



Black Rats & Spanish Pearls

SHIPWRECKED OFF THE FLORIDA KEYS

In 1622, the *Tierra Firme* fleet, laden with gold, silver, pearls, and rats, was sunk off the Florida Keys. Sean Kingsley and Ellen Gerth describe 20 years of research into the world's first deep-sea wreck excavation, and discover a time capsule of daily life from the dying days of Spain's Golden Age.



ABOVE Detail from a painting of the port of Seville, c.1590, by Alonso Sanchez Coello, showing the Americas fleet being prepared to sail. The merchant vessel in the background (centre) is of comparable form to the Tortugas ship.

One of the richest Spanish treasure fleets ever assembled sank in a ferocious hurricane off the Florida Keys on the 5 and 6 September 1622. The *Nuestra Señora de Atocha* and *Santa Margarita* were brimming to the gunwales with three million pieces of eight, silver ingots from the colonial mines of Bolivia and Mexico, emeralds, and crates of Colombian gold. Four of the ships were grounded on the Marquesas Keys and the Dry Tortugas;

'His stories were what frightened people worst of all. Dreadful stories they were – about hanging, and walking the plank, and storms at sea, and the Dry Tortugas, and wild deeds and places on the Spanish Main.'

Robert Louis Stevenson, Treasure Island (1883)

another three or four never reached shore. The loss of these vanished fleet vessels broke the bank of Spain.

The crystal-clear waters of the Tortugas Triangle are strewn with the broken backs of more than 240 ships, and it was here that Greg Stemm and John Morris believed they would find one of the lost 17th-century Spanish galleons.

The survival of a Spanish shipwreck in these deep waters was not in doubt. In 1965, a fishing boat called the *Trade Winds*, trawling for shrimp, snagged its nets on the seabed and came to a shuddering halt. When the badly ripped nets were pulled in, the crew found three intact Spanish olive jars, metal artefacts, and pieces of ship's rigging and wood.

Locating the source of the fishing hang was a daunting prospect. The mystery wreck lay well below diving depths in 400m (1,312ft) of water, 20km (12.5 miles) offshore beyond the sight of land. Stemm and Morris's company, Seahawk Deep Ocean Technology of Tampa, Florida, started a side-scan survey search in spring 1988, and eventually landed on a pile of olive jars and wood in April the following year. From the beginning, they knew that the success of finding the lost ship would ultimately prove to be the easy piece of the jigsaw. Stemm wanted to document the archaeology of this deep-sea wreck scientifically, a feat never done before at such depth. To achieve his goal, the team would have to invent a new discipline, one that replaced human divers with robots, and underwater drawing slates with the nascent world of computers.

World's first deep-sea dig

In 1989, Seahawk ordered a \$1.8 million Remotely Operated Vehicle (ROV) to be customised in Scotland to work archaeological magic. They called the robot Merlin, after the wizard of Arthurian legend, and set out with great expectations to the Tortugas wreck in June

1990. The three-ton robot, launched from the 64m-long (210ft) *Seahawk Retriever* research ship, would need to serve as the eyes of the archaeologist in pitch-black water, and as his hands, replicating shallow-water techniques of excavation, sieving, recording, and recovery.

Merlin was fitted with two titanium manipulator arms capable of lifting up to 226kg (498lbs) each, a suction dredge for stratigraphic excavation, and positioning systems. Six hydraulic-powered positioning thrusters allowed the ROV to hover above the sea floor when working, as if in suspended animation. A Sonardyne long baseline acoustic navigation system enabled the precise positions of all artefacts to be mapped *in situ* with custom-designed data-logging software. Technical and archaeological ROV activities were recorded using live video and vertical and horizontal colour and black-and-white photography.

A crew of three technicians operated Merlin from the control room onboard the *Seahawk Retriever* under the supervision of offshore project manager John Astley and archaeologist David Moore. Video was relayed via fibre-optic cable to the control room, where three 30-inch video screens provided a 180° panorama of the underwater excavation. Pilots watched

events on the sea floor live on monitors, and commanded the ROV's manipulator arms using joysticks at the control console.

The most resourceful custom-made modification was the attachment to Merlin of a 5cm-diameter (2in) suction cup that could pick up the most delicate ceramics and olive jars without damage. Stemm and Astley adapted the idea from money-printing presses that used similar technology to lift freshly printed dollar sheets. This limpet suction recovery system has now become the standard tool of deep-sea artefact recovery, imitated worldwide.

