U.S.S. Alligator Ballast Report

Establishing a Ballast Typology System

ABSTRACT

This report is presented with an aim at establishing a ballast typology with the formulation of various rock ballast modal types. The ballast pile is approached not only as a major archaeological feature, but as an artifact as well. As an artifact, the ballast pile was constructed by humans and served in having a definite purpose. Modal types of ballast will be established with considerations relating to human behavior patterns regarding the placement of ballast within a vessel. Problems associated with the sampling of ballast and the consideration of various sampling techniques are addressed. The modal types are designed so as persons inexperienced in rock identification can utilize the system to gather a large amount of data in a limited amount of time with the least amount of errors. The data for this report was acquired from underwater survey and excavation work done on the U.S.S. Alligator site that lies off of Alligator Reef near Islamorada, Florida.

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INTRODUCTION

Historical Background

The U.S.S. Alligator was constructed at the Boston Navy Yard in Massachusetts. The vessel is a schooner design that made it smaller than the square-rigged men-of-war of the times. This design also made it faster than smaller pilot-boat schooners used by pirates of the era. The U.S.S. Alligator weighted 186 tons, was 86 feet in length, had a twenty-four-foot seven inch beam, with a draft of ten feet four inches. The armament consisted of twelve six-pound cannons. (Zarzynski, 1995)

Construction was started on June 26, 1820 and the vessel was launched on November 2, 1820. In 1821 the U.S.S. Alligator was commissioned with Robert Field Stockton as the commander. There were three other similarly designed vessels along with the U.S.S. Alligator that were constructed to patrol for slavers off the coast of Africa and to suppress piracy off the coast of Florida and the West Indies. The first assignments of the U.S.S. Alligator resulted in the capture of approximately eight slave trading vessels before returning to the United States. In 1822 the U.S.S. Alligator sailed to the West Indies under the command of William Howard Allen. The cruise was successful with the capture of many pirate vessels but with the loss of life to commander Allen. While on an escort duty for vessels bound for the north under the new command of Lieutenant Dale, the U.S.S. Alligator ran aground on Carysfort Reef in the Florida Keys on November

18, 1822. Crewmembers spent three days trying to free the U.S.S. Alligator from the reef. The crew attempted to lighten the vessel by throwing overboard the rigging, guns, shot, chain, ballast, and every other article of weight. The attempt was not successful and the vessel was stripped, abandoned and burned. (Zarzynski, 1995)

Environmental Description

The environmental area surrounding the U.S.S. Alligator is known as the Atlantic Ocean Biogeographic Region, which is a band of living coral reefs paralleling the Florida Keys. The region starts from the shore and progresses toward the ocean and includes the following; inshore patch reefs, Hawk Channel with the mid-channel patch reefs, the Florida Keys Reef Tract, and outlier reefs. The Florida Keys Reef Tract is made up of offshore patch reefs, bank/transitional reefs and intermediate/deep reefs. (US Dept. of Commerce, 1995b: 47-49)

The remains of the U.S.S. Alligator lay adjacent and seaward to a shallow bank reef that may be exposed during mean low tides. (US Dept. of Commerce, 1995a: 50) The biological community that inhabits the area is referred to as a hard bottom community. A hard bottom community contains living coral patch reefs with fire corals, soft corals, sea fans, and sponges. Invertebrates include annelid worms, brittle stars, shrimp, Queen conch, and spiny lobster. Numerous types of fish are present along with endangered hawks bill, green and loggerhead turtles. (US Dept of Commerce, 1995b: 50)

The US Department of Commerce (1995a: 276) writes that,

> Alligator Reef is easily accessible and mooring buoys are currently in place. The reef is heavily used for a variety of recreational and commercial purposes. Diving and snorkeling activities focus on the spur-and-grove system and reef crest. Commercial activities occur in the ruble areas and surrounding flats and include tropical fish collecting and ballyhoo fishing.

Site Location and Description

The U.S.S. Alligator is located approximately three miles off of Islamorada, Florida in Monroe County, off of Alligator Reef. UTM references are zone 17, 626142 easting, 9017510 northing and zone 17, 626140 easting, 9018023 northing. (Mathewson et al, 1996) The site is in approximately eight to ten feet of water located in a sandy area of the sea bottom between Alligator Reef toward the west and patch reefs toward the east. (Figs. 1-3) AVisible features of the Alligator are limited to the lower hull structure, two ballast piles (a primary ballast pile and a secondary ballast pile), coral heads, coral rubble, and sand.≅ (Mathewson et al, 1996)

