sites and shall be subject to appropriate disciplinary action if he continues to do so,
i.e., loss of business permit, suspension of any other license to conduct diving operations, confiscation of diving equipment, boats, and other related business equipment.

Possession of historic artifacts on his person, on his boats, in his workshops, or in the possession of his customers while under his supervision, or substantiated eyewitness accounts of tampering with a historic ship archaeological site by the licensee, his assistants or his customers, shall be grounds for taking action against the licensee under this regulation.

6.4.3 Underwater Research License

6.4.3.1 Underwater Research License - Survey

A license to survey a historic ship archaeological site, or sites in general, may be granted by the Minister to institutions or individuals deemed qualified to carry out such work by the Archaeological Advisory Board. Issuance of an Underwater Research License - Survey should be based upon certain guidelines and criteria as set out in the regulations formulated by the Archaeological Advisory Board (see recommendations below).

The holder of this license may dive on a historic ship archaeological site or sites, as designated in the terms and conditions of the license, except any such site as may be covered by an Underwater Research License - Excavation.
In addition, the licensee may remove from the surface of the wreck and from the immediate area of the wreck a limited number of artifacts which the licensee believes will aid in the identification and determination of the historic value of that site. Any artifacts so removed must be accurately recorded on a site map prior to their removal and must be properly stored, conserved and analyzed upon their removal. All such artifacts are the property of the government and must come into the possession of the government without compensation after a reasonable period of study, as set out in the conditions of the license. The holder of an Underwater Research License - Survey shall not be permitted to use any explosive, prop wash, pressure air hose (except breathing air), waterhose or vacuumhose in the conduct of work under the license.

6.4.3.2 Underwater Research License - Excavation

A license to excavate a historic ship archaeology site may be granted by the Minister to institutions or individuals deemed qualified to carry out such work by the Archaeology Advisory Board. Issuance of an Underwater Research License - Excavation should be based upon certain guidelines and criteria as set out in the regulations formulated by the Archaeology Advisory Board (see recommendations below).
The Underwater Research License - Excavation shall be subdivided into two categories: 1) Limited Excavation and 2) Full Excavation.

The limited excavation license shall be granted for further limited testing of a particular wreck based upon survey data gathered under a survey license. Details of any proposed test excavations, including procedures to be used and site maps, must be presented to the Archaeology Advisory Board and approved by that body before such a license may be granted. Any artifacts so removed must be accurately recorded on a site map prior to their removal and must be properly stored, conserved and analyzed upon their removal. All such artifacts are the property of the government and must be turned over without compensation after a reasonable period of study, as set out in the conditions of the license.

The full excavation license shall be granted for the excavation of a historically significant wreck site based upon data gathered under a survey license or limited excavation license (or both). The license is intended for a detailed scientific study of a wreck under the guidance of a professional archaeologist. All finds and records are the property of the government without compensation and are part of the National Collection.
6.5 Proposed Licensing Requirements

6.5.1 Survey License

6.5.1.1 Underwater Research License - Survey

Applicants for the license must answer the following questions:

1. Name, address and telephone number of individual applicant or institution.

2. References to any previous application to survey or excavate historic ship archaeological sites.

3. Archaeological Director:
   a. Name, address, telephone number.
   b. Experience in archaeological techniques.
   c. Archaeological qualifications (academic or practical).
   d. Diving qualifications.
   e. Name and address of three or more references with knowledge of director's archaeological background.

4. Diving Supervisor:
   a. Name, address, telephone number.
   b. Diving qualifications and experience.
   c. Experience in archaeological techniques.
   d. Archaeological qualifications.
   e. Name and address of three or more references.

5. List resources and equipment for survey.

6. Conservation Specialist:
a. If an organization, give name, address, telephone number and name of contact. In addition, written confirmation of assistance from the organization must be provided.

b. If an individual, give name, address, telephone number, qualifications and experience. Letter of intent from individual must be provided.

7. List conservation facilities available on site and in support.

8. Give name, address and telephone number of any person or organization that has agreed to provide support, resources or financing. Written confirmation of assistance must be included with the application.

9. State general aims of the survey, areas to be surveyed, equipment to be used and methods of operation to be employed.

10. List references to any publications by the Archaeological Director, Dive Supervisor, Conservation Specialist or any other member of the team.

11. List names and addresses of all participants, regardless of their level of participation, in the survey activities and support.

6.5.1.2 Terms and Conditions of Survey license

If a survey license is granted to the applicant the following terms and conditions must be met:
1. All artifacts recovered during the course of the survey are the property of the Government and will be relinquished after conservation and study without compensation. These artifacts then become part of the National Collection.

2. The holder of an Underwater Research License - Survey shall not be permitted to use any explosive, prop wash, pressure air hose (except breathing air), water hose or vacuum hose in the conduct of work under the license.

3. Although full publication of survey data is not required, notices of the project underway, general goals and general seasonal accomplishments must be submitted to recognized archaeological publications such as the Society of Historic Archaeology Newsletter or the International Journal for Nautical Archaeology Notes and News.

6.5.2 Excavation License

6.5.2.1 Underwater Research License - Excavation

Applicants must provide the following information:

1. Name, address, telephone number of individual applicant or institution.

2. Is this an application for a limited excavation (site testing additional to a previous survey) or a full excavation?
3. References to any previous application to survey or excavate historic ship archaeological sites.

4. Name of site, location map of site and a site map from a previous survey.

5. Archaeological Director
   a. Name, address, telephone number.
   b. Experience in archaeological techniques.
   c. Archaeological qualifications.
   d. Diving qualifications.
   e. Name and address of three or more references with knowledge about director's archaeological qualifications.

6. Diving Supervisor
   a. Name, address, telephone number.
   b. Experience in archaeological techniques.
   c. Archaeological qualifications.
   d. Diving qualifications.
   e. Name and address of three or more references.

7. Conservation Specialist:
   a. If an organization, give name, address, telephone number and name of contact. In addition, written confirmation of assistance from the organization must be provided.
   b. If an individual, give name, address, telephone number, qualifications and experience. Letter of intent from individual must be provided.
8. List conservation facilities available on site and in support.

9. Give name, address and telephone number of any person or organization which has agreed to provide support, resources or financing. Written confirmation of assistance must be included with the application.

10. State the historical significance of the particular site and why it deserves excavation.

11. State general and specific aims of the proposed work and outline the methods to be used. Include an overall schedule for field work, archaeological analyses, conservation and publications submissions.

12. Give details of how the work will be carried out including a statement of equipment available and expected to be used.

13. State where the original excavation records will be deposited (either copies of the original records or the original records must remain in the country).

14. State where excavation reports will be submitted for publication:
   a. Popular publications
   b. Professional publications

15. List all publications by all members of the excavation team not included in individual vitae.

16. List all members of the excavation team including the address and the official function of each member.
17. Attach a curriculum vita for each member of the excavation team.

18. Provide a financial statement showing that adequate funds are available for the project.

6.5.2.2 Limited Excavation

If an Underwater Research License - Excavation (Limited) is granted to the applicant the following terms and conditions must be met:

1. All artifacts recovered during the course of the survey are the property of the government and will be relinquished after conservation and study without compensation. These artifacts then become part of the national collection.

2. No explosives or prop-wash equipment shall be used for limited testing of a historic ship archaeological site. Other excavation equipment, such as air lifts, water dredges, and pressure air equipment (other than breathing air), or water hoses shall be used only with the approval of the Archaeological Advisory Board.

3. Although full publication of limited excavation data is not required, notices of the project underway, general goals and general seasonal accomplishments must be submitted to recognized archaeological publications such as the Society for Historic
Archaeology Newsletter or the International Journal of Nautical Archaeology Notes and News.

6.5.2.3 Full Excavation

If an Underwater Research License - Excavation (Full) is granted to the applicant the following terms and conditions must be met:

1. All artifacts recovered during the course of the excavation are the property of the government. All artifacts recovered shall pass into the possession of the Government without compensation after the completion of archaeological analyses and conservation treatment or at the end of the schedule specified in the license, whichever comes first.

2. No explosives or prop-wash equipment shall be used for excavation of a historic ship archaeological site unless the Archaeological Advisory Board agrees that such a procedure is not detrimental to the site, and then only for the sole purpose of removing overburden from the site. Also, excavation equipment, such as air lifts, water dredges, and pressurized air (except breathing air) or water hoses, shall be used only on approval of the Archaeological Advisory Board.

3. Publication of the information gained from the excavation, analysis of the site and analysis of recovered artifacts is required. Submission of such
information for publications in appropriate journals must adhere to the schedule as set out in the license application.

6.5.3 General Requirements for All Licenses

1. Applications must be renewed yearly.

2. Reports must be submitted to the Minister of Culture and the Advisory Board on the progress of the work during the previous year prior to granting of further license.

3. A time limit will be established by agreement of the licensee and the Archaeology Advisory Board for completion of work after which the licensee will no longer have sole rights to publication of the material.

4. All material recovered under the license shall pass into the possession of the government if the terms of the license are not met within the time limits specified by the license.

5. Any time limits under the terms of the license may be extended upon proof of reasonable delay in the work and by recommendation of the Archaeology Advisory Board.

6. No artifacts may be removed from the country without specific written permission from the Minister.
7. The government owns all information obtained from and relating to any historic ship archaeological site. Originals or copies of all records must remain in the country.

8. Copies of all records and a representative selection of the photographic record from the previous season must be submitted to the Archaeological Advisory Board with the application for renewal of license. Submission of copies must be at least four weeks before renewal of the license.

9. Provisions for conservation of artifacts must be made by the licensee and approved by the Minister of Culture before any license will be granted.

10. The Archaeological Advisory Board, through an appointed agent or agents, has the right to inspect the work in progress, any records pertaining to that work, storage of artifacts, conservation facilities, etc., without prior notice to the licensee.

11. Flagrant violation of any of the above regulations or provisions of the license or of any section of the Historic Wrecks and National Collection Act will be grounds for revoking the license at any time.
7. CONSERVATION OF ARTIFACTS

This section presents conservation procedures and requirements for artifacts recovered from marine environments. The purpose is to familiarize government planners with the complexities of conservation of such artifacts. First, basic procedures and requirements are presented, followed by detailed information on specific types of artifacts, i.e., iron, silver, gold, brass, lead, wood, copper, ceramics, leather, bone, ivory, pottery and glass. In the discussions that follow many references are made to chemical treatments; all such treatments should be performed under fume-hoods and conservators should wear protective clothing and eye protection.

Artifact preservation is one of the most important considerations when planning or implementing any action that will result in the recovery of material from a marine archaeological site. It is the responsibility of those who recover materials to see that they are properly conserved. To quote Colin Pearson, a well known conservator of marine artifacts, "I believe that excavation without conservation is vandalism" (Pearson 1977:45).

The conservation phase is time-consuming and expensive, often costing more than the original excavation; but, without conservation most artifacts will perish, and important historic data will be lost. The loss is not only
to the excavator but also to the general public and to future archaeologists who may wish to re-examine the material.

Artifacts recovered from a salt water environment are often well preserved but friable. Artifacts not properly conserved in a timely manner are apt to deteriorate at a rapid rate and subsequently become useless as diagnostic or display specimens. Organic material, e.g., leather, wood, textile, rope and plant products, if allowed to dry without conservation treatment, can, in a matter of hours, crumble and become little more than a pile of dust and debris. Iron, on the other hand, can last for a few days to many months depending on the size and density of the artifact but will eventually deteriorate, fall apart and become useless as a display or diagnostic specimen. Bone, glass, pottery and similar material will, if not conserved, slowly deteriorate and, in extreme cases, become a pile of useless debris. For these reasons conservation must be of paramount concern when excavations of marine archaeological sites are considered.

Many island nations, including the BVI, Jamaica and Bermuda, have in the past been left with artifacts that were not conserved; some individual or group recovered artifacts without prior consideration for conservation and left the artifacts to deteriorate. Of course no intrinsic-value artifacts are ever found in these "discards." Again
these experiences point out the fact that if the motivation for conducting an excavation on a historic ship archaeology site is profit, those scientifically required actions that are not profitable will be ignored.

7.1 Basic Conservation Procedures

Underwater archaeological sites are found in many kinds of environments (bogs, rivers and oceans are some examples). Each type of environment results in different conservation problems because environmental factors such as water temperature, type of water (fresh or salt), type of sea-floor (sand, mud), and so on, affect objects differently. Sites found in salt water present the greatest challenge to the conservator. Artifacts recovered from a marine environment are saturated with salts that must be removed to prevent artifact deterioration.

