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The Deep-Sea Tortugas Shipwreck, Florida: A Spanish-Operated *Navio* of the 1622 Tierra Firme Fleet. Part 2, the Artifacts

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The 405m-deep Tortugas shipwreck excavated in 1990 and 1991 off the Florida Keys by Seahawk Deep Ocean Technology of Tampa, Florida, contained an extensive collection of 16,903 artifacts. These were recorded and recovered solely using the Remotely-Operated Vehicle Merlin. The Tortugas project was the world's first scientific deep-sea shipwreck excavation. The most plausible identification for this ship is the Portuguese-built and Spanish-operated 117-ton *Buen Jesús y Nuestra Señora del Rosario* that sailed with the Tierra Firme fleet for Nueva Cordoba (Cumana) on the Pearl Coast in modern Venezuela before attempting to return to Spain in September 1622.

This report presents the wreck's cargo, domestic assemblage and navigational equipment. The inter-relationship between valuable commodities (gold bars, silver coins, pearls), low-value goods (trade beads) and the domestic assemblage (extensive ceramic tablewares, olive jars, tortoise shell combs, glass bottles, drop spindles, a sundial, faunal remains) makes the Tortugas site an important index of colonial trade with the Americas early in the reign of King Philip IV and towards the end of Spain's Golden Age. The wreck's archaeology reflects Seville and the Casa de Contratacíon's political and economic control over small *flota* vessels. The Tortugas ship enables the material culture from a small Spanish-operated merchantman to be compared to high level state and royal socio-economics typified by the galleons *Nuestra Señora de Atocha* and *Santa Margarita* from the same 1622 fleet.

1. Introduction

Following the discovery of the Tortugas shipwreck in 1989 at a depth of 405m off the Florida Keys, the cargo and domestic assemblage were comprehensively recorded and recovered between 1990 and 1991 using pioneering remote technology developed around the Remotely-Operated Vehicle (ROV) Merlin. The collection of 16,903 artifacts is highly diverse in medium. In terms of greatest numerical order the largest assemblages comprise:

- Pearls: 6,639
- Ceramics (rims/bases/handles/sherds): 3,935 (2,304 table/kitchen wares, 1,631 olive jars)
- Ballast: 1,658
- Lead musket shot: 1,186
- Silver coins: 1,184
- Seeds: 565
- Beads (glass, stone, clay, wood, palm nut, bone/ivory): 258
- Animal bones: 165
- Unidentified concretions: 145
- Glass wares: 127
- Gold bars and bits: 39

Many of these assemblages compare closely to the material culture of other sites excavated on land and underwater.

Volume only reveals one dimension of the ship's colorful, and in some cases unexpected, character. A one-handle Portuguese jug is an anomaly amongst the otherwise Seville focused ceramic tablewares (Kingsley *et al.*, 2012: 17, fig. 22). How exactly the single recovered agate bead from India ended up on the Tortugas wreck is intriguing. Did the owner of this gem also carry the high-status ivory sundial manufactured in Nuremberg, but which was actually functionally useless so far from the West? The three astrolabes are perhaps unexpectedly numerous for such a small merchant vessel.

The collection of tortoise shell contains what seem to be 'blank' scutes and semi-worked examples that hint at the on-site craftsmanship of lice combs and cases by an industrious crew member. Three jadeite artifacts, including a labret mouth adornment, raise speculation about whether a native of South America or Mesoamerica accompanied the ship to Spain and, if so, for what purpose? The evidence of a cat, rats and a parrot on board provide a unique insight into shipboard life and a rare form of cargo transport, and showcases the success of the deep-sea excavation in extracting maximum data from the wreck using nuanced recovery systems (cf. Astley and Stemm, 2012).

What is missing from the shipwreck is equally as illuminating as the eclectic nature of the assemblages. Does the very small number of human bones accurately reflect the decision of the ship's company to have jumped ship at the time of sinking? Despite the presence of iron cannonballs and lead shot, no cannon or musket parts were recovered. Finally, the volume of olive jars are indicative of the transport of shipboard supplies, which leaves unresolved the question of precisely what cargo the Tortugas ship was transporting.

The distribution of the material culture across the wreck site and related patterns have been presented elsewhere (Stemm *et al.*, 2012). The assemblages are discussed below beginning with the ceramics and progressing to the glass wares, gold bars, bits and jewelry, silver coins, pearls, trade beads and buttons, navigational equipment (anchors, astrolabes, ship's bell, sounding lead), followed by an analysis of the tortoise shell, miscellaneous metallic, stone and organic artifacts, human and animal bones, and concluding with the seeds. The most significant classes will be examined in greater detail in separate papers. How the artifacts reflect the date, identification, status and itinerary of the Tortugas ship is also treated individually (Kingsley, 2012).

2. *Botijas* ('Olive Jars')

The most conspicuous class of artifact covering the surface of the Tortugas shipwreck were intact and broken olive jars. During the excavation a policy of total ceramic recovery was implemented, which yielded 86 intact olive jars plus 123 individual rims alongside 1,344 sherds (Figs. 1-12). The ship was thus transporting a minimum of 209 olive jars that were relatively evenly distributed across the site (cf. Stemm *et al.*, 2012: 20-21, fig. 15). The descriptive term 'olive jar' is a misnomer because these vessels were packaged with a wide variety of liquid and solid foodstuffs. However, 'olive jar' has become a generic name for this ceramic form today and is used in this report as a convenient term.

The question of the provenance of the Tortugas ship's ceramic vessels was addressed in 2011 by chemical analysis of a sample of fabrics using Inductively-Coupled Plasma Spectrometry (ICPS) to identify chemical fingerprints. ICPS investigates whether ceramics derive from the same clay source by examining atomic emissions for all the major chemical elements, plus a range of trace elements. This method has the advantage of straightforward calibration, consistent accuracy, precision of results and ready availability as a technique (cf. Hughes, 2008: 120-31). Previous projects using ICPS and neutron activation analysis (NAA) have defined the chemical characteristics of Seville-produced pottery, which were compared to the Tortugas results. The representative selection from the wreck consisted of 57 examples, including principally olive jars, maiolica, Morisco wares, redwares, and Tortugas colonoware cooking vessels (cf. Hughes, forthcoming; Kingsley *et al.*, 2012; section 3 below).

The majority of the Tortugas olive jars adhere to the generic Middle Style A form (Goggin, 1968: 283). The collection also includes seven small globular jars defined as Middle Style B form, as well as two small carrot-shaped jars classified as Middle Style C. Two intact flat-bottomed large vessels are represented within the assemblage.

In terms of a site-specific classification, the following typology is applicable to the Tortugas shipwreck:

- Tortugas Type 1 (87.2% of the total *botija* assemblage; Figs. 1, 7): the prevalent jar type characterized by the classic shape of a tall body with rounded shoulder surmounted by a high-set, short rim inclining relatively smoothly to a gently rounded base. The type's dimensions vary from: H. 43.5-56.5cm, Diam. 17.9-34.1cm, circumference 87.4-107cm, rim H. 2.1-4.5cm, volume 14.2-22.5 liters, weight 5.9-9.9kg, color range from light red (7.5YR 6/6) to pink (2.5YR 8/3), reddish yellow (7.5YR 6/8) and very pale brown (10YR 7/4). Inductively-coupled Plasma Spectrometry (ICPS) analysis suggests production for this type in the region of Cordoba (Hughes, forthcoming).
- Tortugas Type 2 (8.1% of the total; Figs. 1, 8): a small,

compact globular jar, almost anatomically circular, with a continuously rounded base, body and shoulder. The style displays a more pronounced neck and higher rim than Type 1. Its dimensions are surprisingly diverse: H. 27.0-34.0cm, Diam. 23.7-25.8cm, circumference 49.8-78.5cm, rim H. 2.5-4.0cm, volume 3.7-8.1 liters, weight 1.9-3.6kg, color range from very pale brown (10YR 7/3) to pink (7.5YR 8/4), yellowish red (5YR 5/8) and reddish yellow (5YR 6/6). ICPS analysis indicates that this *botija* type bears the chemical signature of Seville clays (Hughes, forthcoming).

- Tortugas Type 3 (2.3% of the total assemblage; Fig. 5): a carrot-shaped vessel, far more narrow than the above series, with a slender body, more v-shaped in profile, leading to a more pointed toe. The simply rounded rim, surmounting a short neck, is far wider in relation to the vessel's diameter than the above types, equating to half the size of the jar's width. H. 33.0cm, Diam. 15.9cm, circumference 49.8cm, rim H. 2.1cm, rim Diam. 8.5cm, volume 2.8 liters, weight 1.8kg, reddish yellow (7YR 5/8).
- Tortugas Type 4 (2.3% of the total assemblage; Fig. 9): anatomically similar to the neck and upper body shape of Tortugas Type 1, but clearly differentiated by an everted neck and short, slender rim. The shoulder is bulbous before assuming a vertical profile along the lower third of the vessel and terminating at a flat base. Type 4 is covered with closely aligned body ribbing. Functionally its slender rim and neck and flat base make this vessel perhaps better suited to use as kitchen or galley ware, rather than as an archetypal transport jar. H. 43.5cm, Diam. 31.2cm, circumference 99.6cm, rim H. 2.1cm, rim Diam. 11.9cm, volume 20.8 liters, weight 6.4kg, reddish yellow (7.5YR 8/6). ICPS analysis suggests that Tortugas Type 4 *botijas* derived from Seville (Hughes, forthcoming).

The Tortugas jars' clay fabrics contain small flecks of gold colored mica, along with sand temper. Spalling is extensive in the walls, indicating that the jars were fired when not thoroughly dry and/or that the clay was improperly or insufficiently wedged. Traces of rilling, or throwing rings, and small pieces of clay within the vessels' interiors, indicate that the jars were thrown in upright positions. Evidence of green glaze is apparent on the interior and dripped onto the exterior of a minority of sherds.

Avery's analysis of the Tortugas wreck collection (1997: 103-104, 106, fig. 15) demonstrated that the rim profiles of Type 1 are angular, while the Type 2 rim shape is rounded. The rims from the traditional Type 1 form display

Fig. 1. Large Type 1 and small Type 2 olive jars (botijas) *from the Tortugas shipwreck.*

Fig. 2. A Type 1 olive jar being prepared for recovery using the limpet suction device.

Fig. 3. A Type 1 olive jar being recovered using the limpet suction device.

Fig. 4. A Type 2 olive jar being recovered using the limpet suction device.

Fig. 5. A Type 3 olive jar in situ.

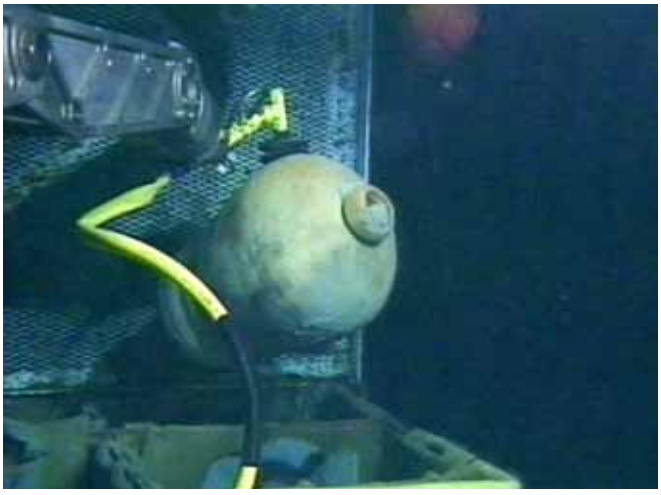


Fig. 6. A Type 1 olive jar being placed in a foam-lined 4Plex storage unit to await surface recovery.

a wide overhang above the neck, while Type 2 rims from globular jars are narrower with less overhang. On average, Type 1 olive jar rims have an interior throat diameter of 4.89cm, a lip diameter of 5.81cm and a maximum diameter of 9.43cm. The average Type 2 rim dimensions are 4.67cm for the interior throat diameter, 6.30cm lip diameter and 8.56cm maximum diameter (Avery, 1997: 123).

Tortugas Types 1-3 are identical to the three main varieties present on the wreck of the *San Antonio*, lost off Bermuda in 1621, just a year before the loss of the Tortugas wreck. The *Atocha* of 1622 was transporting Types 1-4 and, as expected, is thus a direct typological match for the Tortugas wreck's *botija* assemblage (cf. Marken, 1994: 65-71). The more unusual flat-bottomed Tortugas Type 4 jar was visually reported from the site of the *San Antonio* and documented on both the *Atocha* and *Santa Ana*

Fig. 7. A Tortugas Type 1 olive jar.

Fig. 8. A Tortugas Type 2 olive jar.

Maria, wrecked in 1627 off Castletownsend, Ireland (Marken, 1994: 81). Type 4 is an archaeological marker that on current evidence seems to be restricted to shipwrecks of the early 17th-century, although the basic shape had been in evolution in Valencia, Spain, since the 14th century (Marti and Pascual, 1995: 169, fig. 15.8, no. 2).

Graffito incisions present on either the shoulder or rim of some jars appear to have been made, with one exception, prior to firing. One *botija* is incised with a Jerusalem cross on the shoulder, while another displays a post-firing pecked design on the shoulder. Motifs were impressed into the wet clay on the mouths of some jars. Several are identical to marks present amongst the *Atocha botija* assemblage (Marken, 1994: fig. 4.22, B). Small parallel cuts on and near the rims probably result from vessel reuse.

The elaborate cross style on a Tortugas *botija* is paralleled on jars from the wreck of the *San Martin* of 1618 and from the Santo Domingo Monastery at La Antigua in Guatemala. The impressed circular incision present on the rim of another Tortugas jar occurs in at least five styles on 11 olive jars from the Santo Domingo Monastery, ten dated between the late 16th century and *c.* 1641. This form of mark has also been recognized at the colonial port of Bodegas on Lake Izabal in northeast Guatemala (Carruthers, 2003: 46, 48, fig. 7b, fig. 9). A circular mark impressed onto the rim of a *botija* deposited into Pit 4 at

Fig. 9. A Tortugas Type 4 olive jar.

Jamestown, Virginia, shortly after 1610 (Kelso *et al.*, 1999: 39), is also similar to the Tortugas material.

It is seemingly chronologically significant that no *botijas* identified at the Santo Domingo Monastery in Guatemala from contexts post-dating 1641 featured impressed or stamped rim marks. Instead, of the 113 marked olive jars excavated 111 were recorded on early Middle Style Type A rims, suggesting these particular sets of makers' marks were restricted to the period *c.* 1583-1641 (Carruthers, 2003: 52-3). Olive jar collections of the early 18th century lack comparable marks, indicating that the practice had ceased by this time (Marken, 1994: 72). The various motifs may be interpreted as producers' marks.

During the ship's descent onto the seafloor, or soon after deposition, the pressure exerted on the olive jars forced their cork seals to implode: 72 intact and fragmentary cork stoppers were found inside some vessels. Complete examples were tapered and measured 5.1-5.85cm on the upper plane, 4.51-5.08cm on the lower plane and were 1.55-2.29cm thick (Avery, 1997: 123). Resin was detected within some jar interiors demonstrating sealant by coating the edges of conical-shaped corks with pitch. A similar sealant method was used on the *Atocha* and *Margarita*, where intact corks were attached to the rim with *pez* or pitch presumably to seal the jar's mouth (James, 1988: 56-7).

The interior lining of a few sherds was coated with a chalky red stain, which has been interpreted by visual observation alone possibly as red ocher, a product listed amongst ships provisions for carpenters (cf. *Nautical Instruction*, 1587). Alternatively, it may constitute cochineal listed as cargo on ships returning to Europe from the Indies (cf. *The Spanish Rule of Trade to the Indies*, 1702). Olive jar fragments stained red on the interiors, associated with the *San Antonio* sunk en route from Havana to Spain in 1621, similarly suggest that these vessels contained a dyestuff bound for Spanish markets (James, 1988: 61)

Despite the catch-all misnomer 'olive jars' for the material culture in question, in reality Spanish merchants seemingly did not differentiate between either shapes or contents to define jar names, but referred to them by size, including (Pleguezuelo-Hernandez, 1993):

- *Botija de arroba y media* (16.5 liters)
- *Botija de arroba y cuarta* (13.87 liters)
- *Botija de arroba/botija perulera* (11.5 liters)
- *Botija de media arroba* (5.7 liters)
- *Botija de cuarto de arroba/botija de aguda* (2.87 liters)

The volume of *botijas* on the Tortugas wreck is relatively limited and they are unlikely to have served as cargo. Instead, colonial Spain pursued an unwavering policy of stocking all ships with sufficient supplies for entire round trips to the Americas and home. Eight months of food and four months of water were loaded in Seville, typically sufficient surplus to mitigate against unexpected bad weather. Ships often returned with surplus foods, although stocks were commonly replenished at Havana (De la Fuente, 2008 and section 13 below). *Botijas* of all sizes were used for storing a multitude of foodstuffs: wine, oil, vinegar, honey, as well as solids such as rice, almonds, hazelnuts, raisins, capers and olives (Pleguezuelo-Hernandez, 1993). Although recovered from the ROV's SeRF system, and not from jar interiors, it is likely that many of the seeds and pits from almonds, plums, peaches, olives, hazelnuts and grape from the Tortugas shipwreck were originally *botija* contents. The site produced just one fragment of a possible wooden barrel.

In the early 17th century stocking outward-bound ships to the Americas with staple foodstuffs absorbed 26% of total ship preparation costs. The mainstay of the diet was biscuit (1.5lbs a day) and wine (half an *azumbre*/2 pints a day) (Avery, 1997: 165-6). Foodstuffs outgoing to the Indies included wine, olive oil, vinegar, raisins, almonds, figs, olives in brine, fish, rice, flour, *garbanzos* (chickpeas), honey, lard, eggplants and capers, as well as non-consumables such as medicine, turpentine, gunpowder and pitch, all packaged in ceramic pots (Lister and Lister, 1987: 128).

On the basis of current evidence Spanish fleets sailing to the Americas relied seemingly exclusively on containers manufactured in southern Spain. The single anomaly to this pattern was the localized production of Spanish olive jars along the Moquegua Valley in southern Peru, where 130 wine *hacienda* sites have been recorded, including a 17th-century kiln at Locumbilla, developed to satisfy specialized demands linked to regional silver-mining centers (Rice, 1996).

Amongst the exported products of mainland Spain, two olive jar clay fabric types have been identified: a red-firing clay derived from islands in the Guadalquivir River or from pits in the meadows of Triana or Tablada and, secondly, a light firing calcareous clay from the banks of the Guadalquivir (Avery, 1997: 130). A Seville provenance has been confirmed by the excavation of hundreds of olive jars excavated beneath 17th and 18th-century dwellings in the city, where factory rejects were installed beneath floors as humidifiers intended to draw in moisture to help counter the local climate. An origin for these recycled seconds west of Seville in nearby Aljarafe, the delta of the Guadalquivir, or most distant of all at Cazalla in the mountains north of Seville, has been postulated (Lister and Lister, 1987: 136). The Inductively-coupled Plasma Spectrometry analysis of the Tortugas *botijas* points to two sources for this collection, Seville and Cordoba (Hughes, forthcoming).

In terms of diffusion, *botijas* traveled far and wide wherever Spanish merchants, clergymen and immigrants roamed. They are the most common form of earthenware excavated from Spanish colonial sites in the New World (Deagan 1987: 28), widely distributed throughout the Caribbean, Mexico and Central America, and also frequently encountered along the Atlantic coast and occasionally in the American Southwest. Other than within Florida, olive jars are uncommon in the interior of the Southeast (Beck *et al*., 2006: 70).

Functional settlement contexts vary relatively widely across the Americas. Olive jar sherds occur at the Berry site along the upper Catawba River in western North Carolina, which served as the capital of the late 16th-century Native American chiefdom of Joara and of Fort Juan, the most important of a succession of Spanish fortifications constructed by the soldiers of the Spanish explorer Juan Pardo during his expeditions across the Carolinas and Eastern Tennessee (Worth, 1994: 2; Beck *et al*., 2006: 65). *Botijas* were also used by English colonists at Fort Raleigh on Roanoke Island in North Carolina from *c*. 1585 and 1587 (Skowronek and Walker, 1993: 65, fig. 2). Their abundance in Virginia at British Jamestown again reflects the willingness of a militarily hostile population to embrace foreign cultural culinary habits (cf. Malios and Straube, 2000: 18, 19). Examples contemporary with the Tortugas wreck occur in Virginia at the British plantation of Martin's Hundred (Noël Hume and Noël Hume, 2001: 329, fig. 33.4).

Further afield, *botijas* were relied on in the Spanish colony of Puerto Real (McEwan, 1986: 44). These jars were similarly abundant on ecclesiastical and missionary sites, such as Mission San Martin de Timucua (Fig Springs) in Columbia County and Mission San Luis de Talimali near Tallahassee (Deagan, 1972: 34-5; McEwan, 1991: 48, 50). Some 585 *botijas* have been studied from the Santo Domingo Monastery at Antigua, Guatemala (Carruthers, 2003). Olive jars dating to the 17th and 18th centuries reached northwest Europe in large volumes, having been recorded on 110 sites in Britain and Ireland. Examples are also numerous in the Low Countries and penetrated Scandinavia (Hurst, 1995: 46). At perhaps the greatest cultural extreme, *botija* fragments of *c*. 1600 have been excavated in small numbers at Nagasaki, Japan (Kawaguchi, 2011).

3. Ceramic Kitchen & Tablewares

The Tortugas shipwreck ceramic assemblage contains a major collection of 2,304 kitchen and tableware rims, handles, bases and sherds (RBHS), the most extensive associated with the 1622 Tierra Firme fleet scientifically

Fig. 10. Olive jars, a Blue-on-Blue Seville maiolica dish and Blue Morisco ware jug in situ.

Fig. 11. Olive jars and a Seville White ware dish in situ.

Fig. 12. Olive jars and a San Juan Polychrome Mexican juglet in situ *(at center).*

excavated to date. These derive from 22 types of pottery forms (1,390 tin-glazed maiolica sherds, 84 blue-painted wares tablewares, 279 Tortugas colonoware kitchen vessels, 218 unglazed coarse redwares and 333 glazed coarse redwares; Figs. 10-19).

All are currently identified as of Spanish origin centered on Seville with the minor exceptions of a San Juan Polychrome maiolica juglet, one Columbia Plain bowl subform of possible New World origin and one Portuguese jug. In addition, the kitchenware cooking pots and pans solely comprise highly coarse colonoware that could be South American, Mesoamerica or circum-Caribbean products. The ICPS analysis identified the closest match, based on available samples, in the Valley of Mexico (Hughes, forthcoming). In this report this material is referred to as Tortugas colonoware.

In the below analysis, the Tortugas colonoware (Types 10-11; Fig. 19) is excluded from the quantification because they constitute the exclusive kitchenwares used for cooking and are not tablewares functionally comparable to the rest of the assemblage. Sherds are also omitted from the below statistics (based on rim, base and handle counts: RBH) due to wide differences in vessel fragmentation rates caused by variances in body vessel sizes and thicknesses, which can heavily skew count-based results.

Quantification indicates that the tin-glazed maiolica products represent the most numerous tableware category, accounting for a combined 82.4% of the assemblage by RBH count. The Tortugas tablewares may be sub-divided into the following categories following current classifications (pers. comm. Alexjandra Gutíerrez, April 2011), even though the pottery is predominantly of Seville manufacture probably centered on Triana. The prevailing 'Morisco' classification used by ceramicists is misleading for the Tortugas wreck because Seville's Morisco Muslim community was expelled in 1610 (Pike, 1972: 163, 168), over a decade prior to the ship's voyage in 1622, and thus cannot have crafted these wares, even if there they originally inspired some styles. ICPS analysis of the Tortugas pottery implemented to help determine the assemblage's provenance is published in full elsewhere (Hughes, forthcoming).

