THE ANALYSIS AND CONSERVATION

OF TWO 18-POUNDER CARRONADES

FROM THE U.S. NAVY SCHOONER *SHARK*

A Thesis

by

BRENNAN P. BAJDEK

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

MASTER OF ARTS

May 2012

Major Subject: Anthropology

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Approved by:

Chair of Committee,	Donny L. Hamilton
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ABSTRACT

The Analysis and Conservation of Two 18-Pounder Carronades

From the U.S. Navy Schooner *Shark.* (May 2012)

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Chair of Advisory Committee: Dr. Donny L. Hamilton

In February of 2008, two 18-pounder carronades were discovered off the Oregon coast near Arch Cape in Clatsop County. In addition to the carronades, several associated artifacts were collected from the site, including lengths of chain, a heavy iron wedge and a mooring shackle. The carronades and associated artifacts were transported to Texas A&M University's Conservation Research Laboratory for long-term preservation and conservation.

While the primary objective of this thesis is to detail the various methods used in conserving the Arch Cape artifact assemblage, the work also serves as an analysis of the carronades themselves. The design and caliber of the guns as well as historic accounts suggest the carronades are associated with *Shark*, a U.S. Navy schooner built at the Washington Navy Yard in 1821. During its 25-year career, *Shark* spent 18 years operating in the Atlantic Ocean suppressing piracy in the West Indies and the slave trade off the western coast of Africa. The schooner was also stationed in the Mediterranean Sea and the Pacific Ocean before a final survey in the Oregon Territory in 1846 resulted in its loss in the Columbia River.

It was reported that part of *Shark*'s wreckage with three attached carronades came ashore south of Hug Point. In January 1898, a winter storm revealed one of the carronades, which was recovered, along with the schooner's capstan, a cleat and a chock. The discovery of the pair of carronades in 2008 is strong evidence that these, along with the carronade recovered in 1898, are the three guns attributed to USS *Shark*'s wreckage.

This thesis will also analyze indentifying features on the carronades, such as maker's marks and serial numbers, and explore the origins of the guns, determining how they came to be on board the American schooner by referring to records such as the Woolwich proof books and armament lists.

The harsh conditions of the coastal environment affect the assemblage in a number of ways. While much of the metal of the assemblage is stable and can be treated using electrolysis, the delicate organic materials must undergo specific treatments. Since these organic artifacts were treated primarily with silicone oil, the thesis will compare some of the final results of using this polymer passivation technology with different materials, such as wood, leather and cordage.

Finally, in addition to detailing the conservation of the assemblage, this thesis describe the reverse engineering required to disassemble the carronades and gun carriages.

Dedicated to my mother and father.

Their love and support have been invaluable to me.

ACKNOWLEDGEMENTS

The aspiration to enter the field of archaeology came at a young age and through my years of exploring that childhood fascination, I thank my parents, Patrick and Susan Bajdek, for their continued support, patience and generosity, without which, none of this would have been possible. My pursuit of the discipline began as an undergraduate at the University of Texas at Austin and it was Kim Shelton who truly solidified my desire to pursue archaeology. The field school under her direction in Greece presented an opportunity for practical and academic knowledge both in the field and the museum.

During my four-years as a professional archaeologist in Cultural Resource Management with such companies as TRC Environmental, I made several important acquaintances, and would like to thank Paul Matchen, Kendra Luedecke DuBois and Gregory Sundborg for their time and wisdom.

I would like to thank my colleagues and the professors in the Nautical Archaeology Department, all of whom made my graduate education at Texas A&M University a truly enriching experience. I would also like to acknowledge Donny Hamilton for showing me that nautical archaeology is not all about boats, and thank him for giving me the opportunity to discover that with my graduate assistantship at the Conservation Research Laboratory. I am forever grateful for the knowledge, practicality and skill imparted to me at CRL by Jim Jobling, Helen DeWolf and John Hamilton. Their guidance and expertise in archaeological conservation made my thesis work possible.

TABLE OF CONTENTS

1. INTRODUCTION:

THE LEGACY OF USS *SHARK* (1821-1846)

At the time of its sinking in September 1846, the schooner USS *Shark* had served the United States Navy for more than two decades, battling piracy, suppressing slavery and protecting American mercantile interests at sea. *Shark*'s career was defined by its achievements in Africa, the West Indies, the Mediterranean, and the Pacific, and the diverse roles it played were integral to the U.S. Navy's post-1812 activities. The schooner's final mission to Oregon in 1846 brought to the Pacific Northwest both that legacy and the direct presence of the United States government, at a time when the region became what Neil M. Howison would call the "undisputed and purely American Territory of Oregon."[1] It is, however, the experiences of *Shark* prior to its arrival in the Oregon Territory that offer a textured portrait of mid-nineteenth century American naval history.

In the wake of the War of 1812, a nationalistic revolution in Latin America created an unstable diplomatic and commercial situation. After 1815, colonies began to declare their independence from Spain. Possessing no formal navies, these colonies employed the services of privateers, who would come to disregard the fine line between privateer and pirate. It was estimated that fifteen to twenty thousand American sailors became privateers after the War of 1812, when the Navy no longer

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This thesis follows the style of the *American Journal Archaeology.*

[1] Howison MSS 929.

required their services.[2] Many American merchant ships found themselves caught in the middle of this revolution, subject to attack and seizure by both privateers and Spanish ships alike. Between 1815 and 1822, more than 3,000 piratical acts were committed in the Caribbean.[3]

The United States Congress reacted on 3 March 1819 by passing legislation that promoted the suppression of piracy in the West Indies, granting naval officers the authority to seize any ship suspected of piracy. The Board of Navy Commissioners, however, noted that most of the naval vessels as well as foreign vessels captured during the War of 1812 were either worn out or unfit for hunting pirates due to their great draft of water. Congress, by act of 15 May 1820, appropriated $60,000 for the construction of five topsail schooners of no more than 12 guns each.[4]

The Government Pirate Hunters

The first of these ships, USS *Grampus*, was based on a design by Henry Eckford of New York and built in 1821 at the Washington Navy Yard under the supervision of Naval Constructer William Doughty. The other four sister ships were designed by Doughty himself, based on a Baltimore Clipper design; 26 m between the perpendiculars, 7.59 m molded beam, 3.14 m depth of hold and a displacement of 198 tons.[5] From his lines (fig. 1), *Alligator* was built in Boston,

[2] Allen 1929, 243; Bradlee 1922.
[3] Beehler 1890, 2.
[4] American State Papers, I, 616; U. S. Stat., III, 596
[5] Canney 2001, 177-82; Chapelle 1998, 324.

Dolphin in Philadelphia, *Porpoise* in Portsmouth and *Shark* in Washington. The original armament of these ships consisted of an 18-pounder long gun on a pivot, with ten 6-pounder short guns at ports amidships. By the time *Shark* was active in the West Indies, however, the armament had changed to ten 18-pounder carronades and two long 9-pounders. Over the ensuing decades, the configuration changed several more times. Upon joining the Pacific Squadron in 1839, for example, *Shark* was armed with two long 9-pounders and eight 24-pounder carronades.[6] In 1913, a published account of Burr Osborn, the last survivor of *Shark*'s wrecking, indicated that the 24-pounder carronades had been replaced with 32-pounder carronades at the time *Shark* reached the Oregon Territory.[7]

Doughty's sail plan (fig. 2) expanded the standard Baltimore clipper design. While consistent with the traditional two masts and fore-and-aft sail plan, his design incorporated three headsails forward of the foremast. Attached behind the foremast was a loose-footed gaff foresail. Directly above the foresail was a main topmast staysail. The sail plan aft had a similar scheme. Attached to the mainmast was the large mainsail with a gaff and boom, which featured four bands of horizontal reef points. Doughty also included a trapezoidal studding sail that could be raised past the mainsail's after-edge for added speed when encountering lighter winds. In addition, Doughty placed a gaff topsail above the mainsail. Several square sails shared the foremast, including a forecourse that exceeded the mainsail in size, a fore topsail and a fore topgallant. Each of these sails also possessed studding sails, which would flank the

[6] Canney 2001, 179; Chapelle 1998, 334.
[7] Himes 1913, 355-65.

square sails on small booms and allow the ship to take advantage of favorable winds.[8]

The new schooners represented a lighter and swifter naval design, capable of both pursing and overtaking pirate vessels in the Caribbean, as well as maneuvering in and out of the many inlets, shoals and islands that provided pirates with safe harbor. Though fast, the schooners, like many of Doughty's smaller designs, proved to be a little too full aft to be extremely swift. Their extensive rigs and heavy foremasts made them precarious when driven hard under full sail, with a tendency for the ship to lower its bow and dive under. In addition, the ship required a complement of seventy sailors to function, a number small in comparison to the Navy's larger vessels but considerable when compared to mercantile schooners of similar dimensions.[9]

The Suppression of Slavery in Western Africa

While *Shark*'s original purpose was to battle piracy in the Caribbean, its first assignment was to suppress the slave trade in Africa. The United States Congress banned the importation of slaves in 1808, but trade continued and by 1819, Congress authorized U.S. Naval vessels to apprehend American slave traders and help resettle any captured slaves back in Africa. On 17 May 1821, *Shark* was launched at the Washington Navy Yard and soon began a 162-day cruise to the coast of Africa under the command of Lieutenant Matthew C. Perry.[10] This would mark Perry's first independent command.

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[8] Chapelle 1998, 326-30; Canney 2001; 177-82.
[9] Morison 1967, 67.
[10] Matthew M148, R26; *Niles Weekly Register*, 26 May 1821.