Dr. D. L. Hamilton, Associate Professor of Anthropology, Texas A&M University, and a leading authority on conservation of objects from a marine environment, has directed excavations of the sunken city of Port Royal, Jamaica for the past 10 years. He has recovered and conserved thousands of artifacts. Dr. Hamilton teaches graduate level courses in conservation and much of the information presented below in this section derives from class handouts, class notes and personal discussions with him. Additional basic conservation considerations can be

7.1.1 Project Planning Recommendations

Prior to excavating a marine site, the following steps are recommended:

1. Anticipate what you might encounter in the archaeological project be it a survey, or a test, or full-scale excavation.

2. Be aware of the types of breakdown, corrosion and degradation that the recovered material might undergo.

3. Have a person with conservation experience in the field to help with the excavation and to insure that the recovered objects are properly treated.

4. Make arrangements for conservation before initiating any operation where artifacts may be recovered. This may mean contracting with an existing laboratory or establishing special facilities for the project. If the latter is the case, be sure that the laboratory is properly equipped and is headed by a conservator with experience in the field of underwater archaeological conservation. All the artifacts recovered from an excavation should be under the
direct control of an experienced conservator until they are stabilized.

5. Always keep in mind that an archaeological project does not stop in the field; it continues in the lab. As much basic archaeological data is recovered in the laboratory as in the field. The information and records from both the field and the conservation lab have to mesh together in order for the archaeological record to be interpreted properly.

7.1.2 Field Recommendations

Many projects set up a field conservation laboratory near the excavation site. This occurs most often when sites are not located near the main laboratory. In most cases, however, the field laboratory does not have the facilities that would be found in the main laboratory. For this reason it is recommended that field conservation facilities be used as little as possible, aside from general acquisition, cataloging, and initial documentation of artifacts. Proper field conservation procedures can be anticipated by referring to various articles and books such as Pearson (1977, 1987), Singley (1988) and UNESCO publications such as Protection of the Underwater Heritage (1981) and The Conservation of Cultural Property (1979).
Standard field procedures should be followed:

1. Record the precise position and orientation of every object, i.e., ship timbers, encrustations, individual artifacts. Number each item. Numbering is important, as it eliminates (or at least reduces) confusion over how each object relates to the site after the material has been delivered to the laboratory for processing.

2. Do not remove any encrustation or layers covering the artifacts in the field; they provide a protective corrosion-resistant layer around the material and preserve associations within the encrustation. (Several artifacts may be encrusted together.) Also, considerable data can exist in the form of impressions and natural molds of objects which have completely disintegrated inside the encrustations.

3. Keep all material wet at all times, either in sea water or, preferably, in fresh water. (Fresh water will cause salts to start leaching out of the material.) For artifacts made of iron, short-term storage in salt water with the water's pH adjusted with sodium hydroxide to a reading of pH 10-12 is satisfactory. Short-term storage of iron in fresh water with the water's pH adjusted to between pH 8-12 is also satisfactory. Such
fresh water solutions can be prepared by adding to the water 5% sodium carbonate, pH 11.5, or 5% sodium sesquicarbonate, pH 9.7 (Hamilton 1976:21-22).

7.1.3 Laboratory Conservation

Laboratory conservation, from the time a specimen is delivered from the site to its ultimate storage or exhibition, can be separated conveniently into four basic stages:

1. Storage prior to treatment;
2. Mechanical cleaning;
3. Preservation procedure;
4. Storage or exhibition after cleaning.

7.1.3.1 Storage Prior to Treatment

All artifacts must be kept wet before and during the conservation process. This is best accomplished by submerging them in fresh water. Fresh water will start the process of leaching out accumulated salts. For organic material, a antibacterial agent should be added to prevent damage to the artifacts from bacterial growth.

Generally speaking, all metal objects, with the exception of gold (discussed on page 182) and lead and lead alloys (discussed on pages 176-178), should be kept submerged in fresh water with an inhibitor added to prevent
further corrosion. For long-term storage, excellent results have been achieved using a 1% oxidizing solution of potassium dichromate with sufficient sodium hydroxide added to create a pH of 9-9.5. Alkaline inhibitive solutions, such as a 5% solution of sodium carbonate, a 5% solution of sesquicarbonate, or a 2% solution of sodium hydroxide, can also be used for short-term storage, but they are not satisfactory for long-term storage (Hamilton 1976:21-25). As mentioned above, any adhering encrustation or corrosion layers should be left intact until the objects are treated. The encrustation forms a protective coating which retards further corrosion of the artifact.

7.1.3.2 Mechanical Cleaning

X-rays are indispensable for determining the contents of encrustations and the condition of any enclosed object. They also serve as a guide in extracting artifacts from the encrustations. The use of chemicals to remove the encrustation is generally a very slow, ineffective process which can be damaging. The use of well-directed hammer blows and of assorted chisels are generally the most common and effective means of removing encrustations. For many objects, however, especially fragile objects and ceramics, small pneumatic tools are more efficient and less destructive. A larger pneumatic weld-flux chisel is particularly useful for the removal of large amounts of
encrustation. Smaller more precisely controlled air
scribes, with more delicate chisels, are ideal for removing
the encrustation from small, fragile artifacts, and for
reaching tight places. Chisels can be fabricated easily in
the laboratory for specific jobs. Combined use of
pneumatic weld-flux chisels and air scribes is often
desirable and is quite effective in freeing movable parts
on artifacts. Sandblasting can sometimes be used for
cleaning the bores of cannons or guns, but should never be
used on the surface of any piece because the abrasive
action of blown sand may destroy surface details on the
artifact.

7.2 Conservation of Iron

7.2.1 Conservation of Iron from Marine Sites

Iron is the most difficult of metals for the
conservator to treat, especially if recovered from a marine
environment. Its treatment does, however, exemplify the
basic requirements of metal conservation in marine
archaeology. After iron has been removed from a marine
environment the corrosion process begun in reaction to salt
water continues, and even accelerates, unless certain
precautions are taken. It is essential that iron artifacts
be properly stored in a solution designed to prevent
further corrosion. If iron is exposed to the air or not
placed in a solution designed to inhibit oxidation, the
ferrous compounds will oxidize to a ferric state which occupy a greater volume, causing the surface of an artifact to scale off. This process alone can disfigure a piece and will eventually destroy it. The greatest damage, however, is caused by various iron chlorides found in iron recovered from marine environments. Hydrated iron chlorides, on exposure to moisture and oxygen, hydrolyze to form ferric oxide or ferric hydroxide and hydrochloric acid. The hydrochloric acid in turn oxidizes any uncorroded metal to ferrous chloride and hydrogen, or ferric chloride and water. This corrosion cycle continues until no metal remains. The specifics of iron corrosion are too complicated to discuss here; the interested reader is referred to Argo (1981), Gilberg and Seeley (1981), Hamilton (1976), North (1976, 1982), North and Pearson (1978), Pearson (1972a, 1972b, 1987).

Prior to treatment, iron artifacts should be carefully examined and their condition evaluated to determine the most appropriate conservation procedure. Iron artifacts are generally placed in one of three categories. These are based on weight/size ratio, the results of close visual inspection, testing of the surface with a magnet, probing of the surface with a dental pick, and, occasionally, x-rays. The categories are:

1. Iron objects with a substantial metal core and a consolidated surface capable of withstanding most
treatments without significant changes in the form or dimensions of the artifact;

2. Specimens that are badly corroded, with little metal present, with supporting strength possibly weakened, but which still retain their overall shape;

3. Metal artifacts that are so badly oxidized and fragile that they cannot be recovered or treated without disintegrating.

Electrolytic reduction, alkaline sulfite reduction, and hydrogen annealing are the most effective alternatives for conserving iron objects in category one. Artifacts of category two are delicate; many treatments might alter their original form. In this case, the alkaline sulfite treatment has the best chance for success. Category three specimens may have to be consolidated in place, or a cast of the object may be made. Making a replica from the natural mold that often forms around an eroded piece is often the only means of recovering information about the object. Only after the objects are placed into one of these three categories should treatment begin.

7.2.2 Electrolytic Reduction Cleaning

The ease of setting up and maintaining, and the long-term economy of an electrolytic unit, along with the versatility of electrolytic cleaning, makes it one of the
conservation's most valuable tools in treating metals. See Hamilton (1976:30-49) for a detailed discussion of this technique.

The essence of the technique involves connecting an artifact to the negative terminal of a DC power supply, placing it in a vat containing an electrically conductive solution called an electrolyte (e.g., 2% to 5% sodium hydroxide or 5% sodium carbonate) and surrounding the artifact with expanded steel mesh that is connected to the positive terminal of the power supply. In the reduction process, if the amperage rate is controlled, some of the positively charged metallic iron ions in the corrosion compounds are reduced back to a metallic state. In addition, the negatively charged corrosive chloride ions and other anions are eliminated from the specimen as they migrate toward the positively charged anode by electrolytic attraction. Thus the process eliminates salts from the metal while reducing some corrosion products back to stable metal. Also, surface details of artifacts are more likely to be preserved by treatments that reduce ferrous corrosion compounds.

The electrolytic cleaning method can be selected exclusively for the mechanical cleaning action of the evolved hydrogen, for the reduction process or, as is usually the case, a combination of the two. The process can be used for most metal objects, as long as they have a
sound metallic core. Efficient electrolytic reduction, however, involves more than wiring up artifacts for electrolysis. One must be familiar with electrode potential and pH requirements of the various electrolytic solutions, and with how these variables relate to metal reduction, corrosion, passivation, and immunity. These factors are particularly crucial when dealing with chloride contaminated metals from a marine environment. This is not to say that satisfactory results cannot be obtained by the novice, but rather, that a good knowledge of the process enables the conservator to understand and better control what is going on in the electrolytic cell and to correct adverse conditions.

Other procedural factors that must by considered are the equipment, such as type of power supply, terminal wires and clips, anode material, and vat, and experimental variables such as the manner in which the electrolytic cell is set up, the electrolyte selected, chloride monitoring, electrode potentials, and current densities. In general, maximum reduction of the ferrous corrosion compounds is achieved if the current density in electrolysis is in the range of .001 to .005 amps/cm².

7.2.3 Alkaline Sulfite Treatment

The alkaline sulfite treatment was developed by North and Pearson (1975a) to stabilize marine cast iron but is
also used on wrought iron. Bryce (1979:21) found that the treatment is effective on iron objects that are moderately to heavily corroded, as long as they have a metallic core. Otherwise the iron object breaks up in treatment. The procedure is as follows:

1. Once the objects have been mechanically cleaned they are immersed in a solution of 0.5 molar (M) (20 gm per liter of water) of sodium hydroxide and 0.5 M (126 gm per liter of water) of sodium sulfite. The solution is changed periodically. Since the solution is strongly alkaline, contact with the skin should be avoided. Tap water can be used for the first one or two baths but deionized or distilled water should be used in the final baths. The container should be filled as full as possible and sealed to prevent any access to air. The solution is mixed and the object placed in it as quickly as possible to avoid any oxidation of the solution. The container is placed in an oven and, preferably, kept heated to a temperature of 60 to 90 degrees C. The object is processed through several baths until chlorides are eliminated; this may take a week or several months and any number of baths, depending on the size of the artifact and the amount of chlorides present in the artifact. The solution does not attack any
residual metal so there is no danger of using too many baths. When a marine iron object is immersed in this hot, reducing solution the iron corrosion compounds are converted to magnetite and the chlorides are transferred to the solution, where they are discarded with each bath change. The objects come out of the treatment with a very black surface coloration.

2. Once the alkaline sulfite stabilization treatment is completed the objects are washed for one or more hours in several baths of deionized water and then placed in a 0.1 M solution of barium hydroxide (32 gm per liter of water). Barium hydroxide is slightly poisonous, so contact with the skin should be avoided. If the object is intensely rinsed in several baths of deionized water following the alkaline sulfite stabilization, the barium hydroxide baths can be eliminated.

The alkaline treatment has been very effective for conserving iron recovered from a marine environment. The main drawbacks of the treatment are that it has to be carried out in air-tight containers and that the solution should be kept heated. About this treatment Pearson cautions:
Disposal of spent alkaline-sulphite solutions should be done by first leaving the solution in an open drum for at least two weeks to allow atmospheric oxygen to oxidize the $\text{SO}_2^3$ to harmless $\text{SO}_2^4$. The excess alkali should then be neutralized with commercial acid to give an acceptable pH. If acid is added to the solution before $\text{SO}_2^3$ oxidation is complete then large quantities of obnoxious poisonous $\text{SO}_2$ gas will be released [Pearson et al. 1987:223].