Even more innovative was a piece of kit dreamt up by Stemm and Astley to sieve for small finds that might otherwise have been lost in discharged sediment. A dredge receiver attached to the rear of the ROV was built from two 18-gallon stainless steel pressure beer barrels into which excavated spoil was filtered via a 25 horsepower hydraulically driven water pump. The weight of small finds diverted them into the sieve system, while sterile sediment was discharged away from the site through an external exhaust.

In the course of two seasons between June 1990 and October 1991, 16,903 artefacts were plotted and recovered from depths of 394m-406m (1,293ft-1,332ft), and part of the hull analysed. Merlin spent 1,489 hours diving the site. The eclectic finds ranged from 6,639 pearls and 3,935 ▶

BELOW Map of Venezuela by Pieter van der Aa (Leiden, 1706). It shows the Tortugas ship's route between Rio de la Hacha and Cumana (with detail of the Pearl Coast islands).





ABOVE Monitoring archaeological operations on the Tortugas shipwreck from the *Seahawk Retriever*. The top screens displayed sonar and navigation. The three middle colour screens revealed a very wide view of the site under investigation. The lower row of screens depicted compass, vehicle instrumentation, and stern camera data, plus other cameras monitoring the ROV parts. In the foreground, the data logger runs four SVHS recorders and the logging system.

BELOW The three-ton ROV Merlin was designed and built for the Tortugas shipwreck excavation, with its SeRF system hose and nozzle, two manipulator arms, and limpet suction device.



ceramic wares to 1,184 silver coins, 565 seeds, 165 animal bones, 127 glass wares, and 39 gold bars and bits.

Quantity, however, tells only a small part of the Tortugas shipwreck story. What is missing from the shipwreck is equally illuminating. The 209 olive jars were not cargo but had been filled with homeward-bound shipboard supplies, which leaves unresolved the question of what the Tortugas ship had been transporting. Finally, what was the name and background of this mystery merchant vessel? After 20 years of interdisciplinary research we finally have the answers.

The Buen Jesús y Nuestra Señora del Rosario

The association of the Tortugas shipwreck with the ill-fated *Tierra Firme* fleet of 1622 is cut and dry: the Tortugas silver coins include no issues post-dating 1622, and the latest coins are matched by mint and by assayer with those recorded on the *Atocha* and *Margarita* from the same fleet.

Additional sets of artefacts from the *Atocha* are duplicated in the form of gold finger bars stamped with identical mint, *quinto* (taxation), and carat quality production marks, while four forms of olive jars (including parallel graffiti marks), the tableware (Columbia Plain, Blue-on-Blue Seville *maiolica*, Blue Morisco ware), and kitchen colonware clearly originated in the same kilns.

When defining the long-lost name of the Tortugas ship, the historical equation

came down to a matter of size. From the lower sternpost to where the keel started to rise to form the lower stempost in the bows, the ship measured 17.4m (57ft). The ship's size most tightly corresponds to the dimensions of a Spanish merchant vessel with a keel length closest to 30 *codos* according to Spanish shipbuilding laws of 1618 – dimensions that tally with those of the *Buen Jesús y Nuestra Señora del Rosario*.