Prior to its departure for the African coast, *Shark* was in New York to receive Dr. Eli Ayers of the American Colonization Society. In a letter to his old commodore, John Rodgers, Perry described *Shark*'s performance during its initial sailing. Against strong winds "the Schooner has behaved in a manner highly satisfactory, not only as regards her sailing, but the ease with which she carries her guns, her stiffness, her buoyancy, are equally subject of admiration among the numerous vessels fallen in with during our passage."[11] On 26 October, *Shark* delivered Ayres to Sierra Leone, where, under direct orders from President James Monroe, he was to locate and acquire territory for a colony of former slaves and free black families.[12]

After landing Ayres, *Shark* patrolled the western coast of Africa in search of American slavers. According to the *Boston Recorder*, it was "ascertained that there are no American citizens at present engaged in the traffic."[13] Perry and his crew, however, boarded a number of ships flying French and Portuguese flags and the conditions aboard were often frightening.[14] On 10 November, *Shark* chased down a French schooner, *Caroline,* commanded by Victor Ruinet, with a cargo of 133 slaves bound for Martinique. Midshipman William Lynch of *Shark* commented on the condition of the slaves in his personal account, stating that they were so emaciated that "they resembled so many Egyptian mummies half-awakened into life."[15] Without the authority to capture *Caroline,* Perry permitted Ruinet to proceed, only after forcing the French captain to sign an oath in which he and his crew vowed to

[11] Morison 1967, 69.
[12] Alexander 1846, 167
[13] *Boston Recorder*, 26 January 1822.
[14] *Niles' Weekly Register*, 26 January 1822.
[15] Lynch 1851, 149.

never again engage in the slave trade along the coast of Africa.[16]

In his first year of command, Perry was determined to run an efficient and highly disciplined ship. Midshipman Lynch noted in his account that *Shark* was a taut but not very content ship under the strictly enforced "Rodgers system."[17] Established by Commodore John Rodgers, the widely used discipline system sought to keep the crews healthy, obedient and hard at work. Rules and regulations were to be strictly implemented, crews were to be engaged in constant work duties, corporal punishment or flogging was to be used judiciously, and shore leave was to be kept to an absolute minimum.[18]

The West Indies Squadron

In February 1822, *Shark* joined the newly formed West Indies Squadron under Commodore James Biddle, where it would spend the next eleven years patrolling the Caribbean for pirates, with the occasional assignments to deliver supplies and personnel to the coast of Africa.[19] On 15 May 1822, pirates operating

[16] Morison 1967, 74.
[17] Lynch 1851, 139-40.
[18] Schroeder 2001, 31.
[19] *Niles Weekly Register*, December 21, 1822, February 1, and 15, 1823, and March 20, 1823. On the *Shark*'s cruises in the Caribbean and Atlantic, see *Niles Weekly Register*, April 17, 1824, June 12, 1824, December 4, 1824, July 9, 1825, March 11, 1826, September 2, 1826, December 2, 1826, December 16, 1826, August 4, 1827, July 19, 1828, August 2, 1828, September 17, 1831, January 21, 1832, and February 11, 1832; *Christian Register*, October 15, 1824, February 11, 1832; *Cohen's Lottery Gazette and Register*, January 14, 1825; *Saturday Evening Post*, September 9, 1826, April 21, 1827, August 29, 1829; *Boston Recorder and Religious Telegraph*, August 22, 1828; *Trumpet and Universalist Magazine*, October 4, 1828; *The Episcopal Watchman*, November 29, 1828; *New York Sentinel and Working Man's Advocate*, August 14, 1830; *The Military and Naval Magazine of the United States*, March 1833 , and May 1833.

out of Havana seized the American brig *Aurilla* in the Caribbean, robbing, beating and raping many of its passengers. The schooner *Shark* was the first vessel to encounter *Aurilla* after the incident, and the crew reported the terrible news to the American public.[20] In response, Congress quickly appropriated funding for an expedition for the capture of these "villains", in which *Shark* would play a key role in its operations, escorting American vessels and battling pirates. It was during this cruise when *Shark* encountered a waterspout and a squall, the subject of one of the only known paintings of the schooner (fig. 3).

Perry's first success in Caribbean waters occurred off Tampico, Mexico, in May 1822 when he chased a suspicious-looking schooner ashore. *Shark* also operated off the north coast of Cuba later that year, accompanied by *Grampus*. At Sagua la Grande, a notorious pirate rendezvous, they captured an outlaw schooner in a battle Lynch describes in his account. Three days later, the two American schooners pursued another pirate vessel, *Bandera de Sangre.* According to Lynch, the vessel was commanded by "the most desperate and remorseless of ruffians."[21] His men, however, were not as ruthless and fled after a few unsuccessful shots. Both captured schooners and three prisoners were sent to the United States for adjudication.

Under Perry's command, *Shark* was also involved in the formal possession of Key West, Florida on 25 March 1822, known at that time as Thompson's Island in honor of the Secretary of the Navy.[22] Perry would remain in command of the

[20] *Niles' Weekly Register*, 22 June 1822.
[21] For detailed accounts of *Shark*'s encounter with the pirate vessels, see Lynch 1851, 223-45.

schooner until August 1823, when he was relieved by Lieutenant Thomas Holdup Stevens, an old friend of Perry's elder brother Oliver. Perry himself was reassigned to the Brooklyn Navy Yard.

In July 1827, under the command of Lieutenant Isaac McKeever, *Shark* sailed from New York to the Newfoundland fisheries, safeguarding American interests in the north before returning to duty in the Caribbean.[23] Along with the schooner's policing and escorting duties, it also facilitated scientific research. In 1831, naturalist John James Audubon joined *Shark* in St. Augustine, Florida, accompanying the officers and crew for several weeks. While aboard *Shark*, Audubon observed snowy pelicans, cormorants, fish crows, young eagles and herons, and he collected several alligators for the purpose of experimentation.[24]

The Mediterranean and Pacific Squadrons

In 1833, *Shark* was relieved of its duties in the West Indies by the schooner *Experiment,* and was reassigned to the Navy's Mediterranean Squadron for the protection of American mercantile interests.[25] During its time with the squadron, *Shark* sailed though the Hellespont to Constantinople under the command of Lieutenant George F. Pearson, an action in defiance of a treaty between Russia and Turkey that forbade the passage of vessels of war without permission. This action

[22] *Niles Weekly Register*, 11 May 1822.
[23] American State Papers III, 1827, 58.
[24] Audubon 1894, 210.
[25] *Military and Naval Magazine of the United States*, February 1834.

ignited an international incident widely covered by the American and European press and brought the schooner *Shark* to worldwide prominence. The British press claimed that *Shark*'s action was a demonstration on order of the United States government, intended to parade American disdain for the treaty.[26]

Pearson later defended the action in a published letter, stating that the commanding pasha had allowed *Shark* to proceed as an exception to standard protocol, as the ailing Commodore David Porter was on board at the time. "It was in compliment to Commodore Porter altogether that they let us pass," Pearson explained, "and that only on account of his very bad health."[27] *Shark* returned to the United States in March 1838 and underwent its tenth round of repairs at the Norfolk Navy Yard in Virginia. In an exposé by the *Southern Literary Messenger*, the repairs reportedly cost "$18,000 for materials, and $27,000 for labor", almost twice the cost of the schooner's original construction in 1821, although the U.S. Senate stated that *Shark* was practically rebuilt in the process.[28] This was considered an "administrative rebuild". Congress did not authorize the building of a new ship so the U.S. Navy produced a new one by "rebuilding" the old one.[29]

On 22 July 1839, *Shark* departed Hampton Roads under the command of Abraham Bigelow, bound for the Pacific Ocean and the Navy's Pacific Squadron. Instead of doubling Cape Horn, Bigelow sailed the schooner through one of the inner passages known as the Strait of Magellan. The excursion lasted a harrowing thirty-three-

[26] *Army and Navy Chronicle*, 3 August 1837.
[27] *Army and Navy Chronicle*, 14 September 1837.
[28] *Southern Literary Messenger*, May and June 1841.
[29] Chapelle 1998, 115-116.

and-a half days, with gale-force winds and harsh winter conditions. It also marked the first time in history that a U.S Naval vessel of war passed through the strait from east to west. In Bigelow's subsequent report, he praised *Shark*, stating "no vessel could be better calculated to pass through the strait than the Shark."[30]

Shark patrolled with the squadron in the Pacific Ocean, largely between the coasts of North and South America and the Hawaiian Islands. By the early 1840s, the U.S. Navy had become increasingly interested in the area, and the end of the war between Chile and Peru helped increase the number of American merchant vessels in the Pacific. Communication and supply needs, as well as the threat of conflict between Mexico and Great Britain, led the Pacific Squadron to primarily patrol the ocean's eastern waters.[31] The Secretary of the Navy noted in December 1841 that "all who witnessed the operations of the *Shark* were inspired with increased respect for the American flag."[32]

Mission in the Oregon Territory

The territory known as the Oregon Country had been jointly occupied by the United States and Great Britain since 1818. In 1825, the Hudson's Bay Company established its headquarters on the north bank of the Columbia River, calling it Fort Vancouver. The location defined the Columbia River as the Hudson's Bay

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[30] *Army and Navy Chronicle*, 30 April 1840.
[31] On the *Shark*'s activities in the Pacific Ocean, see *Niles' National Register*, July 27, 1839, May 16, 1840; Coggeshall 1858, 399–401; Kell 1900, 17–18
[32] *Niles' National Register*, 25 December 1841.

Company's preferred international boundary. The post prospered and served as the headquarters and supply depot for the Hudson's Bay Company's operations in its Columbia Department, in Hawaii and also as the coastal maritime trading center for the Pacific Coast.[33]

By 1846, a confluence of several factors began to splinter established British interests north of Columbia, bringing the boundary issue to the forefront. A spirit of 'manifest destiny' continued to rise in the United States. President James K. Polk's new nationalistic refrain of "54-40 or Fight!" called for the annexation of the Oregon Country up to the boundary of Russian America and Polk was determined to claim the whole of Oregon for the United States. Conflict soon began between American settlers and the Hudson's Bay Company over control of the land, and it was the general opinion of the press that if no compromise over the Oregon boundary line could be effected, war between Great Britain and the United States was inevitable.[34]

The British had overwhelming naval supremacy over the United States, with nine Royal Navy vessels of war in the northeastern Pacific, three of which were stationed off the Pacific Northwest coast. The sloop-of-war HMS *Modeste* was one of these, anchored at Fort Vancouver in 1844 after having been dispatched to the lower Columbia to protect British interests and keep a close watch over the United States.[35] The other two vessels on the coast were the frigate HMS *Fisguard* and the armed steamer HMS *Cormorant* in Puget Sound.[36]

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[33] On Fort Vancouver, see Hussey 1962.
[34] *Oregon Spectator*, 3 September 1846.
[35] *Oregon Historical Quarterly* 61, 408-36.
[36] Howison 1846, 3-4.

In April 1846, Commodore John Drake Sloat, in command of the U.S. Navy's Pacific Squadron, ordered the schooner *Shark* to Honolulu for repairs, re-coppering and provisions in preparation for a short mission to the Oregon Country. *Shark*'s commander, Lieutenant Neil M. Howison, was instructed to ascertain the number of American and British settlers, the number of annual arrivals on both sides, as well as the prosperity of the territory. Furthermore, he was to rally Americans with a display of the flag, distributing 500 copies of President Polk's message as well as copies of the *Washington Union,* an organ of Polk's administration. As a precaution, Howison was also to implement the order to supply rifles to the American settlers.[37]

Howison and the schooner *Shark* entered the Columbia River on 18 July 1846 and within twenty minutes, *Shark* had run aground on Chinook Shoal, where it remained several hours "thumping severely".[38] On the evening of 24 July, the schooner reached Fort Vancouver, nearly 100 miles (161 km) upriver, startling the Hudson's Bay Company officers, who had not anticipated the visit. *Shark* was not alone at the post's wharf, however, as three Hudson's Bay Company vessels were anchored, as well as HMS *Modeste.* The Royal Navy's sloop-of-war greatly outsized *Shark*, measuring 36.58 m with a displacement of 568 tons. It mounted eighteen guns – two 32-pound long guns and sixteen 32-pounder carronades. It also carried a complement of 90 men, including a detachment of Royal Marines.[39]

[37] Merk 1995, 67-8.
[38] Howison 1846, 2.
[39] *Oregon Historical Quarterly* 61, 408-36.