The tableware types and volumes comprise:

1. *Seville Wares*
   - Blue-on-Blue Seville: 48.4% (Type 1; Fig. 13)
   - Blue-on-White Talavera-Style: 13.5% (Type 2; Figs. 14, 41)
   - White Seville: 6.0% (Type 4; Fig. 16)
   - Andalusia Polychrome: 2.3% (Type 5; Fig. 16)
   - Blue-on-White Seville: 0.9% (Type 8; Fig. 17)
2. *'Morisco' Wares*
   - Columbia Plain: 6.5% (Type 3; Fig. 15)
   - Decorated Linear Blue Morisco: 2.8% (Type 6; Fig. 17)
   - Mottled Blue Morisco: 1.4% (Type 7; Fig. 17)
3. *Others*
   - San Juan Polychrome: 0.5% (Type 9; Fig. 12)
   - Unglazed Coarse Redwares: 11.2% (Types 12-19A; Fig. 18)
   - Glazed Coarse Redwares: 6.0% (Type 19B-22; Fig. 18)

Unglazed coarse redwares represent 11.2% of all the ship's tablewares (Types 12-19A) and glazed coarse wares 6.0% (Types 19B-22). The latter two categories contain mixed forms not dominated by any single product (Fig. 18). A further three classes of coarse wares sharing an identical fabric were common on the shipwreck, one form of cooking pots and one cooking pan variety of Tortugas colonoware (Types 10-11; Fig. 19), accounting for 12.1% of the total combined kitchen and tablewares and seemingly serving exclusively as the onboard cooking vessels.

Counts of intact, or predominantly intact vessels, in addition to unique rim or base fragments, reveal that a minimum of 60 tin-glazed tablewares were onboard the Tortugas ship when it sank: 35 dishes, 11 bowls, four cups, five jugs and five juglets. The 70 other maiolica rim fragments in the collection are too small or indistinct to ascertain whether they derive from the same or different vessels.

The most conspicuous tablewares are 17 Blue-on-Blue Seville maiolica dishes (Type 1: 48.4% of all tablewares; Fig. 13), which incorporate ten different motifs painted across the rims, primarily schematized swirling floral variants. The interior base medallions feature 11 forms of star, fruit and, most common, six sub-forms of floral motifs with outward radiating petals. The same decorative scheme appears on shallow bowl bases. Dish dimensions vary from H. 3.1-4.2cm, Diam. 18.1-21.3cm and rim Th. 0.5cm. This maiolica style was also present in four shallow bowl bases featuring the same decorative scheme (Type 1B). Comparable Blue-on-Blue Seville majolica is attested on the 1622 wreck of the *Atocha* off Florida Keys and further afield in the Convento de San Francisco in the Dominican Republic (Goggin, 1968: 137, fig. 12b). The decorative rim style has been recovered in Seville (Lister and Lister, 1987: 159, fig. 102) and was probably originally inspired by the Chinese ceramic symbol of the lotus flower (cf. Pijl-Ketel, 1982: 276).

Imitating Chinese blue-on-white Wanli porcelain, the Blue-on-White Talavera-Style dishes (Type 2, 13.6% of the total fine wares; Figs. 14, 41) display the most graphic

Fig. 13. Blue-on-Blue Seville maiolica brimmed dishes (Tortugas Type 1).

Fig. 14. Blue-on-White Talavera-style maiolica dishes (Tortugas Type 2).

Fig. 15. Columbia Plain maiolica dishes (Tortugas Type 3).

Fig. 16. Andalusia Polychrome juglets (Tortugas Type 5) and White Seville ware bowls (Tortugas Type 4).

Fig. 17. Linear Blue Morisco ware jugs (Tortugas Type 6, back row), a mottled Blue Morisco ware cup (Tortugas Type 6), a Blue-on-White Seville ware bowl and a Blue-on-White Seville ware juglet (both Tortugas Type 8) (front, left to right).

Fig. 18. A half-dipped green glaze juglet, a one-handle Portuguese redware jug, a green glazed large coarse redware jug, and a glazed coarse ware juglet (from left to right).

Fig. 19. South American, Mesoamerican or circum-Caribbean Tortugas colonoware cooking pot and pan fragments (Tortugas Types 10-11).

decorative schemes within the Tortugas collection. Type 2A imitates kraakware rims with vertical diaper registers and classical base motifs, such as a bird sitting on a rock in a garden landscape. An additional set is adorned with heraldic or religious motifs, such as two crossed keys surmounted by a cross (Fig. 41) and two dish fragments inscribed with the letters 'CAR' 'MO', potentially part of the ecclesiastical name Carmel. Identical dish styles excavated at the Carthusian monastery at Jérez de la Frontera, Spain, inscribed on their interior bases with the monogram 'AM' for Ave Maria, would have been appropriate for ecclesiastical use (Lister and Lister, 1987: 150, fig. 92). While such religiously inspired dishes, and a Catholic pendant and clay figurine of the Virgin Mary excavated from the Tortugas shipwreck (Fig. 69), could have been used by members of the crew, it would not have been unexpected to find a clergyman on the ship traveling between a monastery on the Spanish Main and the Spanish homeland.

Due to the thick and heavy nature of their production, the seven Columbia Plain *platos* dishes (Type 3B, H. 4.8-5.7cm, Diam. 19.5-19.8cm, rim Th. 0.9-1.1cm; Fig. 15) and three *escudilla* bowls (Type 3C, H. 5.9-6.2cm, Diam. 13.0cm, rim Th. 0.65-0.7cm) proved to be the best preserved vessel form on the Tortugas shipwreck, even though they account for just 6.5% of the site's tablewares. This is one of the few categories of Spanish colonial pottery whose origin in Seville is archaeologically verifiable. A workshop and kiln excavated in the famous potters quarter of Triana in Seville (Gerrard *et al*., 1995: 284) is also a likely origin for part of the Tortugas ship's Blue-on-Blue Seville maiolica. A group of intact Columbia Plain plates have allegedly been recovered from a well in Seville (Lister and Lister, 1974: 20).

In addition to the conspicuous presence of Columbia Plain dishes on the *Atocha* (Marken, 1994: 154, 156-7, figs. 5.9, 5.10, pl. 18), four decades earlier the ceramic component of tablewares recorded on the Spanish Armada shipwreck *La Trinidad Valencera* off Ireland was largely unchanged morphologically. In general, the distribution of this ceramic form closely follows the routes of the Seville-based *flotas* and has been hypothesized to be cheap, standardized 'official issue' of the Casa de Contratacíon (Martin, 1979a: 284-6). The favored use of sturdy Columbia Plain dishes and bowls on fleet ships is further exemplified by the Emanuel Point I wreck from the *flota* of Tristán de Luna, which was lost during a hurricane in 1559 during the first European attempt to colonize Florida (Williams, 1998: 141), and by its frequency as the most common

tableware on the St. John's wreck sunk off the Little Bahama Bank soon after 1554 (Malcom, 1996).

The tablewares are completed by a vibrant set of two-handled Andalusia Polychrome juglets, one version painted with a dark blue fruit motif on a lighter blue surface, the second with blue and yellow floral motifs overlying a brownish cream background (Type 5, H. 9.6cm to mid-neck, body Diam. 9.8cm, body Th. 0.57cm; Fig. 16). This form comprises 2.3% of the tablewares and presumably was best suited to the pouring of oil at table. Though well preserved on the wreck, decorated linear Blue Morisco ware two and one-handled jugs and mottled Blue Morisco ware cups represent just 4.2% of the Tortugas tablewares (Types 6-7, Fig. 17). Blue-on-White Seville bowls and juglets (Type 8, Fig. 17), and one San Juan Polychrome juglet, comprise just 0.9% and 0.5% respectively.

To what degree do the Tortugas ship's tablewares conform to recognized patterns with a suggested orientation around official issue Columbia Plain products? The ship's profile notably differs to the majority of Spanish wrecks dated between *c*. 1550-1625 through the numerical dominance of Seville Blue-on-Blue wares. ICPS analysis, however, does reflect a strong gravitation in and around Seville for the tablewares as a whole, but with several minor anomalies. Analyses clarified that the types fell into two major chemical groups (Hughes, forthcoming), which correspond to Seville wares and 'Morisco' wares respectively (as defined by Lister and Lister, 1987).

The first group contains the Blue-on-Blue Seville products, which are chemically similar to the Blue-on-White Talaveran style wares. Assigning Talaveran maiolica to its place of production is complicated by its imitation in Seville (Deagan, 1987: 64-5). Chemical analysis of the Tortugas shipwreck's Blue-on-White Talavera style pottery, however, confirms manufacture in Seville and not Talavera. Andalusian Polychrome juglets proved to be chemically part of the same Seville wares group. Two Seville White Wares again fitted chemically with the Blue-on-White Talavera pottery originating in Seville (Hughes, forthcoming).

'Morisco' wares formed the second major clay chemical group, which was higher in lime (calcium oxide) and lower in the percentage of clay-related chemical elements, indicative of a higher percentage of quartz sand temper relative to the Seville wares. Four Columbia Plain white wares dishes and bowls examined contained three different paste chemical compositions: one had the chemical signature of Seville, one seemingly the signature of New World ceramics, and the other two formed part of a previously unreported group containing high levels of magnesium present as the clay mineral montmorillonite (up to around 11% magnesium oxide in the paste, compared to 2-3% present in Seville pottery) originating in a rural Andalusian context 24km west of Seville, close to the Rio Guadiamar. Combined with suggested evidence of bowl manufacture at Mata da Machada, Lisbon, *c*. 1550-70 (Casimiro, 2011: 144, fig. 71), and possibly in dish form in Mexico in the first half of the 16th century (Lister and Lister, 1974: 24, fig. 3a), far wider colonial imitation must now be considered for Columbia Plain products.

As well decorated and diverse as the tablewares used for dining on the Tortugas shipwreck appear to be, notably no pewter vessels were excavated. This trend seems to reflect the social hierarchy of the 1622 fleet, where gold, silver and pewter tablewares are associated with the *Atocha* and *Margarita* (Mathewson, 1986: 136-7, C-10, C-12, C-30, C-31; Malcom, 1998a). The reliance on ceramic tablewares on the Tortugas ship is an index of its comparatively humble status.

4. Glass Wares

A total of 127 fragments of glass were excavated from the Tortugas shipwreck, including square-sectioned case bottles, a form of vial with an everted rim and a vase or wine glass. By far the most conspicuous class derived from a minimum of two rims and eight bases from square-sectioned case bottles produced in three sizes. The bases are all medium olive green in color and contain air bubbles (Fig. 20). Glass rim and neck sherds were recovered still attached to 14 lead screw collars and caps that originally sealed some of the Tortugas ship's bottle mouths (Fig. 21). A combination of data suggests a minimum presence of 16 square-sectioned bottles on the ship.

The square-sectioned glass bottle rims vary in size from an external diameter of 3.1cm (TOR-90-00163-GL) to 4.6cm (TOR-90-00160-GL) with thicknesses of 0.1cm and 0.3cm respectively. The base diameters provide a clearer reflection of the bottle series' three different sizes, which fall within the parameters of 4.3 x 3.6cm, 6.0 x 5.9cm to 6.4 x 6.3cm, and 9.4 x 8.1cm to 10.3 x 9.9cm.

The two-piece permanent lead collars and caps that originally closed the bottles' mouths possess everted sides and a horizontal shoulder surmounted by a short vertical mouth. Each collar, 1.4-1.9cm high, is subdivided into two seamless elements: at top a narrow screw thread (W. 1.5-1.9cm, Th. 0.2cm) consisting of three convex external edges between two inner recessed threads for receipt of a lead cap, and below the main section (max W. 2.1-3.3cm, bottom W. 1.9-2.9cm, Th. 0.2-0.4cm) that originally covered and protected the glass bottle neck and rim. The two zones are separated by a horizontal ledge, furrowed on the lower edge. The bottom edge of the inner diameter, reflecting the

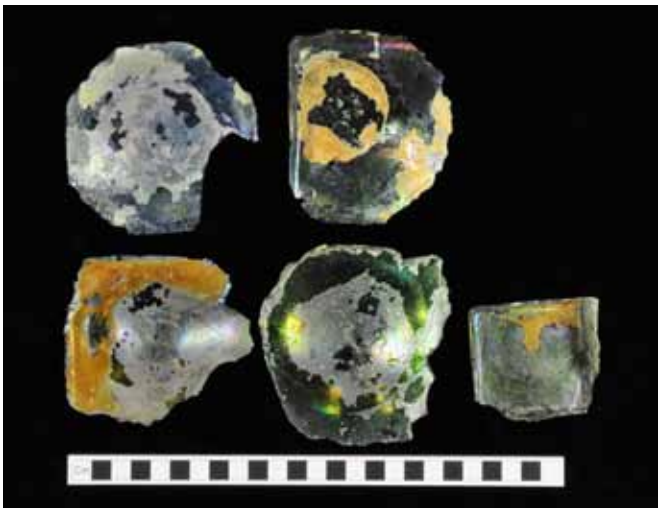


Fig. 20. Base fragments from green glass square-sectioned bottles.

Fig. 21. Lead screw collars and caps from the tops of square-sectioned glass bottles.

bottle's neck diameter, ranges from 1.2-1.7cm. The collar was a permanent component cast over the bottle.

The cap designed to screw onto the underlying collar is 1.8cm high and surmounted by a ring (H. 0.8cm, W. 1.1cm, Th. 0.3cm) comprising an upper section wider than the lower one (W. 2.2cm, Th. 0.2cm), separated by a thickened ridge. A single-link crude chain (L. 3.7cm, Th. 0.3cm) extending through the ring was presumably originally attached between cap and collar to prevent the former from getting lost (pers. comm. Bill Lindsey, 4 September 2012).

The square-sectioned bases derive from what would become termed case bottles in later decades that were common throughout Europe and the Americas. The term derives from the fact that square-sided bottles were particularly developed for packing in wooden cases with compartments (cellarets) for oceanic voyages (pers. comm. Beverly Straube, 11 September 2012). Such bottles primarily contained spirits, which were essential in the 17th century when natural water supplies were considered infectious and alcohol was taken for medicinal purposes (McNaulty, 1971: 98, 100). However, as with most bottles of the era, after being emptied the bottles were often reused for different products (Malcom, 1990; pers. comm. Bill Lindsey, 21 October 2011), which may have been the case on the return voyage of the Tortugas ship.

The Tortugas bases are part of a square-molded bottle type that was seemingly first produced in Germany in the last quarter of the 16th century. Similar bottles dating from 1570-1600 were also manufactured in the glasshouses of Bohemia and Belgium (Van Den Bossche, 2001: 308). The typically green glass form was subsequently introduced into the Rotterdam area of the Netherlands, which began manufacture on a large scale in the 17th century as the country evolved into Europe's major shipping center. The industrialization of glass production, combined with the rapid growth in the standard of living and a burgeoning middle class, provided the demand and means to support the production of an increasingly large glass bottle industry that replaced the more common earthenware and metal vessels (McNaulty, 1971: 91-2, 103).

These bottle forms are common in North America on sites of multiple nationalities. Dozens of square-sectioned bottles have been excavated from the site of Mathews Manor, an early 17th-century English mansion on the James River in present-day Newport News, Virginia. At least one example retains part of a threaded pewter collar (Hume, 1974: 69). Pewter neck and bottle caps also circulated in 17th-century English Jamestown (McNaulty, 1971: 104, 106). The bottle style has been excavated in large numbers at the William Harwood and subsequent structure, the Fort and the John Boyse Homestead, covering the period *c*. 1619-45. The Harwood and post-Harwood farmstead of *c*. 1623-45 was home to at least 108 case bottles (Noël Hume and Noël Hume, 2001: 339-41). Early examples were located in Well 3 at the Reverend Richard Buck Site, Virginia, which was filled in between 1630 and 1645 (Mallios, 1999: 32-3, fig. 32).

Square bottles were equally popular on 17th-century shipwrecks of varied nationality, ranging from the Swedish warship *Vasa* lost in Stockholm harbor in 1628 (McNaulty, 1971: 107) to the *Virginia Merchant*, bound from Plymouth in England to Jamestown in Virginia and sunk off Bermuda in 1661 (Berg and Berg, 1991: 63; pers. comm. Ivor Noël Hume, 25 October 2011). One intact bottle, one neck and 25 square bases from green glass case bottles in two sizes, 11 x 11cm and 10 x 8.5cm, were found on the Dutch East Indiaman *Vergulde Draeck* wrecked off Western Australia in 1656 (Green, 1977: 224-5).

Pewter and lead bottleneck reinforcements of the Tortugas shipwreck form are similarly common on wrecks, such as the Dutch East Indiaman *Batavia* lost off Western Australia in 1629 (Green, 1989: 173), and the VOC *Lastdrager* sunk off Yell, Scotland, in 1653, where they were associated with square-based green glass bottles believed to have held spirits (Sténuit, 1974: 241, fig. 21). Some 26 examples were found on the VOC's *Vergulde Draeck* (Green, 1977: 215-7). The Jutholmen shipwreck of *c*. 1700 in the archipelago of Stockholm, Sweden, contained one pewter screw cap associated with fragments of a square case bottle (Ingelman-Sundberg, 1976: 57, 64).

Especially significant for the case of the Tortugas shipwreck are identical glass bottle bases and lead bottle caps, with reconstructed bottle heights varying widely from 6.6-21.3cm and 300-1,500ml liquid capacity, associated with the lower hull of the *Atocha*. As on the Tortugas wreck, square-sectioned bottles proved to be most common amongst the *Atocha* glasswares. The *Margarita* site also contained a number of bottle closures comparable to the Tortugas wreck, evidence that identical products were aboard this ship (Malcom, 1990). As part of the same Spanish fleet lost in the Florida Keys during the hurricane of September 1622, this parallel evidence may start to question the common assumption that square bottles were largely of Dutch or English manufacture. In light of the fleet's near-total cultural preference for goods made in Seville, epitomized by the ceramic record, this subject requires further research. In reality, very little has been written about the wider European straight-sided and square-sectioned bottles that preceded the emergence of globular forms *c*. 1650 (Noël Hume and Noël Hume, 2001: 340, note 273).

Similar glasswares have been excavated from other Spanish shipwrecks. An intact square-sectioned green bottle was stocked on the Spanish galleon *Nuestra Señora de la Concepción*, sunk off Hispaniola in 1641 (Borrell, 1983: 112). Pewter caps from square-sectioned bottles were recovered from the *San Martin*, the Almiranta of the Honduras fleet en route from Havana to Spain in 1618, and were still in use a century later on the 1715 fleet wrecked off Florida (Deagan, 1987: 133). On the basis of this evidence, it is reasonable to propose that one line of lead-capped square bottles conceivably may have been manufactured in Spain, mirroring in glass the overwhelming dominance of Seville wares amongst the ceramics.

Glass production thrived in Spain since the Roman period and is documented throughout the medieval and colonial periods. Glass was produced at Almería, Castril and María in southeast Spain by the 13th century, while Catalonia (especially Barcelona) was renowned for its craftsmanship as early as 1324, when an edict prohibited the establishment of glass factories inside the city limits. Jeronimo Paulo wrote in 1491 that its glassware compared favorably to Venice and was extensively exported to Rome (Barber, 1917: 8, 11, 15).

Following the artistic patronage of Ferdinand and Isabella (r. 1479-1504), Catalonia held annual glass fairs in the 16th century and the region's production peaked following the migration of Venetian glassblowers from Murano (where they had been virtually imprisoned by the State in the 16th century) across Europe. Glass vessels for pouring wine, water and oil were common in 16th-century households under the names of *gerro*, *aiguamanil* and *setrill* (Frothingham, 1963: 36, 38; Deagan, 1987: 127-8).

A major reason underlying the superiority of Spanish glass was the abundance of high quality *barilla*, a marine plant used in glassmaking. One year before the loss of the Tortugas shipwreck, James Howell (1754: 51-2) described the properties of this wondrous raw material and its processing and sale for "one hundred Crowns a Tun" in southern Spain in a letter dated 27 March 1621.

Utilitarian glasswares (bottles, vials, flasks, tumblers) were produced throughout Spain during the colonial period, and bottles and vials comprise the major part of Spanish colonial archaeological glass collections. An origin in southern Spain's thriving glassworks, particularly Andalusia, has been proposed for these products (Deagan, 1987: 127-8), which would be logical given Seville's function as the hub of the Americas fleet supplies.

Spanish square-sectioned green bottles, frequently associated with pewter caps, first appear on archaeological sites in deposits dated to the first half of the 17th century and are the earliest types of Spanish bottles documented in the circum-Caribbean area. They were blown with rounded, sloping shoulders and straight, non-tapering sides, as were all square-sectioned straight-sided 'case' bottles at this time. Spanish examples are frequently defined by bubble- and striation-filled metal (Deagan, 1987: 131-3).

Seville glassmen and vendors established furnaces and sales rooms throughout the 16th and 17th centuries in a street called El Vidrio, where tablewares, stained glass church windows and ornamental wares were manufactured. The name of one master craftsman, Juan Rodríguez, is listed in records dated to 1557. Originating in the Castillian glass center of Cadalso, Rodríguez settled in Seville and applied for permission to set up a furnace, sponsored by three glassblowers and a merchant. The only other glass center in the region seems to have been at Cala in the Huelva province (Frothingham, 1963: 57-8).

The chances that the Tortugas shipwreck's square glass bottles and lead caps originated in Spain are perhaps

Fig. 22. A selection of the 27 gold bars recovered from the Tortugas shipwreck.

enhanced by iconographic evidence in still life paintings of the first half of the 17th century. Square-sectioned glass bottles with pewter caps are depicted in Juan van der Hamen y Léon of Madrid's *Still Life With Sweets* of 1622, early 1620s *Serving Table*, and *Still Life with Fruit and Glassware* dated to 1629, while *Still Life With Sweets* includes an uncapped square glass bottle painted by Blas de Ledesma, who worked in Grenada and Malaga from 1602 to at least 1652 (Jordan, 1985: 65, 67, 103, 127, 130, 141, fig. 2.3, pls. 13, 14, 20). Awareness and use of the Tortugas shipwreck type of square glass bottle in the Sevillian School of Art and urban society is reflected by a bottle of red wine closed with a pewter collar and cap in Pedro de Camprobin's *Still Life with Chestnuts, Olives and Wine* of 1663 (Jordan and Cherry, 1995: 113). These compositions drew on local life and customs and permit graphic insights into southern Spain's dining rooms in the first half of the 17th century.

5. Gold Bars, Bits & Jewelry

A. Gold Bars & Bits

As the most highly coveted product of the New World the presence of 27 gold bars and 12 gold bits amongst the Tortugas assemblages is unsurprising on a ship of the 1622 Tierra Firme fleet (Figs. 22-28). The material may be interpreted as payment received for outward-bound private consignments shipped to the Americas from Seville (cf. Kingsley, 2012). An additional seven pieces of jewelry, two coins, a 12m-long chain and an emerald finger ring complete the gold collection (Figs. 29-33). The gold bars were clustered in two areas of the wreck: off the north/northwest stern zone and east/west between midship and the stern (Stemm *et al.*, 2012: 21, fig. 17). Specific types were also nucleated. Examples stamped 'EN RADA' were centrally clustered, deposited east to west, while the thinner 'SARGOSA' bars were concentrated off the stern.

The gold bars vary substantially in states of completeness. From a catalogue of 25 examples, only three were intact, four were preserved for three-quarters of their original length, seven for half of their length, four for one-quarter length or less and seven were bits. The lengths of the differently preserved bits and bars vary from 1.2-25.4cm and weights from 2.50gms to 1.224kg and purity stamps from 20 to 22 karats. 'SARGOSA PECARTA' stamps occur on eight bars, 'EN RADA' on seven bars and 'SEBATN ESPANOL' on just one example. *Quinto* tax stamps and karat purity indicators are presented on all bars (Figs. 22-28).

Three intact gold bars display the following dimensions and features:

- 90-1A-000227: an intact small gold bar, unusually symmetrical and incorporating smooth edges, with gently rounded ends, L. 14.3cm, W. 2.4cm, 418.7gms. Four royal seal/*quinto* tax stamps along the bottom surface, each set facing the end to which each is closest. Two creviced depressions on the bottom surface (3.1 x 0.8cm and 3.3 x 0.4cm) reflect the presence of an uneven mold or uneven casting.
- 90-1A-000476: squared off at one end and rounded at the other, with an assayer's bite in the bottom right edge, L. 25.4cm, max W. 2.6cm, W. of squared off end 1.2cm, 646.2gms. Covered with 17 stamps comprising 12 royal seal/*quinto* tax stamps, four purity marks with the numerals XXI surmounted by three solid dots signifying 21¾ karats purity, and one SARGOSA PECARTA stamp within a rectangular frame. The bar's sides are uneven and non-linear (Fig. 23).
- 90-1A-000571: both ends are curved, one blunted to a square edge, the other distorted by the removal of the edge for an assayer's bite, L. 22.4cm, max W. 2.2cm, 396.6gms. The lower surface is densely covered with 12 stamps oriented from the blunted end facing downwards: seven small curved sections of two royal seals/*quinto* tax stamps, two SARGOSA PECARTA stamps in a rectangular frame and three XXI Roman numerals signifying 21 karat purity.