7.2.4 Hydrogen Reduction of Marine Iron

In hydrogen reduction, objects are placed in a special furnace with 100% dry hydrogen gas, or a mixture of hydrogen and nitrogen, and heated to a temperature of 800 to 1000 degrees C (North 1987:227-229). During the treatment all moisture is driven out of the artifact and the chloride corrosion compounds are volatilized. Hydrogen reduces the iron corrosion compounds back to a lower oxidation state or metal. Hydrogen also combines with oxygen in the corrosion products, forming water that is driven off by the heat. This treatment, while successful, has several drawbacks. First, it requires rather expensive and sophisticated equipment that is outside the financial capabilities of most laboratories. Also, the larger the object the more expensive the treatment. Second, there is
the problem of changes in the metallurgical characteristics in the metal when heated to high temperatures. Recent information by Tylecote and Black reports:

The loss of information by the treatment of totally rusted marine cast iron at 800 degrees C will not be great and there seems to be little objection to the use of the hydrogen reduction process at 800 degrees C for this purpose. The reduction of rust on wrought iron is a different matter. The main problem is knowing whether the residual metal contains, either intentionally or unintentionally, enough carbon to give useful information to the archaeometallurgist. If carbon is absent then treatment at 380 degrees C is acceptable although some change will occur. The slag inclusions will suffer very little microscopic change and no macroscopic change. To ensure the removal of chlorides at 380 degrees C the treatment time must exceed 60 hours [Tylecote and Black 1980:95].

7.2.5 Treatment Following Stabilization

After iron objects recovered from the sea have been treated, it is imperative that their surfaces be covered with a protective coating to insulate the metal from the
effects of moisture, chemically active vapors, and gases. It is very important to choose the right sealant or coating to provide a protective moisture barrier and prevent corrosion. In general, the sealant selected should be: (1) impervious to water vapor and gases; (2) natural-looking so that it does not detract from the appearance of the artifact; (3) reversible; and (4) transparent or translucent so any corrosion of the metal surface can be detected quickly. Immersion in molten microcrystalline wax, such as Gulf 75 Microwax, Witco 180M, or Cosmoloid 80H, is widely used. Polyurethane coatings are also used (Hamilton 1976:55), as well as a clear-drying zinc phosphate-based anti-corrosion primer followed by several coats of high durability, clear, matt polymethyl methacrylate acrylic lacquer (North and Pearson 1975b:177).

7.3 Conservation of Cupreous Metals

Here the nonspecific term "cupreous metals" is used for copper and the alloys, such as brass and bronze, where copper predominates. In general it matters little what the specific alloy is, for all are usually treated in the same way. Care needs to be taken only when the alloy contains a high percentage of lead or tin, both of which are amphoteric metals and dissolve in alkaline solutions; see pages 176-178 for information on lead and lead alloys. There are a considerable number of commercial chemical
treatments for copper, bronze and brass, and most are not satisfactory for cupreous metals from marine sites. Detailed information about the conservation of cupreous metal artifacts from marine environments can be found in Hamilton (1976:57-61) MacLeod (1987) and North (1987:232-38).

In a marine environment the two most commonly encountered copper corrosion products are cuprous chloride and cuprous sulfide. The mineral alterations in the copper alloys are more complex than those of just copper. Once any cupreous object is recovered and exposed to the air, it continues to corrode by a process referred to as bronze disease. Cuprous chlorides in the presence of moisture and oxygen are hydrolyzed to form hydrochloric acid and basic cupric chloride. The hydrochloric acid in turn attacks the corroded metal to form more cuprous chloride. The reaction continues until no metal remains. Any conservation of chloride contaminated cupreous objects requires that: (1) the cuprous chlorides be removed, (2) the cuprous chlorides be converted to harmless cuprous oxide, or (3) the chemical action of the chlorides be prevented.

7.3.1 Cleaning by Electrolytic Reduction

Electrolytic reduction of cupreous metals is the best and most efficient method of removing the chlorides from the object and is carried out in the same manner as
described for iron. The alkaline electrolytes, 2% sodium hydroxide and 5% sodium carbonate or 5% formic acid can be used. If formic acid is chosen, stainless steel must be used for the anode, otherwise mild steel is used. In contrast to iron, electrolytic cleaning of cupreous metals is of short duration.

7.3.2 Sodium Sesquicarbonate Rinses

The cupreous chloride component of copper and its alloys are insoluble and cannot be removed by washing in water alone. If the artifact is placed in a 5% solution of sodium sesquicarbonate, the hydroxyl ions of the alkaline solution react chemically with the insoluble cuprous chloride to form cuprous oxide and neutralize any hydrochloric acid by-products formed. Successive rinses continue until the chlorides are removed. The object is then rinsed in several baths of deionized water until the pH of the last bath is neutral.

7.3.3 Benzotriazole

The use of benzotriazole (BTA) has become a standard part of any conservation treatment of a cupreous metal, following any stabilization process and preceding any final sealant. The artifact requiring treatment is immersed in 1% BTA for 24 hours. The BTA is usually dissolved in water, but ethanol can be used. See Greene (1975),
Hamilton (1976), Merk (1981), Pearson (1987), Sease (1978) and Walker (1979) for additional information. BTA forms an insoluble, complex compound with cupric ions. Precipitation of this insoluble complex over the cuprous chloride forms a barrier against any moisture that could activate the cuprous chlorides responsible for bronze disease. The treatment does not remove the cuprous chloride from the artifact, it merely forms a barrier between the cuprous chloride and the moisture in the atmosphere. For artifacts heavily contaminated with chloride, the treatment may have to be combined with one of the processes described above. Treatment by this method alone is not always successful.

7.3.4 Final Treatment and Sealant

Following electrolytic or chemical cleaning the objects are put through a series of hot rinses in deionized water. Because copper tarnishes in water, Pearson (1974:302), recommends washing in several baths of denatured ethanol. If a water rinse is used any tarnish can be removed with 5% formic acid or by polishing with a wet paste of sodium bicarbonate (baking soda).

After rinsing, copper objects should be dehydrated in acetone and sprayed with a protective coating of clear acrylic. Krylon Clear Acrylic Spray #1301, which is Acryloid B-72 in toluene, is recommended for ease of
application, durability, and availability. For additional protection BTA can be mixed with Acryloid B-72 or polyvinyl acetate and brushed on the artifact. Microcrystalline wax can be used, but in most cases has no special advantage over acrylics.

7.4 Conservation of Lead and Lead Alloys

Once recovered from the sea, the corrosion products of objects of lead or lead alloys, e.g., pewter, are stable. The corrosion products may be unsightly or even disfiguring, but they do not take part in chemical reactions that attack the remaining metal. The objects need to be cleaned only for aesthetic reasons and to reveal surface details under the corrosion layers. Lead and lead alloy should never be stored in water that has an alkaline inhibitor added. Lead may dissolve in alkaline solutions. In addition, Pearson (1987:113) cautions that lead and its alloys should not be washed or stored in distilled or soft water because lead is prone to corrosion in them.

Old pewter, being an alloy of lead and tin, should be treated as tin because tin is the more anodic and chemically sensitive metal. Therefore, no acids should be used and neither should sodium hydroxide be used.
7.4.1 Electrolytic Reduction Cleaning

This treatment is carried out in the same manner as described for iron; however, considerable care must be taken when alkaline electrolytes are used because lead will be dissolved by the alkaline solution unless DC electrical current is flowing through the artifact. The power must never be turned off when lead objects are in electrolysis. One difference from iron artifact treatment is that in some cases lead anodes and a 10% sulfuric acid electrolyte is used in the process. In addition, asymmetrical AC current is sometimes employed for maximum reduction of the lead corrosion products back to a metallic state. When dealing with pewter, sodium carbonate should be used as the electrolyte. Additional information can be obtained by referring to Hamilton (1976) and Pearson (1987).

7.4.2 Chemical Treatment of Lead

Because of the ease of treatment and availability of chemicals, the most widely used treatment for lead from any archaeological environment is the acid treatment described by Caley (1955). Lead is immersed in 10% hydrochloric acid, which removes lead carbonates, lead monoxide, lead sulfide, calcium carbonate, and ferric oxide. If lead dioxide is present, it is removed by soaking the object in 10% ammonium acetate. The ammonium acetate also acts as a buffer to protect lead from the action of any hydrochloric
acid that may remain. This treatment is good for lightly corroded specimens, and it gives lead surfaces a pleasing appearance, however, the process must be carefully monitored to avoid etching the metal by the acid. The surface detail that is preserved by this treatment varies with the degree of corrosion on the artifact when it was recovered. In practice, Caley's method is being superseded by electrolytic reduction, discussed above, which has the ability to convert mineral products back to a metallic state.

7.4.3 Sealant

Following conservation treatment and rinsing, lead and pewter objects should be dried with hot air or dehydrated in a water miscible solvent such as acetone. Then they should be sealed by immersion in hot microcrystalline wax or sprayed with an acrylic spray, as described for copper above.

7.4.4 Storage of Lead Objects

Lead is particularly susceptible to organic acids, such as acetic, humic and tannic acids. Lead artifacts, therefore, should not be stored in oak cabinets. Since vapor from wood can initiate corrosion, lead should be stored in sealed containers or polyethylene bags.
7.5 Conservation of Silver

The most commonly encountered corrosion products on silver and silver alloys in a marine environment are silver sulfide and silver chloride (MacLeod and North 1979; Hamilton 1976). Both compounds are stable mineral forms and do not take part in any further corrosive action with the remaining silver. The only reason to treat silver is to reveal underlying detail, for aesthetic reasons, or to reduce mineral products back to a metallic state. In base silver alloys with copper, the copper corrodes preferentially and forms cuprous chloride that continues to corrode the copper component of the silver. In these cases the silver is treated as if it were copper. For marine recovered silver, there are two main alternatives: (1) electrolytic reduction and (2) treatment with alkaline dithionite.

7.5.1 Cleaning by Electrolytic Reduction

The electrolytic cleaning of silver takes advantage of the reduction action of electrolysis by removing chloride and sulfide ions from silver chloride and silver sulfide, and by reducing the silver in the corrosion compounds to a metallic state. Two methods of electrolytic cleaning of silver have been described in the literature: (1) normal reduction and (2) consolidative reduction. Both techniques require that a metal core be present in the artifact. Most
laboratories use the normal reduction method described below.

7.5.2 Electrolytic Reduction

Electrolytic reduction uses a DC power supply that puts out a fully rectified direct current. The same electrolytes as described for copper, 5% sodium carbonate, 2% sodium hydroxide, or 5% formic acid, are used. The current density must be very low. An amperage rate of .3 to .5 mA/cm² of artifact surface gives good results (North 1987:240-41). Alternatively, the regulated DC power supply can be adjusted to give a cell voltage of approximately three volts (Pearson 1974:299). When using a formic acid electrolyte, only inert anodes such as stainless steel No. 316 or platinized titanium should be employed. Mild steel is recommended over stainless steel when sodium hydroxide is used.

7.5.3 Alkaline Dithionite Treatment

The alkaline dithionite treatment is similar to that of alkaline sulfite described for iron. It is a relatively cheap, simple and rapid method for consistently reducing silver corrosion product to metallic silver (MacLeod and North 1979). The steps for processing silver by this method follow:
1. Immerse the object in 10 to 12% hydrochloric acid to remove the encrustation layer that may consist of sand, shell, calcium carbonate, and copper and iron corrosion compounds. This requires from 12 hours to a week, or until all cleaning action ceases and no more gas bubbles evolve. During this step it is necessary to make sure that the solution remains acidic. If necessary, concentrated hydrochloric acid is added to the solution to keep it at a working strength.

2. Rinse thoroughly in tap water to remove all residual encrustation and mechanically remove any stubborn spots.

3. Immerse in a solution of alkaline dithionite. Mix a solution of sodium hydroxide (40 gm sodium hydroxide per liter of water). Once the sodium hydroxide dissolves add 59 gm of sodium hydrosulfite and then immerse the silver quickly to eliminate oxidation of the solution in the container. The container should be completely full of solution and have an air-tight seal.

4. For one week agitate and turn the container daily to keep the solution mixed and to expose all surfaces of the specimens to the solution.
5. After one week remove and rinse the specimens in water until the pH of the rinse water remains unchanged.

6. The corrosion products on the surface of the artifact will be reduced to a gray, metallic silver that can be polished with a wet baking soda paste or a fiberglass brush.