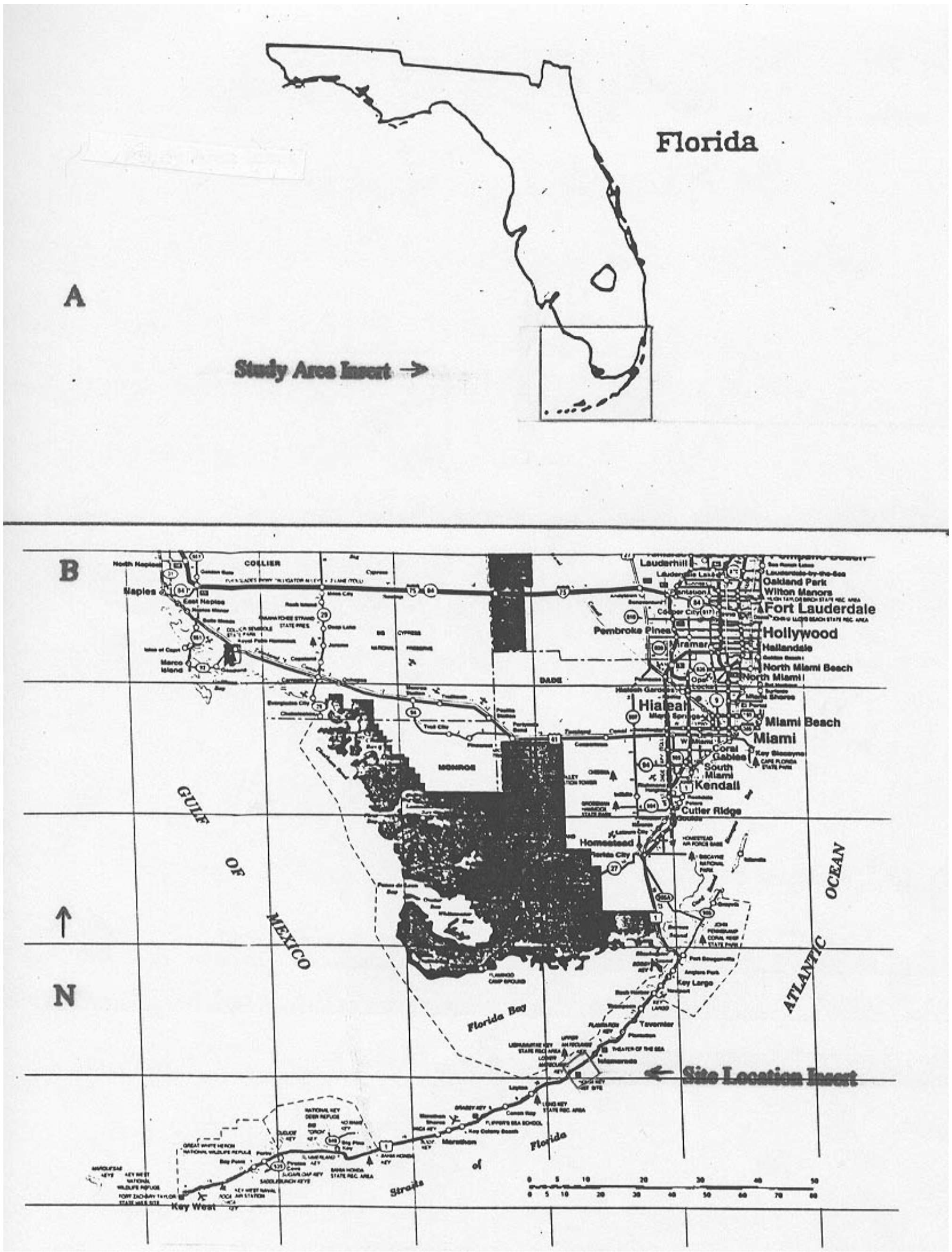

Figure 1. Maps of study area. (Neff Maps Inc. 1995)

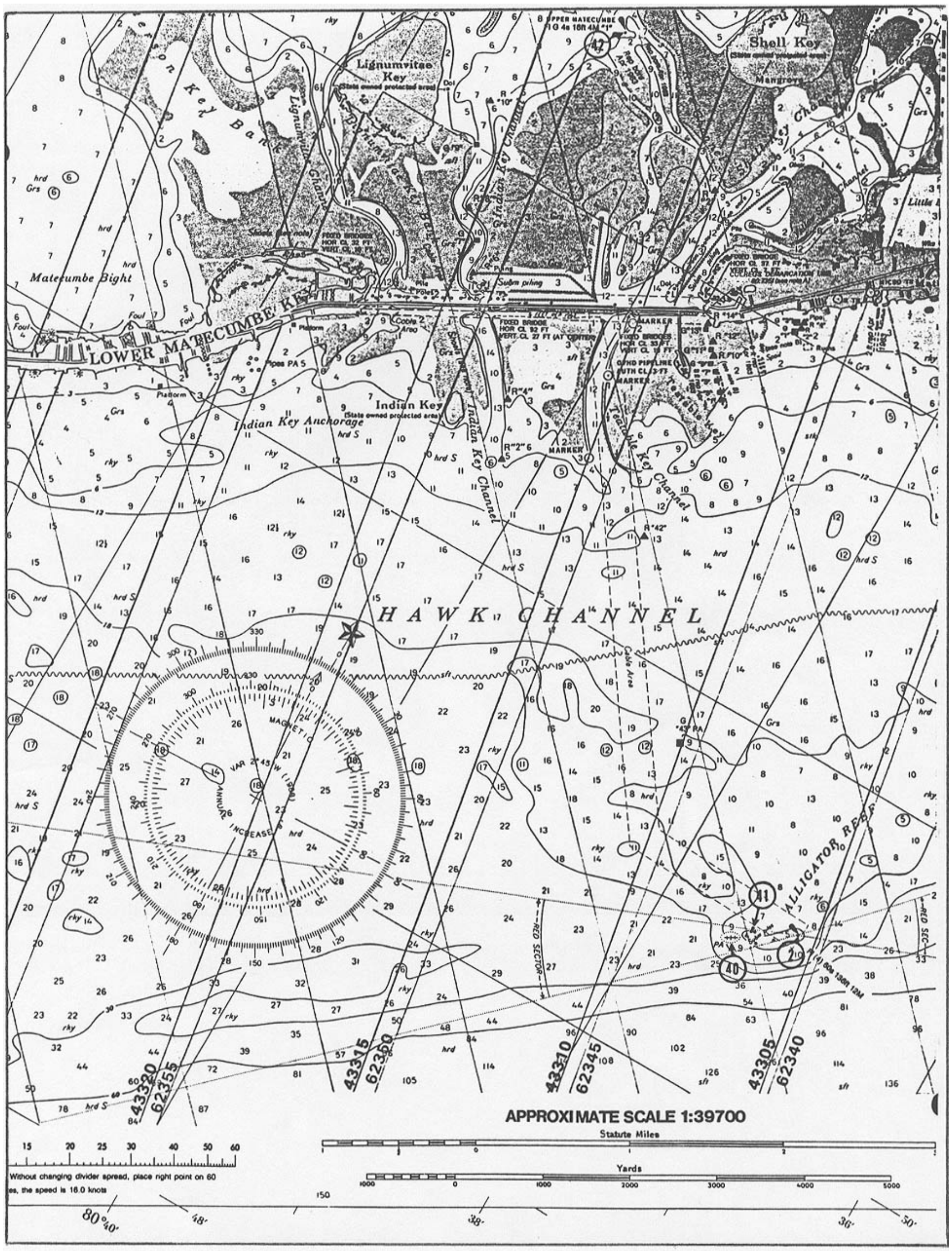

Figure 2. Map of site location. #2 (International Sailing Supply, 1980)