Regarding the men of the Royal Navy, Howison observed that "the English officers used every gentlemanly caution to reconcile our countrymen to their presence, but no really good feelings existed. Indeed, there could never be congeniality between persons so entirely dissimilar as an American frontier man and a British naval officer."[40] Howison recognized his role as a peacekeeper and not a warmonger, and it was his duty to bring important news to the country regarding the U.S. government's efforts to reach a peaceful resolution to the Oregon boundary dispute.

The American settlers were not alone in their welcome of *Shark*. Howison reported that the Hudson's Bay Company "expressed to me their fervent hopes that the United States would keep a vessel of war in the river."[41] Howison spent the majority of his time in Oregon exploring and studying the area. At Oregon City, he was received by George Abernethy, the provisional governor, and for ten days, Abernethy toured Howison throughout the Willamette Valley on horseback. Howison later explored the Tualatin Plains and Chehalem Valley, meeting American immigrants and collecting vital information from the area.[42] His contact was not limited to political, mercantile and nautical information; it also included an extensive evaluation of the area's agricultural potential. With *Shark* permitted to remain only a short time in the Oregon Country, Howison also dispatched his officers to gather local intelligence.

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[40] Howison, 1846, 4.
[41] Howison 1846, 19.
[42] Howison MSS 929.

While Howison spent much of his thirty days in the Willamette Valley, *Shark* and the majority of its crew remained at Fort Vancouver. The post served as the heart of the U.S. Navy's activities and supplies in the Oregon Territory while Howison's explorations extended out to the wider region. The officers and crew of the schooner maintained a cordial relationship with the employees of the Hudson's Bay Company and members of the Royal Navy. The nine officers of *Shark* dined with *Modeste*'s officers on a number of occasions. When *Shark* became grounded at the mouth of the Willamette River during a visit to Oregon City and Willamette Falls, *Modeste*'s officers sent a scow and bateau in support.[43]

In turn, the crew of *Shark* assisted the Hudson's Bay Company and Royal Navy after a fire broke out near the fort. Thomas Lowe, a clerk with Hudson's Bay Company, recorded that on 18 August, "fire broke out this forenoon…by which one house was burned and two others torn down to prevent it from spreading. Men were sent both from the Modeste and Shark with buckets to assist in extinguishing the flames."[44]

The appeal of opportunity and high wages in the blossoming Williamette Valley settlements led to the desertion of ten *Shark* crewmen in August 1846. In one of the Oregon Territory's first printed circulars (fig. 4), Howison publicized a reward of $30 for their return. His descriptions of deserters such as John Tice - "aged about 25, 5 feet 8 or 9 inches high, dark hair and eyes, pretends to be a blacksmith, but is a bungler at that or any other business he undertakes" - provides rare personal details about the *Shark*'s crew.[45]

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[43] Lowe 1846, 27.
[44] Lowe 1846, 28.

The Fate of USS *Shark*

As August drew to an end, so too did *Shark*'s official assignment in the Oregon Territory and the schooner began preparing for departure in early September. Howison believed *Shark*'s presence in the Oregon Territory had been a success and that they had played an important role as representatives of the United States government in the territory. There is no indication from Howison's correspondence that he was aware of *Shark*'s next assignment. In his memoir, Commodore Robert F. Stockton wrote that "as soon as the schooner Shark returns from the Columbia River, I will send her on a cruise for the protection of our whaleships."[46]

Unable to obtain the services of a river pilot, *Shark* departed Fort Vancouver on 23 August 1846, a decision that caused Howison much consternation: "I had not, nor could I procure a map giving even an outline of the general direction of the stream."[47] Strong winds hammered *Shark* and a three-day delay in assisting the grounded barque *Toulon* just below Fort Vancouver further postponed the schooner's arrival at the mouth of the Columbia River. *Shark* reached the mouth of the river on September 8, anchoring at Baker Bay in order to observe the sandbar's change in

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[45] Shark Broadside, 1846, Document no. 13,010, Oregon State Archives, Salem. The deserters include John Tice, Alexander Stevens, John P. Iglehart, George Rathbun, John Whitesell, and Andrew Tilton. In a letter to Abernethy on September 11, Howison lists seven deserters still at large (John Tice, George Rathbun, Tilton, Isaac Stevens, George Buckman, Peter Hollinton, and Jackson). The names and descriptions included suggest that three of the initial deserters - Alexander Stevens, Iglehart, and Whitesell - may have been recovered or otherwise accounted for and that four more had deserted.
See Abernethy Correspondence.

[46] Stockton 1856, A2.

[47] Howison 1846, 5.

position since the last survey was made, as well as complete any final preparations prior to crossing it.

On 10 September, *Shark* cleared Cape Disappointment, hauling on the wind to pass out to sea. The tide forced the schooner into the south breakers. Howison tacked the ship to northward but the attempt was unsuccessful, and as a result, the racing tide turned *Shark*'s bow directly at the breakers and the sands on the bar. Tacking *Shark* to the south, Howison found the current forcing him dangerously to leeward. The anchor was dropped in an effort to hold the schooner but the chain snapped "like a packthread."[48]

Shark stood northward but was losing even more ground to the swift tide. Tacking to the west, a sudden favorable change of wind excited hopes of passing safely out to sea. That hope, however, was lost as the schooner violently struck on the sandbar and held fast. As a last effort, Howison spread a press of sail to try to power the schooner in the direction of the rapid tide and though the bow swung around in that direction, it would not budge and soon broadside waves began to break over *Shark*. Further efforts to save *Shark* were abandoned and Howison turned his attention to saving his crew.

Shark's four boats were ordered over the side. The small gig was the first in the water and it was loaded with the sick, the doctor and the purser, who was laden with the schooner's papers, charts and valuables, including an iron box with $4,000 in gold. While moving away from the schooner, however, a huge breaker dashed the

[48] Howison MSS 929.

gig against the side of the ship and upon the flukes of the anchor, staving it in and causing it to sink. Lines were tossed over the side and the men were hauled aboard, while *Shark*'s papers and valuables went down with the gig.[49]

The pounding surf prevented the crew from lowering the other three boats and Howison realized that the only recourse remaining was to await the abatement of the breakers, which were rolling upon and breaking over the schooner. Captain Jotham Parsons of the American bark *Mariposa* reported that "*Shark* fired minute guns all night, and I answered them from my ship."[50] By 11:00 p.m., *Shark* had five feet (1.5 m) of water in the hold. The tide, however, had shifted and the violent waters subsided, allowing Howison and his men to lower the remaining boats and dispatch all but 24 crew members to Point Adams, on the Clatsop shore. Lieutenant W.S. Schenck and Midshipman Hunter Davidson remained aboard *Shark* with Howison.

To help the schooner hold together until the rescue boats returned, the masts were cut away. By 1:00 a.m., *Shark* was completely waterlogged and the only inhabitable spots on the schooner were the bowsprit and the tops of the two quarterdeck houses. There, Howison and his men remained through the night until sunrise, when the boats returned and delivered the remaining crew to safety. *Shark* was a complete loss but its crew survived the harrowing ordeal. "The conduct of the Officers and men during the whole of this trying occasion was most praiseworthy," Howison reported to Congress, "and to their cool exertions and orderly manner of carrying on the duty may be principally ascribed the preservation of our lives."[51]

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[49] Howison MSS 929; Howison 1846, 5–6; Himes 1913, 355–64.
[50] *The Polynesian*, 10 October 1846.

On the Clatsop shore, the shivering officers and crew of *Shark* lit a fire. Burr Osborn, a member of the schooner's crew, later recalled that "the first fire that was built was made out of the wreck of the sloop of war *Peacock*, U.S.N."[52] *Peacock* was shipwrecked in the Columbia River five years earlier. Captain Thomas Baille of HMS *Modeste* dispatched his pinnace to supply *Shark*'s crew with coffee, tea, tobacco and bread.[53] In addition, the Hudson's Bay Company made their resources available to Howison. Upon his return to Fort Vancouver, Howison learned that his "wants of every kind were immediately supplied by the Hudson's Bay Company and although cash was at Oregon city . . . the company furnished all my requisitions, whether for cash or clothing."[54] The support by both parties is significant considering their negative perception of Howison's visit to the Oregon Territory.

Howison sought to charter a vessel from Hudson's Bay Company to transport his men from Astoria to San Francisco, California, but none were available. While waiting for a vessel, the officers and crew spent several months scouring the mouth of the Columbia River for any last vestiges of *Shark.* Spars, decking and other structural parts washed ashore along 75 miles (120 km) of coastline, including the heel of the bowsprit with two kedge anchors attached, but nothing was salvaged. E.W. Wright indicates in his historical account that a large portion of the wreck came ashore near Tillamook Head but was "torn apart by John Hobson and few others in that neighborhood."[55] Wright also mentions that one of *Shark*'s guns was

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[51] Howison 1846, 5-6.
[52] Himes 1913, 360.
[53] *Oregon Historical Society,* December 1960
[54] Howison 1846, 5.
[55] Wright 1895, 22.

salvaged and brought to Astoria.

In October 1846, Howison learned from the returning *Toulon* that the boundary was settled at the forty-ninth parallel and thus, became one of the first to receive the news in the Oregon Territory. He then began to privately dispatch diplomatic advice to Governor Abernethy. By November, Howison secured the use of the Hudson Bay's Company's *Cadboro*, a schooner even smaller than *Shark*, but had to wait six weeks in Baker Bay for the weather to clear enough to allow for a safe crossing of the bar on 18 January 1847. Before his departure, Howison presented Governor Abernethy with *Shark*'s flag, one of the only items salvaged from the schooner. According to Howison, it was "the first United States flag to wave over the undisputed and purely American Territory of Oregon."[56]

The history of the schooner *Shark* is a fascinating global narrative, ranging from its construction and outfitting in Washington D.C. to its lengthy service on the western coast of Africa, to the Caribbean, to the Mediterranean and through the Straits of Magellan to the Pacific Ocean and the Columbia River in Oregon. Its story chronicles the formative years of the United States Navy in the wake of the War of 1812. USS *Shark*'s tour of duty was much more successful than its sister ships. *Alligator* wrecked off the coast of what is now Miami, Florida in 1823, *Porpoise* wrecked in the Caribbean in 1833, and *Dolphin*, the first of the schooners launched, was found to be rotten in 1835 and dismantled.

[56] Howison MSS 929.

2. AFTER THE WRECK OF *SHARK*:

THE REDISCOVERY OF THE 18-POUNDER CARRONADES

In the wake of the schooner's loss on Clatsop Spit, officers and men of USS *Shark* explored the beaches from Point Adams southward for any articles of the wreck that could be salvaged but "they seldom found a spar or plank from her which the Indians had not already visited and robbed of its copper and iron fastenings."[57] In October 1846, Howison received information through a group of local Clatsop Indians that part of the hull, with guns upon it, had come ashore below Tillamook Head, about 20 or 30 miles (32 to 48 km) south of Point Adams, in an area now known as Arch Cape (fig. 5).