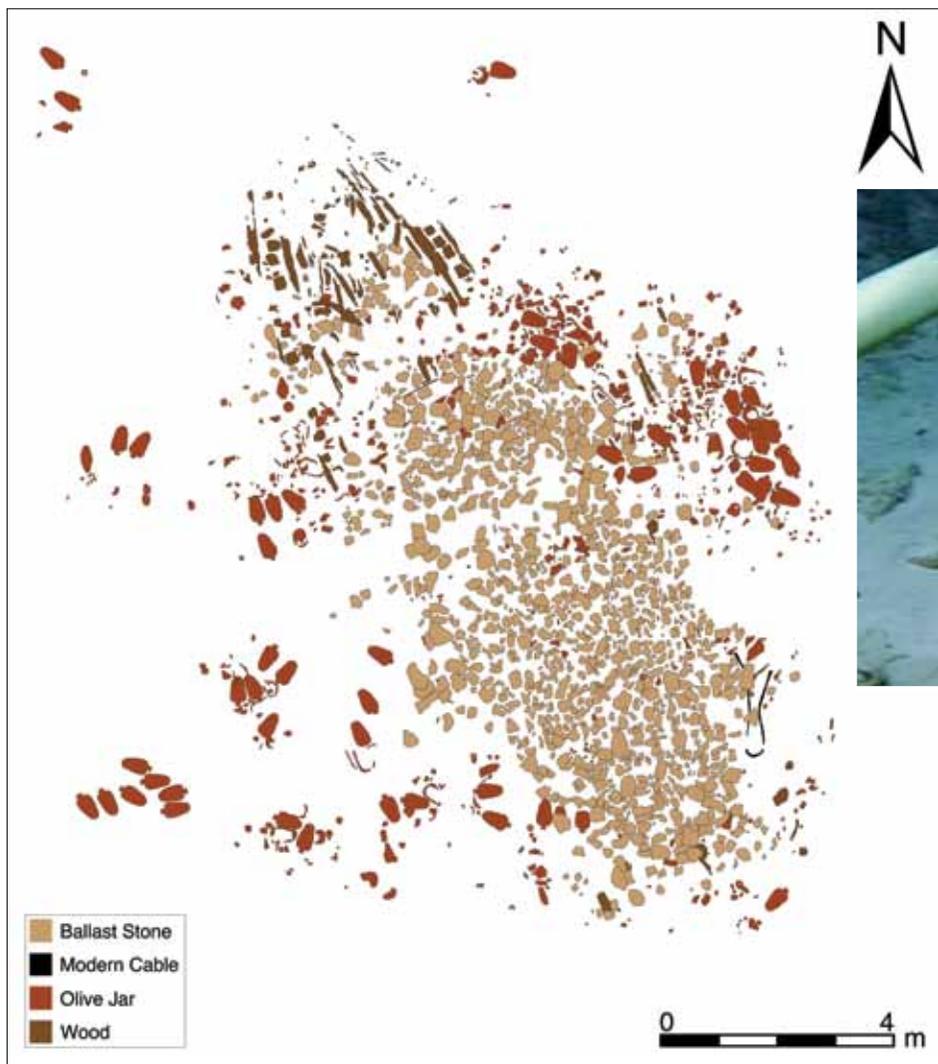
Notably, archival sources in Seville's *Archivo General de Indias* confirmed that the owner of this ship, Juan de la Torre, lost a ship in the Florida Keys hurricane of September 1622. This *navio* was outward-bound to Nueva Cordoba, Cumana, on the

north-east coast of Venezuela, which was the centre of Spanish oyster-harvesting in the colonial era. The discovery of 6,639 pearls on the Tortugas wreck boosts the correlation.

Totalling 21m (69ft) in length and with a 117-ton capacity, the *Buen Jesús* operated at the opposite end of the scale to the royal treasure ships from 1622, transporting heaps of Crown taxes back to Seville. The merchantman piggybacked the well-armed security of the fleet at a time when Dutch and English privateers were blitzing the Americas and Caribbean.

BELOW Anchor A1 at the south-east flank of the site.





LEFT Plan of the Tortugas shipwreck as it looked before excavation.

ABOVE An olive jar being recovered using the limpet suction device.

risk life and limb sailing to the edge of the civilised world?

Returning to Seville with an empty hold devoid of the riches of the New World would have been unthinkable. In the absence of archaeological data from the completely excavated Tortugas ship, any supplementary goods must have been organic in nature. The invisible cargo from the Tortugas site masks one main reason for the *Buen Jesús's* Venezuelan speculation. During the 1590s and early 1600s, Spanish Cumana was transformed ▶

BELOW Vertical view of the sternpost.

With its owner Juan de la Torre Ayala onboard, the *Buen Jesús* left Seville with a mixed cargo of iron goods, 1,400 wine jars, brandy, oil, quince meat, raisins, hazelnuts, almonds, chestnuts, capers, olives, hats, fabrics, women's shoes, and a tapestry depicting the souls of Purgatory. Little did the crew know that they were sailing towards their own living hell.