All the various impressed marks stamped on the bottom surface of the bars, confirming the payment of the 20% royal *quinto* tax, plus numerals and characters signifying the purity of the gold, were struck into the molten bars after casting. Purity was marked in Roman numerals (such as XXI for 21 karat purity) set in rectangular frames; above appeared solid dots enclosed by smaller rectangular frame denoting fractional values (one dot for one-quarter karat, two dots for a half, etc). The word 'EN RADA' appears with several co-joined letters (P and L, A and E, and R and A and N). Other stamps read 'SARGOSA PECARTA' and 'SEBATN ESPANOL'.

These stamps represent abbreviated names of the Antioquía foundries of the Colombia mines where this colonial gold was extracted and cast. The 'SARGOSA PECARTA' gold bars derived from Zaragoza, which started operations in 1582, while 'SEBATN ESPANOL' signifies extraction at the seemingly small San Sebastian mines of Timaná (Craig and Richards, 2003: 77). The 'EN RADA' gold is an abbreviation of 'Peñarenda', a wealthy family that owned gold mine concessions in various parts of the New World, including seemingly Colombia and Mexico (pers.

*Fig. 23. An intact gold finger bar covered with 17 stamps: 12 royal seal/*quinto *tax stamps, four 21¾ karat purity marks, and one 'SARGOSA PECARTA' stamp (L. 25.4cm, 646.2gms, TOR-90-1A-000476).*

Fig. 24. Half of a gold finger bar with nine stamps: five quinto *tax stamps, three 21¾ karat purity stamps, and one 'EN RADA' stamp (L. 13.1cm, 426gms, TOR-90-1A-000766).*

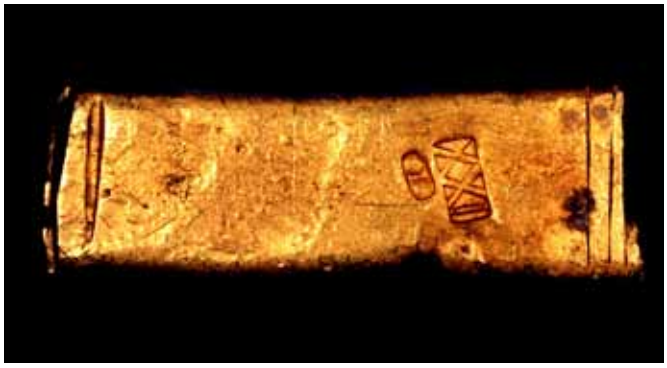


Fig. 25. The central section of a gold finger bar, stamped with 21¼ karat purity mark (L. 7.9cm, 192.5gms, TOR-90-1A-000414).

Fig. 26. Detail of an 'EN RADA' stamp on gold finger bar TOR-90-1A-000766.

comm. John de Bry, 6 March 2012). Different mines seem to have processed the bars in minor contrasting styles. The 'SARGOSA PECARTA' stamped bars exhibit tapered, almost pointed ends, and an assayer's bite cut from the end of the bar. On the 'EN RADA' bars, which incorporate blunt, almost squared off ends, the assayer's bite is found at the end's center.

The Tortugas type of Spanish gold finger bar (and cut bits) was already in circulation on the Los Mimbres ship, wrecked between 1521 and 1536 on the northwest edge of Little Bahama Banks, 88km across the Strait of Florida off Palm Beach (Craig and Richards, 2003: 19). The single gold bar recovered from the group of Spanish ships lost off Padre Island in 1554, from which a section of metal had been cut off as in the Tortugas collection, is thinner and taller than the Tortugas bars, with a more curved upper surface. The stamp 'AVS' signifying gold occurs on the curved upper edge of the Padre Island example (Barto Arnold and Weddle, 1978: 275, fig. 49), not on the underside as appear on the Tortugas gold bars.

Finger bars of identical shape covered with almost circular tax stamps and squared off sections comparable to the Tortugas products foundered on a Spanish wreck of *c*. 1595 off Bermuda (Peterson, 1975: 43). The Tortugas 'SARGOSA PECARTA', 'EN RADA' and 'SEBATN ESPANOL' stamps are all represented on identical gold bars recovered from the *Atocha* (alongside another five named mines), but have not been identified on the *Margarita*. The bar form remained largely unchanged on the wreck of the *Nuestra Señora de las Maravillas*, sunk in the Bahama Channel in 1656, although the absence of EN RADA stamps suggests that the source of this alluvial gold was exhausted by this date (Mathewson, 1986: pl. C-6; Craig and Richards, 2003: 19, 21, 30, 75, 91).

An important contribution of the Tortugas assemblage is evidence of production and function. The collection mainly comprises half and quarter examples, which have been cut for convenient use. These breakage patterns display little functional rationale. An estimate of the required weight and size was simply sliced off as demanded. Obsessive repeat stamping on intact bars demonstrates that such fragmentation was a functional expectation. Efforts were consistently made to preserve a segment of the tax stamp on every piece to confirm that the king's tax had been honored. The presence of even slight royal tax marks on smaller bar fragments would have lent reassurance during exchange and commerce regarding the validity and respectability of a merchant.

Residual gold originating from bars might eventually be converted into improvised coinage, exemplified by three gold bits on the Tortugas wreck (Diam. 0.8cm, Th.

0.1-0.2cm, 0.46-1.46 grams; Fig. 28). Each incorporates four small dots across the surface recognizable as traces of *quinto* stamp sections. The larger bit contains the authentic amount of gold required for a half *escudo* coin. The two smaller bits were suitable as quarter *escudos*. Therefore, it may be assumed that these bits served as improvised or 'homemade' legal coinage. Not only were they marked for legal tender, but the value was in keeping with everyday commerce.

B. Jewelry

A 461-gram gold chain composed of six individual strands crafted with plain oval links, gathered and held together with a gold ring, was recovered off the extreme north/northwest stern area of the wreck (coordinates 83.89/34.97; 90-1A-002457, Fig. 31). Each strand is approximately 2.0m long and contains respectively 770, 762, 762, 766, 761 and 762 links. One link subjected to chemical analysis by Honeywell Materials Testing Lab in Clearwater, Florida, identified the metal as 21-karat purity.

These chains are familiar from other Spanish colonial shipwrecks. The *San Diego* sunk off the Philippines in 1600 produced a braided gold necklace or neck chain comprised of 22 strands braided in chevrons from which probably originally hung a pendant (Provoyeur, 1994: 258). Substantial gold chains from a few inches to 3.6m in length weighing 2.9kg have been recovered from the *Atocha* (Mathewson, 1986: C-13, C-16), at least two 22-karat examples from the *Concepción* lost off the Dominican Republic in 1641 (Grissim, 1980; Borrell, 1983: 107) and from the 1715 fleet off Fort Pierce and Vero Beach, Florida (Burgess and Clausen, 1982: pl. 2-3). Eight sections of gold chain from the Vero Beach site measured between 20.4cm to over 2.04m in length, five were of plain simple link form (four with 3mm diameter links and 53 links per 10cm, and the fifth with 2mm diameter links and 90 links per 10 cm), while four-petaled floral motifs were added to three full chains (thickest diameter 5mm with 44 links per 10cm (Clausen, 1965: 23). A 162.5cm-long, 479gms gold chain composed of six strands of fine flattened rectangular links, with a single scalloped gold ring and clasp in the form of four wire loops, was salvaged from the *Nuestra Señora de Esperanza*, a Spanish galleon of 650 tons lost in Mystery Bay, Gulf of Mexico, in 1658.[1]

The chain's function remains a matter of conjecture: it may have comprised jewelry or, being intrinsically valuable, could have served as a portable 'money belt'. Such chains were used for both ceremonial purposes, as conspicuous displays of wealth and were bestowed as diplomatic gifts throughout the 17th century. These symbols of status

Fig. 27. Detail of a 'SARGOSA PECARTA' stamp on a gold finger bar.

Fig. 28. Twelve gold bar ends and bits recovered from the Tortugas shipwreck.

and wealth appear in 17th-century paintings across Europe from Rembrandt's *Self Portrait with a Gold Chain* of 1633 to Diego Velázquez's majestic full-length portrait of Philip IV (1605–1665), King of Spain of *c.* 1624 (Metropolitan Museum of Art, 14.40.639) and his *Portrait of an Old Gentleman with a Gold Chain and Cross of the Order.* Velázquez himself was gifted a gold chain for his Portrait of Innocent X painted *c.* 1650 (Galleria Doria-Pamphilj, Rome; Armstrong, 2004: 78).

A 1702 edition of *Spanish Rule of Trade to the West Indies* discussed different usage of gold chains whereby:

> "Soldiers wounded in the King's Service, are to be allowed some advance of their pay, or a free gift; such as perform any extraordinary action, to be rewarded with gold chains,

> from 50 ducats value to 200, with a certificate containing the cause why it was bestoyed on them, that upon occasion they may be further rewarded."

The heavy Tortugas chain is of plain design and may have served a purely decorative purpose or had been a convenient means of shipping gold in non-currency form. If the latter, the gold chain would parallel the *Margarita*, where the weights of the largest links were analogous to half and one *escudos* gold coins (pers. comm. Jim Sinclair, 3 September 2012).

A gold finger ring with a single emerald inset (90-1 A-0000073, Figs. 29-30), identified as Colombian in origin, is sufficiently large to have belonged to a man or to have fitted over the gloves of a lady. A similar example was recovered from the *Atocha* (Mathewson, 1986: C-18). Seven miscellaneous gold jewelry stems for bead necklaces or from a rosary were excavated (Fig. 32). A fragment of a badly eroded drilled pearl, estimated at measuring approximately 5-8mm in diameter, encircles the stem of one example. Both the ring and gold stems were presumably personal jewelry rather than cargo.

6. Silver Coins

A significant assemblage of 1,184 silver cob coins in various degrees of degradation was recovered from the Tortugas shipwreck (Figs. 34-39). In the usual process of producing cob coins, silver with the requisite fineness of 92-98% purity was hammered into crude sheets with slight variances in thickness. Pieces of the bar were subsequently cut to approximate size, weighed and the edges clipped until the blanks fell within authorized weight requirements.

These planchets were then reheated or annealed, placed between dies and struck to imprint the crowned Shield of the House of Habsburg on the obverse and a cross with the Lions of Léon and Castles of Castile in the four quadrants of the cross on the reverse. Coins produced in the

Denomination	Mexico	Potosi	Bogota/ Cartagena or Old World	Unknown	Total
8 *reales*	335	212	6	9	562 (53.5%)
4 *reales*	157	67	4	4	232 (22.1%)
2 *reales*	66	45	2	6	119 (11.3%)
1 *reale*	104	31	1	1	137 (13.0%)
½ *reale*	1	--	--	--	1 (0.1%)
Unknown	--	--	--	133	---
Total	663 (56.0%)	355 (29.9%)	13 (1.1%)	153 (13.0%)	

Table 1. Tortugas shipwreck silver coins by quantity, denomination and mint (1999 analysis of 1,184 coins).

Denomination	Mexico	Potosi	Unknown Plus Assume Potosi	Bogota/ Cartagena or Old World	Unknown	Total
8 *reales*	199	34	66	3	41	343 (75.9%)
4 *reales*	28	9	17	2	3	59 (13.1%)
2 *reales*	5	3	11	1	1	21 (4.6%)
1 *reale*	23	2	4	0	0	29 (6.4%)
Unknown	60	4	32	1	98	195
Total	315 (48.6%)	52 (8.0%)	130 (20.1%)	7 (1.1%)	144 (22.2%)	

Table 2. Tortugas shipwreck silver coins by quantity, denomination and mint (2011 analysis of 648 coins).

Figs. 29-30. A gold ring with an emerald inlay and in situ *on the shipwreck below a cluster of olive jars.*

South American mints at Potosi, La Plata, Lima, Bogota and Cartagena featured a Greek cross. Issues from the Mexico mint held a cross whose four extensions ended in an orb. The resultant image was frequently off center, and because both sides were imprinted simultaneously the image is often more pronounced on one side. Since the thickness of the coin also varied, the strike may be clearer from one point to another over the surface. Cob coins were thus never round or even.

Silver coins were recovered from most parts of the Tortugas shipwreck site, but with a heavy concentration in the stern, and tended to be scattered, lying individually rather than in large concreted clumps (cf. Stemm *et al.*, 2012: 21, fig. 17). The average weight of coins identified as 8 *reales* coins after cleaning and electrolysis was 8.99gms, with a total overall range of 1.53-22.5gms. The official standardized weight for 8 *reales*, as minted, was 27.47gms. Considerable weight was seemingly lost due to prolonged immersion and corrosion in saltwater (and during the cleaning and treatment process).

From the sample of 1,184 silver Tortugas wreck coins initially examined, (excluding 'Unknown' examples) 53.5% of the assemblage comprised 8 *reales*, 22.1%

Fig. 31. A 461gms gold chain (TOR-90-1A-002457) composed of six individual strands of plain oval links.

Fig. 32. Miscellaneous gold rosary fittings, one incorporating a fragment of pearl.

Fig. 33. Two pre-1580 Spanish peninsular coins (weights 6gms).

Fig. 34. Mexico City mint; 1 reale *denomination (TOR-90-00763-CN). Obverse: the small framed pomegranate symbolizing New Granada, upper-center, clearly depicted. Reverse: a cross whose four extensions each end in an orb, indicative of the Mexico City mint, quarters the lions of Léon and castles of Castile. Diam. 2.0cm, Grade 3.*

Fig. 35. Mexico City mint; 4 reales *denomination (TOR-90-00382-CN). Obverse: mintmark 'oM' to left of shield, above assayer initial 'D.' Kings' ordinal III clearly visible at the 6:00 position. Reverse: lions of Léon and castles of Castile, quartered by an orbed cross and surrounded by a curving quatrefoil. Diam. 3.1cm, Grade 3.*

Fig. 36. Mexico City mint; 8 reales *denomination (TOR-90-00365-CN). Obverse: Arabic numeral '8' to right of shield representing denomination value. Reverse: lions of Léon and castles of Castile, quartered by an orbed cross and surrounded by a curving quatrefoil. Diam. 3.3cm, Grade 3.*

Fig. 37. Potosi mint; 2 reales *denomination (TOR-90-00762-CN). Obverse: crowned Habsburg shield; mintmark 'P' above 'Q' for assayer Agustín de la Quadra (1613-16). Reverse: lions of Léon and castles of Castile, quartered by a Greek cross and surrounded by a curving quatrefoil. Diam. 2.4cm, Grade 3.*

Fig. 38. Potosi mint; 8 reales *denomination (TOR-90-00402-CN). Obverse: crowned Habsburg shield with mintmark 'P' to left, above the initial 'B' signifying assayer Juan de Ballesteros Narváez. Reverse: the lions of Léon and castles of Castile, quartered by a Greek cross and surrounded by a curving quatrefoil. A Philip II era issue that would have been struck* c. *1577-98. Diam. 3.8cm, Grade 3.*

Fig. 39. Unidentified mint; 8 reales denomination (TOR-90-00517-CN). Obverse: eroded. Reverse: lions of Léon and castles of Castile quartered by a Greek cross surrounded by a curving quatrefoil; partial date of '162-' at 11:00 position. The elaborate open-mouthed lions and rendering of the castles suggest production in one of the Nuevo Reino de Granada mints or a Spanish peninsular mint. Diam. 3.5cm, Grade 3.

Fig. 40. A silver ingot, not stamped and probably contraband (Diam. 8.9cm, 280gms TOR-90-01060-IT).

Fig. 41. A three-pronged silver fork with a key stamped into the head (L. 12.7cm) placed on a Blue-on-White Talavera style dish (TOR 90-1A-000577).

4 *reales*, 11.3% 2 *reales*, 13.0% 1 *reales* and 0.1% ½ *reales*. Two coins were of the *c*. pre-1572 pillar design (Flow, 1999: 87-8). Most common were 8 *reales* issues minted in Mexico (335 coins; Fig. 36). A further 212 8 *reales* issues derived from Potosi (Fig. 38). Third most common were 157 4 *reales* from Mexico (Fig. 35), followed by 104 1 *reale* from Mexico (Fig. 34). In total, 56.0% of the silver coins originated in Mexico, 29.9% in Potosi and 1.1% in Bogota/Cartagena or an Old World mint (Table 1).

A reanalysis by Carol Tedesco in 2011 of a sample of 648 Tortugas shipwreck coins retained by Odyssey Marine Exploration in Tampa yielded differing data (Tedesco, 2012). The quantification produced slightly differing results caused by the smaller sample size and availability for study of badly deteriorated issues (Table 2). The material was still dominated by the Mexico mint (48.6%), but the Potosi coins accounted for a far lower 8.0%, while the Bogota/Cartagena or Old World examples were identical (1.1%). Unknown denominations accounted for an extensive 42.2% of the collection. Due to the superior volume of coins available for analysis in 1999, the statistics derived from that study are considered the optimum data set for the Tortugas shipwreck.

The 2011 reanalysis contributed greater complexity to the understanding of the assemblage. Nine Tortugas coins were identifiable as Philip II (r. 1554-98) period issues. Two coins retain the partial dates of '162-', while a third reads '16--'. Some 30 of the 315 Mexico City mint coins examined incorporated visible assayer's initials, in chronological order: 'O' for Bernardo de Oñate and Luis de Oñate, *c.* 1572-89; 'A' for Antonio de Morales, *c.* 1608-10; and an assayer 'D' confirmed from 1618 through post-1622 shipwrecks (Fig. 35). Of the 52 Potosi mint coins examined, 30 have a visible assayer's initial: 'R' type attributable to assayer Alonso de Rincón, *c.* 1574-76 and Baltasar Ramos Leceta, *c.* 1590-1612; 'B' for Juan de Ballesteros Narváez, intermittently *c.* 1577-1615, and also Hernando Ballesteros substituting for Juan de Ballesteros (Fig. 38); 'Q' for Agustín de la Quadra, 1613-16 (Fig. 37); 'M' for Juan Muñoz, 1616-17; 'T' for Juan Ximénez de Tapia, 1618 through post-1622 shipwrecks. Seven of the coins originated from one of the New World mints of Santa Fe de Bogotá, Cartagena or from a Spanish Peninsular mint (Tedesco, 2012).

Other than the parallel sets of ceramics, pearls, gold bars and astrolabes on the Tortugas shipwreck and in the *Atocha* and *Margarita* collections, the 2011 coin reanalysis established certain evidence for a numismatic link between all three wrecks, confirming that the Tortugas ship sailed with the 1622 Tierra Firme fleet. There are no mints, timeframes or assayers represented in the Tortugas coin assemblage that have not been documented on the *Atocha* and *Margarita*. On all three wrecks assayer 'D' is the final assayer to represent the Mexico City mint, assayer 'T' is the final assayer from the Potosi mint and assayer 'A' is the only operative to represent the mints of Nuevo Reino de Granada. Each of these officers held their posts immediately prior to and after 1622, when the Spanish fleet sank off the Florida Keys (Tedesco, 2012).

In addition to the coins, a 12.7cm-long silver fork with a key motif stamped into its head (Fig. 41) and one single crude silver disc ingot were recovered near the pump well (coordinates 79.26/26.70; 90-1A-000779, Diam. 8.9cm,

280gms; Fig. 40). This ingot form has a long history from its appearance on the Padre Island Spanish shipwrecks of 1554, where some of the *planchas* carried stamps indicating mining districts and others indicating that the *quinto* tax was paid in Mexico (Barto Arnold and Weddle, 1978: 276-7, 279). The form with a hemispherical, porous base prevailed in both silver and gold on the 1715 fleet sunk off Vero Beach, Florida (six silver discs of 11.4-24.1cm diameter, 1.3-3.8cm thickness, weighing 1lb 3 ounces to 271lbs, 90% silver), but whereas the gold examples were stamped on the upper surfaces, only the largest silver example was marked (Clausen, 1965: 15-16). The absence of any marks across the surfaces of the Tortugas wreck ingot points towards its transport as contraband.

7. Pearls

A total of 6,639 pearls scattered across the site was recovered from the Tortugas wreck through the use of the project's SeRF sieve system (Figs. 42-43). When recovered from the dredged sediments many were a dark gun-metal gray color, but after conservation reverted to a range of colors and lustrous finishes. Pearl shapes include round, pear, egg, drop, button, baroque and blister, as defined by the Gemological Institute of America, and vary in color from white to cream, rose, pink, silver, yellow, blue and black. Some 636 of the pearls are drilled. From a sample of 6,494 well-preserved pearls, the sizes range from 1-10mm and five classes were identified:

- Large (7-10mm): 95 (1.5%)
- Medium/large (5.5-6.0mm): 114 (1.7%)
- Medium (3.5-5.0mm): 2,837 (43.7%)
- Small (2.0-3.0mm): 1,752 (27.0%)
- Minimal (1.0-1.5mm): 1,696 (26.1%)

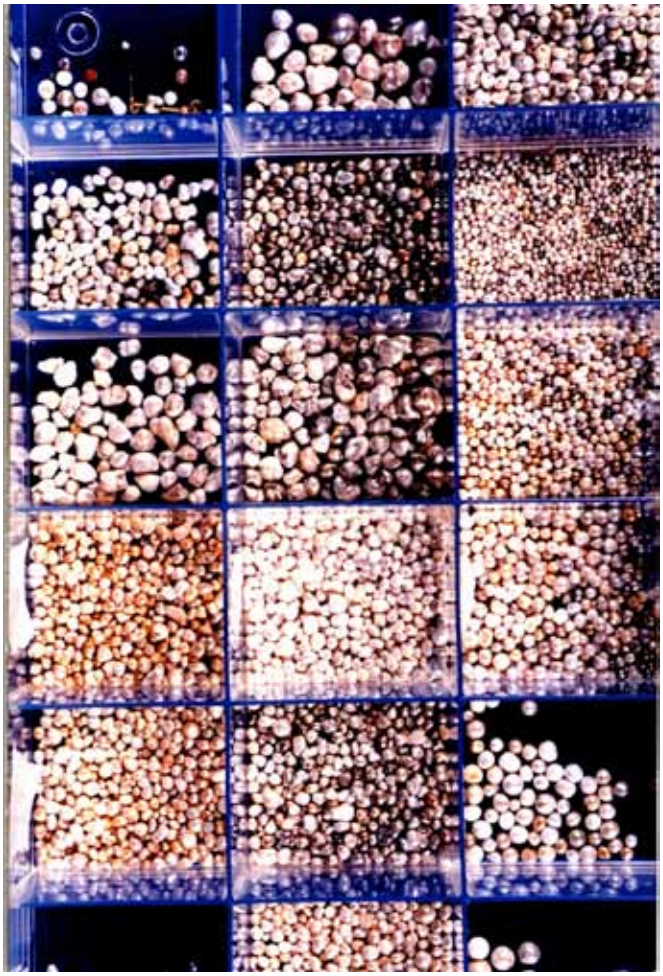


Fig. 42. Some of the 6,639 eastern Venezuelan pearls from the Tortugas wreck sorted according to size and shape.

Despite the heyday of exploitation having long ceased by 1622, the Venezuelan oyster beds were still visited in hope and some success in the first quarter of the 17th century. Three ships from the 1622 Tierra Firme fleet visited these waters: the 115-ton *Santa Ana* sailed for Margarita Island, the 110-ton *San Francisco* for Cumana, while the 117-ton *Buen Jesús y Nuestra Señora del Rosario* headed to Nueva Cordoba, the antiquated name for Cumana. The destination of two additional vessels, the 100-ton *Nuestra Señora del Rosario* and the 180-ton *Nuestra Señora de los Reyes*, is listed generally as 'Venezuela' (Chaunu and Chaunu, 1956: 26-7).

As the earliest source of wealth imported by colonial Spain from the Americas, more than gold and silver the pearl trade symbolizes Spain's non-sustainable exploitation of regional economies in the New World. The islands of

Fig. 43. Drilled Venezuelan pearls from the Tortugas wreck.

Coche, Cubagua and Margarita off the eastern coast of Venezuela and mainland Cumana were the source of Spain's richest pearl beds throughout the 16th and 17th-century colonial exploitation of the Americas. Although Columbus was the first European to realize the economic potential of Cubagua during his third voyage of 1498, when he bartered hawk bells, beads and sugar with the Arawaks of eastern Venezuela's Paria Peninsula for more than six marks (about 1.4kg) of pearls, he never personally landed amidst the fabled source of this wealth (Romero *et al.*, 1999: 59, 60; Romero, 2003: 1014, 1016; Warsh, 2009: 16, 22).