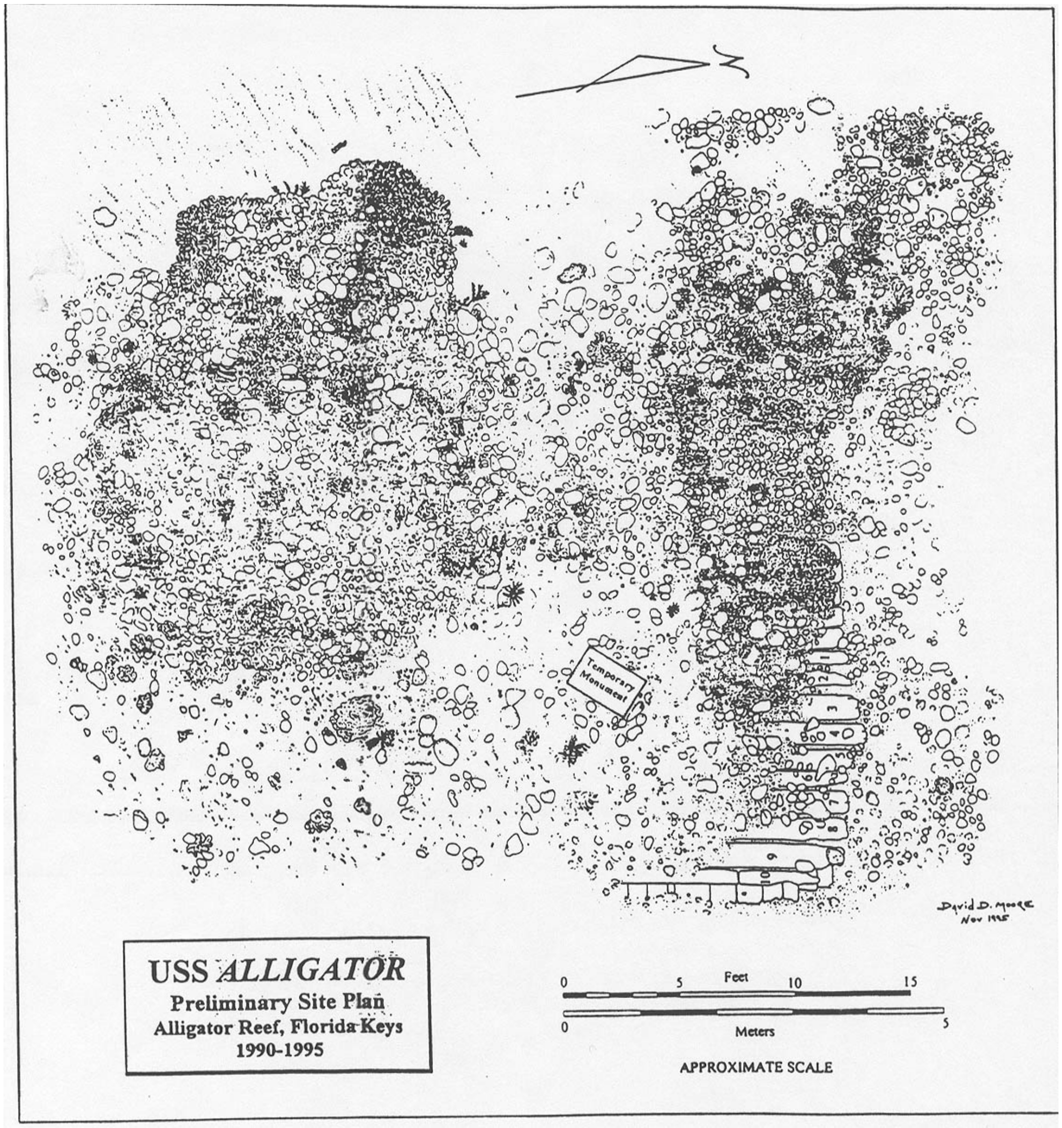

Figure 3. Site plan. (Moore, 1995)

Previous Work

Archaeological work on the U.S.S. Alligator started in July 1990 with volunteer and student divers working under the direction of marine archaeologist R. Duncan Mathewson III of the National Center for Shipwreck Research (NCSR) and Dr. Roger Smith, underwater archaeologist for the State of Florida. The team completed a side-scan survey of the site, a preliminary phase one map of the site, and examination of various hull structure components. In 1992, the NCSR and the FKMS published a diver's slate site map as part of an educational resource book for Monroe County public schools. In 1995, David Whall of the NCSR compiled a photo mosaic of the U.S.S. Alligator site (Fig. 4) and consulting marine archaeologist David D. Moore completed a new phase one map of the site (Fig. 3) using data gathered from 1990 to 1995. In 1995 the site was revisited to further inspect the two prominent ballast pile features on the site.

(Mathewson et al, 1996)

> After this visit, project archaeologists hypothesized that the alignment, size, and structural configuration of the two ballast pile features suggest the smaller feature represents the primary ballast pile with the rocks still in-situ resting on the timbers. The team contends the larger feature represents a secondary ballast pile consisting of discarded ballast thrown out of the vessel in an attempt to lighten it after it ran aground . . .
> (Mathewson et al, 1996)