Howison dispatched Midshipman T.J. Simes to the location and Simes reported that "the deck between the mainmast and forehatch, with an equal length of the starboard broadside planking above the wales, had been stranded, and that three of the carronades adhered to this portion of the wreck."[58] An early report from the *Oregon Spectator* stated that the three guns were 32-pounder carronades.[59] Simes managed to move one of the carronades above the high water mark but the other two were inaccessible due to the surf. Howison determined that the transportation of the carronades over the rough mountain trail was impractical and the decision was made to abandon the guns to the surf and sand. Although Howison related to Governor Abernathy the location of

[57] Howison 1846, 5.
[58] Howison 1846, 6.
[59] *Oregon Spectator*, 15 October 1846.

the carronades, with the hopes of sending a boat round in the summer months to collect them, the guns remained in Arch Cape for the next eight years.

The *Morning Star* of Tillamook

With the arrival of the first settlers into Tillamook County in 1851, the dairy industry of the area began to flourish and there was soon an abundance of butter and milk to take to the larger markets of Portland and Astoria.[60] Due to the remote location of the region, bordered by the Pacific Ocean to the west and the Coast Range to the east, these larger markets were difficult to reach without the often unreliable trading ships or the long wagon rides over rough roads. In the summer of 1854, the last small sloop sailed out of Tillamook Bay but was reported wrecked on Peacock Spit at the mouth of the Columbia River.

Instead of seeing their products go to waste, a group of desperate pioneers, which included Warren Vaughn, Charles Hendrickson, Peter Morgan and O.S. Thomas, met on 24 September 1854 with the intention of building a small trading schooner. The group set to work and from native Douglas fir and began cutting timbers for frames and planking.[61] There was, however, a dire shortage of iron.

John Hobson, a pioneer of Clatsop, informed the group of men of USS *Shark*'s demise in the mouth of the Columbia and that pieces of the deck and hull, all heavy with iron, had washed ashore on the beach of Arch Cape. The group reached Arch Cape on

[60] Orcutt 1951, 62.
[61] Marshall 1984, 77.

horseback and discovered many pieces of hardware that could be salvaged for their schooner. They packed only the useable iron, bolts, knees and nails from the wreckage – nearly all the brass fittings and copper bolts had been taken by earlier scavengers. The group left the carronades they saw where they lay at the mouth of a small creek near a hemlock tree.[62] This stream would subsequently be called “Shark Creek.”

A total of six trips with four packhorses were required to carry the iron loads on the trail over Neah-Kah-Nie Mountain, across the Nehalem River and south to Kilchis Point in Tillamook Bay – roughly 289 miles (465 km). The pioneers quickly built a small blacksmith’s shop and converted the left-over ship’s lumber into charcoal. A local settler by the name of Clark became the town’s blacksmith and began re-shaping *Shark*’s iron as needed. The rigging and sails for their new schooner were made from bolts of canvas, rope and blocks purchased for $10 from the Tillamook Indians, who had salvaged the materials from the 1851 wreck of the bark *Oriole* in Netarts Bay.[63] On 5 January 1855, the *Morning Star* of Tillamook, a two-masted schooner, was launched.

“Cannon” Beach

In 1891, James P. Austin moved to the location where the first carronade was supposed to have been left by Midshipman Simes in the creek south of Hug Point. After building the “Ocean View House”, Austin applied to establish a new post office,

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[62] Marshall 1984, 78.
[63] Marshall 1984, 79-80.

which he named "Cannon Beach."[64] He became the first postmaster of Cannon Beach on 29 May 1891. James had always been fascinated with the prospect of finding the carronade buried beneath the sand and he spent the remaining years of his life searching for it until his death on 7 May 1894.

A winter storm in January 1898 revealed one of the carronades on the beach in front of the town's post office. Mailcarrier George Luce of Nehalem discovered the gun embedded in the creek while on his regular route. Upon returning to Nehalem, Luce told John and Mary Gerritse about his find and they brought a team of horses to the location, where the carronade (fig. 6) was pulled from the sand, along with *Shark*'s capstan, a chock and a cleat.[65] The gun was no doubt the carronade Midshipman Simes had removed from *Shark*'s deck. The other two carronades were presumed to be still buried in the surf beyond access per Howison's 1846 report.

The wooden gun carriage for the carronade was not recovered, as it was likely still attached to the deck, and so a mounting had to be devised. Four large blocks of wood were improvised for the first mounting (fig. 7) and later, a second wood block mount was built, on which the carronade rested for many years (fig. 8).

The Future of the Carronade

By 1906, there was concern in the community for the proper care and preservation of the 18-pounder carronade. According to a newspaper article in the

[64] McArthur and McArthur 2003, 40.
[65] Miller 1954, 7.

Astoria Daily Budget, the carronade "has now been relegated to a corner of the barn, and unless some of the historical societies take charge of it, it will become lost sight of altogether. Some relic hunting vandal has already broken the cascabel off and carried it away."[66] In 1921, the carronade was mounted on a cement base and placed on the original site of the first Cannon Beach post office, along with the capstan, chock, cleat and some old iron chains from USS *Shark* (fig. 9). Some time after this date, however, the chock and cleat were stolen by vandals.

In January 1924, local and historical interest in the whereabouts of the two remaining carronades was renewed. James Burke and William Pickette of Seaside endeavored to locate the guns.[67] According to Burke, the location of the carronades was fairly well established in his mind, and with the aid of tools secured from the county court, he would burrow through the sands until the drills struck resistance. He believed the guns were still secured to the deck of the ill-fated schooner and he would file away the bolts that held the guns in place if necessary. There was no subsequent news of his success.

From 1898 until 1956, *Shark*'s 18-pounder carronade was located on private property, though two replicas of the gun were cast and mounted with plaques at the north and south entrances to Cannon Beach in 1952. Mel Goodin of Portland donated the original carronade and capstan to the public in 1956, and it was moved to an acre of land alongside U.S. Highway 101 (fig. 10). However, the cast iron artifacts were not only exposed to the harsh environmental conditions of the coast but their location in such

[66] *Astoria Daily Budget*, 28 August 1909.
[67] *Astoria Evening Budget*, 7 January 1924.

close proximity to the highway was an open invitation for vandalism. The deterioration of the artifacts raised public awareness of the need to better preserve the carronade and capstan and in April 1989, the pieces were moved to the Heritage Museum of Astoria in order to provide a more protective environment from weathering and potential vandalism.[68]

The carronade and capstan now reside at the Cannon Beach Historical Society. Until recently, the artifacts were kept outside where they continued to be adversely affected by the environment. The society, however, has built an enclosure for both pieces, which is suitable for short-term preservation. Years of exposure have left their mark on the gun and capstan (fig. 11) and a plan for the long-term conservation of the artifacts is undoubtedly necessary in order to ensure their future.

The Recovery of the Arch Cape Carronades

In the winter months, the Oregon coast often has severe storms with strong waves that pull sand from the shoreline and carry it into deeper waters to the north. During the summer, this process is reversed with currents and winds from the north bringing in water from the deep and replacing the sand that it removed earlier. In recent years, however, an unexplained change in storm and wave patterns is preventing the beach sands from replenishing.[69] As the winter storms continue to gnaw away at the shoreline, more and more evidence of historic shipwrecks is

[68] *The Daily Astorian*, 12 April 1989.
[69] Ross 2008, A7.

emerging.

After a winter storm in mid-February 2008, a father and daughter from Tualatin, Mike and Miranda Petrone, discovered one of the two remaining carronades while walking along the beach (fig. 12). Upon recognizing the shape of the carronade (henceforth referred to as Carronade A), they contacted representatives from the Cannon Beach Historical Society who, in turn, contacted the town's mayor to confirm the discovery.[70] News of the carronade attracted many people to the Arch Cape beach and State Park personnel became worried that the gun or other associated artifacts would Be carried off during low tide by people wanting to obtain a piece of Oregon's past.

A second carronade (henceforth referred to as Carronade B) was located further up the beach from Carronade A by Tualatin resident, Sharisse Repp. Oregon Parks and Recreation Department (OPRD) Supervisor Gary McDaniel confirmed the find and a decision was made to haul the Carronade A further up the beach to an area near Carronade B so that retrieval efforts could more easily be conducted. A chain was secured around Carronade A and the gun hauled up the beach by a small John Deere tractor (fig. 13). State Archaeologist Dennis Griffin along with staff members from Nehalem Bay State Park, recovered the guns with the assistance of a backhoe and placed them immediately into tubs of salt water in order to maintain them in a saturated condition.

Several heavily concreted artifacts were recovered during the salvage operations, including the two carronades (figs. 14 and 15), three pieces of chain link (figs. 16 and

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[70] Rollins and Crombie 2008, A4.

17), a piece of wood discovered beneath one of the carronades during the recovery process, and a small metal pipe fragment (fig. 18). Many of these artifacts were collected due their relative proximity to the location of the carronades but their status as actual wreckage of USS *Shark* could not be determined.

All artifacts recovered were placed within two 6 ft (1.8 m) diameter water tanks and submerged to retain a waterlogged environment. A procedure was begun to change the water once a week, each time reducing the amount of saltwater and increasing the freshwater in the tanks; the first week consisting of a 50/50% changed to 25/75% solution, third week a 13/87%, fourth week 6/94% solution with the fifth and each subsequent week comprised of 100% freshwater. A 2% borax acid/borax solution was also added to the water with each change to reduce the chance of any bacterial growth in the tank.[71]

In early 2009, OPRD signed a contract with the Center for Marine Archaeology and Conservation at Texas A&M University in College Station, Texas, and the carronades and associated artifacts were transported to the university's Conservation Research Laboratory for long-term preservation and conservation.

[71] Robinson 1981, 29.

3. A NAVAL INNOVATION:
THE CARRONADE

One of the most important innovations of naval ordnance in the late eighteenth century was the carronade. This short, light style of gun was widely manufactured and used over the next half century, marking the transition between the old long gun and the later shell gun. The carronade allowed smaller classes of warships, such as frigates, brigs and sloops, to become much more effective war vessels capable of dealing serious damage. Its lighter weight allowed it to be mounted where heavier guns could not be supported, such as on the poop or forecastle. Smaller vessels typically carried a higher proportion of carronades in their armaments, and the smallest classes of vessels, schooners and cutters, were often equipped with all-carronade armaments.[72]

The carronade benefited from the advantages of new boring technology. For example, the chamber, where the powder charge was placed, was of a narrower bore than the caliber of the barrel. Because of this, the iron around the chamber remained thicker, allowing for a reduction in the outer diameter of the barrel and thus, the overall weight of the gun.