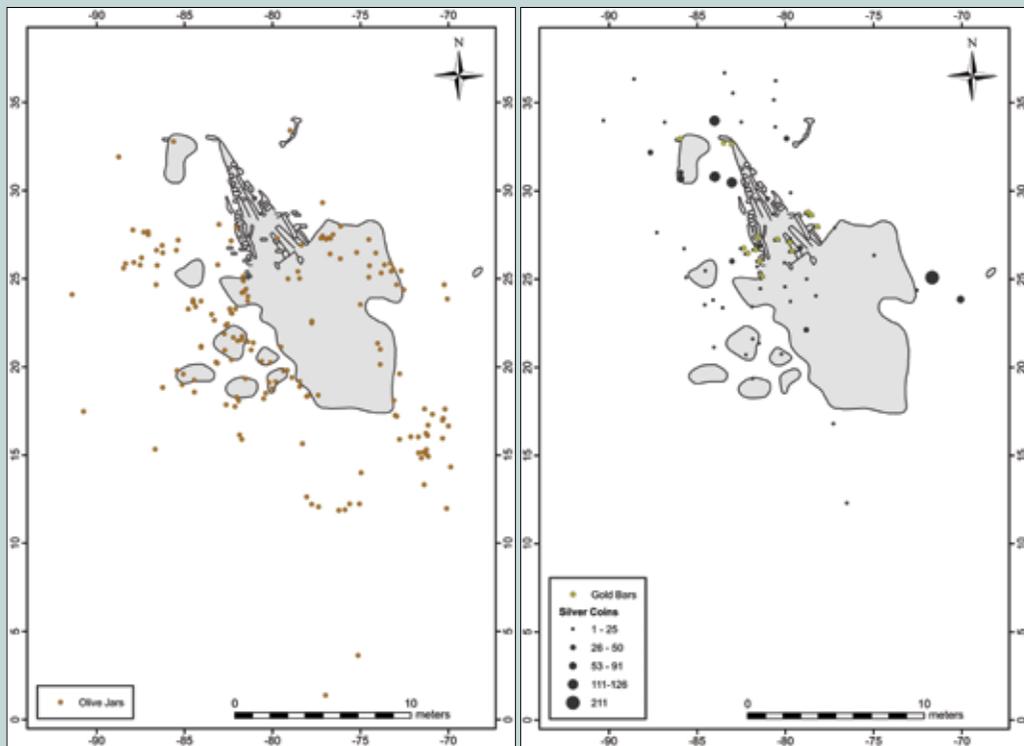
The Pearl Coast

Journey's end for the *Buen Jesús* was well off the radar of most fleet ships, which typically converged on Cartagena, Portobello, and Havana. The decision to sail the hazardous final leg was at best speculative – and at worst reckless. Cumana lay at the heart of Venezuela's Pearl Coast, badlands founded in 1528 as the first European city in South America. Populated by 223 Europeans and 700 natives, the frontier town was plagued by corruption, drinking, gambling, murder, adultery, and the rape of local women.

From 1513 to 1540, an estimated 120 million pearls were fished up from the Pearl Coast. In just two decades, colonial Spain wiped out 60,000 Lucayan Indians from the Bahamas who had been enslaved

as divers, and by 1537 no pearls had been obtained from the Pearl Islands for a year and a half. In 1604, Suárez de Amaya confirmed that the 20% royal *quinto* taxation had dwindled to 1,600 ducats, a sum that could not even cover the governor's salary. So, if the waters had been denuded, why did the *Buen Jesús*





LEFT Plans showing the distribution of olive jars, gold bars, and silver coins on the Tortugas shipwreck.

into Europe's main tobacco supplier, and, according to Andrés de Rojas, populated in 1605 by 'riff-raff who have no other source of income than the tobacco crop that is so esteemed in Flanders and England... the place is like a fair, by way of which contraband enters and reaches as far as Peru'.

Towards the end of the 16th century, north-west Europe was enveloped by an extraordinary market expansion for tobacco. During the lifetime of the *Buen Jesús*, tobacco was a costly luxury in a short-lived boom before expanded production led to a crash in the later 1620s. Society became so deeply addicted to smoking tobacco that in 1604 King James I felt obliged to criticise the sweeping effects of the new social revolution in *A Counter-Blaste to Tobacco*.

The Tortugas ship's voyage to Venezuela made not just good commercial sense, but was also politically motivated. Although the peak era of pearl harvests had ended, consignments could still be secured at source and sold for large profits. If the pearls were obtained as contraband, a cargo of tobacco would have been the perfect camouflage for the ship's presence in Cumana.

Venezuelan trade would also have guaranteed political favour at a time when smuggling had escalated to an unprecedented scale, so that fortunes in Crown taxes were haemorrhaging to contraband. Spain had responded by



desperately ordering the suspension of tobacco sowing for ten years in August 1606, and Pedro Suárez Coronel, the Governor of Cumana, depopulated Cumanagoto, the regional commercial epicentre. By 1622, however, the crop was once again big business.

Homeward bound

More than a risky venture hoping to Hoover up exotic merchandise on a get-rich-quick mission to Venezuela, the *Buen Jesús* emerges as a political pawn that helped maintain a visible government presence at Cumana to guarantee the flow of taxed tobacco to Seville. Alongside the wreck's valuable exotica, the small finds reveal an even

more fascinating snapshot of life at sea. The ship may have been one of the smallest in the *Tierra Firme* fleet, but the three astrolabes, gold rosary stems, an onyx inkwell and shaker, and an elaborate ivory diptych sundial manufactured in Nuremberg reveal a well-appointed *navio* with influential merchants onboard.