On the back of his reports, *capitulaciones* (contracts) were swiftly secured and already in 1499 different voyages by Alonso de Ojeda and Peralonso Niño traded 44.2kg of pearls. By the turn of the 16th century the Crown had declared the pearl trade a royal monopoly subjected to a 50% *quinto* taxation. Clay and straw hut *rancherías* emerged on Cubagua, where the natives exchanged pearls for wine, linen shirts, wheat bread, firearms and European goods (Romero, 2003: 1016).

The two decades spanning 1508-20 witnessed the peak exploitation of the *Costa de las Perlas* – the Pearl Coast. To maximize extraction Spain ceased relying on the local Guayqueri divers from Margarita (Warsh, 2009: 32) and, instead, in 1508 paid as high as 150 gold *pesos* per person for large numbers of Lucayan Indians from the Bahamas (Romero *et al.*, 1999: 62). Renowned as the finest free divers (formerly for conch shells), the Lucayans could dive to 30m, making the average 13m-deep pearl beds easily accessible. Such was the hyper-exploitation of the Cubagua region's resources that by 1518 the Bahamas' Lucayan presence had been entirely denuded of its estimated 60,000 population for slaves (Romero, 2003: 1017).

In 1509 the Spanish government encouraged increased production and trade in pearls by reducing the tax from 50% to 20% of gross production. Inspired by the clamor for this luxury product, in 1528 Nueva Cádiz (Cumana) become the first European city in South America, populated by 223 Europeans and 700 natives, a frontier town plagued by administrative corruption, drinking, gambling, murder, adultery and the rape of native women. Between 1530 and 1535 the island fisheries of eastern Venezuela were exploited to the maximum (Mackenzie *et al.*, 2003: 1; Romero, 2003: 1017).

The oyster beds were already becoming severely depleted by 1528 and due to ever-diminishing returns Cubagua began to be depopulated in 1533 in favor of newly discovered beds on the South American coast, such as Cabo de La Vela and Rio Hacha off the Guajira Peninsula. By 1537 the Crown was informed that no pearls had been obtained from the Pearl Islands for a year and a half. Two years later a maximum of 50 people remained on Cubagua, whose buildings were destroyed in a hurricane in 1541 (Romero, 2003: 1018).

The decline in oyster stocks was caused directly by an ever-expanding drive towards productivity, seemingly resulting in deeper dives from larger boats. By 1628 'canoe' owners employed crews of at least 12 African slaves, an African captain, a Spanish pilot and an overseer. The craft dived from were by now effectively significant boats described as lateen-rigged frigates. A Spanish visitor to Cabo de la Vela in 1653 witnessed pearl boats manned by two Spanish captains and 20-30 slaves (Warsh, 2009: 53).

The volume of pearls harvested from the Pearl Coast was colossal, even though records suggest that only one pearl was found for every 1,000 oysters collected (Romero *et al.*, 1999: 68). In the space of just one or two weeks, six divers working from a single boat could recover around 35,000 oysters in the heyday of resource availability. Based on tax records the total weight of pearls procured from the Cubagua region between 1515 and 1542 achieved a minimum of 11,326kg or 566,300 carats from 113,260,000 oysters (Romero, 2003: 1019). To meet this demand each diver would have needed to harvest 196,321 oysters per month or 2,355,857 oysters annually (Romero *et al.*, 1999: 69). Between 1513 and 1540 an estimated 120 million pearls were fished up from the Pearl Coast (Warsh, 2009: 21). Shipments could be impressive: one of the largest cargos destined for Spain listed in June 1533 carried at least 340kg of pearls (Mackenize, 2003: 10).

Despite the Crown's vigorous attempts to tightly control the Caribbean trade, it fought an unsuccessful battle. Even though Seville's Casa de Contratación served as the official clearing house for the administration of the pearl trade with the Indies, where shipments to merchants, individuals and the royal *quinto* needed to be registered, pearls easily escaped centralized attempts to channel them into the imperial House of Trade (Warsh, 2009: 26).

Historical accounts estimated that over half of the total pearls harvested were never declared. Vast volumes were used at source as currency (Romero *et al.*, 1999: 67-8), even to purchase slaves delivered to the fisheries. Many Spaniards avoided the peninsular markets by offloading their wares in the smuggler-friendly Atlantic islands (Warsh, 2009: 31, 82). The complex web of exchange models through which the Pearl Coast products reached Seville, and increasingly Lisbon, Venice, London and Amsterdam, demands the question of whether 6,639 pearls were being transported on the Tortugas shipwreck through official trade or as contraband?

The size of the Tortugas pearl shipment is considerable, and despite the close proximity of the *almiranta, capitana*

and its officials within the 1622 fleet cargos could not be guaranteed to be contraband free. Bearing in mind Charles V's former prohibition of pearl drilling in 1532 to curtail the production of pearl jewelry on the islands (Warsh, 2009: 29), and the fact that a considerable 636 pearls on the Tortugas ship are drilled (Fig. 43), the specter of contraband cannot be excluded. Their interpretation as smuggled goods is perhaps favored in light of the discovery of a lead box containing 16,184 pearls on the wreck of the *Margarita*, which were categorically not listed on the ship's manifest (Tedesco, 2010a: 21), as would have been compulsory for material subjected to the royal *quinto.*

The Tortugas shipwreck's pearl cargo – the first to be scientifically excavated – is both rare and symbolic of the final decades of an ill-managed colonial industry. Apart from thousands of pearls recovered off Bermuda from the *San Pedro* of 1596 (Marken, 1994: 21-2), from the *Margarita* of 1622, the *Nuestra Señora de Guadalupe* and the *Conde de Tolosa* lost in 1724, no comparable consignments have been identified underwater.

The Tortugas pearls reflect the end of the line – one of history's earliest examples of hyper-exploitation resulting in the depletion of species, changes in ecosystem structure, displacement and extermination of local human populations and their culture. Before the establishment of the silver mines at Potosi in Peru in 1545 and Zacatecas in Mexico in 1547, pearl exports from the American continent exceeded the value of all other exports combined. The depletion of the oyster beds along the Pearl Coast is considered to be the first documented case of unsustainable natural resource depletion by Europeans in the American continent (Romero *et al.*, 1999: 70-1). These massive harvest overkills caused irreparable damage to societies and species, from which the Caribbean pearl fisheries never fully recovered (Warsh, 2009: 22, 45).

8. Trade Beads & Buttons

A total of 258 intact and fragmentary beads manufactured from glass, stone, clay, wood, palm nut and bone/ivory were recovered from the Tortugas shipwreck (around 34% glass, 17% cut crystal, 14% ceramic, 35% organic; Figs. 44-46). The majority of the glass beads are monochrome faceted examples used by European colonists as gifts and for bartering amongst the indigenous peoples of the New World. While 16th and 17th-century Spain largely used beads in rosaries and not as accessories, they rigorously exploited the indigenous cultures' perceived value of these wares (Francis, 2009a: 8).

Beads were already deemed essential for gifts and exchange when Columbus arrived in the Caribbean in 1492, and continued to serve an important role throughout the conquest and settlement of the New World (Smith, 1983: 147; Francis, 2009e: 86). A strong bead-making tradition pre-existed before Spain's arrival, especially in Mesoamerica, the Andes, and amongst the Native Americans of North America. Spain, however, substituted indigenous production with a continuous flow of relatively cheap glass beads, assuming total control over sourcing and imports.

A. Glass & Ceramic Beads & Buttons

The glass trade beads (Fig. 44) include eight white, blue and red faceted and ground Chevron beads of both five and seven-layer glass in three different sizes (maximum L. 2.5cm, W. 1.2cm; Kidd IIIm and IIIm1: bead typology is as defined by Kidd and Kidd, 1970). These drawn beads of compound construction consist of multi-layered glass, which present an appealing star pattern when viewed from each end (Deagan, 1987: 164). 'Faceted' Chevrons are common amongst the earliest New World assemblages, yet prevail into the 1620s and originate in Venice and Holland (Francis, 2009c: 74).

Most abundant amongst the Tortugas glass bead assemblage are 45 monochrome faceted Venetian glass beads, barrel or spherical in shape (Kidd If; Diam. 0.3cm, L. 0.2-0.3cm, holes Diam. maximum 0.1cm). The majority are translucent cobalt blue, while others range from turquoise to light brown, amber and deep red. Most exhibit three to five randomly spaced facets, while two red beads feature 13 and 17 facets. The red color, in particular, is quite unusual and was highly desired (Francis, 2009d: 82; pers. comm. Marvin Smith, 7 December 2011). A dark navy blue spherical bead with three irregularly placed facets (Kidd If) retains a small fragment of its original metal stringing wire within the central bore.

Referred to today as 'charlottes', these products are considered to have been the most expensive class of small faceted beads, which could be threaded onto necklaces but were often used in embroidery (Smith *et al.*, 1994: 39; Francis, 2009b: 63). The Tortugas examples, however, appear too large for the latter purpose (pers. comm. Marvin Smith, 28 February 2012). By 1630 Spain had seemingly stopped importing charlottes, possibly due to their relatively high cost or simply because they had gone out of fashion (pers. comm. Marvin Smith, 23 August, 2012). The Tortugas examples are thus significant exemplars dated towards the end of the period of production.

The bead assemblage includes one half of a translucent turquoise blue-bodied spherical eye bead (TOR-90-01142-GL, L. 0.7cm, Diam. 0.5cm), with a 1.5mm-wide longitudinal white stripe running parallel to the bore and a small

red and white dot in the middle (similar to Kidd IIh1). The color is typical of Ichtuknee Plain beads, distinguished by bubbles termed longitudinal 'spun sugar striations' (Pendleton *et al*., 2009: 42). The Tortugas example appears representative of the Class I, Series A, Sunburst Variety 2 (Smith, 1982: 123-24). Classifiable as an '*a speo*' finished complex bead ('by the spit' as opposed to on an iron pan: Pendleton *et al*., 2009: 42), such wares were produced by the Paternostri Venetian beadmaker's guild.

An additional spherical-shaped opaque turquoise blue/green bead (Kidd IIa40) with a 'striated' or 'spun sugar' appearance is represented within the Tortugas assemblage (TOR-90-00348-GL, W. 0.3cm, L. 0.2cm, hole Diam. 0.1cm). Finished by the *'a speo'* method, these products are again Venetian Paternostri beads, although manufacture in France by Italian glassworkers has also been proposed (Francis, 2009c: 75, 78).

The smallest beads in the glass assemblage are tiny ring-shaped seed beads also known as 'rocailles', which range in color from turquoise blue (Kidd IIa41) to a darker cobalt blue (Kidd IIa56; Diam. 0.1cm, L. 0.1cm, hole Diam. 0.05cm). Seed bead refers to small examples typically produced of drawn glass finished by tumbling (stirring the cut segments over heat, *a ferarazza*: Pendleton *et al.* 2009: 53) that were frequently used in beadwork. Whether these beads were shipped in bulk or strung before shipping is unclear, although the latter would have held the advantage of making these beads easier to handle and divide.

The collection includes 40 intact and seven fragmentary clear quartz cut crystal beads (mainly Diam. 1.3cm, Th. 0.9cm, hole Diam. 0.1cm), similar to examples originally referred to as 'Florida Cut Crystal' (as defined by Goggin and later by Fairbanks, 1968: 13-16), based on examples recovered from 16th-century Native American sites in Florida (Deagan, 1987: 180-1; Francis, 2009g: 117). The examples display between 24 and 40 facets ground into their surface.

Faceted cut crystal beads were largely produced from the end of the 13th century in the major cutting centers of Venice and Paris. However, it has been suggested that poorer quality examples, including those recovered from the *Atocha* and *Margarita*, originated in Spain (Francis, 2009g: 118). Castille has recently been proposed as the source of cut crystal beads excavated on St. Catherines Island, Georgia (Thomas, 2011: x), and could perhaps be the source of the Tortugas examples.

Fig. 44. Mineral beads: cut crystal (back three rows and center); glass beads: amber, light brown, deep red, cobalt, navy and turquoise blue faceted examples ('charlottes'), opaque turquoise blue/green bead, turquoise half of an 'eye' bead; blue seed beads (middle left and lower left); five and seven-layer Chevrons (center); black bead; and black glass buttons (right).

Fig. 45. Cylindrical, barrel-shaped and conical ceramic beads with an incised lattice design (Diams. 0.8-1.2cm).

A single mineral bead (FS 90-1A-000680.57, Diam. 1.0cm, L. 0.9cm), believed to be carnelian or agate, features an equatorial edge cut in two rows of six unevenly sized and smoothed facets to form a total of 12 surfaces. For millennia this rock form was mined along the Narmada River in central India and cut locally at lapidary centers such as Limudra. Cambay (modern Khambhat in western India) earned a reputation as a major bead-making center by at least 1630 and probably several decades earlier (Francis, 2009g: 119). Certainly carnelian and agate beads were already reaching Spain in Portuguese hulls by the early 16th century and were a form of exotica that Columbus transported to the New World on his first journey (Deagan, 1987: 182).

The Tortugas wreck also contained 40 ceramic beads, half of which are undecorated, cylindrical, badly eroded and porous (Fig. 45). The other 20 barrel-shaped and conical examples are decorated with an incised lattice design across the body and incised double or single lines encircling the ends (Diam. 0.8-1.2cm, L. 0.7-0.8cm, hole Diam. 0.1cm). At least three beads exhibit tiny flecks of gold on their surfaces, perhaps remains of original gold leaf veneer. Such beads are generally identified as European trade products (pers. comm. Richard Patterson, 2 March 2012), which are poorly documented within Spanish-contact North American assemblages, suggesting limited use in the New World.

In addition to beads, glass buttons were popular colonial trade products amongst the New World Indians (Bradley, 1987: 158). Examples were frequently used less as garment fasteners than as clothes' ornamentation (Koch, 1977: 73). The Tortugas assemblage includes nine small opaque black buttons (Diam. 1.2cm) with two small holes for iron wire eye attachment. Glass buttons were uncommon items in Spanish commerce, and are largely intimately associated with Dutch merchant trade with the Native Americans of North America.

B. Organic Beads

The 26 intact and 12 fragmentary carved wood beads of undetermined species from the Tortugas wreck (Fig. 46) are largely of simple spherical design (W. 0.9-1.2cm, L. 0.9-1.2cm, hole Diam. 0.2-0.3cm). Larger spherical examples with a hollow interior (five intact and 15 fragments) appear to have been produced from a palm nut (W. 0.9-1.2cm, L. 0.9-1.2cm, hole Diam. 0.2-0.3cm).

Several beads are more intricately carved barrel and conical examples with rows of raised ribbing at both ends (Diam. 1.5cm, L. 1.7cm, hole Diam. 0.2cm). Similar examples strung on a rosary with a gold medallion recovered from the *Atocha* have been identified as ebony (*Atocha* database inv. A86.1127).

The Tortugas assemblage includes 27 largely intact and eight fragments of undecorated small spherical beads, which bear some resemblance to ivory, bone or possibly a seed product (Diam. 0.8cm, H. 0.7cm, hole Diam. 0.2 cm). These round beads are mainly brown with cream-colored eroded patches, and are again comparable to examples from the *Atocha*, which are thought to be ivory or bone rosary beads (Malcolm, 1993: 7). The smallest organic bead examples recovered from the Tortugas wreck (Diam. 0.4cm, L. 0.3cm, hole Diam. 0.1cm) resemble examples produced from seeds.

Some of the Tortugas wreck's organic beads produced from palm nuts appear similar to those described by John Esquemeling in his *Buccaneers of America* of 1684. Citing the various palm species on the island of Hispaniola, he referred to the "Palma a Chapelet" (rosary-palm), whose hard, small seed was "very fit for making rosaries or beads to say prayers upon" (Esquemeling, 1684: 36). A total of 261 whole or fragmentary palm seeds, some seemingly bored, were recovered from the Tortugas wreck (see section 14); their function aboard ship is difficult to determine unless they were raw material intended for future rosary bead production in Spain.

C. Distribution & Function

The significant assemblage of beads and buttons on the Tortugas ship may be interpreted largely as residual cheap trade goods cargo intended for bartering or gift giving to grease the wheels of commerce amongst the native populations of South America. Given the presence of pearls on the vessel and its plausible identification as the *Buen Jesús y Nuestra Señora del Rosario*, which sailed to Cumana, the beads were

Fig. 46. Organic beads (left to right): smallest beads in the assemblage, possibly produced from seeds (column 1); carved spherical wood and bone (or possibly ivory) beads (columns 2-4); incised beads of unknown organic material (columns 1 and 2); ribbed barrel and conical-shaped wooden (ebony) rosary beads (column 5 and 7); carved ebony beads, possibly from/for an abacus (column 7); wood and palm nut beads (and bead fragments), the larger examples likely intended as rosary beads (columns 8-15).

probably at least partly intended for use along the east and west coast of Venezuela. The palm nut and possible ivory or bone beads are exceptions seemingly under export to Spain for rosary production, although some may have originated from crew or passengers' personal rosaries.

Few comparative assemblages have been published from South America. The geography and character of exploitation are best assessed through collections excavated west of Venezuela. The Tortugas bead repertoire is strongly represented amongst Spanish and Spanish-influenced sites. Chevron beads were common on Spanish colonial sites in the Americas between the early 16th century and the early 17th century, and were especially popular in Mexico and Peru (Smith and Good, 1982: 7-8; Deagan, 1987: 165; Mitchen and Leader, 1988: 44, 47). Examples reached the Franciscan mission site at Tipu in western Belize, which was occupied from the 1540s into the early 17th century (Smith *et al*., 1994: 31, 36). A dozen early Chevron beads have been recovered from the Governor Martin site in Tallahassee, Florida, a native Apalachee settlement (Anhaica) occupied in 1539-40 by Hernando De Soto and his army (Ewen and Hann, 1998: 15-16, 85, 98). Chevrons also circulated beyond the sphere of Spanish colonial influence, such as 96 examples from 17th-century English Jamestown in Virginia (Lapham, 2001: 6; pers. comm. Beverly Straube, 11 September 2012).

Charlottes are one of the largest bead groups recovered from Tipu in Belize (mid-16th to early 17th-century), where faceted examples constitute 16.2% of the assemblage (Smith *et al*., 1984: 38-9; Francis, 2009b: 63). Examples in turquoise, blue and red have been found at Spanish Nombre Di Dios, one of the first European settlements on the Panama Isthmus occupied from 1510-96 (pers. comm. Richard Patterson, 1 March 2012). The type is represented in the 16th-17th century Spanish Mission of Santa Catalina de Guale on St. Catherines Island, Georgia, predominantly within the cemetery, where one Native American burial contained over 900 faceted cobalt blue beads (Blair, 2009: 160-1).

Given the distinctive qualities of crystal beads, they are not thought to have functioned significantly within the mainstream New World trade orbit (Fairbanks, 1968: 14-15; Deagan, 1987: 180-1). The Tortugas wreck examples are thus seemingly of higher status than the rest of the ship's bead assemblage, a point highlighted by the personal belongings of Queen Isabella, the wife of Philip II (r. 1554-98), who owned earrings adorned with prized rock crystal and a girdle decorated with 32 crystals (Deagan, 1987: 180; Francis, 2009g: 118).

Just half a dozen cut crystal examples amongst the 69,000 glass trade beads were excavated from the Franciscan Mission of Santa Catalina de Guale on St. Catherines

Island in Georgia (Pendleton *et al.*, 2009: 50; Thomas, 2011: vii, x), which served as the northernmost Spanish settlement along the Eastern seaboard for a century until 1680. This pattern reflects the comparative rarity of these products. Cut crystal beads and pendants, however, were common in the Mission San Luis de Talimali in modern Tallahassee, capital of the missions in western Florida and home to the largest Christianized Apalachee population in America *c.* 1656-1704 (McEwan and Poe, 1994: 90; pers. comm. Marvin Smith, 1 December 2011), where a significant deposit was located within with the Chief's house, the site's sole Apalachee structure.

Southeastern Indians believed that crystal possessed unique mystical properties and examples have been discovered amongst shamans' belongings.[2] Further west, cut crystal beads reached the large Cherokee mound centers of the Upper Little Tennessee River in the 16th century, where the early Spanish explorers Hernando de Soto (1540) and Juan Pardo (1567) first made European contact (Badger and Clayton, 1985: 114). These beads are thought to have functioned as exotic Spanish gifts to the Indians (Deagan, 1987: 181). Crystal beads also occur on shipwrecks dated between 1550 and 1625, including the *Margarita* (Deagan, 1987: 180; Francis, 2009g: 118; pers. comm. Corey Malcom, 4 November 2011).

The glass buttons are an anomaly within the pattern of Spanish control and exploitation of European beads in the Americas. The Dutch seem to have dominated the trade in these wares, exchanging them as gifts with Indian tribes since the late 16th century. They occur in the Northeast on Dutch-contact sites occupied by the Onondaga Iroquois (Bradley, 1987: 158; pers. comm. Marvin Smith, 19 December 2011), and are associated with Dutch colonial trade objects in western New York State on Seneca sites of the first half of the 17th century (Baart, 1987: 6). Few wire eye buttons have been recovered in 16th and 17th-century Spanish contexts and none from pre-1550 Florida or the Caribbean (Deagan, 2002: 161-2). Their rarity opens up the possibility that they served as fastenings for clothing belonging to a passenger onboard the Tortugas ship.

In summary, multivariate statuses and to some degree functions may be proposed for the Tortugas wreck's beads. The majority are recognizable from Spanish-contact sites and were seemingly being transported for trade, barter and gift giving along at least the coast of Venezuela (Chevrons, charlottes, turquoise, eye, striated and seed beads: 23% of the total assemblage). Alongside these, Venetian and French wares are more rare products of greater social hierarchical value, including cut crystal beads possibly manufactured in Spain (18.5% of the beads), a carnelian or agate bead from central India (<0.5%), and evidence of gilt-covered ceramic wares (16%). The ivory or bone beads (10%) and some palm nut products (16%) may have originated from the crew and passengers' rosaries. Finally, the glass buttons (3.5% of the bead assemblage) closely resemble Dutch commodities and may have been dress-related rather than commercial cargo.

9. Navigational Equipment

A. Anchors

Limited navigational equipment was identified during the Tortugas shipwreck excavation, the largest of which were the site's three iron anchors (excluding a fourth large example snagged by a steel cable dragged between two shrimp boats during a prior salvage attempt in 1972: Marx, 2009: 57). Anchor A1 lies to the southeast of the site (coordinates 72.6/16.8, L. 2.5m, arm W. 1.3m; Figs. 47-48) and thus remains close to the bows, where it was presumably catted unused on the ship's port flank at the time of sinking. Its arms are rounded, albeit slightly angular, and terminate with well-defined palms, which occupy half the arm's length. The shank is oriented on a 18º axis with the arms facing north. Solidly adhering to the anchor's heavily concreted surfaces and clustered around them were eight intact olive jars on the southern side of the anchor shank as well as a wooden plank just below the sand displaying a nail hole and diagonal scarf.

One intact *botija* and fragments of at least three more jars were uncovered in shallow mud in front of the intact anchor arms alongside a one-handle half-dipped jug (TOR-90-00016-CS). A1's arms literally rest on top of an olive jar rim. A gold bar was discovered next to the anchor during the site metal detector survey (coordinates 73.01/15.56). A further extensive linear concretion underlying and perpendicular to A1's lower shank extending westwards is a third anchor on the site, A2 (and thus a fourth in total from the wreck).

Anchor A3, by contrast, lies amongst loose mud sediments with its arms and lower shank on a 14º southwest/northeast axis at the northeastern, stern flank of the site and seems to be out of context, perhaps having been displaced from the bows by bottom trawler impacts (coordinates 79.3/33.3; Figs. 49-50). Although broken at its midpoint, the shank is 2.30m long and has a maximum concreted thickness of about 13cm. The east-facing palms are broken off. One intact and two broken olive jars lay to the sides of the arms, while a Blue-on-White Talavera-style dish was located between the eastern arm and shank juncture. The ring (L. 37.5cm) survives at the end of the shank. The broken arms (current L. 67cm) were evidently originally curved rather than v-shaped.

Figs. 47-48. Anchor A1 at the southeast flank of the site contextualized with Type 1 olive jars.

Figs. 49-50. Anchor A3 at the northeast flank of the site.