The carronade was cast in an assortment of calibers, most commonly as 12-, 18-, 24- and 32-pounders. On U.S. naval vessels, 18-, 24- and 32-pounder carronades were generally mounted on smaller frigates, whereas 9- and 6-pounders were more common

[72] Lavery 1987, 123.

on schooners and clippers and smaller British warships, such as sloops-of-war.[73] The range of carronades was short, the product of their small propellant charge, and with the reduction of range, the penetrative power was also reduced. The point blank range of carronades was less than 500 yards, meaning that at greater ranges, a carronade-armed vessel would be outmatched against a ship with long guns.[74] Carronades, however, could be fired at least twice for every discharge of the conventional long gun.[75] The U.S. Navy continued to use carronades until 1844-1848, when they were removed from most ships.

Carronade Design

Designed as a short-range naval weapon with a low muzzle velocity in the mid-eighteenth century, the carronade (fig. 19) became the favored gun among British merchant ships during the American Revolutionary War. After the war, however, the design of the carronade was greatly revised. The first generation of carronades were generally thought to have been too short, which increased the possibility of setting fire to the rigging.[76] Over the next few years, the length of the carronade was steadily increased. The 18-pounder, for example, increased from 73.152 cm in 1780 to 80.77 cm in 1781, reaching a maximum length of 103.63 cm in 1793.[77] The weight of the carronade also increased through the years. The earliest 18-pounder carronades had a

[73] Tucker 1989, 117; see also Chapelle 1935, 152; *Scribner's Magazine* 36, 605; Statham 1910, 299.
[74] Padfield 1974, 107.
[75] NMM, MID.9/2/16, 20
[76] Lavery 1987, 125.
[77] Burney and Falconer 2006, 344.

weight of 8 cwt (406.42 kilos) but by 1804, the weight had increased to 10.25 cwt (520.72 kilos).[78]

By 1790, a further improvement to the carronade was achieved by the addition of a nozzle or muzzle cup to the muzzle. This added little to the weight of the gun but carried the burning propellant further clear of the ship. After 1805, the nozzle was hollowed out to make loading easier. The addition of the nozzle also increased the strength of the foremost part of the muzzle, which had been vulnerable to the effects of each discharge. With the nozzle, the carronade did not need the swell of the muzzle like ordinary guns.[79]

Sights were being fitted to carronades by the 1780s. Normally, a piece of ordinance can be sighted in two ways: by the short axis, from the breech ring to the reinforce ring, or by the long axis, from the breech ring to the muzzle. The carronade, however, attempted to have it both ways. A mounting for the aft sight was placed on top of the breech ring. On earlier carronades, the fore sight was fitted above the muzzle but by around 1805, it had been moved back to the reinforce ring.[80] There were various planes, notches and bumps on the sights, intended to facilitate aiming at selected elevations.

From 1790, carronades were often fitted with elevating screws. These passed through an elevating screw base on the cascabel, and were turned to elevate or depress the gun as needed. The threaded hole of the elevating screw base often included a bronze

[78] Caruana 1997, 119.
[79] Lavery 1987, 104-109.
[80] Caruana 1997, 124.

insert and the top of each screw was covered, usually with leather, to prevent the entrance of water and potential rusting.[81] The elevating screw base of the carronade has its own characteristics. The base of a British-made carronade, for example, had a flattened cylindrical shape while the American-made variation took on a more spherical shape.

During or soon after the American Revolutionary War, the trunnions of the carronade were replaced with a loop cast on the underside of the gun. The loop or lug would receive a stout bolt, often called the lug bolt or lug pin, which secured the carronade to carriage bed through a slot or joint chock (fig. 20).[82] The carriage bed was then connected to the slide by a gudgeon and slide bolt, which was fixed to the bed but free to move backwards and forwards in the traversing slot of the slide (fig. 21). When fired, the carronade recoiled, pushing the bed back along the slide and against the breeching ropes that arrested the recoil. Breeching rings, to retain the breeching rope, were likely added to carronades in the 1780s, at the same time they first appeared on long guns.[83] After reloading, the gun crew used tackle to haul the carronade forward to its firing position.

There were several variations of the carronade mount as it developed over the years, and as the guns were adopted for various kinds of ships and different positions on board. The standard shipboard carriage for long guns had four trucks, brackets and quoins, and some carronade carriages were a reinterpretation of this design.[84] These

[81] Lavery 1989, 84.
[82] Tucker 1989, 119.
[83] Lavery 1987, 107.
[84] Murray 1871, 79.

were mainly employed on smaller vessels, such as sloops and cutters. However, the standard type of carronade mount was used primarily on the poops, forecastles and quarterdecks of frigates and ships of the line. It had two main components: the bed, which held the gun and enabled it to be elevated and depressed and the sliding bed or slide, which allowed it to recoil. The slide was fixed to a pivot bolt at its forward end, allowing the carronade to be traversed.

The type of bed employed depended on whether or not the carronade had conventional trunnions. Once the trunnions had been replaced with the lug under the gun, a simplified design came into wide-spread use. It was often made up of a single piece of wood, with an iron joint chock at the front, through which the lug of the carronade was rotated. The rear served mainly as a base for the elevating screw, as well as to hold eyebolts for the tackle (fig 20).

Gunfounding in the Early Nineteenth Century

The United States Navy initially purchased British-made carronades before it began using guns cast by American gunfounders. Many carronades were cast at the Carron Foundry in Scotland and carried certificates showing that they had been proofed. Some British carronades purchased for American ships prior to 1808 carried the designation P WG 1798 or variations such as 1798 WG. British iron founder John Wilkinson sold carronades to the United States, deliberately using false trunnion marks so the Board of Ordnance would be unaware of how many guns he was casting for the Americans. An inspection in 1833 identified a large number of British guns bearing this mark, which served as a release mark allowing the guns to be shipped to the United States.[85]

The British Government's Board of Ordnance was supplied with carronades by contract. These contractors were the iron masters who offered their guns at the lowest price, casting the pieces at foundries in England and Scotland. With naval carronades, one distinguishing characteristic is certain; if it does not bear a broad arrow, it was never passed for proof for the Britain's Royal Navy. Proofing was, by and large, conducted at Woolwich, which proved costly when transporting guns from Scotland or Sussex.[86]

At Woolwich, the guns were examined in respect to their dimensions, the conformity of the axis of the bore, and the position of the touch-hole. The guns also underwent a proof of powder, firing them with an unusually heavy charge to check their soundness. If any cavities or "honeycombs" were found in the bore, the gun was rejected and if a gun failed a proof, it was fit only for the scrap heap.[87] The proofs were made at the risk of the contractors, who generally examined and proved the guns at their works before sending them on to Woolwich.

Originally, the Carron Company had a monopoly of carronade manufacture. The company was founded in 1759. In its early years, it was more economical for the Carron Company to use scrap metal instead of mining and smelting ore. It drew many of its supplies from Woolwich, where there was a large store of broken or captured guns. The later success of the Carron Company was based on its ability to mass-produce cast iron

[85] *Army and Navy Chronicle*, 18 June 1835.
[86] Ffoulkes 1937, 82-83.
[87] Cleere et al. 1985, 201-2.

cannon of high quality using coke iron.[88] After the gradual failure of the Sussex foundries, the British government was forced to rely largely on the Carron works, whose cast iron guns were both efficient and reliable.[89]

However, shortly after the carronade was introduced into naval service, the Carron monopoly was broken. It would appear that this occurred in 1783. According to the Chatham Survey Book, 45% of all carronades supplied to the Board of Ordnance up to 1808 were manufactured by the Carron Company.[90] Another large contractor of the period was Samuel Walker and Company, which was founded at Sheffield in 1741 and began supplying the Board of Ordnance in 1771. By 1781, Walker and Co. was supplying 1200 tons of guns a year.[91] Other British suppliers of carronades included Gordon and Harley, Wiggin and Graham, Sturges, and Danson.

It is unknown exactly how many British-manufactured guns were mounted on U.S. warships during the early era of the American Navy. One estimate states that at least one-third, and perhaps as many as one-half of naval guns in use during the Quasi-War with France were British.[92] The majority of these were carronades. By the War of 1812, however, American gunfounders were capable of meeting the Navy Department's needs for ordnance without a reliance on foreign purchase. Of the early American-made carronades, many imitated the designs and practices of the Carron Company, making them almost indistinguishable from the Carron guns. As American gunfounders continued producing carronades, an American style was established and became

[88] *Scientific America*, 1 July 1868.
[89] Campbell 1961, 83-85.
[90] PRO ADM 160/154
[91] John 1951.
[92] Palmer 1987, 34

prevalent on ships equipped with carronades after 1808 or on those built during the War of 1812. American manufacturers included Cyrus Alger & Company, the Bellona Foundry, the Columbia Foundry, and the Fort Pitt Foundry.[93]

Wiggin & Graham

Before Wiggin & Graham established themselves in ordnance production, the company specialized in the sale of iron. In the 1760s, John Wiggin, an apprentice to Thomas Henshaw, traveled south to London to act as an agent to the Carron Company.[94] From 1772 until about 1779, Wiggin continued as an agent before developing his own iron-dealing business, which began to supply shot to the Board of Ordnance in 1779.[95] By 1790, Wiggin & Company was selling both brass and iron guns to the East India Company, guns which were proofed at Woolwich.

In the late 1780s and 1790s, John Wiggin's company was recorded in the directories of London with a number of partners, typically Wiggin & Graham, though Hepburn and Hill were occasionally added. For example, from 1797 to 1803, the company was recorded as Wiggin, Graham and Hill of Castleyard, Upper Thames Street.[96] William Graham was an assignee for the bankrupt Kinman family, a probable source of bronze guns. He was also involved in the trials of experimental rifled brass guns in the spring of 1790. Upon partnering with John Wiggin, the pair first represented a number of

[93] Tucker 1989, 66-68.
[94] Blackmore 1986, 139.
[95] Kennard 1986, 154.
[96] Kennard 1986, 155.

gunfounders for the Board of Ordnance, including John Wilkinson and his successor Thomas Jones, as well as other firms such as Sturgess & Company, Dawson & Company, Carron Company and Clyde & Edington.

In 1793, Wiggin & Graham offered to supply the Board of Ordnance with old guns cast by Wilkinson, who owned a boring mill at Rotherhithe. The guns dated from the American War of Independence and were marked B-SOLID (Bored Solid).[97] The company continued to supply the Board with a variety of iron guns, both old and new. These types included carronades, howitzers and mortars, as well as shot and shells.

In 1795, however, Wiggin & Graham ran into some trouble with the proofing procedure at Woolwich. As it was not uncommon for a contractor to have part or their entire supply of guns cast by another iron founder, the source of faults during proofing was harder to check. Wiggin & Graham applied for an extension of their contract for mortars, which were being supplied by Sturgess & Co., but Woolwich was displeased with Mr. Sturgess' mortars as many of the pieces he delivered burst at proof. Sturgess, along with Wiggin & Graham, wrote to Woolwich in April 1795 concerning the terms on which they would be willing to submit their guns for proof. They were politely told to communicate with the Board of Ordnance as, without its sanction, there could be no deviation from the normal mode of proof and reception, as laid down in the Founders' Contract.[98] Wiggins & Graham were later informed that the thirty-one 18-pounder carronades being sent to Woolwich by Wilkinson could only be received according to the usual method of reception or rejection.