7.5.4 Rinse and Sealant

Following electrolysis or any chemical cleaning, the specimens should be thoroughly rinsed in deionized water. If an alkaline electrolyte or chemical is used, the rinsing should be more intensive. The silver then should be dried with hot air or dehydrated in acetone and coated with clear acrylic lacquer, such as Krylon Clear Acrylic 1301.

7.6 Conservation of Gold and Gold Alloys

Gold is a very noble and inert metal that does not corrode. Therefore, gold and high gold alloys do not require any treatment. The copper or silver corrosion compounds of low gold alloy are treated by the same techniques described above for copper and silver.

7.7 Conservation of Wood

Being of organic origin, wood normally decays under combined biological and chemical attack when buried in the
ground. It can, however, survive prolonged exposure to extremes of dryness or wetness. In anaerobic waterlogged environments there are profound chemical changes and alterations in the composition and microstructure of wood. Over time, waterlogged wood loses much of its structural strength but retains its overall shape and form.

Due to the considerable loss in physical strength, waterlogged wood must be consolidated. This can often be accomplished using synthetic resins (diluted with evaporating solvents) such as polyvinyl acetate, polymethacrylate and acryloid B-72. All the resins must be applied in dilute solutions, and the applications must be repeated several times to ensure that an adequate amount of resin is deposited in the wood to strengthen it.

Wax impregnation, solventless epoxies and polyester resins are also used quite often to consolidate waterlogged wood. These treatments have certain advantages over the solvent type synthetic resins in that they do not depend on the evaporation of a solvent for the resins to harden; thus there is less shrinkage. They are sufficiently mobile to penetrate the decayed wood and will set, in situ, at room temperature to a hard mass that gives considerable mechanical strength to the wood. The length of time required for the resin to harden can be controlled by the selection of various hardeners and plasticizers, as well as by the viscosity of the resin/hardener system selected.
The epoxy and polyester resins can also be used to make pastes with inert powdered material (such as Cabosil or ground glass) to make repairs and restore missing pieces.

Another method of considerable promise consists of impregnating the wood with a liquid monomer, such as styrene or methyl methacrylate, and polymerizing the monomer in situ in the wood by exposure to gamma radiation. The impregnated wood possesses improved dimensional stability, good strength properties and resembles the untreated wood in general appearance.

In all wood, after long periods in wet soil, peat bogs and marine sites, bacterial action causes a degradation of the cellulosic components of cell walls. In general, water soluble substances such as starch and sugar disappear from wood first, along with mineral salts, coloring agents, tanning matters and other bonding materials. In time, through hydrolysis, cellulose in the cell walls disintegrates, leaving a lignin network to support the wood. Even lignin will break down over a long period of time. As a result of the disintegration of cellulose and lignin, spaces between the cells and molecules increase and the wood becomes more porous and permeable to water. All deteriorated parts, all cell cavities and intermolecular spaces are filled with water. The remaining lignin structure of wood cells and the absorbed water preserves the shape of the wood. The loss of the finer cellulose
tissue does not cause much alteration in the gross volume of wood, but the porosity is increased and the wood absorbs water like a sponge. As long as the waterlogged wood objects are kept wet they will retain their shape. If excess water is allowed to evaporate from unconserved waterlogged wood, the surface tension forces of the evaporating water will cause the weakened cell walls to collapse, resulting in considerable shrinkage and distortion. For example, freshly cut sound wood through water loss will shrink about 3 to 6% radially, 5 to 10% tangentially, and 0.5% longitudinally. Oak shrinks 4% radially and 8% tangentially when air dried after cutting, while waterlogged oak can shrink 12% radially and 24% tangentially. The amount of shrinkage is dependent upon the degree of disintegration and the amount of water present. The amount of water in waterlogged wood (expressed as a percentage) is determined by the formula:

\[
\text{weight of wet wood} - \text{weight of oven dried wood} \times 100 \over \text{weight of oven dried wood}
\]

Anything greater than 200% is considered to be degraded.

The conservation of waterlogged wood is a twofold problem that involves the removal of the excess water by a method that will prevent any shrinkage or distortion of the wood, and incorporation of a material into the wood that will consolidate and confer mechanical strength to it. The
most common techniques for treating waterlogged wood are discussed below.

7.7.1 Methods of Conserving Waterlogged Wood

7.7.1.1 Polyethylene Glycol (PEG) Method

The polyethylene glycols are synthetic materials that have the generalized formula \( \text{H}_2\text{OCH (CH}_2\text{OH}_2)n\text{CH}_2\text{OH} \). Those with low molecular weights (300-600) are liquids, those with intermediate molecular weights are semi-liquids, or have the consistency of vaseline (1000-1500), and those with higher molecular weights (4000) are wax-like materials. The PEGs are now designated by their average molecular weight, but this only came about in recent years, and the names have been changed. What was once called PEG 1500 is now called 540 Blend and is a mixture of equal parts of PEG 300 and PEG 1500. PEG 1540 is now called PEG 1500 and PEG 4000 is now called PEG 4250. Although the PEGs have some of the physical properties of wax, they are distinguished from true wax by the fact that they are freely soluble in water and alcohol (e.g., ethanol, methanol, isopropanol). PEG 4000, which has a melting point of 53-55° C, was once the most commonly used PEG in wood treatment because it was the least hygroscopic, however, its large molecules prevent it from penetrating dense wood. Now PEG 1500 and 540 Blend are more commonly used.
The use of PEG was the first reliable method for treating waterlogged wood that was also simple to carry out; excess water in wood is removed and the wood is bulked in one operation.

In the PEG treatment process, a waterlogged object is cleaned first to remove all dirt on the surface. It is then placed in a container of PEG dissolved with water. The container is then placed in a ventilated oven where the temperature is gradually increased until, after a period of weeks, it has reached 60° C. During this time the PEG is increased in concentration by evaporation of the water or by adding increments of PEG. In the process, the wax slowly diffuses into the wood, displacing the water. At the end of the operation, the wooden object is covered with a molten solution of 70% to 100% PEG, depending upon the nature of the wood. The object is then removed, the excess wax wiped off, and the wood is allowed to cool. When cooled, any excess wax on the surface is removed with a hot air gun or with hot water. When applying this method in a container in which the PEG concentration is increased by evaporation of the solvent, it is important that the dimensions of the container be such that the initial quantity of wax present will be more than enough to cover the object at the end of the process.

When using PEG in water it is necessary to use a fungicide such as Dowicide A (sodium salt o-phenylphenol).
A concentration of 0.1% of the weight of the PEG is recommended. On the Wasa, a fungicide consisting of seven parts boric acid and three parts sodium borate was used in a concentration of 1% of weight of PEG (Grattan and Clarke 1987:170-71).

7.7.1.2 Acetone-Rosin Method

This treatment consists of replacing water in wood with a natural rosin, in this case pine rosin, also called colophony. In this text rosin is used to denote natural products while resin denotes synthetic products. The treatment was developed to conserve well preserved hardwoods, such as oak, where the higher molecular weight PEG could not penetrate. The following procedure is recommended:

1. Wash the object thoroughly, removing all dirt.
2. Submerge the wood in a 3.5% muriatic acid (HCl) bath. To make the bath, mix one part HCl to nine parts water; in conservation terms, this is a 10% solution. For objects 5-10 cm thick, leave the wood in the acid for four days. Objects less than 5 cm should be left in for two days. Treatment with HCl is supposed to bleach the wood to a more natural or original color, but Dr. Hamilton has found that the bleaching is only temporary and rarely affects the final color of the treated
piece. The HCl treatment improves the penetration of rosin into wood by breaking down organic acids in the wood. Caution must be exercised because the HCl treatment can cause treated objects to develop a checked surface and be more subject to cracking after the conservation treatment is completed. Treatment with HCl can also be used to improve penetration of PEG into wood.

3. Rinse the wood in running water for three to five days to thoroughly remove all traces of the HCl.

4. Dehydrate the wood completely in three successive baths of acetone. Objects 5-10 cm thick require about four days in each acetone bath. Objects less than 5 cm thick require about two days in each acetone bath.

5. Place the wood in a sealed container containing a saturated solution of rosin dissolved in acetone heated to 52° C. In a sealed container at a thermostatically controlled 52° C, a saturated solution of rosin in acetone is 67% rosin. To insure a saturated solution, an excess of rosin should be placed in the container so that there is a thick viscous layer of rosin in the bottom of the container. The object being treated should be suspended or supported above this thick, undissolved rosin. Leave objects 5 to 10 cm thick
in the solution for four weeks. Objects less than 5 cm thick should be left in the solution for two weeks.

6. After the recommended length of time, remove the objects from the rosin solution and wipe off any excess rosin with a lint-free cloth soaked in acetone. Because of the cost and danger of using acetone the treatment is only feasible for small objects. The treatment has been successfully applied at room temperatures. The process also has been successful using solvents such as isopropanol and any of the other alcohols that are less flammable than acetone. The HCl pre-treatment is optional and is often eliminated because of the potential damage to the object.

7.7.1.3 Alcohol-Ether Method

This method is similar to the process used for drying biological specimens. First, clean the wood as required. Then immerse the object in successive baths of alcohol until all water has been replaced by alcohol; isopropanol or ethanol is usually used. This is followed by successive baths of acetone. The dehydration progress is followed by measuring the specific gravity of each bath to determine the water/alcohol ratio. When all water has been replaced by acetone, the object is immersed in successive baths of
dimethyl ether to replace all the acetone with ether. When this has been accomplished, the object is dried very quickly by placing it in a vacuum so that the ether volatilizes rapidly. Ether is used because of its very low surface tension (0.17 dyne/cm compared to 0.72 dyne/cm for water). This means that when ether evaporates the surface tension forces are so low no appreciable collapse of the weakened cell wall occurs. If necessary, 10-20% dammar resin, colophony rosin, or a mixture of the two can be dissolved in the final bath of ether so that the rosin is deposited in the pores of the wood to act as a consolidant. Alternatively, polyvinyl acetate (PVA) can be used on some pieces. The rosin not only consolidates the wood, but more importantly, it seals the wood, reducing warping (which results from changes in the relative humidity).

This method has proved to very successful, producing a natural looking, light weight and light color wood. But it is only economically feasible for the treatment of small objects. The alcohols and especially the ether are highly flammable. Extreme caution should taken when this process is used. The dehydration process can be very effective, but the alcohols and ether used must be free of water contamination. For some objects, a dehydration process using only alcohol and acetone is effective.
7.7.1.4 Sucrose Method

The sucrose (sugar) method of conserving waterlogged wood was developed as an alternative to more expensive methods (Parrent 1985). Wood to be conserved should be carefully cleaned by rinsing in baths of fresh water. Once the wood is clean the following procedure is recommended:

1. Prepare a solution with a sufficiently low sucrose concentration to prevent the dehydration of well preserved wood or regions of sound wood within an otherwise deteriorated piece. This necessitates the thorough examination of the wood to be treated in order to determine its state of preservation before treatment begins. With highly degraded wood it is possible to start with a higher concentration of sucrose; however, if in doubt, start with a 1% to 5% weight/volume solution. Commence a program of weighing a representative sample of wood in treatment to determine when the wood has reached equilibrium with its solution. Once saturation of solution is achieved, increase the sugar concentration by 5% to 10%.

2. Select an antimicrobial agent such as Dowicide A, and add it to the solution when the latter is initially prepared. This allows for the complete penetration and protection of the wood by the antimicrobial agent.
3. The incremental percentages of increase can be higher and more closely spaced if the wood is highly degraded. It is best to start with a low percentage increase, i.e., 1% to 5%, and increase this to 10% after the wood has reached equilibrium at 50% solution. Again, if in doubt, low incremental increases are recommended for the duration of treatment.

4. If deemed necessary, select an additive that will discourage insect and rodent attacks on the treated wood. There are many pesticides that will work; selection depends on local availability. For thorough protection of wood, add the insecticide to the initial solution. If the wood is kept in a museum environment, problems with insects and rodents should be minimal and probably would be controlled by alternative means.

5. When the wood has reached equilibrium with the highest solution desired, air dry it slowly under conditions of controlled high humidity. Humidity can be lowered slowly as the wood dries. Submitting the wood too quickly to conditions of low humidity may cause the wood to warp.

6. Store the wood under conditions of less than 70% humidity if possible. The wood should not be subjected to humidity over 80% because of the
possibility of condensation forming on the wood; this could leach out the sugar.