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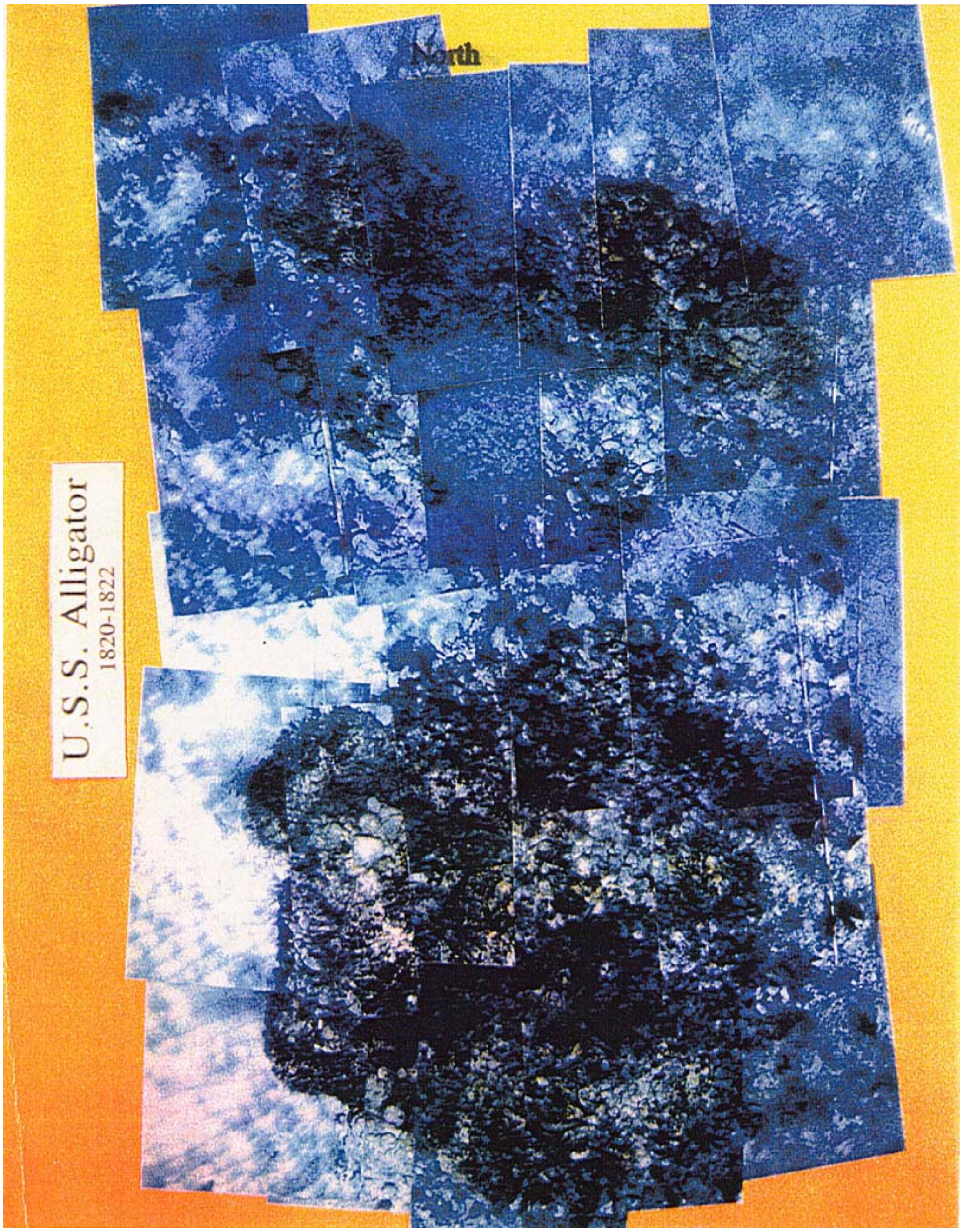


Figure 4. Photo mosaic. (Whall, 1995)

RESEARCH OBJECTIVES

Ballast Introduction

> Ballast rock piles are probably the most enduring of all the possible archaeological remains of shipwrecks. They are often identified by their characteristic ellipsoid or >ship-like= shape. Analysis of their dimensions can yield estimates of the size and gross tonnage of the vessel. In some cases, geological analysis of their constituent stones can identify the vessel=s port-of-origin or ports-of-call if the ballast stones are found which are diagnostic to a specific region.
> (US Dept. of Interior, 1989: 7-3)

Establishing Human Behavior Patterns With Ballast

A ballast pile cannot only be looked at as a major archaeological feature, but can also be looked upon as an artifact. As an artifact, the ballast pile was constructed by humans and served in having a definite purpose. Ballast was a major feature of wooden hulled sailing ships because it lowered the ship's center of gravity to provide stability to counter act the stress from wind upon the sails. A ship would become top heavy and capsize if the lower portions of the ship did not have enough ballast. (Mathewson, 1991)

With this in mind, it can be hypothesized that wooden hulled sailing vessels were ballasted with a major attempt in assuring that the ballast did not shift while the vessel was underway. What evidence shows that the ballast was stacked to eliminate the threat of this problem? Is there evidence to show that the ballasting of a vessel was done at random with no regard for the possible threat of ballast shifting and the possibility of the vessel capsizing? What are the variables of shape, size, and rock type that determined the placement of ballast within the pile? Can it be determined if there are stratigraphic features visible within the ballast pile? Are there any indications that ballast was further modified from its original form to further its intended use within the ballast pile?

Ballast Sampling Considerations

The first consideration when sampling a ballast pile is that the sample size must be kept small, while at the same time the sampling procedures utilized need to be kept unbiased. A second consideration is that the samples must be representative of the overall variations of ballast within the entire population being sampled. Random sampling will fulfill these criteria. Random sampling procedures rely on the theory of probability, with the samples being taken from a known population. AThe problem with sampling ballast deposits has always been that the population is never known from which to draw the samples from.≅ (Mathewson, 1996)

Aims at Establishing a Ballast Typology

One aspect of research on the U.S.S. Alligator archaeological site was to use the site for the development of a training system for divers performing identification of ballast rocks underwater with a minimal amount of recovered samples. The system chosen is able to facilitate the classification of various kinds of recovered samples. The system was designed so as persons inexperienced in rock identification can utilize the system with the least amount of confusion or errors, especially while working underwater. A diver working underwater has only limited bottom time to accomplish tasks. With this in mind, the typology system must be simple to use underwater. The classification system will not function properly if too much time is spent by the diver in trying to decide the attributes of a single sample. The system was designed so many different attribute types are not placed in any single category. The various attributes used must be easily recognizable and understood without the aid of complex references.

The typology system utilizes the attributes of shape, size, and rock type to formulate various modal types of ballast rocks. Modal types are chosen because the ballast rocks were chosen for a specific purpose in a cultural setting when originally placed upon the vessel. The attributes must be well defined and understood before an attempt is made to utilize them underwater.

FIELD METHODOLOGY

Sampling Techniques Utilized

Ballast from the U.S.S. Alligator was sampled utilizing the following methods, stratified random sampling, cluster sampling, and opportunistic sampling. A stratified random sampling technique was incorporated to sample a stratified section of ballast that remains previously undisturbed and in-situ resting on top of ceiling timbers. The stratified random sample method was chosen so that attributes of the ballast sample could be studied in positions relative to each other within the stratified section. A cluster random sample technique was employed to narrow the sample down from a large heterogenous population to small homogenous units within the population which are easy to sample. (Mathewson, 1996)

An opportunistic sampling procedure was used to find samples that have any of the obvious visible attributes such as shape, size, or rock type which is being utilized in the formulation of the ballast modal types. Ballast was only sampled in the area of the primary north ballast pile. (Fig. 3)

Formulation of Ballast Modal Types

The first criteria to be determined are the initial shape of the ballast sample. Using the identification sheets, it is possible to make an initial determination on whether the ballast sample is round, sub-round, oval, or angular. (Figs. 5-9)

In determining the initial shape it is important to remember the inclusion of secondary features when judging ballast which may have the inclusion of a fracture or fractures that may mislead the identification of the sample as angular, when the sample conforms more closely to round, sub-round, or oval, while possessing the inclusion of the secondary descriptor of being fractured. (Fig. 10) After the initial shape has been determined, one next proceeds to note any secondary descriptors. Round, sub-round, and oval types may have the secondary descriptor of being fractured. (Fig. 10) Oval samples may have the secondary descriptor of being flat. Angular samples may be geometrically defined.