The *Buen Jesús* was crewed by ten sailors and a licensed pilot, supported by eight cabin boys and three pageboys. The personnel were mixed in age and nationality: excavated human teeth derive from both a ten-year-old child and an adult, while two wooden spinning rods are a type of tool typically used by women. Two greenstone whetstones and a *labret* (lip adornment) hint at her ethnicity as possibly native South American or Mesoamerican. One can only speculate whether one of the ship's merchants was sailing home with a native slave, or perhaps even an Indian wife.

The 64 pieces of tortoiseshell on the Tortugas ship betray an unusual culinary delight that broke the monotony of dining. According to the English missionary Thomas Gage, who worked in the Americas between 1614/15 and 1637,

ABOVE LEFT Drilled Venezuelan pearls from the Tortugas wreck.

BELOW Half of a gold finger bar with nine stamps: five *quinto* tax stamps, three 21-carat purity stamps, and one 'EN RADA' stamp. This features conjoined letters representing Penaranda, a family that controlled the Colombian gold quarry.





Spanish ships returning to Seville craved tortoise meat, which they 'boiled with a little garlic, and I have heard them say that to them it tasted as well as any veal'. An industrious crew member may have found a way to cash in on his dinner. Both unworked shell from Hawksbill sea turtles and finished delousing combs and cases were excavated from the Tortugas ship, perhaps representing a rare snapshot of a shipboard craft practised in the idle hours.

Analysis of 165 bones in 2011 by Dr Philip Armitage has intensified the technicolour picture of shipboard life. Pigs dominated 40% of the faunal assemblage, and the presence of teeth point to the transport of live animals. Sheep and goat accounted for 13.9% and domestic fowl for 6.2% of this total.

Once again, it is single finds recovered thanks to the project's underwater sieving capability that proved the most unexpected. The right and left lower jawbones of the ship's cat have been detected, as have the first parrot bones ever discovered from any colonial-period shipwreck. Dr Armitage and Dr Joanne Cooper from the Natural History Museum have speculated that the tarsometatarsus and femur from a blue-headed parrot were part of a small cargo of rare birds.

A disturbing 32.3% of the animal bones were black rats, a discovery that illuminates an infamous problem of 1622. Aboard the homeward-bound *Nuestra Señora de la Candelaria*, the Spanish Carmelite monk Antonio Vázquez de Espinosa vividly recounted an invasion that overtook his ship. At Havana, rats were found to have devoured flour, hard tack, chickpeas, beans, and meat. Even



ABOVE A brass figurative medallion depicting the Virgin Mary and Jesus on one side, and on the reverse a single figure plus the inscription 'SANTA CATARI--' and 'ROMA'. (Height: 2.9cm/1.14in.)

though over a thousand were killed in port, another 3,000 rats overran the ship on the high seas. The *Rattus rattus* from the Tortugas ship added pestilence to the misfortune that beset the *Buen Jesús* and other fleet vessels in 1622.

The archaeology of the Tortugas shipwreck juxtaposes an unusual array of people and paraphernalia. Transporting gold and silver payment for the outward-bound cargo, and newly stowed pearls glittering above tobacco leaves, the *Buen Jesús* headed for the infamously malevolent Straits of Florida – and its final gamble with nature.

While a possible native Indian woman spun cotton and a member of the crew licked turtle meat from his lips as he carved lice combs and cases, a caged consignment of blue-headed parrots

ABOVE LEFT Animal bones, including the jawbone from the ship's cat (MIDDLE), recovered from the Tortugas shipwreck, and (RIGHT) comb fragment, lice combs, and cases from Hawksbill marine turtle shells.

squawked in the captain's cabin under the beady gaze of the ship's cat. Rats ran amok under foot.

On the basis of the highly limited human remains (restricted to a few teeth), the majority of the ship's company jumped into the abyss as disaster struck and the bell sounded its final fury.

A tragedy for the shipwrecked sailors and their families, 1622 was an economic catastrophe for King Philip IV of Spain. Riddled with enormous debt, rampant military expenditure, and 300% inflation since the turn of the century, the sinking of the royal treasure fleet off the Florida Keys marked the beginning of the end of the Golden Age of Spain.

Twenty years of research into the *Buen Jesús y Nuestra Señora del Rosario*, based on the world's first deep-sea dig, has brought to life an echo of a real world just as incredible as Robert Louis Stevenson's fictional *Treasure Island*. ▣

FURTHER INFORMATION

The permanent Tortugas shipwreck artefact collection and archive, owned and curated by Odyssey Marine Exploration, is available for study in Tampa, Florida. The first set of scientific reports on the shipwreck is available at www.shipwreck.net/publications.php

SOURCE Sean Kingsley, Director of Wreck Watch International. Ellen Gerth, Curator for Odyssey Marine Exploration.