Ten comparable iron anchors were recovered from the *Atocha* and *Margarita*, whose construction contracts listed six anchors for each ship (Mathewson, 1986: 38-9). Many feature arms that are v-shaped and with a diagnostic stepped anatomy that are dissimilar to Tortugas anchor A1 (bearing in mind the presence of thick concretion on the latter, which was not recovered for study). However, the *Margarita*'s kedge anchor (L. 1.65m, ring Diam. 0.22m, arm L. 0.52m, palm L. 0.27m), whose crown bore the date of 1618 and a foundry mark, was distinctly rounded like A1. One published v-shaped *Atocha/Margarita* anchor (inv. 52898, L. 2.02m, arm L. 0.85m, palm L. 0.45m) features a round section for the stock and square section for the arms; the palm is triangular.[3]

Tortugas anchor A1 seems to be transitional between these stepped/v-shaped and rounded examples. In all *Atocha, Margarita* and Tortugas anchors related to the 1622 fleet the flukes occupy just over 50% of the total arm length. As in the case of a *Margarita* stream anchor still associated with its wooden stock, identified as rosewood, palm and *lapacho* (Mathewson, 1986: 38-9), and a white oak stock from the 1554 Padre Island Spanish fleet (Barto Arnold and Weddle, 1978: 230), the Tortugas anchors would have been equipped with wooden stocks.

The interpretation of a concretion with 24cm-long links (inv. 52899) associated with a *Margarita* anchor as anchor chain is not confirmed at Tortugas or by contemporary shipwrecks worldwide. Instead, rope cable retained its traditional function. Double chains encrusted onto the crown and arms of a large iron anchor from the 1554 Spanish fleet lost off Padre Island, Texas, were probably intended to hold the main stay or other major rigging in place. Rope was found wrapped around its crown (Barto Arnold and Weddle, 1978: 322). The Emanuel Point I wreck's rope was made from hemp or *Canabis sativa* and was probably supplied from the Iberian region of Navarre (Burns, 1998: 78). A 6-7m length of 0.13m diameter hemp cable (four main strands laid left-handed along a heart rope) found on the wreck of the Spanish Armada transport *La Trinidad Valencera*, lost off Donegal, Ireland, in 1588, as well as a short length of similar cable wrapped around the shank of the southern anchor (Martin, 1979b: 32), confirm the traditional use of cable on Spanish vessels of the period.

Comparisons between the above Spanish anchors of 1622 with the 1544 Padre Island fleet suggests an evolution in design from examples with v-shaped arms towards open rounded arms by the second quarter of the 17th century. The seven anchors recovered from the 1544 fleet wrecked off Texas display v-shaped arms with average angles of 57.4° (Barto Arnold and Weddle, 1978: 229), which essentially fits the general proposition that before *c*. 1550 the angle between the fluke, crown and shank tended to be around 45° and around 60° after that date (Tinniswood, 1945: 85). The 3.15m-long Emanuel Point I Spanish wreck of 1559 retains an identical v-shaped morphology of approximately 65° with arm lengths of 1.25m and fluke lengths of 0.60m (Burns, 1998: 72-5).

Despite the opening up of the arm angle on two wrought-iron anchors from the Spanish Armada transport *La Trinidad Valencera* (L. 4.57m and 4.80m, total arm W. 2.44m and 2.74m), which closely mirrors those from the *Santa Maria de la Rosa* from the same 1588 Armada, its arm angle remains distinctly more v-shaped than Tortugas A1. Another example associated with the *Gran Grifon* measured 4.15m in length, while three examples salvaged from the *San Juan de Sicilia* off Tobermory, Mull, measured 5.48m, 4.57m, and 3.05m in length (Martin, 1979b: 31). With its very lightly rounded arms that display angular tendencies with long palms taking up almost half the length of the arms, the Tortugas A1 anchor is similar to the *Vasa*'s port bower anchor (Cederlund, 2006: 467).

Unlike the far larger *Atocha* and *Margarita* galleons equipped with six anchors, the Tortugas ship almost

certainly carried four main examples, as registered for the *Santa María de Yciar* of 1554 and counseled in 1575 by Escalante de Mendoza (one sheet and three bowers, each weighing 10 *quintales* or about 460 kgf) (Barto Arnold and Weddle, 1978: 224; Castro *et al*., 2010: 21). Four were specified for the *Buen Jesús y Nuestra Señora del Rosario* of 1622 (*Contratación* 1172, N.2, R.1), which is believed to equate to the Tortugas wreck. At 2.3m and 2.5m in length the Tortugas anchors are notably shorter than all of the 1554 and 1588 anchors listed above, although closer to the size of the *Margarita*'s kedge anchor and another of 2.02m. A1 and A2 evidently were not bowers and most likely functioned as kedge or stream breaking mechanisms.

B. Astrolabes

Surprisingly for the modest size of the Tortugas ship, two bronze astrolabes recovered in the stern half of the ship near the pump well (coordinates 78.6/27.0) and a third from the southern extremity of the site (coordinates 76.9/1.3) were available to its captain (Figs. 51-54). The forerunner to the sextant, the astrolabe was widely utilized in the 16th and 17th centuries as a navigational device to measure the angle of a celestial body in the sky and hence to determine latitude in conjunction with declination charts and tables. The device was developed for shipboard use by the Portuguese in the mid-15th century (Brigadier, 2002: 30). With solar tables and an accurate instrument with which to measure the height of the sun at meridian passage, latitude could be computed without reliance on viewing the Pole Star.

The earliest recorded use of a sea astrolabe was by the Portuguese Diogo d'Azambuja in 1481 on a voyage down the west coast of Africa. Early astrolabes were large wooden instruments (Vasco de Gama's measured 0.61m diameter) suspended from a frame. Smaller brass instruments replaced the earlier wooden variety in the 16th century to become essential parts of navigational assemblages. A 1635 directive (Phillips, 1986: 130) required that:

> "each pilot was to carry with him four compass needles, fixed and well conditioned with the lodestone; six hourglasses (ampolletas), each of one half hour; a sailing chart for the voyage, marked with compass points; an astrolabe weighting over ten pounds; a forestaff with three scales marked for the sun and stars; 150 brazas (825 feet) of sounding line, fine and thin and well-tarred; and three lead weights (escandallos) of six, ten, and fifteen pounds each."

Suspended by a ring from the thumb, the instrument was held at arm's length and the center alidade rotated so that the sun or specific star could be sighted through a hole in the vertical plates. The altitude of the object was read by noting the number to which the alidade pointed on a scale

Fig. 51. Bronze astrolabe TOR-90-00007-CU (Diam. 18.6cm, 3.08kg).

Figs. 52-53. Bronze astrolabe TOR-90-00006-CU (Diam. 18.5cm, 3.1kg) with the armillary sphere of the Armazéns Reais royal warehouse incised onto the front face, the official symbol of the administration of King Dom Manuel I of Portugal 1495-1521.

Fig. 54. Bronze astrolabe TOR-90-00008-CU (Diam. 17.3cm, 2.54kg).

of degrees engraved around the perimeter of the device. A book of tables was consulted to interpret the reading and to estimate latitude. Astrolabes went out of use after the mid-17th century, and finds of subsequent date are rare. Some 65 examples are listed in Simpson's *The Mariner's Astrolabe* (1987), but the updated total currently stands at 81 (Garcia, 2008: 249-50). A catalogue of the three Tortugas shipwreck astrolabes is presented below and derives heavily from the published work of Gustavo Adolfo Garcia (2005: 75-82; 2008: 263-5), who personally examined and recorded the Tortugas examples as part of his doctoral research:

- TOR-90-00007-CU (Fig. 51): the best preserved astrolabe from the Tortugas shipwreck (Diam. 18.6cm, top Th. 2.3cm, bottom Th. 2.4cm, weight 3.08kg). A typical example of a Type Ia Iberian astrolabe manufactured during the first half of the 17th century.[4] A substantial section of the alidade, 14.8cm long, remains secured in position by remains of the axis pin. Parts of the sighting vanes also survive, although they are broken beneath the observation pinholes. The suspension ring is absent. No scales of limb or other marks are distinguishable due to extensive surface erosion.
- TOR-90-00006-CU (Figs. 52-53): a Type 1a instrument and the most remarkable astrolabe in the collection (maximum Diam. 18.5cm, minimum Diam. 17.1cm, maximum Th. 2.6cm, 3.126kg). An unusual feature of this instrument is an exceptionally clear image of an armillary sphere set on the front face of the bottom ballast. Only one other archaeologically attested astrolabe dated to 1593 and recovered off Cuba shares this attribute. The armillary sphere was the official symbol of the administration of Dom Manuel I, king of Portugal from 1495 to 1521. Hence, it is theorized that this mark may have been stamped on instruments coming from the Armazéns Reais, the Portuguese royal warehouse. The suspension ring of the Tortugas astrolabe is absent, but a section of the alidade survives. The instrument's diameter is more typical of Iberian astrolabes of this period.
- TOR-90-00008-CU (Fig. 54): the cast brass wheel of a Type 1a astrolabe (Diam. 17.3cm, top Th. 2.1cm, bottom Th. 2.3cm, approx. 2.54kg), fairly well preserved. Parts of the axis pin are present and the brass alidade was recovered separately. Other than the pin the suspension ring is similarly absent. As with its two counterparts this astrolabe is a typical Iberian instrument dating to the first half of the 17th century. Most of the original surface is eroded, but the upper spoke exhibits pairs of thin parallel lines on the lower quadrant typical of similar examples.

While the site of the *Margarita* yielded one astrolabe, five comparable examples were recovered from the wreck of the *Atocha* (Malcom, 1998b), one of which derives from the same manufacturer as one of the three examples used on the *Nossa Senhora dos Mártires* sunk down the River Tagus in 1606 (Brigadier, 2002: 43-7). A comparable cast example inscribed with the date '1616' was recovered from the Rincón wreck. Similarly dated and designed astrolabes found on shipwrecks dated from 1555/6 to 1645 and located off Cuba, Manila, Malaysia, Cape Verde, Florida Keys (America), Canada and Portugal have been catalogued (Garcia, 2005: 35, 45-95). The Dutch East Indiaman *Batavia*, lost off Western Australia in 1629 (Green, 1989: 84-9), carried four astrolabes. Despite its small size and status, the Tortugas *navio* was thus surprisingly well stocked with this sophisticated class of navigation equipment.

C. Ship's Bell

A bronze bell (TOR-90-00010-CU, H. 27.2cm, maximum Diam. 21.8cm, H. of canon ring 7.2cm, W. of cannon ring 9.3cm, Th. of canon ring 1.6cm, 4.1kg; Figs. 55-56) was the first artifact recovered from the Tortugas wreck site. The bell was found with a gaping hole on one side, without its clapper and is heavily patinated and degraded greenish blue with copper chloride corrosion products. No decorative symbols or inscriptions are visible, just three ridges set three-quarters down the body. The shoulder is surmounted by a single suspension canon ring subdivided into three sub-triangular spaces suitable for lifting with a single hand. One side of the bell is extensively broken and missing.

Figs. 55-56. Bronze bell (H. 27.2cm, TOR-90-00010-CU).

Ship's bells were utilized mainly to identify the passage of time during the day, marking the half hours, changes of watch and time for prayers and dinner. The sounding of the bell also warned of danger, fire, fog or an enemy ship (Wede, 1972: 4; cf. Cunningham Dobson, 2011: 89-90). The Tortugas bell would almost certainly have been the last sound that rang out wildly as the ship sank in the hurricane of 5 September 1622.

The basic shape of the Tortugas bell mirrors an example recovered from the wreck of the *Concepción* (Hispaniola, 1641) with its gently tapered bottom, again featuring a series of narrow ridges three-quarters down. This example, however, has a traditional single vertical canon without a tripartite division (Borrell, 1983: 106). An identical canon form, however, occurs on the bell from the 16th-century Spanish-operated Western Ledge wreck off Bermuda (Watts, 1993: 118), while a 35.5cm-high silver example from the *Atocha* is identical in all respects other than metal medium, and may have been an unusual ruse to ship contraband.[5] The same tripartite canon is paralleled by a bronze bell from the 1715 fleet (Wagner, 1967: 96). The canon shape with the tripartite apertures prevailed in use over centuries and was still utilized on the bell from *L'Astrolabe* wrecked off the Solomon Islands as late as 1788 (Wede, 1972: 58-9).

Fig. 57. Lead coastal sounding weight (L. 17.9cm, 2.9kg, TOR-90-00022-LD).

D. Sounding Lead

A single mildly triangular sounding lead (TOR-90-00022-LD, L. 17.9cm, base W. 5.6cm, rope hole Diam. 5.6cm, base recess Diam. 2.4cm, base recess H. 0.4cm, 2.9kg; Fig. 57) was recovered from coordinates 73.22/25.25 east of midship. The basic elongated shape remained highly conservative throughout the 16th and 17th centuries. Sounding leads generally either incorporated a mild triangular shape with outward angled sides and rounded summits pierced by a single hole, as with the Tortugas artifact, or had near-parallel sides with flattened summits (sometimes with multi-chamfered edges).

This generic style of equipment was relied on to determine the depth of water between the keel and seabed. Those with an arming hole recessed into the base, as on the Tortugas example, could be used not just to measure water depths, but to ascertain sediment compositions. The earliest sounding lead was first illustrated in Lucas Janszoon Wagenaer's *Spieghel der Zeevaerdt* (1584), although the basic shape, largely unchanged, was widely exploited across the Mediterranean Sea by the Roman period (Oleson, 2008). Leads varied extensively in weight according to the depths in which use was intended. Deep-water examples set at the end of a 200 fathom-long line (360m) weighed over 14 pounds or 6.36kg. Coastal leads for sounding depths up to 20 fathoms (36m) typically weighed 7-14 pounds or 3.18-6.36kg (Swanick, 2005: 98-9). At 2.9kg the Tortugas sounding lead is distinctively a lightweight coastal device.

The Tortugas version was already in use, albeit with chamfered sides (H. 23cm), on the early 16th-century Molasses wreck off the Turks and Caicos Islands (Keith *et al.*, 1984: 56, fig. 12). The form is again represented amongst the suite of eight both cylindrical and triangular examples of 2.55-7.2kg on the wreck of the VOC *Batavia*, sunk off Western Australia in 1629 (Green, 1989: 94).

Notably, two examples from the *Atocha* or *Margarita* that also feature a tallow recess in the base (inv. M83 912 and M 2821) are far more paralleled-sided than the Tortugas sounding lead. Another cylindrical 6.4kg example has been excavated from the Portuguese-owned 'Wanli' ship lost off Malaysia *c.* 1625 (Sjostrand and Idrus, 2007: 41), while a 6.55kg example associated with the VOC *Lastdrager* off Yell, Scotland, in 1653, is again notably parallel-sided (Sténuit, 1974: 231-2). The three deep-sea leads associated with the *Vergulde Draeck* of 1656 are all cylindrical (Green, 1977: 290). Yet another parallel-sided example is a 5.3kg sounding lead from *La Belle* of 1686 (L. 33.1cm, 5.3kg). A cylindrical version is associated with the wreck of the 38-gun Royal Navy ship *Dragon*, lost off the Casquets, Channel Isles, in 1712 (Bound and Gosset, 1998: 154, fig. 6). However, two triangular sounding leads with chamfered edges from the 1715 Spanish fleet off Florida (Clausen, 1965: pl. 1d) suggest that shape cannot be judged an obvious index of chronology or conditioned by suitability for depth.

10. Tortoise Shell

A collection of 64 pieces of cut tortoise shell recorded on the Tortugas site (the thin, epidermal plates that overlie the bones of the shell of the hawksbill turtle, *Eretmochelys imbricata)* possibly reflects a formerly unreported aspect of 17th-century Spanish shipboard life. Alongside one intact and two broken lice combs, plus two excavated cases, the majority of the assemblage comprises partly worked shell and apparent processing waste (Figs. 58-59). The combined data indicate that lice combs may have been crafted on the ship during its final homeward voyage.

The intact comb (TOR-90-00025-OC, L. 12.3cm, W. 5.7cm, Th. 0.3cm, teeth L. and Th. Side A 2.1cm and 0.1cm, teeth L. and Th. Side B 2.2cm and 0.2cm), missing just one of its large teeth, incorporates two rows of teeth on opposite sides, one finer and one coarser. The rectangular case is carved from a single piece of mottled brown, amber and golden yellow tortoise shell (TOR-90-00024-OC, L. 12.2cm, W. 7.2cm, Th. 0.3cm). A geometric incised decoration on both sides of the case consists of parallel lines forming a rectangle. From each right angle of the rectangle an incised line extends outward and intersects with another incised line, which then frames the case, forming an exterior rectangle. The case exhibits surface crackling. Drilled holes are present at each end.

The material used in the shipwreck's combs and the raw unused scutes has been visually identified as tortoiseshell (pers. comm. Anne Meylan, 15 February 2012) and subsequently confirmed by DNA analysis (pers. comm. Brian Shamblin, 6 April 2012). The hawksbill has been historically highly valued for the horn-like scales or plates (scutes) covering its bony shell (Goode, 1884: 149; Witzell, 1983: ii). Although greatly diminished in numbers through overexploitation (Spotila, 2004: 114-5), the Atlantic species of the hawksbill turtle, *Eretmochelys imbricata*, inhabits a large region spanning the southern coast of Florida and the states bordering the Gulf of Mexico, extending southward into the West Indies, northeastward to Bermuda and as far south as Guiana and Brazil (Aspinall, 1912: 141). Smaller than the loggerhead or green turtle, a mature hawksbill normally weighing up to 54kg may produce 1.3-1.8kg of tortoise shell (Parsons, 1972: 44).

A symbol of luxury since time immemorial in many cultures, European treasure ships returning from the New World were commonly laden with tortoise shell (Witzell,

Fig. 58. Unworked Hawksbill sea turtle shell and partly worked shell comb cases, processing waste and two fragmentary combs, possible evidence of at least comb case craftsmanship on the Tortugas ship during its homeward-bound voyage.

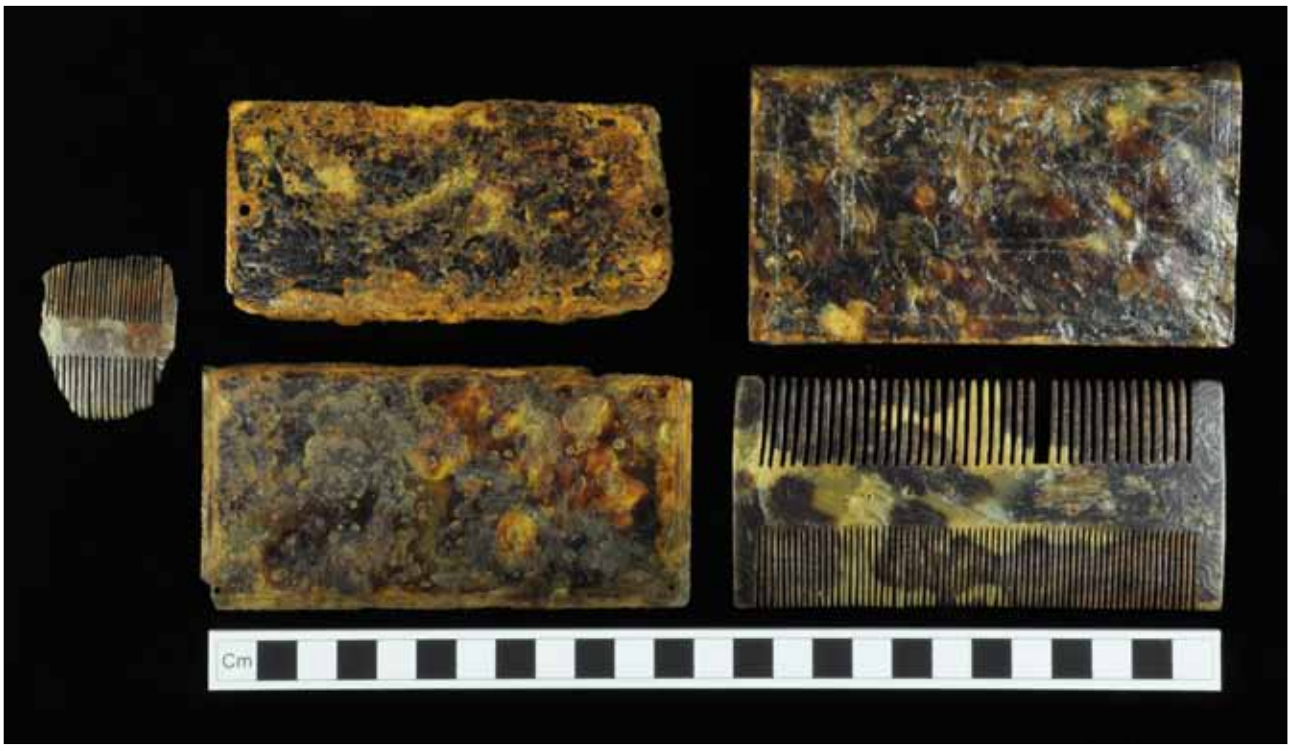


Fig. 59. Lice combs and cases from Hawksbill sea turtle shells: comb fragment TOR-90-00026-OC (L. 3.4cm), one half case TOR-90-00027A-OC (L. 12.3cm), one half case TOR-90-00027B-OC (L. 11.1cm), intact case TOR-90-00024-OC (L. 12.2), and intact comb TOR-90-00025-OC (L. 12.3cm) (from left to right).

1983: 49), much of which seemingly originated in the West Indies, where the hawksbill once flourished (Fish, 2011: 6-17). Exploited throughout the 17th century and later, its shell was procured extensively for the production of snuff and pill boxes, spectacles, hair combs and as inlay for fine furniture (Pearson and Hoffman, 1995: 203). Rather than high-quality trade goods, the five individual tortoiseshell combs and cases recovered from the Tortugas shipwreck are seemingly less exotic objects crafted from raw material derived largely from the insular Caribbean and along the coast of Central America (pers. comm. Brian Shamblin, 4 September 2012). Such combs functioned as critical delousing and grooming kits for lice-infested passengers and sailors whose cramped and unsanitary living quarters and limited water supply for washing were ideal breeding grounds for such vermin (Fine, 2006: 42).

Additionally, on a second fragmentary bone lice comb from the Tortugas wreck one side contains larger teeth, while finer teeth are visible on the other side. This arrangement typifies lice combs (pers. Comm. Corey Malcolm, 29 September 2011). The small size of this comb suggests that it was a 'nit' comb intended for removing lice eggs or nits, much like the small examples found on the 19th-century American Civil War Ironclad *Cairo* lost in the Yazoo River, Mississippi (Bass, 2004: 276, 283).

The fine, narrowly-spaced tines on one side of the Tortugas combs would have allowed the owner to look for and remove both louse eggs and adult lice from head hair and beards; the regular teeth on the other side of the comb were designed for hair combing and grooming (cf. Bass, 2004: 283). Lice combs renowned for thwarting these bloodsucking creatures have been relied on for hundreds of years and are still considered effective today (Eldridge and Edman, 2000: 109).

Pediculus humanus humanus live in the seams of clothing and attach themselves to the body only when feeding, while head lice thrive in the hair, particularly the back and sides of the head. The problem of lice even inspired a 16th-century belief that the condition inexplicably disappeared at a line of longitude approximately 100 leagues west of the Azores. At the same meridian, eastbound sailors would become afflicted with lice. The legend's root may actually relate to the increase in temperature and removal of clothing associated with tropical climates and, correspondingly, greater lice density in colder climates where heavier clothes were worn (Schowalter, 2009: 375).

While itchy lice bites on the body and head often became infected from excessive scratching, 'ship fever', better known as typhus fever and occurring between a few hours and up to two weeks after the vermin's bite, was more serious. Symptoms included high fever, chills and fatigue, combined with splotchy skin and a foul odor emitted by the victim. This contagious disease was known to kill more than half of afflicted sailors (Cofer, 1912: 13). Lice-borne typhus killed more passengers on 19th-century Atlantic crossings than any other disease (Bass, 2004: 283).

Early seafarers may not have been particularly knowledgeable about hygiene, or have been aware that lice transmitted a potentially lethal disease, but grooming for bodily comfort and aesthetics was certainly important. Related delousing combs crafted of tortoiseshell, bone, ivory, horn and wood have been recovered from shipwrecks spanning centuries, as well as described in abundant historical sources.

The 11th-century Serçe Limani vessel off southwest Turkey is one of the earliest wrecks that has yielded such combs, in this case associated with scissors, razors and knives from a barber's kit (Bass, 2004: 283-4). The anaerobic mud and silt environment in which the *Mary Rose* sank in 1545 produced the remains of bedding and clothing impregnated with traces of lice infestation (Konstam, 1999: 11) – rare physical evidence of the parasites that habitually plagued seafaring communities. The *Mary Rose* also contained a number of delousing combs, some located in the barber-surgeon's cabin (accompanied by razors) and others discovered individually in personal chests in decorated leather cases in the main deck (Marsden, 2003: 120, fig. 12.12).