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[97] Elvin 1983, 34.
[98] Baker 1983, 33.

Problems persisted for the company. In 1796, Wiggin & Graham were reprimanded by the Board of Ordnance for inaccurate work on carronades and were responsible for subsequent inclusion of a penalty clause for non-delivery in contracts. This was due to the fact that on 5 November 1795, they had promised to deliver two hundred 6-pounder guns at an urgent request by the Board but by 26 May 1796, only twenty-one guns had been delivered. Furthermore, the delivered guns were of a longer and heavier type than requested, resulting in the increase of the top weight of the vessels that were equipped with them.[99]

Wiggin & Graham first began supplying their own 24-pounder carronades in 1796. From December 1796 through May 1798, the Board of Ordnance ordered three hundred 24-pounder carronades from the company.[100] Carron Company and Walker & Company were highly regarded during this period and supplied the Board with the majority of guns. Conversely, Wiggin & Graham were regarded as second-best and the company's three hundred carronades in two years seem to indicate that they were only being kept on the list for the sake of competition. The firm was, however, the main supplier of iron guns to the East India Company between 1797 and 1798.[101] They continued to expand in the early nineteenth century and over the period of 1800 to 1808, specialized in providing carronades in the 12-, 18-, 24-, and 32-pounder calibers.

The survival of Board of Ordnance proof books at both the Royal Armouries Library and at Woolwich provides information on the marks on guns proofed between 1793 and

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[99] Baker 1983, 35.
[100] NMM Monograph 56, 1983.
[101] BL OIOC L/AG/1/5/25

1808, and show the variety of marks used by Wiggin & Graham. Their carronades were marked with S, WG, W&G, W, G, WGH and possibly WC. Apart from the S, which represents the Sturgess ironworks, none of these marks can be identified as belonging to a known iron founder. It is most likely that Wiggin & Graham were ordering guns from smaller iron foundries, such as the Kinman's ironworks in Lambeth and the foundries around the London Docks. In this case, the name Wiggin & Graham may have been seen as more prestigious than that of a lesser-known iron founder. The company, however, also had strong connections with the more reputable gunfounders of Britain and it is possible the guns came from one of these ironworks.

After the death of John Wiggin in 1808, the company was renamed William Graham & Sons and continued as subcontractors to the Board of Ordnance until the early 20th century. In 1810, it was noted that Graham & Sons owned a cast iron warehouse in Trigg Lane, Upper Thames Street, where the firm was primarily based.[102]

[102] Kennard 1986, 84.

4. AN ANALYSIS OF THE ARCH CAPE CARRONADES

The pair of 18-pounder carronades recovered from Arch Cape is not merely represented by the guns themselves but includes the intact wooden carriage beds and associated artifacts. These artifacts, which include lengths of chain and a heavy iron wedge, serve as possible evidence of the salvage efforts following *Shark*'s demise in 1846. As layers of concreted sand and stone were carefully removed from the carronades during conservation, the various components and details of the guns and carriage beds were slowly revealed, providing a wealth of information concerning manufacturing techniques and origin.

The diversity of materials in the artifact assemblage also adds a unique challenge to the conservator. Metals, such as the cast iron of the guns and the copper of the fittings, are treated differently from wood or organics, such as leather sheathing or plant-fiber breeching rope. The materials are a clear indication of gunfounding and naval outfitting practices in early 19th-century Britain and the United States. The analysis of the artifact assemblage of the Arch Cape carronades will supplement the historic record of USS *Shark*, from its construction and years in service to its fate in the mouth of the Columbia River.

In order to accomplish this analysis, each artifact was evaluated using a set of criteria that serve as a framework. The information in these categories was complied into a detailed catalog (Appendix C).

Criteria of the Arch Cape Carronades Catalog

An artifact catalog for the Arch Cape carronades was developed in order to explore the manufacturing of early 19th-century carronades and the tools used for salvage purposes. Five different categories were generated, including artifact record number, artifact identification, raw materials, tool marks and dimensions. The following section will describe each of these categories in detail.

Artifact Record Number

While only the pair of carronades and a small number of associated artifacts were recovered during the Arch Cape excavation, each item removed from the carronade or bed during the conservation process was assigned a unique artifact number. These numbers were then entered into a database for easy access and materials sorting. The carronades were labeled A and B, and all artifact numbers associated with each carronade begin with either "ACC Oregon" A or B. Upon completion of the conservation treatment, the artifact was given a tag with the full artifact record number.

Artifact Identification

The majority of artifacts in the assemblage are related to the manufacture and assembly of the carronades and carriage beds. The purpose of the artifact identification category is to provide a concise description of these components and how they relate to the overall construction of the carronades. Artifacts possibly associated with the post-wreck salvage efforts will be identified as such. In some cases, multiple components will comprise a single artifact designation. For example, ACC Oregon A.4.13.1 is composed of four copper nails, taken from iron wear plates at the rear of the carriage.

Raw Materials

The Arch Cape carronades are made of cast iron but other metals were used in the various components, such as copper and brass. Organics are also present in the assemblage, including wood, leather and rope. The materials category of the artifact database was designed to permit easy access to this information.

Tool Marks

The tool marks category is one of the more rewarding categories in the Arch Cape Carronades database. There are two groupings within this category, to include makers' marks and tool marks. Makers' marks are common among 19th-century gunfounders and they provide the best means of determining the origin of the guns. A serial number present on Arch Cape Carronade A contributes immensely to the overall analysis and dating of the gun. Other marks reveal the weight and caliber of the carronade.

Dimensions

The artifacts within the carronade assemblage were primarily measured using a metric caliper, although larger pieces, such as the actual guns, were measured using a retractable metric ruler. The dimensions provided for each artifact were recorded in centimeters and are accurate to one hundredth of a centimeter. While the carronades differ in origin and were likely made according to the imperial units or English feet and meters, it is important for the material culture to be measured in the metric system in order to facilitate comparisons with other collections. Some of the artifacts were not intact upon removal or recovery and these were measured at their widest points.

Treatment

While the treatment of the Arch Cape artifact assemblage will be discussed in detail in a separate chapter, a brief summary will be included with each individual artifact in the catalog. The summary is intended to serve as a quick reference for the various methods used, including mechanical cleaning techniques and chemical names and percentages.

The Carronades of *Shark* and their Origins

During the conservation process, a wealth of data is mined from each layer of concretion removed from the artifact. This uncovered information, along with the historic background provided earlier in this work, can help to address questions regarding the origins and construction methods of artifacts and the post-wreck salvage efforts at Arch Cape, Oregon. The artifact assemblage can also provide insights into the final journey of USS *Shark* in the Oregon Territory.

The Origins of the Arch Cape Carronades

At the time of its construction at the Washington Navy Yard in 1821, the schooner *Shark* was outfitted with guns from the inventory of the shipyard's naval storehouse. Storehouses of the period contained both American and British-made ordnance. Though American gunfounders increased production for the U.S. Navy following the War of 1812, guns were still being borrowed from the U.S. Army's supply.[103] British guns were initially purchased by the United States in the late 18th century, however, relations between the two countries were particularly tense from 1807 to 1812 and it is likely that the export of British military equipment to a potential enemy in the United States was prohibited by a government decree.

[103] Tucker 1989, 117.

There is considerable evidence for the importation of guns from England by private contractors. These firms seem to have been acting both for the U.S. Government and on a speculative basis, and the volume of imported ordnance must have been considerable. A large number of British guns dating from this period were still in naval storehouses during the inspection of 1833.[104] The high volume of British guns in storehouses can also be attributed to ships captured during the War of 1812. For example, from 1812 to 1815, over fifty 18-pounder carronades were taken.[105]

The Arch Cape 18-pounder carronades represent both British and American styles. ACC Oregon Carronade A (figs. 22 and 23) is a cast iron British gun fashioned in the classic Carron Company manner, normally associated with the period of the Napoleonic Wars. It has a fully formed nozzle, pierced pyramidal breech with a breeching ring, stepped sight and no trunnions. A British crown property broad arrow (fig. 24) is engraved behind the stepped sight, indicating that the gun passed proof and went into service with the Royal Navy. Engraved in front of the vent hole is the weight of the gun (fig. 25), which is represented by 10 hundred weight (10 x 112 pounds or 509.1 kgs), 0 quarters (0 x 28 pounds or 0 x 12.7 kgs), 4 pounds (1.82 kgs), for a total of 1124 pounds (510.9 kgs).

On the underside of the carronade are the engraved marker's mark, caliber and serial number (fig. 26). W&G was one of the marks used by the firm of Wiggin and Graham, which is discussed in Chapter 3 of this work, and 18 P refers to the weight of the shot fired. The serial number (No. 1271) is an important clue for determining the casting date

[104] *Army and Navy Chronicle*, 18 June 1835.
[105] Emmons 1853, 56-58.

of the carronade, as well as tracing its sale from the foundry to the Royal Navy. The earliest carronades marked W&G that are listed in the Woolwich proof books date to 1804, with serial numbers in the 60s and 70s. W&G 18-pounder carronades in the range 1000 to 1400 were being proofed in the autumn of 1805, between 18 September and 1 November 1805.

While a general casting date exists for the carronade, there is little information on its sale. The records of the Naval Ordnance Department list purchases from foundries but do not provide specific details such as serial numbers or where the guns were sent after purchase. The problem lies in connecting the carronade to the ship or ships on which it served. A volume entitled *Returns of ordnance on H.M. Ships: 1803 – 1812* provides a list of Royal Navy ships with details of their armament, including caliber and serial number.[106] The volume is exclusively concerned with warships either built, refitted or armed by Chatham Royal Dockyard, including a few at the adjacent Sheerness Dockyard, which did not possess its own gun wharf.

The returns seem to refer to three types of ship: new construction that was armed and fitted out at Chatham; existing units about to recommission after a period of refit, repair or reconstruction, with or without changes in armament; and ships whose guns had been removed for reconditioning and then put back on board. The returns disclose that 47 ships carried one or more W&G carronades at various times from 1805 to 1812 inclusive, comprising 11 ships of the line, 7 frigates, 3 post ships of the 6th rate, 2 ship sloops, 12 brig sloops, 8 gun brigs, 3 cutters and 1 schooner (Table 1). All of them were

[106] PRO ADM 160/154

built at royal or contract yards on the east coast of England, except for two foreign prizes and five ships that were constructed in yards on the south coast, and therefore would have been fitted out and armed at either Portsmouth or Plymouth Dockyard.

The British built exceptions, with their launching dates, are the ship of the line *Trident* (1768), frigates *Cerberus* (1794) and *Horatio* (1807), brig sloop *Sheldrake* (1806), and gun brig *Rebuff* (1805). The ship of the line *Princess Caroline* was part of the Danish fleet seized at Copenhagen in 1807 and brought back to England, where she was refitted and rearmed with British ordnance at Portsmouth in 1808. The other prize was the French frigate *Guerriere*, captured in a frigate action in 1806 and repaired and re-equipped to Royal Navy standards at Chatham in 1807. Consequently, this ship was USS *Constitution*'s first naval victim in the War of 1812. She carried more W&G carronades than any other ship surveyed, apart from the brig sloop *Skylark* – in each case 13 pieces, 32-pounders in *Guerriere* and 24-pounders in *Skylark*.