Following the identification sheets, the sample is next checked for size (Figs. 11-12) by using a modified and expanded version of methods devised by Mathewson (1983: 60) (1991) in 1977, and used on the Atocha and Pilar sites. The final steps in field identification consist of determining the rock type. The staged method from Pellant (1992: 40-45) has been adapted to aid with this identification. By using surface texture, it is possible to determine if the sample is igneous, metamorphic, or sedimentary. Surface texture shows the general structure of the crystals or grains.

Igneous

Igneous rocks will show a crystalline structure of interlocking mineral crystals. If it has been determined that the sample is an igneous rock, than the next step is to determine the grain size and color. The color of an igneous rock is usually a good indicator of the mineral content of the sample. Light colored igneous rocks are referred to as acid or felsic rocks and are rich in silicates, while dark colored igneous rocks are referred to as basic or mafic rocks and are rich in ferro-magnesian minerals. Rocks in between these two categories are referred to as intermediate. (Pellant, 1992: 33, 42-43) (Press and Siever, 1994: 69-71) Features used to determine that the sample is igneous such as the inclusion of phenocrysts must be noted for the possibility of a more exact rock type by identifying mineral content of the phenocrysts.

Metamorphic

Metamorphic rocks will show signs of foliation that is often wavy. If it has been determined that the sample is metamorphic, then the degree of foliation along with the grain size and color will be utilized to make a more exact determination of the rock type. Foliated rocks are classified by the increasing intensity of the metamorphism as when the metamorphism increases, so do the crystal size and coarseness of foliation. The lesser-metamorphosed rocks have a slaty cleavage and are referred to as slates. Medium metamorphism lends to schistosity and is called schist. Intense metamorphism shows banding and is referred to as gneiss. (Press and Siever, 1994: 176)

Unfoliated metamorphic rocks can be identified by noting the grain size and color. The lighter marbles can range in grain size from coarse to fine, while darker hornfels are medium grained.

Sedimentary

Sedimentary rocks are made up of mainly rock fragments and will show layering. The grains are held poorly together and may be able to be rubbed off with your fingers. To determine the rock type, one must decide what are the mineral constitutes in the sample. Whether the rock is coarse, medium, or fine grained, most sedimentary rocks will have a mineral composition primarily composed of quartz, calcium carbonates, or other minerals. The quartz-composed rocks will normally be defined as gray in color and very hard. Limestones that are rich in calcium carbonates will be pale in color. Sedimentary rocks containing other minerals will be medium or fine grained and normally darker in color. (Pellant, 1992: 42-45)

Formulation Modal Types

SHAPE

ROUND

Criteria:

1-Circular

2-Shaped like a round ball

3-All sides being spherical

4-All diameters are equal

Secondary Descriptors:

Fractured (see definition page 21)

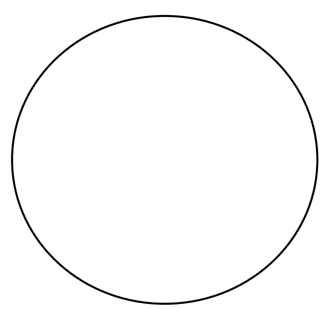


Figure 5. Illustration of round shape.

Formulation Modal Types

SHAPE

SUB-ROUND

Criteria:

1-A lesser degree of being round

2-Irregular rounded shape

3-All diameters are not equal

Secondary Descriptors:

Fractured (see definition page 21)

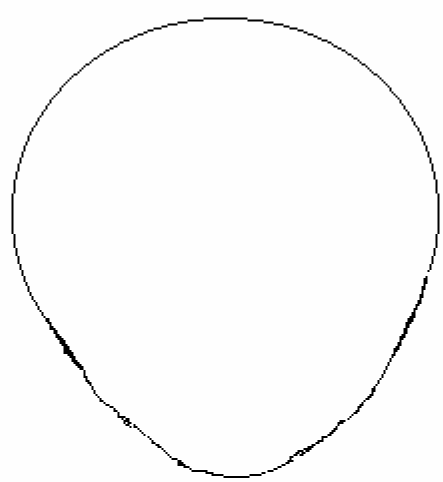


Figure 6. Illustration of sub-round shape.

Formulation Modal Types

SHAPE

OVAL

Criteria:

1-Oblong shaped

2-Egg shaped

3-Curvilinear

4-Long axis diameter is approximately twice the size of the short axis diameter

Secondary Descriptors:

Fractured (see definition page 21)

Flat: Where the long-laterial faces of the sample are less spherical than of the typical egg shape.

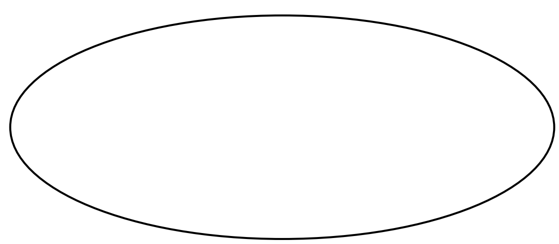


Figure 7. Illustration of oval shape.

Formulation Modal Types

SHAPE

ANGULAR

Criteria:

1-Sharp defined corners

2-Distinct angles

3-Points

4-Closely conforming to a geometric shape, i.e., square, rectangle, wedge, etc.

Secondary descriptors: sub- i.e., sub-square, sub-rectangular, sub-wedge, etc.

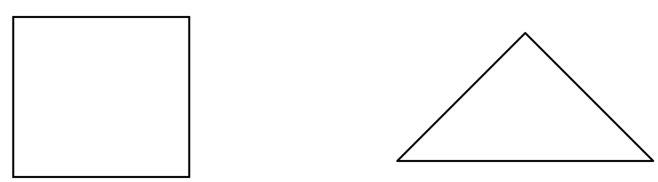


Figure 8. Illustration of angular shape.