Other shipwrecks carrying similar lice combs ranged from the medieval Culip VI wreck off Spain to the *Vasa* sank in 1628, the Dutch East Indiamen *Kennemerland* lost off Scotland in 1664 (Price and Muckelroy, 1979: 319), the Vergulde Draeck of 1656, the 1697 Portuguese warship *Santo Antonio de Tanna* (Piercy, 1978: 305), and *La Belle* lost in Matargorda Bay, Texas, in 1686 (Bruseth and Turner, 2005: 3-4).

Lice combs were recovered from the Spanish armada ship *La Trinidad Valencera* lost off Ireland in 1588 and from the 1622 *Margarita* (Fine, 2006: 42), which bears a resemblance to the intact tortoise shell comb recovered from the Tortugas site. An ivory lice comb was also recovered from the *Nuestra Señora del Populo*, a dispatch or war scout ship that sailed with the 1733 Spanish Plate fleet and foundered in a hurricane in Biscayne National Park, Florida (Weller, 1990: 14).

For personal grooming and hair adornment, Europeans had a long history of fashioning combs out of bone, ivory, tortoise shell and wood, a custom they transmitted into the New World. The trade goods en route to New Amsterdam on the 1657 Dutch vessel *De Wasbleecker* included an inventory of almost 300 combs and 65 comb cases. The Seneca people modeled their bone combs on these imported Dutch forms, but while European combs were largely intended for hygiene, amongst the indigenous peoples they

became status symbols associated with luxury and wealth (Loren, 2008: 106).

The evidence for comb and case production on the Tortugas ship on its homeward voyage may have been functionally linked with the capture of both land and sea turtles for consumption, a recognized source of nutrition. According to the Englishman Thomas Gage during his missionary work in the Americas between 1614/15 and 1637, at Cartagena "All these ships make their provision for Spain of tortoise meat. They cut the tortoises in long thin slices… and dry it in the wind after they have well salted it, and so it serveth the mariners in all their voyages to Spain, and they eat it boiled with a little garlic, and I have heard them say that to them it tasted as well as any veal" (Thompson, 1958: 334). Antonio Vázquez de Espinosa confirmed that tortoises could also be purchased at Havana in the 1620s (Clark, 1942: 103).

Similar consumption, followed by functional reuse of the shell for comb production, may have been practiced by a crew member on the Tortugas vessel in the idle hours. The scale of activity seems to have been small-scale and individualistic, unlike the shipment of four boxes of hawksbill turtle shell on the *Nuevo Constante*, wrecked off Louisiana in 1766 en route from Mexico to Spain, where 5.1kg from the two boxes of lost *carei* (91kg) were found in excavations. The tortoise shells were roughly square to rectangular (upper size limits of 36 square inches) and exhibited cut edges, but otherwise had received minimal processing with no effort to trim the shell (Pearson and Hoffman, 1995: 203-204). By contrast, the Tortugas shell seems to have been prepared for working.

Fig. 60. Bronze mortar for grinding herbs and food preparation or related to medicinal use (H. 10.9cm, TOR-90-0004-BZ).

Fig. 61. Bronze pestle (L. 23.6cm, TOR-90-00005-BZ).

11. Miscellaneous Metallic, Stone & Organic Artifacts

A. Cooking & Food Preparation

An intriguing collection of both recognizable and unusual artifacts excavated from the Tortugas shipwreck contributes to the constructible image of shipboard life in the Americas trade in the waning years of the Golden Age of Spanish colonial seafaring. The two sets of bronze mortars (TOR-90-00004-BZ and 90-1A-000554, coordinates 83.25/27.32, H. 10.9cm, maximum Diam. 15.2cm, Diam. at base 10.3cm, rim Th. 0.6-0.9cm, 2.8kg; Fig. 60) and pestles (TOR-90-00005-BZ and 90-1A-000499, coordinates 84.30/29.09, L. 23.6cm, W. grinding end 4.7cm, W. handle 2.1cm, 0.9kg, Fig. 61) located 1.4m apart, just beyond the hull in the starboard stern, are of familiar form used on vessels of multiple nationalities. The Tortugas mortars are mold decorated externally with what resemble human faces or zoomorphic figures.

Such mortars were manufactured with little stylistic change between *c.* 1600 and the mid-18th century and have been recorded on Dutch East India vessels typified by the *Mauritius* wreck (1609; L'Hour and Richez, 1989: 182), *Batavia* (1629; Green, 1989: 95), *Vergulde Draeck* (1656; Green, 1973: 285) and the *Hollandia* (Scilly Isles, 1743; Marsden, 1975: 290) inscribed 'AMOR VINCIT OMNIA ANNO' ('Love Conquers All') followed by the date of production (the mortars were a minimum of two years old at the date of loss, and in the case of the *Hollandia* a remarkable 50 years old), in these instances suggesting production as wedding presents (Green, 1977: 174). Comparable non-inscribed bronze mortars were used on the Spanish merchantmen *San Diego* (Philippines, 1600; Veyrat, 1994: 177-8), the Portuguese *Nossa Senhora dos Mártires* (Lisbon, Portugal, 1606; Brigadier, 2002: 120-1), the *Atocha* (Florida Keys, 1622; Mathewson, 1986: 100) and amongst

Figs. 62-63. Copper cauldron (H. 44.5cm, TOR-90-00246-CU).

Fig. 64. Bronze cauldron handle (H. 14.4cm, TOR-90-00161-CU).

Fig. 65. A granite mano *and* metate *(L. 33cm) excavated from the stern.*

assemblages from the 1715 Spanish fleet lost off the Cabin Site, Florida (Marx, 1973: 97). An identical pestle on the Emanuel I ship of 1559 further points towards conservatism in production (Smith *et al.*, 1998: 102).

These utensils are commonly interpreted as surgeon's mortars, undoubtedly due to their depiction in paintings such as *Interior of a Dutch Pharmacy* by the School of Terborgh dated to 1665 and in *The Surgery* by Gerard Thomas, 1663-1720 (Green, 1977: 174). However, these objects enjoyed an equally broader function for basic food preparation. The precise Tortugas type of bronze mortar is extremely common in still life works by the Seville school in the Golden Age, typified by Diego Velázquez's *Kitchen Scene with Christ in the House of Martha and Mary* of 1618, *Christ at Emmaus* of *c.* 1620 and *Two Young Men at a Table,* assigned a date of 1623-24 (Jordan, 1985: 78, 87-8. fig. 3.7, pl. 8; Jordan and Cherry, 1995: 38, 41). The same object is represented in Francisco López Caro's *Boy in a Kitchen*, painted in the 1620s, and Giovanni Ruoppolo's riotous mid-17th century *Kitchen Still Life* (Jordan and Cherry, 1995: 90, 101).

The origin of the Tortugas wreck's bronze mortars and pestles is unverifiable, but certainly as early as 1549 a letter written in Seville reveals that a metal mortar weighing 9lbs cost 1½ *real* per pound and a pestle 2 *reales* (Barto Arnold and Weddle, 1978: 73-4). Since the record is concerned

with how "To transport the containers from Triana to the apothecary shop" (in this instance perhaps revealing usage for grinding medicinal herbs), production within Seville may be hypothesized.

The lower third of a large copper cauldron with a gently rounded base and inclined sides (TOR-90-00246-CU, H. 44.5cm, maximum Diam. 51.7cm, Th. top sheet 0.2cm, Th. bottom sheet 0.6cm; Figs. 62-63) was recorded in grid area 76.19/11.74, 6.0m south of the ballast pile. The surviving vessel is crafted of two sections of copper interconnected using 21 copper rivets set horizontally 6.5cm apart (center to center) and ranging in diameter from 2.2-2.7cm. A resinous pitch embedded in the base suggests that this pot comprised part of a boatswain's stores, used to melt pitch with which to secure the leaking hull and running repairs, rather use for cooking within the galley.

The far earlier Emanuel Point I ship's kettle dated to 1559 displays similar base riveting, although this example has parallel sides (Smith *et al*. 1998: 98). An intact example snagged by fishermen from the Gnalic shipwreck *Gagiana*, based in Dubrovnik and lost off Croatia in 1583, may represent a closer parallel (pers. comm. Filipe Castro, 30 August 2012). From a rounded base its upper half is funnel-shaped and two handles are set vertically just below the rim. Its interior was still filled with tar.[6]

A bronze cauldron handle (TOR-90-00161-CU, H. 14.4cm, W. 11.0cm, Th. 1.3cm; Fig. 64) with its attachment flange, interconnected by a single 2.0 x 1.7cm rivet at each lower handle lug, may derive from one of the Tortugas ship's cooking cauldrons. Both the above artifacts contrast markedly to a three-legged iron cooking pot associated with the *Atocha* (database inv. M82 3975), but is identical to the base of another cooking vessel from the same site (*Atocha* database inv. 86.98.1119/3457).

A basalt *mano* pestle (L. 25.0cm, W. 11.0cm, Th. 5.5cm) and *metate* grinding stone (H. 11.0cm, L. 44.0cm, W. 33.0cm) were excavated in close proximity at coordinates 80.63/28.04 and 82.02/26.70, respectively north of the pump well and just outside the starboard stern hull remains, thus close to the original location of the decomposed galley structure (Fig. 65). This standard domestic equipment was used for grinding corn flour. A three-legged *metate* from the *Nuestra Señora de la Concepción*, wrecked off Hispaniola in 1641 (Borrell, 1983: 30), a four-legged example from the Praia dos Ingleses 1 wreck of 1687 off Santa Catarina Island, Brazil (Noelli, 2009: 101, fig. 5), and a three-legged basalt example of a type of 1766 that was common in Mexico, plus nine fragments of *manos*, from the wreck of the *Nuevo Constante*, Louisiana (Pearson and Hoffman, 1995: 164-5), reveal comparable shipboard food preparation. The need to grind flour became increasingly central from the 1570s with the replacement of hardtack for maize used to make cassava bread (Super, 1984: 60).

Fig. 66. Some 1,190 lead musket shot were recovered from the Tortugas wreck (Diams. 0.7-1.9cm).

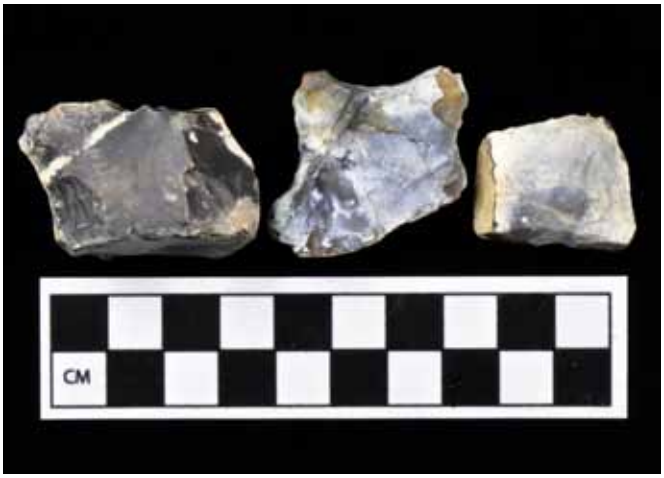


Fig. 67. Flints probably used to light fires on the Tortugas ship (L. 2.7cm, Th. 0.8cm).

B. Artillery

An anomaly on the Tortugas wreck was the presence of 14 cannonballs (Diams. 6.5-9.0cm) clustered exclusively to starboard outside the hull and ballast zone between midship and the bows, but no cannon. Dated to 22 March 1622, *Contratación* 1172, N.2, R.1 records that at departure from the Guadalquivir river for Tierra Firme the *Buen Jesús y Nuestra Señora del Rosario* was expected to transport four iron cannon and 12 muskets. In their absence on the site the likelihood that these guns were jettisoned during the fateful hurricane of 5 September seems high. Around 1,190 examples of lead shot were also recovered from the wreck (Diams. 0.7-1.9cm; Fig. 66), although in a parallel picture to the cannonballs no muskets or related wooden barrels were identified.

Fig. 68. A brass figurative medallion depicting the Virgin Mary and Jesus on one side, and a single figure plus the inscription 'SANTA CATARI--' and 'ROMA' on the reverse (H. 2.9cm, TOR-90-00256-ML).

Fig. 69. The head and fragmentary torso of a clay figurine depicting the Virgin Mary (L. 9.3cm, TOR-90-00345-CS).

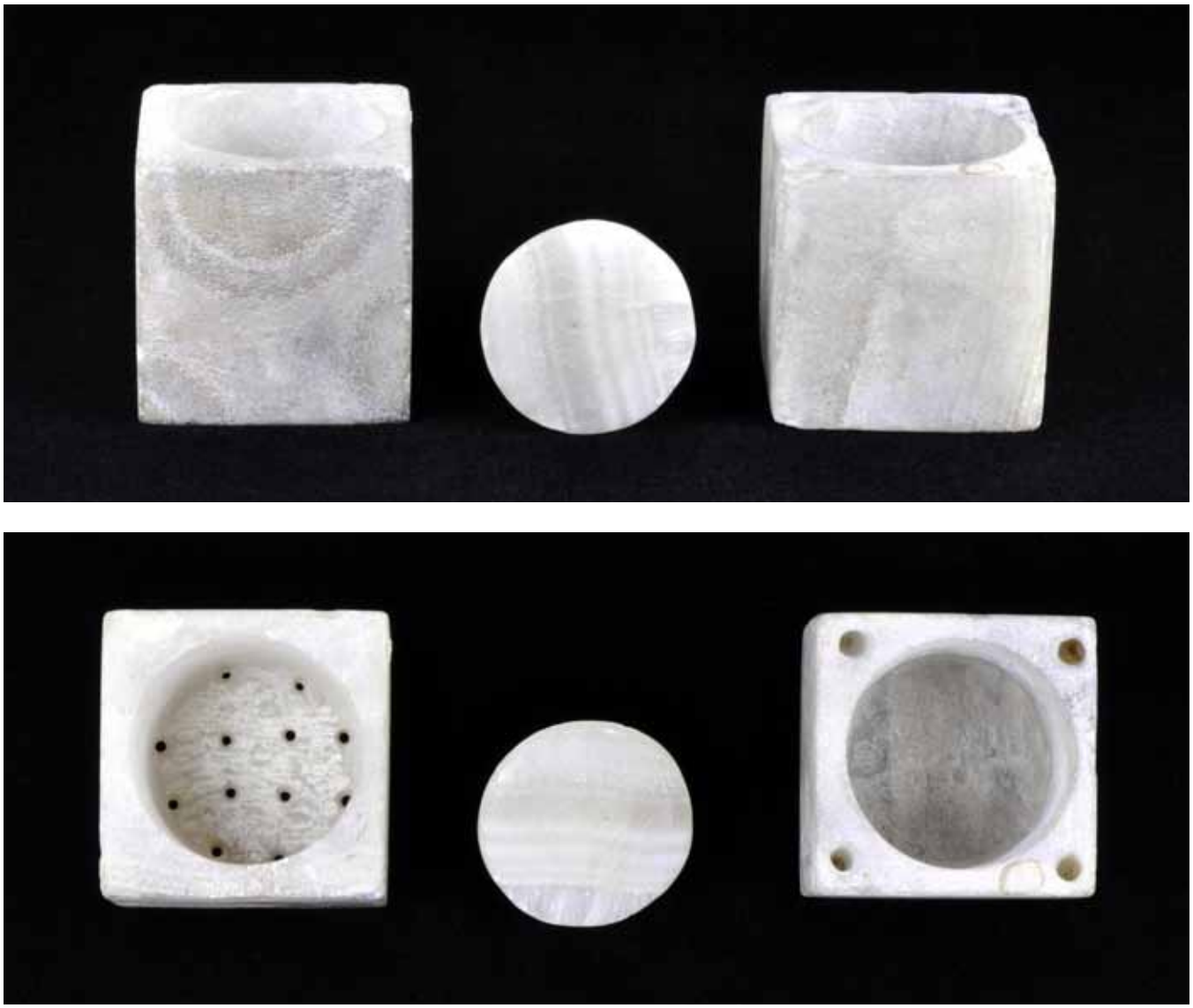
The Tortugas wreck site contained several flints (L. 2.7cm, Th. 0.8cm) of a type superficially comparable to those used at a later date to ignite pistols' powder charges (Harding, 1999: 191; Fig. 67). The presence of such small arms, first developed in France in the first quarter of the 17th century, would be especially early in a 1622 context. The flintlock is generally dated from *c.* 1625 (Garigen, 1991: 1, 18), several years after the sinking of the 1622 fleet, and only became popular in the second half of the 17th century. No flints were recorded on the Emanuel Point I ship lost in 1559 (cf. Smith *et al.*, 1998). One of the Tortugas flints shows some sophistication (Fig. 67, far right), but early wedge gunflints were essentially 'do it yourself' types (as defined by de Lotbiniere, 1984: 207).

In light of the absence of gunflints on either of the far more heavily armed 1622 *Atocha* or *Margarita* fleet ships (pers. comm. Jim Sinclair, 1 September 2012), the function of the Tortugas flints remains unclear and may be related to fire lighting. Snaphaunce pistols, however, did rely on a cock with a pair of jaws that held a wedge-shaped piece of flint and were in use by 1560, as was the Spanish 'Miquellet' design developed in the reign of Philip II (1556-98), whose popularity peaked in the first quarter of the 17th century (Given, 1994: 20, 22-23; Kinard, 2003: 17-18).

C. Personal Belongings

Religious artifacts are poorly represented on the Tortugas wreck and other than probable rosary beads are restricted to a figurative rosary pendant and a section of a clay figurine. The highly degraded brass rosary pendant (TOR-90-002560ML, H. 2.9cm, W. 1.6cm, Th. 0.2cm; Fig. 68) depicts the Virgin Mary holding Jesus on one side attended by a second female, and reverse another religious figure presumably identified by the overlying inscription, partly legible as 'SANTA CATERI--- and ROMA', holding an unidentifiable object with a sword to her right. This medallion probably represents St. Catherine of Siena, a 14th-century Dominican nun who had a vision of a mystical marriage with Jesus in the presence of Mary (pers. comm. Beverly Straube, 31 August 2012).

Such pendants in cupreous or precious metal form featuring saintly imagery are extremely common on shipwrecks across the colonial period, crafted of gold on the *Atocha* (hanging from a rosary comprised of carved ebony beads) and present within the 1715 Spanish fleet off the Florida Keys (Wagner, 1967: 78-9). Amongst numerous examples, bronze oval-shaped equivalents comparable to the Tortugas site went down off the Philippines in 1600 on the Spanish merchant vessel *San Diego*, showing the Immaculate Conception scene (Virgin Mary, probably



Figs. 70-71. Onyx powder shaker (H. 5.8cm, TOR-90-00033-SN), lid (Diam. 4.5cm, TOR-90-00034-SN) and inkwell (H. 5.8cm, TOR-90-00014-SN).

assuming the form of St. Francis), while another double-sided medallion adorned with St. Francis of Assisi and St. Antony of Padua was recovered from the Genoese ship *Santo Christo de Castello* sunk in 1667 off Mullion Cove, Cornwall (McBride *et al*., 1975: 246). These religious artifacts were common across the colonies from English Jamestown to the Portuguese Fort Jesus at Mombasa, Kenya, in the late 17th century (Kirkman, 1974: pl. 44; Provoyeur, 1994: 278; Kelso, 2006: 188).

A comparable brass example associated with 22 black glass beads from the Dutch East Indiaman *Vergulde Draeck* lost off Western Australia in 1656 further suggests these objects were common in rosaries (Green, 1977: 223). There is no reason to consider the Tortugas pendant as anything more significant than a belonging of one of the ship's non-ecclesiastical passengers or crew. The reference to Rome hints that the owner may have coveted this souvenir as produced in the capital city of the Catholic Church.

A second religious artifact from the Tortugas wreck appears to be an incomplete and unglazed ceramic figure featuring the head and torso of the Virgin Mary holding something in her arms, presumably the Christ child (TOR-90-00345-CS, L. 9.3cm, H. 7.4cm, W. 4.2cm; Fig. 69). If this artifact depicts the standing Virgin Mary, then the remaining object would seem to represent about one-third of the original figurine. Some of the highly eroded facial features can be observed, including the forehead, eye sockets and the outline and folds of draped garments covering the head and upper torso. The degraded condition of the artifact leaves much to speculation.

Fig. 72. A possible bronze writing stylus (L. 5.5cm, TOR-90-00234-CU).

Fig. 73. Brass box/furniture appliqué (L. 1.3cm, TOR-90-00297-OC).

Fig. 74. Part of a bronze furniture or lamp suspension element. Fragment A (left: L. 5.9cm, TOR-90-00255A-CU), fragment B (top right: Diam. 3.5cm, TOR-90-00255B-CU), fragment C (bottom right: H. 3.2cm, TOR-90-00255C-CU).

A grayish ridged band running along the top of the figure's head and shoulder may represent a mold seam, and as such would be suggestive of a European origin (pers. comm. Byron Sudbury, 28 August 2012). The figure resembles pipeclay (white ball clay) figurines made in the Netherlands in the 15th and 16th centuries, whose iconography focused on the Virgin Mary, the Christ child and the female virgin saints (Gilchrist, 2012: 156). A Mary and Child found in the Overijssel Province of the Netherlands in a context dating to *c*. 1525-75 is one such early parallel (pers. comm. Beverly Straube, 28 August 2012). The Tortugas example, however, does not seem to typify Dutch manufacture (pers. comm. Don Duco, 11 September 2012). The reddish tint of the Tortugas example may represent iron-stained pipeclay. Alternatively, the clay could be earthenware material. Accurate differentiation is impossible without chemical analysis.

The production of white pipeclay figurines is considered to have been a sideline for pipe-making centers that flourished in England, the Rhineland and the Netherlands in the 17th century (Hurry and Grulich, 2012: 8). Traces of the paint that originally decorated figures' dress are still visible on one example (Gilchrist, 2012: 156) and the Tortugas example may have been similarly decorated. The discovery of these figurine types in urban domestic contexts suggests that they were objects of personal devotion thought to be popular amongst women praying for help to manage conception, pregnancy and childbirth. Such figurines were acquired as souvenirs and gifts perhaps purchased during pilgrimages (Hurry and Grulich, 2012: 8; Gilchrist, 2012: 156; Wesler, 2012: 230).

More contemporary to the Tortugas Virgin Mary figurine is the head of a white pipeclay figurine recovered from the St. John's site, an English Farmhouse built in St. Mary's City, Maryland, in 1638. Produced in a two-part mold, the head may represent a cherub, angel or the infant Jesus. Figurines of similar material have been found on sites in New York, Rhode Island, Virginia and Jamaica in the Caribbean, as well as in the Netherlands, Germany and the United Kingdom (Hurry and Grulich, 2012, 1-2).

While the Tortugas figurine would have been suitable for personal devotion, its appropriateness aboard ship was bolstered by the Virgin Mary's religious status as the protector of mariners, *Stella Maris*, the 'Star of the Sea' (Hall, 2004: 17). In the 9th century the French-born monk Paschasius Radbertus described Mary as the 'Star of the Sea', a guide to be followed on the way to Christ "lest we capsize amid the storm-tossed waves of the sea."

Also known as the North Star, *Stella Maris* was the most important celestial body for sailors. Mariners typically sang *Ave Maria* at sundown to protect against the

perils of the night and very possibly to welcome the arrival of Polaris, Mary's North Star (Hall, 2004: 46). Most Spanish sailors wore amulets of the Virgin Mary or their favorite saint around their necks to seek protection (Anderson, 2002: 231). For similar protective reasons Christopher Columbus' flagship was named the *Santa Maria* (Hall, 2004: 45-8).

Over a century later, Spanish mariners continued to embrace the cover of Mary's protective mantle. An ivory Virgin Mary and Child is associated with the 1601 Manila galleon *Santa Margarita* sunk at Rota in the Northern Marianas Islands, while a small bronze figure derives from the *Margarita* of the 1622 Tierra Firme fleet (pers. comm. Corey Malcom, 28 August 2012).

Unsurprisingly given the detailed book-keeping practiced by Spain in its long-distance maritime trade, evidence for literacy on the Tortugas ship is present in the form of an onyx set of inkwell, shaker and several bronze styli (Figs. 70-71). The inkwell (TOR-90-00014-SN, H. 5.8cm, W. 5.7cm, coordinates 87.05/27.51) located 5.2m west of the stern starboard planking is crafted of onyx and consists of a square cube featuring a central ink reservoir (Depth 4.3cm) and four holes on the upper edges to hold pens (Diams. 0.7cm). A circular lid (TOR-90-00034-SN, Diam. 4.5cm, Th. 0.6cm) enabled the well to be closed when not in use. The onyx shaker (TOR-90-00033-SN, H. 5.8cm, W. 5.8cm) also has a central reservoir (Depth 4.0cm), but in this example is pierced with 12 holes (Diams. 0.2cm) designed to allow powder to be dispersed over parchment and dry ink.