Maintaining artifacts treated by sugar in a controlled atmosphere will ensure the continued success of the conservation procedure. Artifacts thus treated require no more or no less care than those treated with other preservatives. This method constitutes an acceptable means of conserving waterlogged wood and is the least expensive.

7.8 Conservation of Bone and Ivory

The main inorganic constituents in bone and ivory are calcium phosphate associated with carbonate and fluoride along with organic tissue called ossein. Ossein constitutes at least 30% of total weight. It is often difficult to distinguish between bone and ivory unless they are examined microscopically. Bone is coarse grained, with characteristic lacunae or voids, while ivory is hard dense tissue with lenticular areas. Both are easily warped by heat or moisture and are decomposed by prolonged action of water. In archaeological sites the ossein is decomposed by hydrolysis and the inorganic framework is disintegrated by acids. In waterlogged sites bone and ivory are converted to a sponge-like material. In arid sites they become dry, brittle and fragmented. In some circumstances they become fossilized as the ossein is replaced by silica and mineral salts. Archaeological bone and ivory can only be cleaned
and strengthened and stabilized; satisfactory restoration is often impossible.

7.8.1 Surface Cleaning

For structurally sound bone or ivory the following steps are recommended:

1. Wash with soap and water or alcohol (to facilitate drying) and then towel dry.
2. When washing with water limit the amount of time the object is in water.
3. Brush the artifact lightly with brushes or lightly scrape with wooden, plastic or metal tools. Dental tools are particularly serviceable.

Unsound bone and ivory must be consolidated to prevent damage during cleaning. Consolidation can be accomplished by applying a 5% solution of soluble nylon to the artifact.

7.8.2 Removal of Soluble Salts

Bone and ivory from a salty environment absorb soluble salts that will tend to crystallize out, thereby breaking up the specimen. It is not necessary to remove all the salts, just the bulk of them, especially from the near surface region. The following steps are recommended:

1. If the bone or ivory is structurally sound the salts can be diffused out by rinsing in successive baths of water.
2. If the bone or ivory is structurally unsound it can be consolidated with a 5% solution of soluble nylon and then rinsed. Soluble nylon is water permeable and will allow salts to diffuse out during the rinsing process.

3. Dry in a series of alcohol baths (50% alcohol/50% water, increasing baths to 90% alcohol/10% water, and then two baths of 100% alcohol).

4. After the artifact is dry apply a final coat of soluble nylon.

7.8.3 Removal of Insoluble Salts (calcium carbonate)

Structurally sound bone can be immersed in 5% to 10% solutions of hydrochloric acid, or formic acid to remove calcium carbonate. Monitor this process closely.

Unsound bone should be treated with localized applications of the acid with a brush. If unsound bone is submerged, the evolution of carbon dioxide from the decomposition of the calcium carbonate will break up the specimen. Very fragile bone may require that the acid be applied to stubborn spots.

For either method discussed above, rinse the treated artifact in water to remove acid, dry in alcohol, and consolidate as discussed below.
7.8.4 Consolidation

The following method of consolidation is recommended:

1. Use a 5% to 10% solution of a suitable transparent synthetic resin such as soluble nylon.

2. Apply the soluble nylon with a brush for surface consolidation. Apply a coat; let it dry; repeat the process several times in order to soak sufficient resin into the material being consolidated. Repeated applications are necessary. The resin solutions must be diluted to decrease viscosity and increase penetration.

7.9 Conservation of Pottery


Generally pottery recovered from archaeological sites requires only minimal treatment. Well-fired pottery need only be washed in a mild detergent. Some scrubbing of edges and surfaces with a soft brush may be required. Care should be taken not to remove traces of food, paint, pigments, and soot that are on the interior or exterior surfaces. The conservator must be careful not to mark the pottery surface when using a brush, or any other object, during cleaning. Fragile, badly fired pottery requires
more care, but the procedure is the same. Fragile pieces, pottery with friable surfaces, flaking surfaces or fugitive paints may require consolidation with polyvinyl acetate (PVA) or Acryloid B-72. Make sure painted pottery is color-fast before washing it.

Pottery excavated from some sites becomes saturated with soluble salts, or the surfaces become covered with insoluble salts such as calcium carbonate and calcium sulfate. The soluble salts (chlorides, phosphates and nitrates) must be removed to stabilize the pottery. The soluble salts are hygroscopic and repeatedly dissolve and crystallize as the relative humidity rises and falls. The salts eventually reach the surface of the pottery, where extensive crystallization takes place, causing exfoliation of the pottery surface. Internal stress caused by salt crystallization can cause pottery to break apart. At times, masses of needle-like crystals can cover the surface, hiding all detail. The soluble salts can be removed by repeated rinsing in water. A running bath is the quickest and most effective method but is very wasteful. If sherds of pottery are too fragile to withstand the rinsing process their surfaces can be consolidated first with Acryloid B-72 (formerly soluble nylon was used) then rinsed. Since Acryloid B-72 is somewhat water permeable, although not to the degree that soluble nylon is, it will allow the salts to diffuse out.
The diffusion process will be considerably slower if the pottery is treated with any consolidant. A conductivity meter can be used to monitor the progress of salt removal.

7.9.1 Insoluble Salts

In most cases the safest and most satisfactory method of removing insoluble salts from the surface of pottery is by hand. Most wet calcareous concretions can be removed easily by scraping with a scalpel, dental tool or similar tool; however, if allowed to dry, calcareous concretions can take on the consistency of cement. Dental burrs and air chisels (especially the latter) are also quite useful.

Insoluble salts also can be removed chemically. Nitric acid, hydrochloric acid, and oxalic acid are most commonly used. Before using any acid on pottery, make sure that the object is thoroughly wetted so the acid will not be absorbed into the paste. Although 10-20% nitric acid can be used to remove calcareous concretion, it is potentially the most damaging acid of the three. More care should be exercised when it is used; dilute nitric acid dissolves lead glazes.

Glazed pottery from marine sites are often cleaned of any calcareous encrustation with 10 to 20% hydrochloric acid, which in most cases is safer to use than nitric acid. The sherds are left immersed in the acid solution until all gas evolution ceases, usually in less than an hour. The
process is repeated if necessary. Care must be exercised because hydrochloric acid can discolor glazes, especially lead glazes whose appearance will turn milky. After treatment the samples are washed thoroughly in tap water and then immersed in 10% oxalic acid (a very toxic chemical) for 10 to 20 hours to remove iron stains. The sherds are then rinsed again and dried. It is imperative that pottery with a carbonate temper, e.g., shell, calcium carbonate, not be immersed in hydrochloric or nitric acid because acid will dissolve the tempering material from the paste, thoroughly weakening the pottery.

While nitric, oxalic and especially hydrochloric acid treatments will remove calcareous deposits, they also tend to dissolve iron oxides from pottery pastes or glazes. Many stoneware glazes contain iron oxides. The use of these acids on glazes containing iron oxides increases their tendency to exfoliate, especially if the glazes are friable. To avoid over-cleaning, acid should be applied locally on the surface with a cotton swab or by drops. The excess acid is then immediately wiped off when the effervescing stops; alternatively, the object is held under running water to remove the acid. Earthenware and terra cotta ware often contain iron oxides. They are more porous and more prone to deteriorate when treated with these acids, therefore acid treatments for them should be avoided.
A useful chemical for removing calcareous deposits from ceramics is ethylene diamine tetraacetic acid (EDTA). A 5% solution of the tetrasodium salts of EDTA (pH 11.5) removes calcareous material best without seriously affecting the iron content of the pottery. Iron is more soluble at pH 4 while calcareous deposits are more soluble at pH 13 thus the treatment with a pH 11.5 solution is best for calcareous removal but has little affect on pottery iron content. In this treatment the sherds are immersed in the solution and left until the deposits are removed. Periodically, the solution may have to be replenished. In the process, the iron stains that are usually bound in with the calcium salts are removed along with the calcium. It is a slow but effective treatment.

Soaking calcareous encrusted sherds in a 5% aqueous solution of Calgon (sodium hexametaphosphate) has been used to remove calcareous deposits, but the Calgon has a tendency to soften the paste of the sherd more readily than it softens the calcareous encrustation.

Calcium sulfate is difficult to remove from pottery. To test for the presence of calcium sulfate, drop dilute nitric acid on deposits, then add three drops of 1% barium chloride solution. If a white precipitate forms, it indicates the presence of sulfates. These can be dissolved slowly by immersing the pottery in 20% nitric acid. As the sulfates are dissolved, dangerous sulfuric acid is
produced, which cancels out the reaction of the nitric acid. The nitric acid must be changed often. This technique is not generally recommended. Mechanical cleaning is preferred.

Silicates on the surface of pottery can be removed with hydrofluoric acid, but this acid is very dangerous and is not recommended for use by amateurs. Again, mechanical cleaning is recommended.

7.9.2 Stain Removal

Local application (with cotton swabs) of 10% oxalic acid on the surface of wet pottery is generally a successful method for removing iron stains from stoneware and earthenware ceramics that contain iron oxide in the paste or glaze. Five percent disodium EDTA can be used on pottery not containing iron oxide in glaze or paste. In all treatments, caution must exercised to avoid over cleaning. Intensive rinsing after cleaning is required.

Black metallic sulfide stains are common on pottery from marine sites. These can be removed by immersion in 10-25% by volume hydrogen-peroxide solution for 24 to 36 hours, or until the stains disappear. No rinsing is required after treating with hydrogen peroxide. Hydrogen peroxide can be applied directly to sherds that have been treated with nylon. The hydrogen peroxide permeates the nylon film. Hydrogen peroxide is also useful for removing
organic stains. Carefully monitor the progress of the treatment, especially on tin enamel wares, i.e., delft, majolica, faience, when the glaze is crazed because bubbles generated during treatment may lift off the poorly attached glaze.

7.9.3 Mending Broken Pottery

To mend broken pottery, glue with PVA (V25 or equivalent) or any good celluloid glue such as Duco. A serviceable glue can be prepared by dissolving cellulose acetate cuttings into a solution composed of equal quantities of acetone and amyl acetate. A 0.5-1% plasticizer such as camphor, castor oil or preferably dibutyl phthalate should be added. A thick PVA solution in acetone, acetone/toluene or acetone and amyl acetate can be used. Alphacyanoacrylate glues (Super Glue) are very handy. They are slowly dissolved in acetone and toluene after setting.

Fragile sherds may have to be consolidated before they are glued or repaired. This can be accomplished by immersing sherds in a dilute solution of PVA.

7.9.4 Cleaning of Stone

Small objects of stone can be treated in essentially the same manner as described for pottery (once pottery has been fired it is actually a form of stone). The same
chemicals can be used, but the acid solutions should be no stronger than 5%. Of course, stone monuments, buildings, and other large structures are specialized cases and are not considered here. Interested persons can read chapters devoted to these in Gairola (1979), and Plenderleith and Werner (1979).

Lichen, mold and algae, and the organic stains they cause, can be removed from stone by submerging the stone in, or applying to the stone a 10-25% hydrogen peroxide solution. No rinsing afterwards is required when using hydrogen peroxide.

Acids should not be used on any of the sedentary rocks, e.g., limestone, marble, sandstone. They can be destroyed quickly by the acid.

7.10 Conservation of Glass

Glass is usually the most stable of archaeological materials, but it can undergo some complex disintegration. This is especially true for nineteenth century glass (Gedye 1979:109-13; Pearson 1987:113-15; Plenderleith and Werner 1979:343-51). Ideally, glass should consist of 70-73% silica, 16-22% alkali or soda ash (sodium carbonate), or potash (potassium carbonate, usually derived from wood ash), and 5-10% lime (calcium oxide) used as flux. Soda-lime glass is the most common glass throughout the history of glass-making. This type of glass is
characteristic of southern Europe where it is made from crushed white pebbles and soda ash derived from burnt marine vegetation. Potash glass is more characteristic of inland Europe, where it is made from local sands and potash derived from wood ash and burnt inland vegetation. A little salt and minute amounts of manganese are added to make the glass clear, but potash glass is less clear than soda glass. Most early glass is green because of iron impurities in the glass.

The alkali in glass lowers the melting point of the sand, while the flux facilitates the mixture of the components. As long as the mixture is kept in balance, glass is stable. Problems arise when an excess of alkali and a deficiency in lime (calcium oxide is used as a stabilizer) is used in the mixture; this makes the glass especially susceptible to attack by moisture (relative humidity higher than 40% can be destructive to such glass).