Since the returns seldom indicate whether they are recording guns already in ships before they arrived at Chatham, or placed on board while at the gunwharf, usually the only way to determine whether ordnance originated from Chatham is to correlate building locations and dates of new construction, or recent refits at the dockyard, with the returns. The following ships seem to have been surveyed around the time they were completed, and are consequently the best adapted for assessing the allocation patterns of W&G carronades from 1805 onwards (year of return in brackets): ship of the line *Stirling Castle* (1812); frigate *Orlando* (1811); 6th rate post ships *Cossack*, *Banterer* and *Coquette* (all 1807); ship sloops *Favorite* (1806) and *Sapphire* (1807); brig sloops

Skylark (1806), *Barracouta*, *Nautilus* and *Sparrowhawk* (all 1807), *Zenobia*, *Ephira* and *Wildboar* (all 1808), and (in 1809) *Opossum*, *Reynard* and *Bermuda*; gun brigs *Fearless*, *Exertion*, *Redbreast*, *Strenuous* and *Starling* (all 1805); cutters *Algerine*, *Pioneer* and *Pigmy* (on one consolidated return in 1810); and finally the schooner *Woodcock* (1806). The total amounts to 26 vessels, or more than half of those shown with W&G carronades.

Equally valuable are the returns of ships rearmed at Chatham, either fully or partially, shortly before the date of the return. *Guerriere* (1808) falls into this category, as do the legendary ship of the line *Victory* (1808) and the gun brig *Bloodhound* (1809). The ship of the line *Dictator* may have received a substantial enhancement of her armament, including 9 W&G carronades (only one of them an 18-pounder), when she was taken out of ordinary at Chatham and prepared for Baltic service in early 1808. The rearmed ships add 3 to 4 vessels to the 26 new builds, and together they account for nearly two-thirds of the returns.

In all, 141 W&G carronades are registered in ADM 160/154, the breakdown by caliber being nine 12-pounders, fifty-eight 18-pounders, twenty-six 24-pounders and forty-eight 32-pounders. Thus 18-pounders are in the majority, but 13 of them were mounted in Fort Pitt at Chatham and in the Sheerness Garrison and New Lines, so the actual number afloat was 45. The only 18-pounders with serial numbers higher than 1000 are No. 1031, sent to *Bloodhound* at Sheerness on 18 March 1809, No. 1037 in *Ephira* on 26 August 1808, and No. 1038 in *Opossum* on 31 January 1809. The relationship between year of issue and serial number is rather weak overall, though one can discern a tendency to slightly higher numbers in 1808-09 compared to 1805. However, by contrast, the seven 18-pounder carronades issued in 1810 to the three cutters were all in the 200 and 500 series, much lower than the 800s, 900s and 1000s that predominate in earlier years. With 32-pounders, the highest numbers are recorded in 1807 when the caliber first appears, the examples placed aboard *Barracouta* and her sister *Cruizer* class brig sloops *Nautilus* and *Sparrowhawk* being the only W&G carronades to show numbers above 1200, with the exception of the solitary 12-pounder in the frigate *Orlando* in 1811 (which was transferred from another ship).

There could be several reasons for this. If there were block allocations of individual founder's guns to certain ordnance stations and ships (and there is some evidence for the practice in the ships returns), it may be that W&G 18-pounder carronades cast in the 1200 number range were sent to Portsmouth or Plymouth, or overseas. Alternatively, it may have been Ordnance Board policy to retain a portion of recently produced and proved naval artillery in store against contingencies, on the assumption that it could be more quickly distributed if needed than older pieces that might need to be renovated before use.

Another possible explanation mentioned earlier in this work is that W&G's output was not rated all that highly and thus was used when nothing better was available, but otherwise was kept in reserve. Blomefield's recommendation to contract with the Clyde Co. for future carronade orders might have reflected that. In this connection, the annotation 'from Spare' appears on the ordnance lists of *Exertion, Redbreast, Strenuous, Starling* and *Thetis* in 1805, though it should be stressed that it applies to all, or at least most, of the guns aboard, and not just those made by Wiggin & Graham. However, the only part of the sloop *Sapphire*'s armament to be sourced from spare weapons in July 1807 was two 32-pounder carronades, one made by W&G and the other possibly by its successor – firm Graham & Son (founder's mark G).

Although *Barracouta's* 32-pounder carronade (No. 1279), assigned in 1807, is the closest in terms of serial numbers to the Arch Cape W&G 18-pounder, it cannot be assumed that No. 1271 entered Royal Navy service around the same time. (fig. 27) According to the ex-secretary of the Ordnance Society, Rudi Roth, it was more usual for gunfounders to number artillery pieces in separate sequences by caliber.[107] In reviewing the numbering of all 141 W&G carronades, two pieces share the same number, 855 – an 18-pounder aboard *Thetis* in August 1805, and a 24-pounder in *Ardent* in June 1812. With that in mind, it may be that W&G 18-pounder No. 1271 went into service before 1807, especially if 18-pounders began to be cast earlier than 32-pounders, as the returns suggest may have been the case.

In referencing copies of letters received by Portsmouth Ordnance Office from 31 December 1805 to 2 June 1806, the subject matter is little different from the minutes referenced thus far.[108] There are the same Ordnance Board orders to arm HM ships about to complete or to exchange armament between ships, and to remove ordnance and stores from vessels going into dock. Following the precedent set by the minutes issued and received, the orders merely specify the number and 'nature' (caliber) of the pieces designated, and do not indicate maker's marks and serials numbers that should be

[107] Roth 2011.
[108] PRO WO 55/2031.

allocated. Minutiae of that sort were evidently left to the discretion of local Ordnance Office employees. Thus, in the matter of the newly built gun brig *Richmond*, designed to carry ten 18-pounder carronades and two 12-pounder guns, the Portsmouth officers were instructed on 24 March 1806 to 'cause such Ordnance to be selected and the Carriages prepared as soon as possible'. Another order, issued on 14 April 1806, requested the preparation of fourteen 24-pounder carronades and two 6-pounder guns, with carriages, for the sloop *Sheldrake* under construction at Hythe – one of the carronades chosen may have been the W&G piece registered aboard *Sheldrake* at Chatham in February 1811.

With No. 1271 proofed in the autumn of 1805, another possible destination for the carronade is among the 20 *Confounder* class gun-brigs ordered on 20 November 1804, and launched between April 1805 and January 1806. The standard armament for these gun vessels was ten 18-pounder carronades and two 12-pounder long guns.[109] They therefore required a substantial number of 18-pounder carronades, 200 pieces in all, and it may well be that they were not all manufactured by the same gunfounder, considering the wide variation in the brigs' launching dates.

As mentioned earlier, the 18-pounder carronade was not solely allocated to gun-brigs and sloops. Captured vessels were often rearmed with British guns. For example, HMS *Rivoli*, a French line-of-battle ship taken in 1812, was to be fitted out with guns at Portsmouth, including six 18-pounder carronades. Any pieces that could not be supplied from Portsmouth's own stock were to be obtained by indent to the Board of Ordnance.[110]

[109] PRO ADM 1/4017
[110] PRO WO 55/2236.

Carronades were not only being placed on British ships at home but also abroad. In November 1805, a stockpile of guns was requested by Admiral Alexander Cochrane for the use of the British fleet in the West Indies.[111] His request included a tabular statement of the equipment to be sent out to the Leeward Island Station. (fig. 28) The table shows, to quote the accompanying letter, 'the number and Description of Pieces of Ordnance which are now under Orders to be forwarded to Barbadoes and Antigua as a Depôt for His Majesty's Fleets on those Stations'. The consignment was surprisingly large, with nearly 700 guns complete with carriages, of which 344 were carronades. Heavy 32-pounders predominated in the latter category but 18-pounders were the second most numerous carronade, with 93 pieces total.

Although the precise reason for such an impressive reserve of guns was not given, the letter conjectures that, since HM ships in the area were adequately armed, the admiral requested them for the specific purpose of arming vessels hired by the Treasury or Navy Boards; in other words, for transports.

There is a strong possibility that the ordnance destined for the West Indies includes pieces made by Wiggin & Graham. The company was already under contract to supply material to the West Indies in November 1805. An entry for Wiggin & Graham in a letter to the Board of Ordnance from Woolwich, dated 23 November 1805, mentions the "supply of Carr. ss (iron) for W Indies."[112] The abbreviation 'Carr. ss' likely refers to carronades, as carriages were usually denoted by the contraction 'Carr. gs'. The fact that No. 1271 could not be found in the volume *Returns of ordnance on H.M. Ships: 1803 –*

[111] PRO ADM 1/4017.
[112] PRO WO 45/72.

1812 may indicate that the gun was not assigned to a regular warship. It could be that the West Indies reserve of ordnance was constituted from new and unused guns, including No. 1271, as opposed to secondhand guns removed from decommissioned ships.

A West Indian destination for No. 1271 could also explain how the carronade ended up in the hands of the United States Navy. American privateers were exceptionally active predators on British shipping in the area during the War of 1812. If hired transports were armed from the ordnance sent out in 1805-06, it is possible that one or more of the ships may have fallen victim to commerce raiders, and were brought back to U.S. ports as prizes of war. It was mentioned earlier that over fifty 18-pounder carronades were taken from captured British ships between the years 1812 and 1815.

Furthermore, the schooner *Shark* captured or assisted in the capture of several piratical vessels as part of the U.S. Navy's West India Squadron. These ships were often armed with carronades of all calibers.[113] Although unofficial, a listing of such prizes was published in George F. Emmons' *The Navy of the United States*.[114] In addition, piratical captures were also mentioned in the 'Naval Affairs' series of the American State Papers.[115] It is possible that the U.S. Navy maintained lists of ships captured and their armament but the serial numbers and marker's marks were probably not recorded. It is highly speculative to believe No. 1271 was taken off one of the captured pirate vessels.

Another scenario might be that the West India reserve of ordnance was returned to store once the war was over. In a collection of Ordnance Office returns from the West

[113] *Niles' Weekly Register*, 13 July 1822.
[114] Emmons 1853, 76-79.
[115] American State Papers, I, 804.

Indies, dated 1810-1817, numerous returns from several West Indian islands are listed, including Antigua and Barbados.[116] The most relevant documents are the states and remains of naval ordnance, ammunition and stores at Barbados tallied by the Ordnance Storekeeper on the island. Five of these lists survive, one compiled during the war and the others after it. Items are categorized under three heads – serviceable (S), repairable (R), and unrepairable (U). All except one show substantial numbers of 18-pounder carronades, but lack any indication of makers and serial numbers. There were 53 available on 30 September 1810, all serviceable; and 62 on 31 March 1816, 31 December 1816 and 30 June 1817, of which one was repairable and the others serviceable on all three dates.