This style of inkwell, seemingly in bronze and with geometrically decorated sides, is depicted in Francisco de Zurbaran's *Visit of San Bruno to Urbano II* painted in 1655, and an exact bronze parallel was excavated from the Spanish ship the *San Diego* (Philippines, 1600; Veyrat, 1994: 181). A hardy stone version impervious to humid, salty environments was a sound choice for shipboard use. At least one shaft and tip of a bronze styli was excavated from the Tortugas wreck (Fig. 72).

Additional miscellaneous metallic artifacts include an applique from a brass box or piece of furniture (TOR-90-00297-OC, fragment L. 1.3cm, Th. 0.05cm; Fig. 73), three sections of bronze from a furniture fitting or lamp suspension element (TOR-90-00255A-CU; L. 5.9cm, Diam. 1.9cm, ring role internal Diam. 0.4cm; TOR-90-00255B-CU, H. 1.2cm, Diam. 3.5cm, internal hole Diam. 1.0cm; TOR-90-00255C-CU, H. 3.2cm, Diam. 3.8cm, hole 1.2 x 1.0cm; Fig. 74), and a possible bronze vessel handle or canvas sail seam ripper (TOR-90-00242-CU, L. 3.4cm, central barb W. 0.3cm, Th. 0.3cm; Fig. 75). A section of pewter or lead with a v-shaped termination

Fig. 75. A possible bronze vessel handle or sail seam ripper (L. 3.4cm, TOR-90-00242-CU).

Fig. 76. A probable pewter sword hanger (L. 4.8cm, TOR-90-00080-ML).

Fig. 77. A wooden drop spindle for spinning fibers (L. 31.6cm, TOR-90-00042-CS).

Fig. 78. A wooden drop spindle for spinning fibers (L. 24.4cm, TOR-90-00043-CS).

Fig. 79. Sections of an ivory octagonal diptych sundial manufactured in Nuremberg. Estimated external Diam. 6.1cm (TOR-90-00293-OC).

Fig. 80. Ten fragments of felt and leather from one or two shoes.

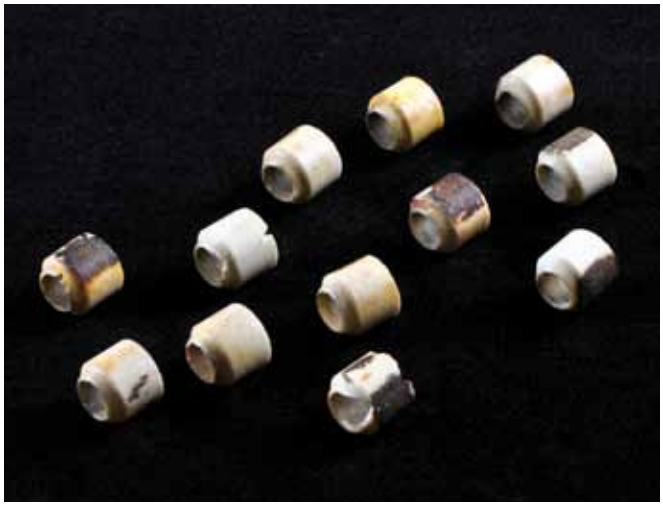


Fig. 81. Bone or ivory probable syringe joints (L. 0.7cm) perhaps suggest a consignment of medical instruments on the Tortugas ship.

Fig. 82. An unidentified South American or circum-Caribbean ceramic object (L. 1.8cm, TOR-90-00074-CS).

Fig. 83. An unidentified South American or circum-Caribbean ceramic object (L. 1.6cm, TOR-90-00075-CS).

Fig. 84. Pipe stem fragments from probable South American or circum-Caribbean colonoware and one white clay tobacco pipe stem (Diam. stem 0.7-1.2cm).

and pierced with two rivets, within which small pieces of leather are preserved (TOR-90-00080-ML, L. 4.8cm, W. 2.9cm, Th. 1.2cm; Fig. 76), may have functioned as a possible sword hanger attached to a waist belt on the basis of parallels from the *Atocha* (pers. comm. Corey Malcom, 28 November 2011), although examples manufactured in this metal medium are otherwise unknown.

Further organic artifacts include two thin elongated pieces of wood, circular in section, identifiable as hand-held drop spindles or spinning rods used to spin various fibers into thread (TOR-90-00042-CS, L. 31.6cm, Th. at center 1.8cm, Th. right tip 0.6cm, Th. left tip 0.2cm; TOR-90-00043-CS, L. 24.5cm, Th. at center 1.5cm, Th. right tip 0.8cm, Th. left tip 0.6cm; Figs. 77-78). Comparative evidence from Prehispanic Mesoamerica, described in the *Codex Mendoza* as *malacatl*, indicates that women used a wooden spindle fitted with a ceramic disk or whorl, in conjunction with a small ceramic bowl to support the spindle as it twirled, to spin cotton thread in the conquest period (Smith and Hirth, 1988: 349).

Wooden spindles of comparable form from medieval Coppergate, York, were used to spin wool with a top-loaded spindle by hip spinning, and the warp was spun with a bottom-loaded spindle by the drop-and-spin method (Walton Rogers, 1997: 1734, 1745-9). The traditional process of spinning using this tool has been described and illustrated in detail for modern rural Indian Peru (McRobb, 1980: 58-62). Considering that spinning was a traditional gendered activity, these artifacts point towards the presence of a low-status woman (Villanueva, 1985: 17, 19) – presumably a slave – on the Tortugas shipwreck.

Six sections of worked ivory are an extraordinary discovery on the Tortugas ship (TOR-90-00293-OC; lower horizontal leaf: estimated external Diam. 6.1cm; base Diam. 6.3cm, base Th. 0.3cm, base octagonal edges L. 2.8cm, base hole Diam. 0.1cm; base raised box edges: maximum W. 2.6cm, Th. 1.2cm, hole Diams. 0.1cm, incised bands 0.4cm apart; upper vertical leaf: star motif

Fig. 85. Two greenstone slate whetstones (L. 16.5cm, Th. 0.5cm & L. 16.0cm, Th. 0.4cm; 90-1A-10240015 & 90-1A-000567).

decorated leaf W. 2.9cm, Th. 0.2cm, hole Diams. 0.07cm, total W. central star motif 2.2cm, L. each ray 1.1cm, adjoining sun/moon motifs Diams. 0.4cm).

These fragments derive from the upper vertical and lower horizontal leaves of a portable octagonal sundial diptych with sides interconnected with cuprous wire and originally closed with a brass hinge (Fig. 79). The upper plane of the horizontal box leaf that once contained a compass is simply adorned with three bands of dual lines, on one fragment pierced with two holes. The octagonal base was originally secured to the overlying box sections with a three-part bronze hinge composed of two central linear pins on either side of a central hexagonal bolt. It is also pierced at center for securing in place a string gnomon and is incised on the outside edge with one set of dual lines.

The star-decorated ivory plaque was originally set in the center of the upper vertical leaf's exterior surface. Also octagonal, it is covered with a star design subdivided into six rays with curved edges. Between the external edges of each is a single sun motif (six in total). Outside these symbols at the plaque edge are three incised lines. A similar dual incised line extends longitudinally through the center of the star symbol. The sundial's overall decorative scheme is crude.

Two holes pierce the upper vertical leaf on one edge; on the opposite surface these are surrounded by cupreous stains from a three-part bronze hinge similar to that on the base plaque. This indicates that this point corresponds with the lower plaque edge joined to the underlying horizontal leaf. A single hole on the opposite edge of the vertical leaf accommodated the gnomon.

This form of portable sundial is rare on colonial Spanish shipwrecks, but three examples have been identified at Site PB-3 on Pedro Bank, Jamaica, associated with a 30m-long ballast pile, 21 iron cannon, Middle Style B olive jar sherds and two silver coins, one minted in Lima dated to 1686, the other produced at Potosi in the second half of the 17th century. These dates suggest this site may be one of four Spanish vessels bound for Havana in 1691 (Hoyt, 1984: 102, 106). The Pedro Bank sundials are identical to the Tortugas example.[7] Their gnomons were set at 42°, the line of latitude for either Boston and Madrid, and it is suggested that these finds functioned as minor trade items manufactured in the New World for sale in Spain (Hoyt, 1984: 105, 106, fig. 7B). Such a hypothesis seems unlikely (see below).

Several portable ivory sundials from a heavily looted early 17th-century wreck at Mijoka, Croatia, accompanied a ship transporting raw materials from production centers such as Nuremberg and Murano between Venice, the Adriatic and eastern Mediterranean ports.[8] An octagonal ivory sundial identical to the Tortugas example excavated at Castle Cornet, Guernsey, pre-dates 1690, while a further example in the National Maritime Museum is marked as manufactured by Bloud of Dieppe, France (Burns, 1984: 339-40). The wreck of the Dutch East India Company ship *Vergulde Draeck*, lost off Western Australia in 1656, contained six portable ivory sundials (Green, 1977: 427).

The Tortugas sundial seems to be the earliest octagonal example attested on a shipwreck, and was almost certainly manufactured in the great mathematical tool production center of Nuremberg in Germany under the control of six dominant 'compass-maker' families between *c*. 1550 and 1730: Troschel, Ducher, Karner, Lesel, Miller and Reinmann (Gouk, 1992: 35). The use of ivory in such great quantities was unusual for dials, but was the specialty of Nuremberg's compassmakers (Higton, 2001: 50).

The star and sun motifs on the upper leaf of the Tortugas dial are stylistic identical to decorative schemes unique to Nuremberg (Gouk, 1988: 118, nos. 18 and 24). The multiple holes may be *Elevatio Poli* or *Polhoehe* (height or angular elevation of the pole star, Polaris), which correspond to different latitudes so the sundial could work in varied European cities. The star and sun symbols on the diptych's outer vertical surface seem to be part of a lunar volvelle designed to convert time at night from the shadow cast by moonlight to a corresponding solar time (Lloyd, 1992: 17-18, 24).

Between the 15th and 17th centuries the 24-hour day and sundial helped the devout keep to prayer schedules, while universal portable sundials worked at multiple latitudes to cater for merchants, pilgrims and long-distance travelers (Schechner, 2001: 120, 197, 201, 211-2). The science of sundials not only saved pious souls, but was considered necessary to preserve the market economy and society. As the English mathematician William Leybourn wrote in the preface to Thomas Stirrup's *Horometria: Or, the compleat diallist* of 1659, "What is more necessary in a well ordered Common-wealth [than dialing]? what action can be performed in due season without it? or what man can appoint any business with another, and not prefix a time, without the losse of that which cannot be re-gained, and ought therefore to most be prized?" The Tortugas wreck's sundial signifies the presence of a well-appointed merchant on the ship, if it was not the personal property of the captain.

Ten fragments of worked leather from one or two shoes were excavated from the Tortugas shipwreck, including soles and heel sections (Fig. 80). While the fragments – largely interior shoe remains (L. 3.0-10.5cm, W. 1.4-5.2cm, Th. 0.1-0.6cm, average stiches 0.3 x 0.1cm and three stitches per cm) – may be leather, badly degraded or delaminated waterlogged leather can give the appearance of wool felt, which is similar in structure. The use of felt in shoe soles was not uncommon in 17th-century and later footwear, such as examples recovered from the English warship HMS *De Braak* wrecked in Delaware Bay off northeast America in 1798. The footware from this English warship included sock-linings (false insoles). These were made from wool hat felt for added warmth and insulation (pers. comm. D.A. Saguto, 5 March 2012).

Fig. 86. A probable plagioclase feldspar South American or circum-Caribbean labret (lip ornament) (L. 1.8cm, TOR-90-00343-SN).

The Tortugas wreck presents a shoe styling with a continuous outsole toe to heel, covering a low 'spring' (wedge-shaped) heel built up of multiple leather lifts (layers). This shoe type relied on stitching rather than wooden pegging, which is more closely associated with stacked leather heels that became increasingly common in the mid-to-late second quarter of the 17th century (pers. comm. D.A. Saguto, 5 March 2012). In the alternate method, by contrast, heels were built up by pegging several layers of leather at a time (Goubitz, 2007: 81). The large diamond-section stitching holes visible on most of the Tortugas shoe fragments reflect the use of a stout diamond-section awl (tool), more commonly associated with Continental European shoemaking schools than with English shoemakers, who preferred oval-section awls (pers. comm. D.A. Saguto, 5 March 2012).

A set of four intact and eight fragmentary carved wooden beads are spherical in form with beveled or slanted angles (L. 1.9cm, Diam. 1.9cm, W. 1.8cm, hole Diam. 0.2-0.3cm; Fig. 46). In addition to the holes at each end of the bead, smaller holes are visible on the body. The bead shape is similar to abacus beads, and as such may have been intended for use in an abacus counter, a tool used for performing arithmetic processes since ancient times and today still widely used by merchants in many parts of the world, particularly Africa and Asia.

A series of 13 probably bone, but possibly ivory, small cylindrical hollow objects, all seemingly unused (L. 0.7cm, W. 0.8cm, Diam. of hole 0.5cm; Fig. 81), seem to be spare joints for an undetermined form of utensil or instrument, potentially medical, such as enema syringes.

Two worked ceramic artifacts defy identification (TOR-90-00074-CS, L. 1.8cm, W. of base 0.7cm, W. at top 0.4cm, handle L. 0.9cm, handle Th. 0.2cm, 0.8gms; TOR-90-00075-CS, L. 1.6cm, base Diam. 0.8cm, W. at top 0.4cm, handle L. 0.9cm, handle Th. 0.2cm, 0.7gms; Figs. 82-83). Both are solid cylinders of clay with flaring bases to which a single handle extends upwards to mid-body, while three crude lines and striations have been incised along the lower two-thirds of the object. Two additional incised lines are present on the summit of TOR-90-00074-CS.

In style, these objects resemble miniature thunder-mugs/servidors, candlestick holders or possibly flagons that have been suggested to have served as gaming pieces. A few board pieces were found at Castillo De San Marcos at St. Augustine, Florida (pers. comm. James Levy, 2 December 2011). The crude decoration is reminiscent of North American 'Fort Walton Punctuation' motifs (pers. comm. Marie Prentice, 1 December 2011). However, an origin anywhere in South American, Mesoamerica or in the Caribbean is more likely. A rich tradition of miniatures production, often used as children's toys, existed in colonial Mexico. Their use as thimbles for sewing has also been proposed, although the objects' opening width seems to prohibit such an option. The tiny size of these objects may point towards a different function, and stringing on a necklace or bracelet has been proposed. The cessation of decoration half way down both objects may suggest a practical use as vials for small spouted bottles, the loop being intended to take a string to prevent them being parted from the vessel (pers. comm. Ivor Noël Hume, 16 August 2012). Alternatively they may have been vessel stoppers.

Eight fragments of tobacco pipe stems (Diam. stem 0.7-1.2cm, Diam. inner hole 0.3-0.5cm; Fig. 84) derive from one iron-stained white clay tobacco pipe of possible European or Euro-American manufacture and six Native American earthenware tobacco pipes (pers. comm. Byron Sudbury, 7 March 2012). They are identified as personal belongings of the ship's company, and the six examples attributed a New World origin represent unusual evidence for tobacco trade and use in the first quarter of the 17th century. Cuba and Venezuela are their most likely source of production (Sudbury, forthcoming).

Arguably the least expected artifacts associated with the Tortugas wreck are three jadeite or greenstone objects. Two of the objects are elongated oblong and pendant-like (90-1A-000567 and 90-1A-10240015, L. 16.5cm, W. 3.0cm, Th. 0.5cm; Fig. 85), each with a shaped blade and a carved terminal, one of which features a more elaborate floral motif and a recessed (though not pierced) central drilled hole.[9] The third artifact is small, roughly T-shaped and seemingly crafted of polished plagioclase feldspar with hints of white and brown (TOR-90-00343-SN, H. 1.8cm, W. 1.3cm, Th. 1.0cm, protruding T-bar 0.9 x 0.8cm; Fig. 86). The shape and the finish suggest the object is a labret (lip ornament).

The blade-like artifacts closely resemble celts, objects of both religious and economic significance amongst the indigenous people of pre-Columbian Mesoamerica, which were exchanged or reworked into statues, jewelry and other precious objects (Grande and Augustyn, 2009: 211). Celts were often worn vertically as pendants, dangling from belts or masks, or worn horizontally as pectorals. A similar, but plain oblong celt-like greenstone object was recovered from the *Margarita;* double drill holes in its center suggest it was worn horizontally as a pectoral ornament (Tedesco, 2010b: 18). Current thinking suggests that the Tortugas examples served more mundanely as whetstones due to the presence of distinct surface wear.

All three artifacts are of almost certain Mesoamerican origins, where jadeite and other physically similar greenstones have deep cultural roots. The Spanish term for jade, *piedra de yjada,* translates as 'stone of the loins', a name inspired by observations of how the native population used jade for therapeutic purposes when mixed in powdered form with water as a cure for internal disorders (Gasco and Voorhies, 1989: 59).[10] In turn, Spaniards attributed to jade the power to cure kidney pain and other healing either when worn as jewelry or placed next to an affected area (Grande and Augustyn, 2009: 211).

Mesoamerica was the main source of jade in the New World, with the dominant sources concentrated in Guatemala, particularly the central Motagua Valley, where appropriate geological conditions exist and several ancient jade-working sites have been recorded along the Upper Rio El Tambor drainage area (Helferich, 2012: 200; Taube *et al*., 2005). The 16th-century *Codex Mendoza* lists seven provinces as paying tribute to Spain partly in greenstone that is believed to have originated largely in the Motagua Valley, Polochic Valley, Sierra de Santa Cruz, Altos de Cuchumatanes, Sierra de las Minas and Sierra de Chuacus, all in Guatemala (Gasco and Voorhies, 1989: 59, 61-2).

The Tortugas ship would have encountered little difficulty acquiring jadeite and greenstone objects in the main ports of South America and Mesoamerica, but the principal question remains for what reason this Spanish-operated vessel was transporting them? Three interpretations seem feasible: the objects were curiosities being shipped as souvenirs, they had been procured for their curative properties, or they belonged to a Native American Indian onboard the merchant vessel. The last two options seem most logical, and combined with the presence of two

unparalleled possible Native American or Caribbean Indian ceramic beads or pendants, and two indigenous wooden weaving spindles, the presence of a female Indian onboard the Tortugas ship cannot be excluded. The labret is so small that it arguably only makes sense as a facial adornment. A Spaniard certainly would never wear one and presumably would have preferred a larger object if it was desired for its curative properties, whether intact or reduced to powdered form. On the other hand, a large greenstone paperweight found in addition to one greenstone celt and another amulet on the *Margarita* (Tedesco, 2010b: 18-19) may reflect a broader trade pattern.

12. Human Bones

The human skeletal material from the Tortugas shipwreck was restricted to a small number of teeth recovered in the ROV's SeRF system. Some upper and lower molars exhibit a discolored, tartar-like substance near the base and two adult molars have cavities. Wear evidence varies from none (a tooth had not erupted) to molars with smoothed cusps and pinhole penetrations through the enamel. Several specimens are represented only by enamel caps, the root and interior of the tooth being completely decomposed.

Separating the teeth by wear creates two groups with type distributions, indicating a minimum number of individuals (MNI) in each (Tables 3-4). The teeth represent at least one child and one adult. Judging from the amount of wear on the teeth, and consulting dentition charts for ages of eruption, the child was ten years old (+/- 30 months).

Type	Child	Adult	Unknown
Incisors	0	1 (L)	----
Canines	0	2 (1U, 1L)	----
Bicuspids	4 (?)	0	----
Molars	7 (3U, 4L)	2 (L, L)	1 (L)

Table 3. Distribution of teeth by probable age of individual.

13. Animal Bones

A. The Sample

A collection of 165 animal bones excavated from the Tortugas shipwreck was reanalyzed by Dr. Philip Armitage in 2011 (Figs. 87-88). His study concluded that the majority of the assemblage was poorly/moderately well preserved with substantial evidence of post-depositional attritional damage from seabed sedimentary disturbance and, in some cases, corrosion caused by prolonged exposure to seawater (cf. Armitage, 2012).

Accounting for 40.0% of the bones, pig predominated over cattle and sheep/goat (13.9%), reflecting the high frequency of this animal in Spanish mariners' diet within the Americas fleets. The inclusion of teeth suggests that live pigs were carried on board the Tortugas ship to supply fresh meat during the trans-Atlantic crossing, a common practice testified in historical accounts. Domestic *Gallus gallus* fowl bones represented 6.2% of the faunal sample. Measurements point towards the consumption of scrawny, bantam-sized birds. One possible turkey bone was identified.

Comprising 32.3% of the Tortugas assemblage, *Rattus rattus,* from at least five black rats were highly represented. Rodent tooth gnawing marks were also identified on a chicken humerus (TOR-90-00214-BN), reflecting scavenging by a shipboard rat.

Unexpected faunal remains consisted of the right and left lower jawbones (TOR-90-00193-BN) from an adult cat (Fig. 88) and, most remarkably, a tarsometatarsus (TOR-90-00170-BN) and a femur (TOR-90-00217-BN) from a parrot. *Pionus* are indigenous to the Caribbean, Central American and northern South American mainland regions. Transport as commercial exotica plausibly explains the parrot's shipboard presence (possibly within a larger caged consignment). The opportunity to purchase these birds would have been possible when the Tierra Firme fleet entered the ports of Portobello (Panama) and Cartagena (Columbia). Former evidence of the trade in small parrot species is scarce, and physical evidence almost non-existent (Armitage, 2012; Cooper and Armitage, forthcoming).

B. Flota Meat Provisions

Outward-bound Atlantic fleets transported livestock to the colonies in the Americas or for slaughtering during the voyage. Although a Spanish law of 1621 prohibited livestock carriage on warships, merchant vessels continued to load hoofed and winged animals, prized amongst the myriad stocks taken to sea in the centuries before ice or refrigeration (Fish, 2011: 406-407). Sailors, soldiers and low status passengers subsisted on a mundane diet almost exclusively comprising dried and salted meat and fish, beans and chickpeas. Hard biscuit was standard fare, the most important sustenance for energy served with a little vinegar as relish and sometimes some butter and cheese, plus the customary rations of wine. Fish acquired during the voyage broke the monotony (Peterson, 1975: 85; Phillips, 1986: 168-9).

Inv. No.	Type	Condition
90-1A-000397.00	Human molar, crown, neck & section of root intact	Very little wear on the four cusps. Two roots indicate a tooth from the lower jaw. Probably a second molar.
90-1A-000397.001	Human bicuspid or premolar, crown, neck & section of root intact	Very similar in wear & size to 90-1A-002066.1189. A tiny facet on one cusp; otherwise little wear. Position is undetermined.
90-000434.118	Mostly intact right lower first bicuspid or premolar	No wear facets
90-1A-000474.114	Human molar crown, small section of root & neck intact	Cavities on both the mesial & distal occlusal surface, one of which penetrates the enamel. Five cusps & oblong shape suggest this was a lower molar. Cusps worn smooth, but discernible. Position undetermined.
90-1A-000474.115	Enamel of a human molar, cusps in Y-5 pattern	Little wear, but has discolored to black
90-1A-0000485.8	Enamel of a human molar, three cusps	Little wear; enamel discolored to black
90-1A-000524.116	Enamel cap of human molar, three cusps	Little to no wear
90-1A-000558.449	Mostly intact human molar with two roots from the lower jaw. Very large tooth, 13mm long, 10mm wide	Extreme wear; the cusps are discernible but smooth; the enamel worn through at three points. Mesial & distal occlusal surfaces have cavities that do not penetrate the enamel
90-1A-000628.1808	Crown, neck & small amount of root of human incisor	Not shovel shaped, enamel worn through on the cusp
90-1A-000680.70	Human first or second molar from lower (left?) jaw, cusps in Y5 pattern	Wear has produced a facet on one cusp, no discernible wear other side
90-1A-000876.071	Crown only of human premolar (or molar?)	No wear facets; stained overall
90-1A-000876.72	Human second molar (right?). Oblong shape & suggestion of three roots indicate upper tooth	Crown intact, small amount of cementum at the neck. Very little wear on four cusps
90-1A-000980.70	Human canine tooth; cingulum indicates upper position, curvature & groove on root flat surface indicate from mouth right side	Mostly intact, only root top broken; some evidence of wear
90-1A-02066.1189	Human bicuspid or premolar, crown & neck intact	Grayish white enamel; cementum is gray, ivory & tan. Tooth not yet erupted
90-1A-002066.1190	Human canine (very similar to 90-1A-00980.70). Crown & neck intact, small part of root present	Cusp worn flat, pinhole penetration through the enamel. No cingulum apparent suggesting from the lower jaw
90-1A-002507.209	Human lower molar crown & some parts of neck. Cusps in +5 pattern, position undetermined	Very little wear
90-1A-002507.211	Human bottom molar, five cusps in Y5 pattern	Crown, neck & part of root intact; no wear
90-1A-00524.117	Crown of a human molar?	Broken & deeply pitted on the surface; impossible to determine the original shape.