If old glass contains 20%-30% sodium or potassium it may begin to weep and break down when exposed to moisture in a process called glass disease. Sodium and potassium oxides in glass are hygroscopic, therefore the surface of the glass absorbs moisture from the air. The absorbed moisture combined with exposure to carbon dioxide causes NaO₂ or NaOH and KO₂ or KOH in the glass to convert to sodium or potassium carbonate. Both NaCO₂ and KCO₂ are extremely hygroscopic. At a relative humidity (RH) of 40%
and above, and in some cases as low as 20% RH, drops of moisture appear on the glass surface. In water, especially salt water, the Na and K carbonate can leach out leaving only a fragile, porous, hydrated silica (SiO₂) network. This causes the glass to craze, crack, flake and pit, giving the glass surface a frosty appearance. In some cases an actual separation of layers of glass from the body occurs.

At present the decomposition of glass is imperfectly understood, but most glass technologists agree that glass decomposition is due to preferential leaching and diffusion of alkali ions (Na & K) across a hydrated porous silica network. Sodium ions are removed and replaced by hydrogen ions that diffuse into the glass to preserve the electrical balance. The silicates are converted into a hydrated silica network through which sodium ions diffuse out. Decomposed glass often appears to be laminated, with iridescent layers on the surface.

Glass retrieved from an acid environment often displays an iridescent film that is formed by the leached silica layers. The alkali that leaches out is neutralized by the acid, and fewer hydroxyl ions are available to react with the silica. This causes the silica layer to thicken and become gelatinized.

Glass excavated from an alkaline environment is less likely to have laminated layers because there is an
abundance of hydroxyl ions to react with the silica network. Normally a protective layer does not form on glass exposed to alkaline solutions. The dissolution of the glass proceeds at a constant rate. The alkali ions are always extracted in excess of the silica, leaving an alkali deficient layer that continually thickens as the deterioration moves deeper into the glass.

There are considerable differences of opinion over what to do with unstable glass. Some advise that the only treatment should be to keep the glass in low relative humidities so the glass does not have any moisture with which to react. Depending on the stability of the glass, a relative humidity range of 40 to 55% is recommended. The weeping or sweaty condition of glass is sometimes made worse by the application of a surface lacquer or sealant. No resin sealants are impervious to water vapor and the disintegration continues under the sealant until the glass falls apart. Some glass conservators try to remove the alkalinity from the glass to halt deterioration.

7.10.1 Technique for Stabilizing "Weeping" Glass as Described by Plenderleith & Werner (1979:345):

1. Wash thoroughly in running tap water.
2. Soak in distilled water.
3. Dry in two baths of alcohol to facilitate quick drying. This treatment will retard disintegration
and improve the appearance of the glass. It does not, however, always stop the breakdown of the glass.

4. If applicable, apply an organic lacquer, such as PVA or Acryloid B-72, to impede disintegration.

5. Store in a dry environment with a relative humidity no higher than 40%.

Other conservators say 20%-30% relative humidity is ideal. The Corning Glass Museum keeps incipient crizzled glass stored at 45 to 55% relative humidity. Relative humidity of 42% is the critical point at which KCO₃ becomes moist.

7.10.2 Treatment Used in the Leningrad Museum to Clean Glass (Gerassimova 1979).

7.10.2.1 Removal of Soluble Alkaline Corrosion Products

Immerse the glass in 50% water and 50% ethanol or acetone to remove the surface sodium and potassium carbonates and hydroxides without causing any further glass leaching. If placed in straight water the Na and K oxides are leached, readily weakening the glass further. Washing in water alone will not remove all the corrosion products. Water will remove the carbonates, but not the hydroxides. Washing in ethanol alone removes only the alkali metal hydroxides without disturbing their carbonates. Therefore, cleaning only in alcohol is not effective. The presence of
an organic solvent, ethanol or acetone, considerably decreases the hydrolysis of glass by water.

Dry the glass in two baths of ethanol or acetone, then air dry. Do not heat the glass; heat will cause glass to crizzle.

7.10.2.2 To Neutralize "Weeping Glass" and Remove Flaking Calcium Carbonate Deposits from Glass

To neutralize any alkaline corrosion products, immerse the glass in 1% nitric acid mixed in 50% water and 50% ethanol. Do not leave glass in this acid solution for more than 1 hour. More stable glass can be treated by immersion in 1% nitric acid in water. The deterioration of glass by acids is considerably restrained by adding 50% ethanol or acetone to the acid. This treatment removes the white flaky calcium carbonate and neutralizes the alkaline condition in the glass. Rinse in 50% water and 50% ethanol baths until the solution has a neutral pH (stays at the pH of the solution when freshly mixed). Finally, dry the glass in two baths of ethanol. Apply surface sealant if needed. Store the glass in a dry environment.

The above treatment removes surface corrosion products. The decision to remove surface corrosion products has to be made on a case by case basis as the process sometimes can weaken glass objects significantly. Indiscriminate removal of surface corrosion products can
weaken, blur or alter surface details. The corrosion layers of a glass object may be deemed a part of the history of the object.

7.10.3 Devitrification

The surface of any glass, especially soda glass, becomes hydrated through time. Devitrification occurs when the surface of glass becomes partly crystalline as it absorbs moisture from the atmosphere. As the surface becomes crystalline it becomes crazed and flakes from the body of the glass. Devitrified glass has a frosty or cloudy, iridescent appearance. Pane glass is especially susceptible. To prevent further devitrification and to consolidate the crazed surface apply a coating of PVA or Acryloid B-72. Any of these surface adhesives will smooth out irregularities in the pitted, crazed surface of glass and, by filling in the small cracks and forming optical bridges, makes it appear more transparent. Merely wetting glass will cause it to appear clearer for the same reason.

7.10.4 Reconstruction

Glass can be repaired and reconstructed with the same glues as described for pottery, but clear epoxy resins are generally used as they adhere to smooth non-porous glass more readily. They also dry clearer and shrink less than the solvent resins, are less noticeable and form stronger
bonds. Epoxy resins, however, are usually irreversible. Hysol Epoxy 2038 with Hardener 3416 and Araldyte, are the two brands most commonly used in glass repair. The new "super glues" made of cyanoacrylate are used quite often to piece glass together quickly. After using cyanoacrylate, an epoxy is flowed into the cracks with an artist's brush to permanently glue the pieces. It is exceptionally difficult and time-consuming to gap fill glass. It requires considerable work and experience. The problem of matching transparent glass colors is equally difficult.

7.10.5 Miscellaneous Glass Conservation Information

The color of glass is determined by the type of metal additives in it. Green glass contains either iron or chromium. Magnesium and lead produce clear glass. Blue glass has cobalt blue or cupric oxide added. Cupreous oxide, selenium or gold is added to produce red glass.

The following treatments can be used for glass:

1. A 10% nitric acid solution is used to remove lead oxide.

2. A 5% sulfuric acid solution is used to remove iron oxide and to neutralize the alkalinity of glass that is breaking down; it is occasionally used for removing calcareous deposits.

3. A 10% solution of hydrochloric acid is used to remove calcareous deposits.
4. A 5% oxalic acid solution is used to remove iron stains.

5. A 5% disodium of EDTA solution is used to remove iron stains.

6. A 5% tetrasodium EDTA solution is used to remove calcareous deposits.

7.10.6 Treatment of Onion Bottles from Port Royal, Jamaica

The following treatment is used by Hamilton for onion bottles recovered from the 1692 sunken city of Port Royal, Jamaica.

1. Place the bottles in a vat of fresh water until conservation can be started.

2. If required, mechanically clean the bottle of adhering encrustation. Do as much mechanical cleaning as possible without damaging the bottle.

3. If necessary, place the bottle in 2% sulfuric acid to remove calcareous deposits.

4. If necessary, place in 1% nitric acid to remove lead oxide.

5. Rinse the bottle thoroughly until all conservation chemicals and any alkalis from the disintegrating glass are removed. Continue rinsing until the pH of the deionized water remains unchanged.

6. Dry the bottle in several, at least three, baths of ethanol or acetone.
7. Vacuum impregnate the bottle with PVA or Acryloid B-72 in a vacuum chamber.

8. Ideally, store the conserved bottle in low relative humidity (below 40%).

7.10.7 Stemware

Leaded glass, e.g., some stemware and various cut lead crystal, normally very clear, will be badly stained with lead sulfide when it is recovered from a marine or anaerobic site. Such glass will have a dense black film on its surface. As with ceramics, a 10 to 15% hydrogen peroxide solution is used to remove the sulfide stain.

7.11 Conservation of Leather
7.11.1 Preliminary Cleaning

All archaeological leather conservation is preceded by washing to remove any ingrained dirt. First try washing in water alone (Jenssen 1987). Leather may, however, require a variety of mechanical cleaning techniques, depending on the condition of the leather and the particular cleaning problem. Soft brushes, water jets, ultrasonic cleaners and a Cavitron may be required. If chemical cleaning is necessary to remove ingrained dirt, a small amount of non-ionic detergent (a solution of about 1% is best) or sodium hexametaphosphate can be used. If Calgon is used, make sure the pH is between 3 and 5. The addition of
additives in Calgon may make it unsafe for leather treatment. Rinse the leather well after washing. Do not use any chemicals that will damage the collagen fibers of leather.

For stain removal, particularly of iron, 3-5% ammonium citrate or disodium EDTA solutions are used. Soak the leather in the solution for 2 to 3 hours while monitoring the treatment closely. Next rinse the leather in running water or standing tap water, until all chemical residues are removed. Check the pH of the standing bath of water containing the leather to determine the complete removal of the chemicals. Always keep in mind that the chemicals used to clean rusts and mineral concretions (oxalic acid, HCl, EDTA) may produce further hydrolysis of proteinaceous collagen fibers, leather's main constituent, and that they can remove tanning, coloring agents, painted decorations and other features that are part of the diagnostic attributes of the leather object.

7.11.2 Treatment of Wet or Waterlogged Leather

Prior to treatment, waterlogged leather should be stored in water with an antibacterial agent such as 0.1% Dowicide 1. Treated leather should not be stored at a relative humidity higher than 63%.
7.11.3 PEG Treatments

Leather can be treated with PEG 400, 600, 1450 and 3350 or 540 Blend. Start with a dilute solution (10%) of PEG and increase the concentration through evaporation of the solvent or by adding PEG up to a concentration of 30%. Aqueous solutions are slower but less expensive. Solvent solutions are much faster, and considerably more costly, but produce a lighter leather with more uniform shrinkage. Some conservators prefer alcohol treatments, while others think that alcohol treatments cause the leather to shrink more than comparable aqueous treatments. All the PEG treatments can be satisfactory by themselves, but the treatments are considerably enhanced if taken through a freeze-drying final step. A commercial freeze-drying vacuum chamber may be used, or a domestic chest freezer can give good results. The former takes only a week or so, while the latter may require several weeks. Progress is determined by regular weighing of the object to determine weight loss as the leather dehydrates.

7.11.4 Combination EDTA, Acetone and Bavon Treatment

1. Wash the leather in a 1% solution of Lissapol. Never use commercial detergents on leather as they may extract tanning material. Use castile soap, soft soap or saddle soap.
2. To remove iron stains, place the leather in 3-10% disodium EDTA (pH 4) or ammonium citrate (pH 5) for a maximum of 1 hour, less if possible. Tap water can be used, but the leather may yellow from iron tannate dissolved by the EDTA. EDTA has been reported to damage fibers of leather but is relatively safe if used selectively and cautiously. A 3-5% ammonium citrate (pH 5) can also be used and, in fact, is recommended over disodium EDTA by the Canadian Conservation Institute. This step is necessary only if iron stains are present.

3. If necessary, place the leather in 2% HCL for up to 1 hour to dissolve calcareous material.

4. Rinse the leather very thoroughly in running water for 30 minutes to lower the leather's pH to between pH 3-6 or to the pH of the rinse water.

5. Dehydrate the leather in acetone. Use two or more baths, e.g., four successive baths of 1 hour each.

6. Air dry until the "leather feels like leather," then place it between absorbent tissue and glass to continue drying for 24 hours.

7. Apply Bavon Leather Dressing with a brush. Flex and manipulate the leather during the application of the Bavon. The formula for Bavon is:

   a) 1 liter of stabilized 1:1:1 trichloroethane
b) 1 gram Dowicide 1

c) 50 grams anhydrous lanolin

d) 20 grams Bavon ASAK-ABP

Bavon ASAK-ABP is a copolymer of polyhydric alcohol and a partial ester of an unsaturated hydrocarbon. When applied as a leather dressing it lubricates the leather, resulting in a pliable, natural brown leather.