Formulation Modal Types

SHAPE

SUB-ANGULAR

Criteria:

1-Sharp defined corners

2-Distinct angles

3-Points

4-Not having a geometrically defined shape

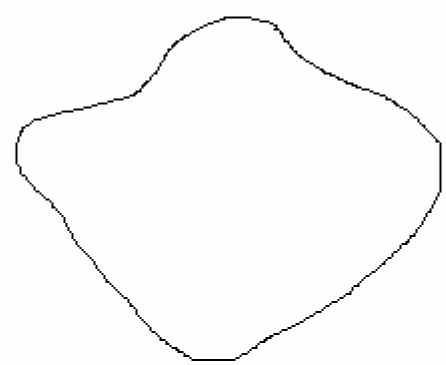


Figure 9. Illustration of sub-angular shape.

Formulation Modal Types

SHAPE

Secondary Descriptor: FRACTURED

Criteria: Having the inclusion of a presumably human-made break or breaks in a sample that otherwise would resemble a primary shape.

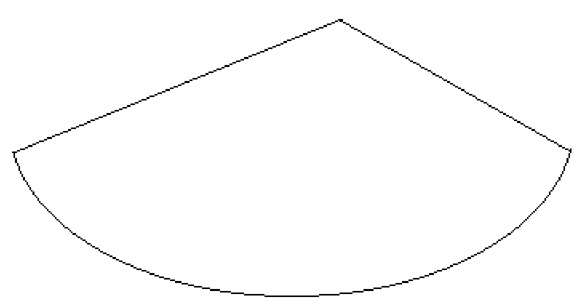


Figure 10. Illustration of fractured shape.

Formulation Modal Types

SIZE

Long Axis Diameters (LAD)

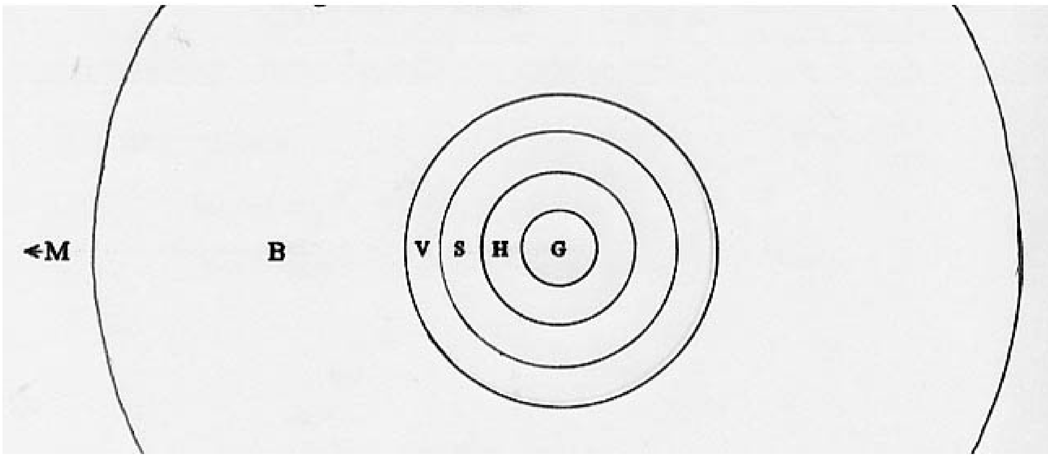
DESCRIPTOR Name Ltr. Code	Actual dia. inches/feet	Actual dia. centimeters	**LAD inches/feet**	**LAD centimeters**
Golf ball G	1 11/16"	4.3cm	**>2"**	**>5cm**
Hard ball H	2 13/16"	7.2cm	**2"-4"**	**5-10cm**
Soft ball S	4"	10.5cm	**4"-6"**	**10-15cm**
Volley ball V	8"	21.0cm	**6"-8"**	**15-20cm**
Basket ball B	10"	25.5cm	**8"-2'**	**20-60cm**
Medicine ball M	13 3/8"	34.0cm	**<2'**	**<60cm**

Figure 11. Size chart.

Formulation Modal Types

SIZE

Long Axis Diameters (LAD)



Reduced 1/4 Actual Size

Figure 12. Illustration of size scale.

Formulation Modal Types

ROCK TYPE

Surface Texture

IGNEOUS: rocks will have the following characteristics

1-Randomly oriented crystals

2-Interlocking crystals

3-Lack of bedding

4-Lack of fossils

5-Having phenocrysts

METAMORPHIC: rocks will have the following characteristics

1-Foliated bands

2-Wavy bands

3-Schisted

4-Fused crystalline structure

SEDIMENTARY: rocks will have the following characteristics

1-Weakly cemented crystals that can be rubbed off by hand

2-May have layering

3-May have the inclusion of fossils

Formulation Modal Types

Rock Types

GRAIN SIZE

NOTE: Grain size refers to the grains in the main body of the rock and not of any odd large crystals present.

Coarse:

Easily visible with the naked eye

Medium:

A hand lens would be needed to see the grains but a texture will be visible by eye as compared to being fine grained.

Fine:

Grains will not be visible without the aid of a microscope

COLOR

Light	Medium	Dark

DATA

Acquisition of Field and Laboratory Data

In designing the modal type identification system, the actual field data was not assessed underwater as the modal type identification chart had not yet been designed. The data and samples from the U.S.S. Alligator were utilized to construct the design of this modal type identification system, and the data has been presented in the form of a field data chart as *if* the data had been collected underwater. Compiling of the field data was assessed while the samples were both uncleaned of marine concretions and wet, so the samples were as close to the actual recovered state as possible. Photographs of samples were taken while samples were dry but uncleaned of marine concretions.

Laboratory data was assessed after the samples had been cleaned of marine concretions. Initial mass was determined with an accuracy of +/- .35% for samples less than 5,000 grams with a resolution of two grams. Samples more than 5,000 grams were measured on an available pound/ounce scale with a +/- .75 % accuracy and a resolution of .10 pounds with the results being converted to grams. Long axis diameters (LAD) were measured with a modified caliper type table ruler with an accuracy of +/- .1 cm.