Table 4. Condition of human teeth recovered from the Tortugas shipwreck.

While provisions varied little in the 16th and 17th centuries, by the mid-17th century the recommended rations had reduced in proportion. The anonymous *Diálogo* of 1635 cited six ounces of salted meat or fish as the basic ration, the former of which often took the form of bacon or salt pork. This allowance compared unfavorably to the 1560 fleet that permitted half a pound per person. When available, 12 ounces of fresh beef replaced the six ounce salted meat ration. The 1647-51 Indies fleet consumed similar official rations enhanced by 12 ounces of pigs' feet (Phillips, 1986: 168).

Given the obvious preference for fresh produce, *flotas* were habitually provisioned with New World livestock on the homeward leg to Spain. A 1573 order instructed that it was at Havana, the convergence point for returning fleets of New Spain and Tierra Firme, where fleet ships should "take on water, firewood, and meat… and supply all ships properly, so that they do not suffer shortages during the trip" (De la Fuente, 2008: 53).

After returning to Spain from the Americas in 1622, the monk Antonio Vázquez de Espinosa confirmed that at Havana the fleet ships "outfit themselves and take on the supplies necessary to pass through the Bahamas Channel and sail to Spain." Espinosa's testimony from the time of the Tortugas ship's sinking clarifies that all the dietary supplies required by its crew were readily available in Cuba. Havana was built on a deep lagoon and provided an "abundance of meat, fish, turtles, tortoises, corn, manioc, and flour", while plantations of bananas, coconut palms, plums, pineapples, oranges, lemons and vegetables were cultivated in the hinterland (Clark, 1942: 103). In short, the city lived and died by the Carrera, from where it was a 65-day journey to Spain, compared to 115 days from Cartagena, the main north coast port of Tierra Firme (Macleod, 1986: 353). Spanish officials had such confidence in the New World environment that certainly in the 1570s they only provisioned ships with meat for outward journeys (Super, 1984: 61).

The transport of live animals, as attested archaeologically on the Tortugas ship for at least some pigs and chickens, fits with colorful historical sources. The tortoise shell from the hawksbill sea turtle excavated from the Tortugas wreck could also have been sourced in Havana and exploited as welcome by-product after meeting the crew's dietary needs. Thomas Gage, an English Dominican who lived in Mexico and Guatemala between 1625 and 1637, observed at Cartagena (Thompson, 1958: 334) how:

Fig. 87. Animal bones recovered from the Tortugas shipwreck.

> "… as hog's flesh there is held to be so nourishing, so likewise no other meat is more than it and tortoises, wherewith all the ships make their provision for Spain… They also take into their ships some fowls for the masters' and captains' tables, and live hogs, which would seem to be enough to breed some infection in the ship, had they not care to wash often the place where such unclean beasts lie. In the ship where I was passenger, was killed every week one for the masters', pilots', and passengers' table."

Spanish Manila galleons sailing across the Pacific Ocean similarly carried egg-laying hens, roosters and pigs, the latter of which were eaten by the officers and passengers, and the leftovers thrown into the stewpot for consumption by the crew (Fish, 2011: 406). The 17th-century Italian traveler Giovanni Francesco Gemelli Careri described livestock taken aboard the Spanish galleon *San Jose* during its stop at Albay in the Philippines, where the mayor gifted the ship's captain 20 pigs plus 500 chickens (Fish, 2011: 401, 407).

Closer to the geographical route of the Tortugas ship, Jonathan Dickinson was caught in a storm while tacking from Cuba to Florida in 1696. During the drama, "Our hogs and sheep were washed away and swam on shore, except one of the hogs which remained in the vessel" (Andrews and Andrews, 1985: 5). These passages conjure up images of the squalid and cramped conditions aboard fleet ships and other merchant vessels, and of human lives closely intertwined with the hoofed animals that provided their sustenance.

The Tortugas shipwreck's faunal assemblage closely mirrors the 986 identifiable bones from the *Atocha*. Excluding the marine fish species on the grounds that this material likely includes a predominance of intrusive bone, the 543 identifiable edible species from the *Atocha* comprised sheep/goat (32.4%), pig (30.0%), cattle (11.9%), sheep/goat/pig (8.1%), sheep/goat/deer (5.7%), land tortoise (5.5%), chicken (1.7%), deer (1.3%), sheep (0.9%), sheep/deer (0.9%), goat (0.7%) and turkey (0.7%) (tabulated from Chapin, 1990: 36-8). The variety of species compares closely to the Tortugas ship with the single exception of a higher representation of land tortoise and the presence of deer, which may reflect the higher social status of the *Atocha* galleon and its passengers' access to veal as specified in 1570s *libro de raciones* (cf. Super, 1984: 60).

The animal bones on the earlier dated St. John's wreck of Spanish identity, lost off the Little Bahama Bank soon after 1554, include an adult pig and cow (Malcom, 1996). Pig, bone and white-tailed deer are attested on the Spanish-operated Western Ledge Reef wreck lost off Bermuda in the last quarter of the 16th-century (Franklin, 1993: 80).

Fig. 88. Animal bones, including the jawbone from the ship's cat (far right), recovered from the Tortugas shipwreck.

Chicken, pig, cow, sheep/goat were represented within the assemblage of 339 bones on the Emanuel I wreck (Smith *et al*., 1995: 75-81). The faunal remains from the *San Diego*, a Spanish galleon that sank in 1600 off the western Philippines, reveal that the ship carried chickens, pigs and cattle for its crew of 450 men, with some meat stored in 13 'dragon jars' (Cuevas, 1996: 201; Fish, 2011: 407).

A further significant counterpoint to the Tortugas' wreck's faunal assemblage are the animal bones excavated from middens at Nueva Cadiz on the island of Cubagua on the Pearl Coast, where the *Buen Jesús y Nuestra Señora del Rosario* sailed in 1622. The island's main period of *ranchería* occupation dated from *c*. 1516-45. Not surprisingly for a far-flung colonial 'desert island', sea food was most highly represented, followed by mammals and birds, of which local deer and rabbit predominated. Pig followed by chicken was the most significant domesticated species (Wing, 1961: 163-4). The eastern Venezuelan colonial pattern of indigenous consumption was thus a far cry from *flota* supplies.

C. Black Rats

The evidence for rats on the Tortugas ship is not unexpected, but helps illuminate an infamous problem experienced by mariners in 1622. Having departed from the Honduran port of Trujillo aboard the *Nuestra Señora de la Candelaria*, the Spanish Carmelite monk Antonio Vázquez de Espinosa vividly recounted the invasion that overtook the ship. While transferring dyestuffs at Havana, rats were found to have devoured flour, hard tack, chickpeas, beans and meat. Over one thousand rats were allegedly killed on the *Candelaria* in port, but at sea the crew discovered a few thousand more infesting the ship from bow to stern, which ruthlessly consumed several tons of food, gnawing through sacks, boxes, jars, casks and stoppers (Peterson, 1975: 232, 241-2; Phillips, 1986: 157). They overran the storage holds, below the quarterdeck and plundered the stern salon, the cabins and even the pilot's seat. The vermin took four quintels of bread from the priest's cabin, plus the biscuits stored under the hatchway. Ham and sides of bacon hanging in the stern store chest were also heartily consumed (Galeanon, 1985: 197).

Thirsty passengers found drowned rats floating in barrels of water. All that remained in the hencoop were bones and feathers. Caged parrots were defenseless against the rodent army (see above for a unique point of archaeological convergence on the Tortugas wreck). Equipped with clubs and knives, the *Candelaria*'s sailors kept watch over the remaining food day and night, eventually killing over 3,000 rats before the fleet reached home (Galeanon, 1985: 197; Phillips, 1986: 157).

The rat bones associated with the Tortugas shipwreck contribute to our understanding of shipboard conditions at sea during the 1622 fleet's return to Spain. The problem, of course, was neither new, nor unique: excavation of the 1559 Emanuel I wreck recovered 206 bones from both young and adult *Rattus rattus*, as well as two from house mice (Smith *et al*., 1995: 78-82).

14. Seeds

A. Sample

A total of 565 intact seeds and fragments derived from the ROV's SeRF system was recovered, examined and catalogued from the Tortugas site (Table 5; Figs. 89-93). The species type identifications were reconfirmed in 2012 by Victor Vankus, Southern Region Native Plant Coordinator, USDA Forest Service, National Seed Laboratory, Georgia. These provide little more than a flavor of the site's total archaeobotanical collection. Following the pattern of plant and food remains deposition observed on the Emanuel Point shipwrecks (Lawrence, 2010: 79), more substantial material is likely to be preserved among and under the ballast stones in the lower hull, which was not excavated on the Tortugas site. Positive identification was not always feasible given the fragmentary condition of much of the Tortugas material.

A number of seeds belong to the *Prunus* genus of plants, including intact specimens of peach (*Prunus persica*, L. 2.5cm) and the cherry family (Diam. 0.4cm). Also present are endocarp that appear to be almonds, *Prunus dulcis*, as well as fragments of plum seeds that are flatter in shape than peach (pers. comm. Victor Vankus, March 2012). Peaches, in particular, were amongst the earliest fruits shipped to the Americas by Spain and introduced into Mexico in the early 16th century; less than 50 years after Cortez conquered the country, peach trees were common regionally (Hedrick, 1917: 39-40). Historical records indicate that the peach was procured for cultivation at the failed Luna colony in Pensacola in 1559, and that peach trees were brought to Florida by the Spanish to St. Augustine not long after (Lawrence, 2010: 13, 40-1).

The presence of fruit and nuts aboard the Tortugas ship is not surprising in light of the devastating effects of the disease now known to be scurvy. While sailors had only limited knowledge about this fatal disease, by at least 1620 the condition was understood to be connected to diet and sea travel (Drymon, 2008: 114-5). Sailors were conscious that fresh provisions were somehow linked to the prevention of sickness (Phillips, 1986: 173), and fruits and nuts were considered especially beneficial for long journeys. Recognizing their nutritional value, these hearty edibles

Type	No. Whole	No. Fragments	Total No.
Almond (*Prunus dulcis*)	5	4	9
Burr (*Xanthium strumarium*)	1	0	1
Coconut (*Cocos nucifera*)	4	12	16
Grape (*Vitis vinifera*)	1	0	1
Hazelnut/filbert (*Corylus Americana*)	1	25	26
Melon (?) (*Cucurbitaceae*)	1	0	1
Olive (*Olea*)	98	77	175
Palm (round) (*Arecaceae*)	104	38	142
Palm (ribbed) (*Arecaceae*)	2	117	119
Cherry (?) (*Prunus cerasus*)	5	2	7
Squash (*Cucurbitaceae*)	1	0	1
Unidentified	22	45	67
TOTAL	245	320	565

Table 5. Seed types and volumes recovered from the Tortugas shipwreck.

were often added to official provisions, enhancing an otherwise bland diet (Smith *et al*. 1995: 94; Konstam, 2004, 35).

In addition, sugar, raisins and nuts were thought to hold curative properties. Almonds are cited in Habsburg-period provision lists as comprising special foodtsuffs transported for the sick, wounded and for highest-ranking fleet officials (Phillips, 1986: 97). The *Nuestra Señora de la Concepcion* was provisioned with almonds on its 1552 voyage from Seville to New Spain (Veyrat, 1994: 168). For the 1629 fleet in which Martin de Arana's six galleons first sailed to the Indies, 1,500lbs of almonds were listed among the *dietas* (special foods) retained for the original 3,000-man fleet (Phillips, 1986: 178).

The most prevalent seed type recovered from the Tortugas wreck was a hard, round, woody palm nut from one of the species in the *Arecaceae* palm family, most examples of which were intact (Diam. 2.4cm). These may have functioned as raw material for carving beads (carved and drilled examples of this nut type on the Tortugas shipwreck are discussed in the beads category: see section 8 above). Certainly in the late 17th century this raw material was used for palm-crafted rosaries, examples of which are associated with the *Atocha*. Two intact and many fragmented examples of a second type of palm nut were also recorded. Four intact coconuts and several broken coconut endocarp shell fragments were also recovered (Th. 0.4cm).

The olives pits can be subdivided generally into two sizes, the smaller approximately 1cm in diameter and the larger approximately 1.5cm in length (with maximum lengths for some examples of 2.0cm), suggesting the consumption on the Tortugas ship of two types of shipboard olives. One intact hazelnut was recovered (L. 2.0cm), alongside further fragments, as well as a single grape seed. One example of a burr (*Xanthium strumarium*, Diam. 0.4cm) could have been matted into the hair of either a human or animal host or could have attached itself unnoticed to clothing or other material.

One seed has been classified as squash (L. 2.1cm) and another identified tentatively as melon (closely resembling a mature watermelon seed), but may have been a variety of squash as well. These seeds could have come aboard the ship in numerous ways: as food for the crew and passengers, on animals, as dunnage, fuel, stomach/intestinal contents, embedded in hooves, in or on cargo, or matted in hair, fur, feathers or clothing.

B. Parallels

The archaeobotanical material from the Tortugas shipwreck is largely typical of Spanish shipboard collections, which are otherwise more eclectic. The approximately 54 macrobotanical types recovered from the Emanuel Point II shipwreck (Florida, 1559) ranged from common hazelnuts, grape seeds, palm, cherry, almond and plum to a wide variety of remains mainly unattested on the Tortugas wreck: persimmon (*Diospyros virginiana*), English walnut (*Juglans regia*), apple or pear *(Malus* sp. or *Pyrus* sp.), black cherry (*Prunus serotina*), mustard family for flavoring food (*Brassicaceae*) and coriander (*Coriandrum sativum*). Additional seeds unique to the Emanuel Point I site were sapote (*Pouteria* sp.), New World papaya (*Carica papaya*) and a single fragment of coconut shell (*Cocos nucifera*) (Lawrence, 2010: 35-37, 39-44, 46).

The recovery of 175 olive pits from the Tortugas wreck, and 400 from the Emanuel Point I shipwreck (Lawrence, 2010: 81), obviously reflects the centrality of olives and olive oil in the Spanish diet. Included in the Emanuel Point I sample are cherry seeds, hazelnuts and almonds. Olive pits, almond shells and hazelnuts were similarly excavated from the 1554 *San Estéban* lost off Padre Island, Texas (Smith *et al*., 1995: 92, 94).

Fig. 89. Seeds recovered from the Tortugas wreck using the SeRF system.

The Iberian vessel wrecked off Western Ledge Reef, Bermuda, in the last quarter of the 16th century contained an exotic assemblage reflecting New World food consumption and exploitation. The common olive pits and plum/cherry were accompanied by Jerusalem artichoke, pumpkin, American chestnut, one fragment of coconut, liquorice, English walnut and sweet almond (Franklin, 1993: 77-8). Further afield off Malaysia 150 hazelnuts, 30 peach pips and coconut were identified on the Spanish ship *San Diego* (Veyrat, 1994: 171). Nine different species of seeds were recovered from the *Atocha*, including samples which are similar to the seeds and nuts carried aboard the Tortugas ship: pumpkin/squash (*Cucurbita pepo*), hazelnut (*Corylus* sp), Mediterranean olive (*Olea Europa*), and Royal Palm (*Roystonea* sp) (Malcom, 1993: 8).

Two sets of atypical data emerge as particularly significant from the Tortugas shipwreck. Palm nuts account for 46.2% of the sample and seemingly reflect their consumption for food and recycling in Spain for rosary bead production. The four intact and 12 coconut shell fragments seem a high representation compared to the single example recorded on both the Emanuel I and Western Ledge Reef sites.

Coconuts were first recorded in the Americas by Oviedo *c*. 1524 on Cocos Island on the shores of the Bay of Panama, and at Burica Point, and by 1580 were also documented at Motín along the central Pacific coast of Mexico between Colima and Zacatula. Fray Alonso Ponce commented on the profusion of coconut palms near Colima in 1587, where their woody shells were turned into drinking vessels for export to Spain (Bruman, 1945: 213).

The coconut was not indigenous to Panama and Mexico, but was washed there naturally from the Pacific islands, especially the Philippines, by the Equatorial Countercurrent (Bruman, 1945: 214-5; Salvaggio, 1992: 336). The product had become so commercially successful by 1610

that on 29 March a decree of Luis de Velasco, the Viceroy of New Spain, sought to curtail Filipino immigrants making wine from coconut palms in the Colima area (Bruman, 1945: 215):

> "There is so great an abundance of these palms in the towns that in one of them alone there are sixty taverns where the wine is sold. The wine is cheap and strong, and the natives use it to such excess that it costs them their health and their lives. The sale of Castilian wine is hindered in these provinces by the excessive use of palm wine, and the royal treasury is thereby deprived of its rightful amount of tax money… The manufacture and sale of vino de cocos is therefore prohibited."

The ruling had little effect, and the trade was thriving so widely in 1619 that the naval officer Sebastián de Pineda proposed repatriating the native Indians back to the Philippines from Colima (Bruman, 1945: 215-6). The coconuts on the Tortugas ship may have originated in Mexico and been shipped intra-regionally into the Gulf of Mexico, possibly Havana, where they entered this merchantman as a source of nutrition and possible vessel production.

Figs. 90-93. Seeds recovered from the Tortugas wreck using the SeRF system: a ribbed palm nut, burr, pumpkin/squash and plum (top left to bottom).

15. Conclusion

The Tortugas shipwreck's significance lies in its status as a small *navio* operating at the opposite commercial spectrum as the *Atocha* and *Margarita* lost in the same Tierra Firme fleet off the Florida Keys in September 1622. The ship is most plausibly identified as the Portuguese-built and Spanish-operated *Buen Jesús y Nuestra Señora del Rosario* (Kingsley, 2012). Although the three sites share many cultural features – including olive jar types, tablewares, Tortugas kitchen colonowares, gold bars, silver coins, astrolabes, pearls, rosary beads, glass bottles, bronze mortars and pestles, animal bone, seeds and even Native American greenstone exotica – the Tortugas ship was not transporting gold,

silver and copper en masse. Differences rather than similarities are some of the wreck's most enduring characteristics.

The Tortugas ship contained at least 209 *botijas* produced in two sources in Cordoba and Seville, which are interpreted as ship's stores rather than cargo. Sources indicate that the *Buen Jesús y Nuestra Señora del Rosario* was licenced at Seville in March 1622 to carry 2,500 jars, but finally transported a reduced 1,400 jars of wine on behalf of various merchants (cf. AGI *Contratación* 3041 and *Contratación* 1172, N.2, R.1). The small quantity of olive jars excavated from the wreck accounts for just 8.4% of its authorized capacity and is best explained as containing foodstuffs intended for consumption by the crew and passengers on the return journey to Spain. Perhaps some of the site's olives, grapes (wine), hazelnuts, almonds, cherry and nuts derived from spilled *botija* interiors. Based on the geographic movements of the *Buen Jesús*, tobacco – now completed decomposed – has been proposed as the Tortugas ship's primary cargo (Kingsley, 2012).

The ship combined valuable goods and exotica alongside humble personal belongings. The 27 gold bars originating in the Colombian mines of Zaragoza and San Sebastian, some operated by the Peñaranda family, and the 1,184 silver coins largely minted in Mexico (56%) and Potosi, Bolivia (30%), may be interpreted as payment for the outward-bound cargos sold by and consigned to Juan de la Torre. The 6,639 pearls would have been picked up in eastern Venezuela at Cumana, the *Buen Jesús*'s outward-bound destination in 1622 (Chaunu and Chaunu, 1956: 26-7).

Although historical sources decried the severe depletion of the Pearl Coast's oyster beds in the second half of the 17th century, the archaeology of the Tortugas ship demonstrates that profitable stocks could still be secured, especially if shipped as contraband, as the evidence implies. The three astrolabes, gold rosary stems, onyx inkwell and shaker, and elaborate ivory diptych sundial manufactured in Nuremberg complete the picture of a well-appointed *navio* with influential commercial prowess.

A fascinating counterpoint to the owner and captain's adventurous spirit in traveling beyond the Spanish safe havens of Mexico and Cuba to eastern Venezuela, a sea lane that was being increasingly blitzed by Dutch and English privateers in the first quarter of the 17th century, is the near-total cultural monopolization of the ceramic olive jars and tablewares by Andalusian products. Other than one Portuguese jug, a Columbia Plain bowl of possible New World manufacture, one San Juan Polychrome juglet from Mexico and South American, Mesoamerican or circum-Caribbean colonoware relied on exclusively for cooking, 99.8% of the 2,025 tablewares derived from Seville and a rural location 24km west of Seville, close to the Rio Guadiamar. Unlike the *Atocha* and *Margarita*, no high-end gold, silver or even pewter tablewares were attested on the Tortugas site. A Spanish source is similarly not impossible for the ship's square-sectioned green glass bottles.

As home to the all-powerful Casa de la Contratacíon, Seville's monopoly over the Tortugas ship's stores is logical (albeit not mirrored strictly on contemporary English and Dutch merchant vessels), although the dominance of Blue-on-Blue Seville wares over Columbia Plain is unexpected. The major exception to this trend is the monopolization of the cooking wares by the Tortugas colonoware, a feature shared by the *Atocha*. In light of the clear cultural bias towards Andalusian ceramic repertoires, and dismissing the improbable assumption that the cooking pot assemblages from both ships broke simultaneously en route to the Americas, demanding replacement in South America or the Caribbean, this divergent pattern remains anomalous. According to contemporary documents, the *Buen Jesús y Nuestra Señora del Rosario* was crewed by ten sailors and a licensed pilot, supported by eight cabin boys and three pageboys (Kingsley, 2012). How many additional passengers accompanied them is unknown, although the ivory sundial, gold chain and gold rosary fittings may point to at least one wealthy individual. The personnel were mixed in age and nationality: the excavated human teeth derive from both a child and an adult, while the two drop-spindles are fiber spinning tools typically used by women. The two Native American ceramic pendant-like artifacts from the wreck and three greenstone whetstones and labret hint at her ethnicity as being Native South American or Mesoamerican.

While the woman weaved cotton, and a member of the crew idled away the quiet hours cutting lice combs and cases from Hawksbill tortoise shell, a caged consignment of blue-headed parrots squawked in the captain's cabin and the ship's cat looked on as a ferocious hurricane bore down on the unforgiving Florida Keys. On the basis of the highly limited human remains, the majority of the ship's company may have chosen to take their chances in the open sea as disaster struck and the bell sounded its final fury.

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Notes

1. Christie's Auction 7748, 21 October 1993, New York: http://www.christies.com/LotFinder/lot_details.aspx?intObjectID=2455842.
2. See Mission San Luis de Talimali, US Department of the Interior, NPS, 9: http://www.nps.gov/nhl/designations/samples/fl/San%20Luis%20de%20Talimali.pdf.
3. Dimensions taken from artifacts at: http://www.historicshipwrecks.com.
4. Types of astrolabes are as defined by Waters and Stimson: cf. Garcia, 2008: 250.
5. See: the auction catalogue for *Gold and Silver of the Atocha and Santa Margarita* (Christie's New York, 14-15 June, 1988).
6. See: http://inadiscover.com/blogs/gnalic-project.
7. See: http://ina.tamu.edu/pedrobank/pedrobank.htm.
8. Zmaic, V., 'Post Medieval Shipwreck from the Early 17th Century at the Mijoka Shallows off the Island of Murter': http://icua.hr/en/archaeologyprojects/114-novovjekovni-brodolom-s-poetka-17st-na-pliini-mijoka-kod-murtera.
9. The description of the greenstone objects 90-1A-000567 and F24001.0015 is based on one drawing. The artifacts are no longer in the Tortugas collection maintained by Odyssey Marine Exploration in Tampa, Florida.
10. See: Howard, Kim Be, Jadeite (Canadian Institute of Gemmology, Vancouver, no date).

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