Thicker pieces of leather can be soaked in PEG 4000 at 60° C. The concentration of PEG should be increased gradually over a week or two from 10% to 100%. This allows the water to evaporate as equal amounts of PEG replace the evaporated water.

7.11.5 Dehydration Using Organic Solvents

This treatment involves the replacement of water in leather with a water miscible organic solvent. In most cases a sequence of solvents with decreasing polarity are used, e.g., a series of baths of 50% water and 50% isopropanol, a bath of 100% isopropanol, a bath of 100% ethanol or 100% methanol, followed by a bath of 100% methyl ethyl ketone, then 100% acetone and finally 100% ether may be used. This example is a very conservative method of treatment. In most instances fewer baths are used, and for some leather, drying only through acetone is necessary.
Slow desiccation of glutinous collagen fibers allows their surfaces to become less sticky and less brittle, thus more flexible.

7.12 Conservation of Textiles

The term "textiles" applies to woven and interlaced fabrics. The term is used also for non-woven materials in which fibers gain coherence by a process other than spinning and to describe the fibers, yarns, twines, cords, and ropes produced by spinning, twining and rope-making processes. This short discussion of textile conservation is limited to the natural fibers of animal and plant origin (wool, hair, silk, cotton, flax, jute, hemp, nettle, and grass). Often textiles deteriorate rapidly underwater, so it is unusual to recover them from underwater sites. Those that are recovered are extremely susceptible to further decay from the actions of molds, mildew and bacterial action.

Animal fibers are made primarily of protein and are more resistant to decay than vegetable fibers, which are composed primarily of cellulose. All textiles are deteriorated by light, insects, micro-organisms and air pollution that singularly, or together, cause considerable loss of tensile strength and pliability. Oxygen in the atmosphere affects all organic substances to varying degrees. Textiles are prone to aging and deterioration
from exposure to the atmosphere. The speed of deterioration varies according to the nature of the fibers and environmental conditions. The main factors that promote decay of textiles can be categorized into three groups: (1) organic; (2) physical; and (3) chemical.

Because textiles are organic, they are subject to attack by molds and bacteria. Decomposition of textiles is greatest in situations (such as damp heat, stagnant air and the contact of the material with vegetable matter) that favor the growth of these organisms. Attack by insects may also be encountered.

Physical factors such as excessive heat cause desiccation and brittleness, whereas exposure to ultraviolet light causes a type of deterioration known as tendering and photochemical degradation of susceptible dyes.

Chemical decay occurs when textiles are exposed to noxious gases. In some cases these gases convert to acids when in contact with textiles and are the main cause of deterioration for some types of textiles.

The identity of the fibers composing a fabric should be known before any treatment begins, particularly if stain removal is required. Physical tests, such as burning small strands of the material, can readily identify animal fibers. These do not burn readily and when burnt shrivel into a residue of carbon. Also, they usually emit the
distinct odor of singed hair. On the other hand vegetal fibers burn easily to a fine ash. Many fibers and hairs can be identified readily by microscopic examination. For instance, many animal hairs can be identified by their characteristic cuticle patterns and medullar cross-sections.

The textile materials most often encountered in archaeological sites are linen, cotton, wool, and silk. Linen is a vegetable based fiber derived from flax stalks and branches that have been spun and woven. Linen fibers lie close together and are sturdy. They withstand moderate alkaline conditions because of their cellulose contents, but are easily affected by acids. Moisture easily passes through linen, and it does not take dye readily. Linen is usually found bleached white or in a natural unbleached state.

Cotton is also a vegetable fiber; it can survive in moderate alkaline conditions, but it is adversely affected by acids. Cotton does not transmit moisture like linen. Once processed it is very absorbent and is dyed easily. Cotton thread has a characteristic clockwise twist; for this reason it is commonly spun in a "z" twist.

Wool is the hair of sheep and consists of protein fiber. The majority of the amino acids in the protein of wool are keratin, which contains sulfur. Wool is the favorite food of some insects. Its fiber absorb more
moisture than vegetable fibers and it have a physicochemical nature that causes them to accept dyes better than any other natural fiber. Wool is not a strong fiber and weakens considerably when wet.

Silk is an animal (insect) fiber that is derived from the cocoon filament of the silk moth. Because it is basically protein, silk is easily affected by alkalies and various inorganic acids. Like wool, it absorbs moisture easily and will take dyes readily, however, the dyes are not as light-fast as on wool. While a strand of silk is as strong as a steel wire of the same diameter, silk is very light-sensitive and will break down faster than wool when exposed to ultra-violet rays.

The proper treatment of textiles usually requires shallow pans, hot plates, and racks or other devices to support fragile textiles during rinsing, treatment, and drying.

Each specimen is thoroughly documented with photographs, drawings and written descriptions. The various features and properties recorded should include: (1) the type of fabric (animal or vegetable); (2) the spin of the yarn ("z" or "s" twist); (3) the number of wefts and warps per centimeter; (4) the type of weaving; (5) the type of dye (water-fast or -soluble); (6) the presence of paint, metal threads, and any other features of the specimen that may be diagnostic or of interest.
7.12.1 Cleaning to Remove Soil, Discoloration and Stains

A great number of substances found on textiles can be removed simply by washing the fabric in water. Since water is the best solvent for ordinary dirt, cleaning can be as simple as washing in tap or deionized (DI) water. Where possible, DI water is always preferable. Add to the DI water 0.4% ammonium hydroxide for animal fibers and 1% ammonium hydroxide for vegetal fibers for greater cleansing power. For stubborn soil stains, add 1% neutral non-ionic detergent, such as Lissapol N, to reduce the surface tension of the water. During the washing and cleaning, the fabric usually can be bleached in a solution of 4% hydrogen peroxide and 4% ammonia.

For textiles that cannot be cleaned with water (such as textiles with water-soluble dyes) solvent-cleaning, i.e., dry-cleaning is used. Organic solvents such as perchloroethylene, trichloroethylene, or petroleum solvents (such as white spirits) are good dry-cleaning chemicals. A solution of 20% lanolin in toluene can be applied to fibers that have a tendency to shred or lint. There are distinct advantages to solvent cleaning:

1. Solvents do not soften textile fibers as water does, therefore there is less risk of shrinkage and loss of shape.
2. Dyes that may leach out in water may be undisturbed in solvents.
3. Solvents are more efficient than water for dissolving grease.

4. In general, solvents are volatile and dry quickly.

The cost of solvent-cleaning is much higher than cleaning with water and the problems of toxicity and inflammability must be taken into consideration.

7.12.2 Removal of Metallic Stains

Iron rust stains can be removed from textiles using a 2% to 10% solution (normally 5%) of the following: (1) hydrochloric acid; (2) oxalic acid; (3) acetic acid; (4) formic acid; (5) ammonium citrate.

Cotton fibers can be damaged by chemical treatments whose pH levels are low, i.e. 2.5 or lower. Oxalic has a pH of 1.0, hydrochloric acid has a pH of 0.7 and should only be used with caution. The stain removal process must be monitor carefully to prevent damage to the artifact.

Black sulfide stains, organic stains, mildew and mold can be removed with a 30% hydrogen peroxide solution. If necessary, stronger solutions may be used. For copper corrosion stains use 1% to 5% ammonium hydroxide. Silver corrosion stains can be removed by first soaking the stain with potassium cyanide and then applying a few drops of iodine, which converts the stain to silver iodide. The
silver iodide product may then be removed with a 5% solution of sodium thiosulfate.

After using any chemicals, rinse the textile in neutralized DI water intensively to remove all chemical residues which may adversely affect the fibers over time.

7.12.3 Reinforcing Fragile Textiles

Quite often the only way to reinforce fragile textiles is to fasten them to a mesh of light cotton fabric, fiber glass, or some other suitable substance. In most instances heat-sealable adhesives such as PVA, Acryloid B-72, and emulsions of these, are used to coat the backing, which is then ironed (heat-sealed) onto the fabric. Particularly fragile textile artifacts may be mounted between sheets of plastic or glass.

In other cases synthetic resins are used to consolidate and reinforce fragile textiles. The most often recommended are listed below along with some of their properties:

1. Polyvinyl alcohol, which is water soluble and dries clear with minimum shrinkage.
2. Polyvinyl acetate, which may cause shrinkage on drying and distortion of fibers.
3. Ethulose (ethyl-hydroxyethyl cellulose) is water soluble and remains pliable after drying.
4. Cellulose nitrate.
5. Polymethacrylate.
6. Five percent soluble nylon in methanol.

Since water softens, and makes textile fibers pliable, the emulsions and water-soluble resins are preferred for many applications. Of course water-based adhesives give the conservator more working time than volatile solvents.

Breaks in fibers can be repaired with drops of glue to prevent additional unraveling.

7.12.4 Sterilization

Sterilization, to stop or prevent mold and insect infestation, is a major consideration when dealing with textiles. For wholesale treatment of mold and insect infestation, place the infested objects in a closed container with thymol crystals. The crystals can be vaporized by holding the container over a light bulb. After treatment with thymol crystals, spray the objects with a 0.5-1% solution of the following: 0.1% Dowicide 1 (ortho-phenylphenol), 68% ethanol, and 30% DI water. This treatment will remedy most problems. A 0.05% solution of the above mix is lethal to most bacteria, fungal spores and surface mildews. Keep in mind that the fungicide is a topical treatment and not long-lasting. Carbon disulfide can also be used as a fumigation agent.
7.12.5 Conservation of Waterlogged Canvas and Rope

After a series of tests by the Conservation Division of the Western Australia Museum on canvas and rope recovered from a ship sunk in 1803, and tests in Dr. Hamilton's conservation laboratory, the following sequence of treatment was proposed for the conservation of canvas (and other similar fabrics) and rope:

1. Immerse the fabric or rope in 10% hydrochloric acid to remove adhering encrustation; some iron corrosion and stains will also be removed.

2. Rinse the fabric or rope in running water (watch for any dyes that may be adversely affected).

3. Soak the fabric or rope in acetone to remove any tar, pitch, tallow or other acetone soluble substances (watch for any dyes that may be removed).

4. Soak the fabric or rope in 5% oxalic acid to remove the bulk, if not all, of the iron stains (time of treatment will vary from a couple of hours to a couple of days);

5. Immerse the fabric or rope in 5% EDTA disodium to remove any remaining iron stains (soaking time will vary from a couple of hours to up to 3 days);

6. If the artifact was originally white, bleach in a 30% hydrogen peroxide solution (this should not
be necessary for rope and of course, never use hydrogen peroxide on hair).

7. Rinse the fabric or rope thoroughly (DI or distilled water is recommended for fine fabrics).

8. Dehydrate the material in acetone and air dry.

9. If necessary, consolidate the material with a suitable synthetic resin, and in some instances, treat with heat sealable resin, and dry mount or heat seal to a backing of another fabric, such as light cotton or synthetic mesh.

7.12.6 Proper Storage

Store conserved textiles under proper conditions that include: (1) protection from atmospheric pollutants; (2) limited exposure to ultra-violet light; and (3) a relative humidity of less than 68% (mold will grow in humidity above 70%). Ideally textiles should be stored in a dark place with a low temperature of 10°C and a low relative humidity of 50% or less. These conditions prevent bio-deterioration of the cellulose of vegetal fibers by micro-organisms. In addition, moths and other insects should be deterred by keeping moth balls (paradichlorobenzene) in the storage area. Such care is especially needed for wool. If mold is detected, treat the textiles by spraying them with Dowicide 1, or treat them with a 0.5-1% solution of the following: 0.1% Dowicide 1 (ortho-phenylphenol), 68% ethanol, and 30%
DI water. And then eliminate the source of mold in the storage environment to prevent future problems.

7.13 Storage of Conserved Artifacts

Conserved artifacts should be stored in a museum environment where temperature and humidity are controlled. Also, pests control measures should be in place. The storage of artifacts is of prime concern, since all of the time and expense employed to conserve the artifacts will have been wasted if conserved artifacts are allowed to deteriorate in storage. Detailed information about proper storage and museums can be found in UNESCO (1979) and Pearson (1987).
8. CONCLUSION

The Caribbean region is rich in archaeological sites representative of the diverse cultures that, over the years, have found a home there. The value of these archaeological sites is not so much in the intrinsic value of artifacts to be found but in what the sites represent. Embodied in them is an unwritten record of the European exploration and settlement of the New World. As a site is destroyed by treasure hunters a part of that record is lost forever. If, however, the sites are left alone the record remains intact. At some point, now or later, qualified archaeologists can properly excavate the sites and write that portion of history that is currently unknown.