Density calculations were accomplished by using smaller pieces that were had after the sample was subjected to a fresh fracture. Density was measured by a standard volumetric displacement method with an overall accuracy of an estimated +/- 1%. After the sample had been fresh fractured, the texture, grain size, color, and other attributes were determined by utilizing rock type identifications modified after Pellant (1992: 40-45). A standard 10x hand magnifier lens was used for texture and grain size identification. It was noted that field identification of some samples seemed lighter in color even while wet before being fresh fractured. This seems to be due to the inclusion of marine incrustation present on the rock's surface. This mistaking of color can lead to confusion when typing a sample but with the knowledge of this problem, and a selection of some representative fresh fracture samples should alleviate any confusion.

During the course of designing the shape types, there were originally only four categories, round, sub-round, oval, and angular. With the aid of volunteers, this system was tested and the results showed that there were too many visibly different categories of types included in the angular type category. The definition of angular was modified to include only geometrically shaped rocks, while a new sub-angular shape type was added as a catch all for rocks that did not conform to any other shape type. The shape type system was further tested with volunteers and found to distribute the rock samples more easily within the now five available shape types.

A secondary descriptor was added to the shape type system as a means to broaden the attributes within singular types while limiting the addition of shape types so as not to have a complex and unmanageable system. The secondary descriptor of fractured was devised as a means to bring attention to rock samples that may have been included as another shape type which may have actually been modified by human kind from a presumably original shape type.

Sizes based on long axis diameters were subject to an initial problem because a large portion of samples with gross visible differences in size were included as volleyball sized. This was over come by modifications to the LAD range between descriptor sizes. The system was than tested on volunteers and found to be suitable if the various ranges in size were discussed in relation to the descriptor name prior to an attempt by a volunteer to type for size.

U.S.S. Alligator Ballast Data Key

Sampling Technique Used:
C- Cluster sampling technique
S- Stratigraphic sampling technique
O- Opportunistic sampling technique

Shape:
R- Round
S- Sub-round
O- Oval
A- Angular
X- Sub-angular

Secondary Descriptors:
F- Fractured
T- Flat
S- Square
R- Rectangular
W- Wedge
s- sub prefix

Size:
G- Golf ball
H- Hardball
S- Softball
V- Volley ball
B- Basket ball
M- Medicine ball

Texture:
I- Igneous
M- Metamorphic
S- Sedimentary

Grain Size:
F- Fine
M- Medium
C- Coarse

Color:
L- Light
M- Medium
D- Dark

Other Attributes:
F- Foliated
U- Unfoliated
S- Schisted

NA- Not applicable
?- Not recognizable

U.S.S. Alligator Ballast Field Data

#	Location	sampling technique	shape	secondary descriptor	size	texture	grain size	color	other
005	UM2	C	S		V	I	F	D	
006	UM2	C	S		V	M	C	NA	F
007	UM2	C	S		H	M	F	NA	F
008	UM2	C	X		V	M	F	NA	F
009	UM2	C	S		S	I	F	D	
010	UM2	C	A	W	V	I	F	D	
011	UM2	C	S	F	S	I	F	D	
027	C1	S	O		V	I	M	D	
028	C2	S	S		H	I	M	M	
029	C2	S	S		S	I	F	D	
030	C2	S	S		B	I	F	D	
031	C2	S	S		S	I	F	D	
032	C2	S	S		S	I	C	L	
033	C2	S	S	F	H	I	M	D	
034	C2	S	A	sW	S	?	?	?	
035	C2	S	A	SR	V	I	F	D	
036	C2	S	S		S	M	F	NA	F
037	a90/1/11/4	O	A	R	B	I	F	M	
053	A20-25	O	A	sS	S	I	F	D	
054	A20-25	O	X		S	I	F	D	
055	UM2	C	A	sW	S	M	M	NA	S
056	UM2	C	S		S	I	C	M	
057	UM2	C	X		V	I	F	D	
081	UM2	O	A	sW	H	I	F	D	

U.S.S. Alligator Ballast Laboratory and Fresh Fracture Data

#	mass grams	density g/ml	LAD cm	texture	grain size	color	other
005	2930	2.66	17.9	I	M	D	
006	2604	2.64	17.2	I	C	L	
007	406	2.30	9.6	M	M	NA	F
008	1780	2.16	16.7	I	C	L	
009	988	3.33	11.4	I	M	D	
010	1608	3.09	18.3	I	M	M	
011	474	2.43	13.3	I	F	D	
027	3036	2.80	24.0	M	M	M	F
028	382	2.25	9.0	I	M	M	
029	552	2.86	11.3	I	M	D	
030	11113	3.22	29.0	I	M	D	
031	1288	2.67	13.0	I	M	D	
032	1750	2.80	14.6	I	C	L	
033	362	2.62	8.8	I	M	D	
034	610	2.48	13.5	I	M	M	
035	1836	3.08	17.1	I	M	D	
036	416	2.99	11.5	M	F	NA	F
037	11567	3.29	29.0	M	M	M	
053	924	3.16	12.0	I	F	D	
054	942	2.71	13.4	I	M	D	
055	726	2.51	13.7	M	M	NA	S
056	1266	2.95	14.0	I	C	M	
057	2020	2.92	16.5	I	M	D	
081	146	2.64	8.0	I	M	D	

Interpretation of Field and Laboratory Data

During the disassembly of the ballast pile over ceiling timbers number one and two (Figure 14) while acquiring statagraphic samples numbers one to ten (Figure 13), it was noted that all ballast removed and observed was close fitting with no large noticeable gaps between the various rocks being present. Samples number three, seven, and eight were wedged between other rocks. Both samples number three and seven have the inclusion of possible human made fractures, while sample number eight was of a sub-wedge shape naturally.

Of the twenty-four samples of ballast rocks chosen for study 79% were igneous intrusive rocks, with the majority being feldsparic in composition. The remaining 21% were metamorphic rocks with the majority being foliated. The density of all samples ranged from 2.16 g/ml to 3.33 g/ml, with an average density of 2.77 g/ml. A comparison of the field and laboratory data indicated a 79% success rate for correctly identifying the rock type by texture and color, but only a 42% success rate for correctly identifying grain size.

Sample #	Tag #	Level Location	Notes
1	027	on C1	
2	028	on C2	
3	029	2nd	wedged
4	030	on C2	
5	031	middle	
6	032	middle	
7	033	2nd	wedged
8	034	2nd	wedged
9	035	on C2	
10	036	middle	

Figure 13. Key for drawing of stratigraphic sample location

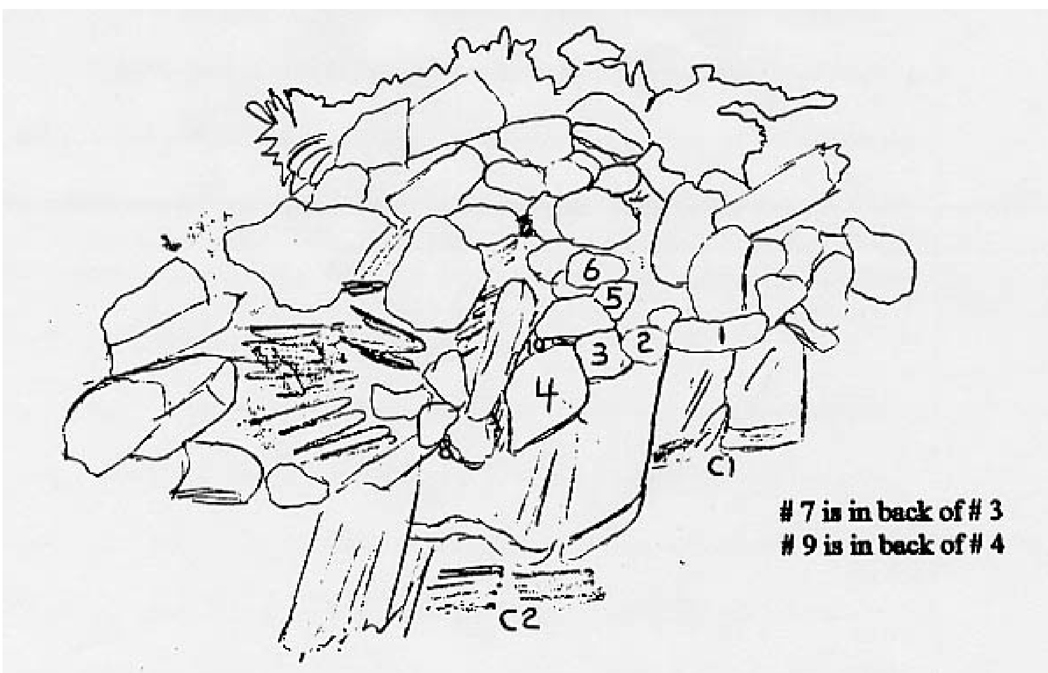


Figure 14. Drawing of statigraphic ballast sample. (Farrell, 1996)

Field and Laboratory Comparison Sheet

#	shape	sec desc	size	texture	grain size	color	other	texture	grain size	color	other
005	S		V	I	F	D		I	M	D	
006	S		V	M	C	NA	F	I	C	L	
007	S		H	M	F	NA	F	M	M	NA	F
008	X		V	M	F	NA	F	I	C	L	
009	S		S	I	F	D		I	M	D	
010	A	W	V	I	F	D		I	M	M	
011	S	F	S	I	F	D		I	F	D	
027	O		V	I	M	D		M	M	M	F
028	S		H	I	M	M		I	M	M	
029	S		S	I	F	D		I	M	D	
030	S		B	I	F	D		I	M	D	
031	S		S	I	F	D		I	M	D	
032	S		S	I	C	L		I	C	L	
033	S	F	H	I	M	D		I	M	D	
034	A	sW	S	?	?	?		I	M	M	
035	A	SR	V	I	F	D		I	M	D	
036	S		S	M	F	NA	F	M	F	NA	F
037	A	R	B	I	F	M		M	M	M	
053	A	sS	S	I	F	D		I	F	D	
054	X		S	I	F	D		I	M	D	
055	A	sW	S	M	M	NA	S	M	M	NA	S
056	S		S	I	C	M		I	C	M	
057	X		V	I	F	D		I	M	D	
081	A	sW	H	I	F	D		I	M	D	

Color key: X correctly identified, X not correctly identified.

CONCLUSION

The formulation of the ballast modal type system was successful in that the system has been designed for the acquisition of the largest amount of data with a minimal amount of time spent and samples recovered. Having a standard ballast typology system will enable a researcher to acquire usable data for the study of various archaeological ballast questions. With the retesting of this ballast modal type system on other archaeological sites, it will be possible to assess the ability of this system to provide such usable data. Retesting of the system will also be used to compare conclusions and the adaptability of the system while working underwater. There is at the present time plans to proceed with this retesting.

A ballast pile should not be considered as a random association of rocks. A ballast pile should be considered as a purposeful selection of rocks that have been stacked in a meaningful and definite pattern. This pattern results in a compact and dense mass of rocks that interlock with one another. This interlocking of rocks results in a stratigraphic pattern that is not apparent unless looked for. The stratigraphic pattern is composed of a layer of rocks that are topped between their spaces and edges fitted with other rocks, with another layer of rocks on top of those. This pattern is repeated to form a close fit and compact mass of rocks. Within this fitting of rocks is the aspect that certain ballast rocks have been modified by humans to accomplish the task of a tighter fit between certain ballast rocks. The data acquired from the U.S.S. Alligator in reference to this fitting of rocks is evident. Further retesting of this assumption on other ballast piles will enable the researcher to draw a more exact conclusion as to whether the evidence shows these rocks to be possibly human fractured, or natural phenomena.

APPENDIX

Example of Ballast Laboratory Tracking Form

Caribbean Shipwreck Research Institute Laboratory Ballast Tracking Form

TAG # 011 DATE RECOVERED 07 / 19 / 96 LOCATION # UM2

SITE NAME USS Alligator EXCAVATOR Robert J Benson

DATE IN LAB: 07 / 27 / 96 PHOTO [x] Date 07 / 30 /96 By: RJ Benson

Field Data	**data**	**Laboratory Data**	**data**	**Match**
Sampling technique	C	------------------------	-------	-------
Shape	S	------------------------	-------	-------
Secondary	F	------------------------	-------	-------
Size	S	------------------------	-------	-------
Texture	I	Texture	I	Y
Grain size	F	Grain size	F	Y
Color	D	Color	D	Y
Other attributes	--	Other attributes	--	--
------------------------	-------	Mass	474	-------
------------------------	-------	Density	2.50	-------
------------------------	-------	LAD	11.3	-------

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