Treasure hunters will argue that the sites are being destroyed by one action or another, but their arguments are self-serving. Today, the greatest threat to submerged historic ship archaeological sites is the treasure hunter who views the sites as bank vaults to be looted.

Of course, this document is written from an archaeologist's point of view and, for the most part, archaeologists have always been in conflict with treasure hunters concerning archaeological sites. The conflict is based on distinct differences between the two group's motives and methodologies. Archaeologists seek information about the past through the study of archaeological sites;
treasure hunters seek profit through the exploitation of sites. Archaeology is the study of artifacts; treasure hunting is the sale of artifacts. Archaeologists are concerned with all artifacts and their interrelationship with one another; treasure hunters are most interested in artifacts with intrinsic value. For an archaeologist, an artifact's value is based on its information potential; for treasure hunters it is its resale value.

The obvious motivation of a treasure hunter is profit and notoriety. His goals are simple: create a situation that will be of interest to potential investors and go after their money. No matter what public front the treasure hunters present or how hard they argue otherwise, the bottom line is profit, and profit and archaeology are mutually exclusive terms.

Recently treasure hunters have gone to great lengths to demonstrate their use of the same techniques applied by archaeologists in site excavations and the conservation of artifacts. Treasure hunters have come to believe that mastering technical procedures constitutes proper archaeology. The fallacy of this type of thinking is that archaeology is not about techniques or recovering artifacts. Archaeology is a demanding science whose aim is to understand man's past through the study of objects (artifacts) left by man as discards in day-to-day living, or through some catastrophe such as an earthquake, mud
slide, volcanic eruption or shipwreck. The artifacts alone are of little importance; it is the information gleaned from them by archaeologists and passed on to the public through papers, magazines, TV programs and museums that is important. Field techniques are important because the integrity of the artifact assemblage must be maintained to maximize its information potential. But, field techniques are only the means; knowledge of past man and extinct cultures are the end. Anyone can learn how to dig up an object, but only a person who has spent years studying a particular culture or time period can interpret what that object represents as an artifact of history.

The dispute between archaeologists and treasure hunters has been brought to public attention through numerous news sources. Claims and counterclaims are aired in the media with little or no progress toward settling the issue between the antagonists, let alone in the minds of the general public who, I am sure, view the conflict with mixed feelings of amusement and confusion.

Most often archaeologists lose in the battle for favorable public support because of what they are: professional archaeologists. Most archaeologists devote their time to the pursuit of knowledge through study and scientific investigations. Archaeologists spend very little time on developing skills in public relations. In contrast, most treasure hunters are skilled in the art of
persuasion, and often their treasure hunting enterprises
depend upon their ability to convince individuals to invest
in treasure hunting expeditions. Also, treasure hunters
are not bound by ethical standards and guidelines as are
archaeologists employed by universities and government
agencies. Treasure hunters can, and often do, make
unfounded and outrageous statements that are based on
fantasy, not fact. Such a policy is not tolerated in the
community of scholars. Archaeologists are guided by
principles, standards and practices set forth by the
professional archaeological community. Like most
professionals, archaeologists do not embellish facts to
make their projects more glamorous and exciting but often
lean the other way to down-play their own excitement about
a discovery until all of the facts are known.

Many treasure hunters claim to be amateur
archaeologists when in truth they are instead pot hunters.
Pot hunters are people who indiscriminately collect
artifacts for sale or private display. The majority of
amateur archaeologists are persons who have made themselves
aware of the importance of the archaeological record and
strive to protect its integrity. An amateur is defined as
one who cultivates any study or art without pursuing it
professionally, or as a person who does something with
varying amounts of skill. Most amateur archaeologists
recognize their limitations and work with professionals.
They are of great importance to professionals, and they provide many useful talents in the field, laboratory and in archives. Many beneficial ideas and insights are provided to professionals by amateur archaeologists, and it is a disservice to them if they are grouped with treasure hunters.

Another ruse used by treasure hunters is to try to alienate the sport diving community from professional marine archaeologists. Treasure hunters have tried to convince sport divers that archaeologists wish to have laws passed that will prevent sport divers from diving on shipwreck sites. This is absolutely false. What archaeologists and most sport divers want is to stop the destruction of shipwreck sites.

Most projects with which I am familiar depend on volunteers from the sport diving community, and often their help is crucial to the success of a project. Sport divers bring a range of professional expertise necessary to an archaeological excavation. Engineers, doctors, boat operators and dive masters contribute their valuable skills to projects. In some cases volunteer sport divers contribute (besides their time) funds to projects through organizations such as Earthwatch.

The conflict between archaeologists and treasure hunters will continue as long as the latter exploit the world's cultural resources for personal gain.
Archaeologists must endeavor to protect the resource while striving to educate the public of its importance. Education is perhaps the single most powerful weapon that can be used against treasure hunters. A public aware of any wanton and destructive activity will, through various means, cause that activity to cease. Once people are aware that their heritage, their artifacts and their history are being destroyed, then the era of treasure hunting will end.
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APPENDIX

The following document is copied directly from the Guide to the Society of Professional Archeologists (SOPA:5-9).

Code of Ethics and Standards of Research Performance

Code of Ethics

Archeology is a profession, and the privilege of professional practice requires professional morality and professional responsibility, as well as professional competence, on the part of each practitioner.

I. The Archeologist's Responsibility to the Public

1.1 An archeologist shall:

(a) Recognize a commitment to represent archeology and its research results to the public in a responsible manner;

(b) Actively support conservation of the archeological research base;

(c) Be sensitive to, and respect the legitimate concerns of, groups whose culture histories are the subjects of archeological investigation;

(d) Avoid and discourage exaggerated, misleading, or unwarranted statements about archeological
matters that might induce others to engage in unethical or illegal activity;
(e) Support and comply with the terms of the UNESCO convention on the means of prohibiting and preventing the illicit import, export, and transfer of ownership of cultural property, as adopted by the General Conference, 14 November 1970, Paris.

1.2 An archeologist shall not:
(a) Engage in any illegal or unethical conduct involving archeological matters or knowingly permit the use of his/her name in support of any illegal or unethical activity involving archeological matters;
(b) Give a professional opinion, make a public report, or give legal testimony involving archeological matters without being as thoroughly informed as might reasonably be expected;
(c) Engage in conduct involving dishonesty, fraud, deceit or misrepresentation about archeological matters;
(d) Undertake any research that affects the archeological resource base for which she/he is not qualified.
II. The Archeologist's Responsibility to Colleagues

2.1 An archeologist shall:

(a) Give appropriate credit for work done by others;

(b) Stay informed and knowledgeable about developments in his/her field or fields of specialization;

(c) Accurately, and without undue delay, prepare and properly disseminate a description of research done and its results;

(d) Communicate and cooperate with colleagues having common professional interests;

(e) Give due respect to colleagues' interests in, and rights to, information about sites, areas, collections, or data where there is a mutual active or potentially active research concern;

(f) Know and comply with all laws applicable to her/his archeological research, as well as with any relevant procedures promulgated by duly constituted professional organizations;

(g) Report violations of this Code to proper authorities.
2.2 An archeologist shall not:
   (a) Falsely or maliciously attempt to injure the reputation of another archeologist;
   (b) Commit plagiarism in oral or written communication;
   (c) Undertake research that affects the archeological resource base unless reasonably prompt, appropriate analysis and reporting can be expected;
   (d) Refuse a reasonable request from a qualified colleague for research data;
   (e) Submit a false or misleading application for certification by the Society of Professional Archeologists.

III. The Archeologist's Responsibility to Employers and Clients

3.1 An archeologist shall:
   (a) Respect the interests of her/his employer or client, so far as is consistent with the public welfare and this Code and Standards;
   (b) Refuse to comply with any request or demand of an employer or client which conflicts with the Code and Standards;
   (c) Recommend to employers or clients the employment of other archeologists or other
expert consultants upon encountering
archeological problems beyond her/his own
competence;
(d) Exercise reasonable care to prevent her/his
employees, colleagues, associates and others
whose services are utilized by her/him from
revealing or using confidential information.
Confidential information means information of
a non-archeological nature gained in the
course of employment which the employer or
client has requested be held inviolate, or
the disclosure of which would be embarrassing
or would be likely to be detrimental to the
employer or client. Information ceases to be
confidential when the employer or client so
indicates or when such information becomes
publicly known.

3.2 An archeologist shall not:
(a) Reveal confidential information, unless
required by law;
(b) Use confidential information to the
disadvantage of the client or employer;
(c) Use confidential information for the
advantage of herself/himself or a third
person, unless the client consents after full
disclosure;
(d) Accept compensation or anything of value for
recommending the employment of another
archeologist or other person, unless such
compensation or thing of value is fully
disclosed to the potential employer or
client;
(c) Recommend or participate in any research
which does not comply with the requirements
of the Standards of Research Performance.

10.1.2 Standards of Research Performance

The research archeologist has a responsibility to
attempt to design and conduct projects that will add to our
understanding of past cultures and/or that will develop
better theories, methods, or techniques for interpreting
the archeological record, while causing minimal attrition
of the archeological resource base. In the conduct of a
research project, the following minimum standards should be
followed:

I. The archeologist has a responsibility to prepare
adequately for any research project, whether or not in the
field. The archeologist must:
1.1 Assess the adequacy of her/his qualifications for the demands of the project, and minimize inadequacies by acquiring additional expertise, by bringing in associates with the needed qualifications, or by modifying the scope of the project;

1.2 Inform herself/himself of relevant previous research;

1.3 Develop a scientific plan or research which specifies the objectives of the project, takes into account previous relevant research, employs a suitable methodology, and provides for economical use of the resource base (whether such base consists of an excavation site or of specimens) consistent with the objectives of the project;

1.4 Ensure the availability of adequate staff and support facilities to carry the project to completion, and of adequate curatorial facilities for specimens and records;

1.5 Comply with all legal requirements including, without limitation, obtaining all necessary
governmental permits and necessary permission from landowners or other persons;

1.6 Determine whether the project is likely to interfere with the program or projects of other scholars and, if there is such a likelihood, initiate negotiations to minimize such interference.

II. In conducting research, the archeologist must follow her/his scientific plan of research, except to the extent that unforeseen circumstances warrant its modification.

III. Procedures for field survey or excavation must meet the following minimal standards.

3.1 If specimens are collected, a system for identifying and recording their proveniences must be maintained.

3.2 Uncollected entities such as environmental or cultural features, depositional strata, and the like, must be fully and accurately recorded by appropriate means, and their location recorded.

3.3 The methods used in data collection must be fully and accurately described. Significant
stratigraphic and/or associational relationships among artifacts, other specimens, and cultural and environmental features must also be fully and accurately recorded.

3.4 All records should be intelligible to other archeologists. If terms lacking commonly held referents are used, they should be clearly defined.

3.5 Insofar as possible, the interests of other researchers should be considered. For example, upper levels of a site should be scientifically excavated and recorded whenever feasible, even if the focus of the project is on underlying levels.

IV. During accessioning, analysis and storage of specimens and records in the laboratory, the archeologist must take precautions to ensure that correlations between the specimens and the field records are maintained, so that provenience, contextual relationships and the like are not confused or obscured.

V. Specimens and research records resulting from a project must be deposited at an institution with permanent curatorial facilities.
VI. The archeologist has responsibility for appropriate dissemination of the results of her/his research to the appropriate constituencies with reasonable dispatch.

6.1 Results reviewed as significant contributions to substantive knowledge of the past or to advancements in theory, method or technique should be disseminated to colleagues and other interested persons by appropriate means such as publications, reports at professional meetings, or letters to colleagues.

6.2 Requests from qualified colleagues for information on research results directly should be honored, if consistent with the researcher's prior rights to publication and with her/his other professional responsibilities.

6.3 Failure to complete a full scholarly report within 10 years after completion of a field project shall be construed as a waiver of an archeologist's right of primacy with respect to analysis and publication of the data. Upon expiration of such 10 year period, or at such earlier time as the archeologist shall determine not to publish the results, such data should be
made fully accessible for analysis and publication to other archeologists.

6.4 While contractual obligations in reporting must be respected, archeologists should not enter into a contract which prohibits the archeologist from including her or his own interpretations or conclusions in the contractual reports, or from a continuing right to use the data after completion of the project.

6.5 Archeologists have an obligation to accede to reasonable requests for information from the news media.
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