Strangely, there is another Barbados return of naval ordnance dated 31 December 1816 recording no holdings of 18-pounder carronades at all, enclosed in a letter to the Ordnance Board of 10 May 1817. The first return of that date was sent home with a letter dated 1 January 1817, yet there is no explanation of the discrepancy between the two inventories, or even any reference to it. Presumably, it is simply an example of lax administrative standards, not uncommon at the time. The Barbados stockpile was probably the residue of the carronade shipment from Britain in 1805-6, but without access to individual identification marks in either case, it is impossible to know for certain.

As the other returns are concerned, the only ones to mention carronades are those for Dominica on 1 January 1816 (2 iron carronades repairable, caliber omitted); Grenada,

[116] PRO WO 44/350.

reporting six 6-pounders on 30 April 1815, and six 12-pounders on 31 December 1816 and 31 August 1817, in every case with four serviceable and two unrepairable (the 6-pounders may be another clerical error); and another Barbados return dated 31 December 1816, with nine 18-pounders, none of them unserviceable. All these are returns of dismounted brass and iron ordnance, and are distinguished from separate returns of mounted ordnance submitted by the commanding officer of artillery, which are not filed in WO 44/350. They are therefore land service guns and should be disregarded.

It could also be that the returned guns were never issued, and the whole or part of the stockpile sold off to the United States government, which, after all, was perhaps the most likely purchaser in the region, and the one best able to afford to buy. If the carronade was exported to the United States between 1805 and 1807, it was likely a direct commercial sale by Wiggin & Graham to the U.S. Government, in which case one could hardly expect to find evidence of the transaction in the Board of Ordnance records. As mentioned earlier, John Wilkinson had used false WG trunnion marks during the American War of Independence so that the Board of Ordnance would be unaware of how many guns he was casting and there may he an element of the company deliberately disguising the source of the carronades for their own reasons.

From a survey of naval stores and arms conducted in 1818, it appears that the 18-pounder carronade no longer formed part of the armament of any Royal Navy ship, apart from the gun-brig, as it was the only type shown with carronades of that caliber.[117] If so,

[117] PRO WO 55/1749.

it strengthens the case for assuming that there was a policy of post-1816 disposal of surplus 18-pounder carronades, meaning No. 1271 may have been purchased shortly before the construction of the schooner *Shark.*

ACC Oregon Carronade B (fig. 29) is a cast iron 18-pounder that was likely cast by an American founder; it appears nearly identical to the Arch Cape carronade discovered in 1898. Although the gun lacks any identifying maker's marks or serial numbers, construction details such as the spherical elevation screw base on the cascabel, the solid fore sight and the smoothly-rounded outer breech face, as opposed to the ringed breech mouldings of the British gun, are qualities of American design and manufacture. The British 18-pounder carronade was subject to criticism for its lightness and unsteadiness in action but the American variant was much shorter in the breech, and longer in the muzzle, meaning it heated more slowly, recoiled less and carried further.[118] U.S. Navy plans for an 18-pounder carronade (fig. 30) correspond with the design of the barrel and the loop cast on the underside of ACC Oregon Carronade B. Since the gun is devoid of any marks, an exact origin and date for the gun is unattainable.

The carriage beds for ACC Oregon Carronade A and B are identical (figs. 31 and 32). They were built using white oak, a wood native to the eastern United States, which seems to indicate that these were American-made carriages. The joint chocks are cast iron and are embossed with the number "18", the caliber of the carronade. No other maker's marks or numbers are visible on the beds, making it difficult to determine an exact origin. It is likely that Washington carpenters and shipyard workers built the

[118] James and Chamier 1837, 219.

original carriage beds locally for installation on USS *Shark*. However, the carriage beds were presumably replaced at least once during *Shark*'s career.

The associated finds, such as the iron wedge, bear no maker's marks and were likely the products of the early Clatsop settlers who salvaged the iron from the wreckage of *Shark.* A copper bolt (fig. 33) found embedded in the concretion near the muzzle of ACC Oregon Carronade B was, however, stamped with the letters "U.N.Y.", a mark of the United Navy Yard of Brooklyn, New York, where the schooner *Shark* underwent repairs in 1825.[119]

Recommendations for Further Analysis

While this study investigated a number of primary records, which offered some probability of relating the Arch Cape gun to a specific ship, there are additional records that, if surviving, could potentially prove useful in the further analysis of the 18-pounder Wiggin & Graham carronade, No. 1271.

The volume *Returns of ordnance on H.M. Ships: 1803 – 1812* proved valuable in learning the allocation of guns at Chatham. If Chatham recorded the naval ordnance it handled then logic suggests Portsmouth and Plymouth did as well. All indications are that their books - if they existed - haven't survived, and that the Chatham returns are unique. Portsmouth was the premier naval base and its ordnance returns would have been even more voluminous than Chatham's. If The National Archives did inherit them,

[119] Mooney 1976, 466.

it would have had to allot a separate piece number as it did for the Chatham volumes, and that should have shown up in the catalogue. There may be similar periodic returns, though much more restricted in scope, for Portsmouth and Plymouth hidden within the Ordnance Board or Admiralty papers.

In order to learn which 18-pounder carronades were sent to which ships or depots, it may be essential to review the correspondence addressed to the Board of Ordnance from outstations and not the other way round. Even then, the chances of tracing such details are far from good. No such material is visible in the catalogue descriptions of Ordnance records, but there may be examples in the numerous classes of general and colonial reports in WO 55, and returns could conceivably be filed with communications from the naval ports and the Admiralty in WO 44. Dockyard gun inventories are known to form part of WO 44/648 but no earlier than 1823 in this volume. Other ordnance returns might show up in WO 44/524, Inspectors, 1814-55, though the starting date is rather late, and in WO 44/540, Artillery, 1808-28.

According to Charles James, in his essay length entry on the Board of Ordnance, stock inventories were taken at all Ordnance depots in Britain every seven years, when a war ended, and when a new storekeeper was appointed.[120] On foreign stations, inventories were only taken when the storekeeper changed, but annual accounts of receipts and issues were sent home. Since inventories of guns and naval stores at various dockyards in 1823 are known to exist in WO 44/648, an audit of naval artillery at home

[120] James 1810, 587.

should have occurred in 1816, more or less dovetailing with the end of the Napoleonic and American wars, and perhaps there was another in 1809.

One item of interest in WO 55/2031 is a letter from the Office of Ordnance (an alternative title for the Board) to the Portsmouth officers on 13 March 1806, regarding certain unserviceable articles that it enumerates. The list was extracted from a 'General Survey and Remain of Ordnance Stores at Portsmouth dated 31st January 1806'. If a copy of that survives, it could be extremely useful if it does in fact record the marks and numbers of naval guns, especially in view of the date. Whether it would do so is a moot point — the inclusion of stores hints at a facsimile of the West Indies returns, and the allusion to unserviceable stores strengthens that impression. On the other hand, the word "survey" is not used in the West Indies submissions, so there may be some basis for optimism.

To volumes WO 44 and 55, the following should be considered — from the Admiralty archives, ADM 7/615, Armaments, 1787-1816, which may refer to armaments in the sense of mobilizing a fleet rather than cannon, but it should nonetheless be evaluated; ADM 7/677, Ships' Ordnance, 1679-1810; and ADM 160/155, the companion volume to the ordnance returns in 154, but for the period 1817-1835. The postwar volume may be useful in tracing 18-pounder Wiggin & Graham carronades nearer to No. 1271 in the pre-1820 lists of ships in commission, though the peacetime fleet was far smaller and to that extent less likely to yield results.

From the Ordnance Office records, there is a register of armaments for ships, and stores required in the Inspector of Artillery Department from 1783 to 1819 (WO

18/214). Though it is intriguing, it is filed oddly in a series of payment warrants for Ordnance Office expenditure, so it could prove useless. Other sources include Miscellaneous Papers from 1690 to 1830 (WO 55/1795-1802), Miscellaneous Papers relating to Foreign Stations, from 1805 to 1832 (WO 55/1845) and Miscellaneous Papers relating to Home Stations from 1807 to 1823 (WO 55/1853). Although each these recommendations may turn out to be barren, the fascinating feature of the Ordnance records is their utter unpredictability, and the frequency with which the actual contents belie the cover descriptions.

Construction Methods

Though the Arch Cape carronades differ in origin, the methods used for their construction were likely the same as the early 19th-century cast iron gunfounding practices were shared among British and American iron masters. Cast iron guns have the advantage of enduring the heat of repeated firing and in the case of Royal Navy ordnance, cast iron guns alone were used on board British ships, whereas brass guns were principally used as field pieces. Nevertheless, cast iron was not an ideal material for carronades. Great bulk was required to make the metal rigid and flaws often occurred in the casting process. When cast iron guns cooled from the outside in the casting process, the outer surface was harder than the wall of the bore, and the stresses set up in the metal added nothing to the strength.[121]

[121] *The Mechanics' Magazine, Museum, Register, Journal, and Gazette* 1120: 25 January 1845.

The carronades were molded, cast and bored in the same way as cast iron long guns. The molds into which the molten fluid was poured were often formed of dry sand. These molds required patterns, which were designed to be the exact figure of the gun required. Typically, the mold in sand was enclosed in a large case of cast iron, called the gun box, which was made into sections and bolted together. The sand which lined the gun box received its impression from the pattern. Specific parts of the carronade, such as the cascabel, were cast separately. Once the piece had sufficiently cooled, it was stripped of the mold and transported to the boring mill.[122]

The standard carriage bed was constructed of a solid piece of timber with a cast iron joint chock at the front, a gudgeon and slide bolt for the slide and a plate at the rear to take the butt of the elevating screw. While most of these components are present on the Arch Cape carriage beds, the beds are unique in that they were constructed of two pieces of timber (white oak), held together by a series of four long bolts and a wooden dowel of yellow pine. (fig.34)

The cast iron joint chock was formed from the mold of a pattern, similar to the carronade construction method described above. The joint chock was secured to the bed by four square-headed chock fastening bolts. (fig. 35) The gudgeon and slide bolt were inserted through the middle of a protective iron plate (the bed was built to accommodate the pin) and further reinforced with a smaller iron plate on the underside of the bed. (fig. 36) Once the bed was assembled, other iron components were added, including the bearing plate for the elevating screw (fig. 37), tackle eyebolts and a pair of iron rings for

[122] The Corp of Royal Engineers 1850, 524-26.

the breeching rope. (fig. 38) These rings were sheathed in leather in order to prevent chaffing to the rope. The portside tackle eye on Carronade A's carriage featured a rope grommet and wooden plug. (fig. 39) While the intended purpose of the plug-and-grommet arrangement is unknown, it may be as simple as a means to protect the eye from being bent or broken by impacts. The grommet is also served with a wrap of fine line to protect it from chaffing.

Another unique feature of the carriage beds is the inclusion of a pair of spike sockets at the rear. (fig. 40) Four long iron wear plates lined each socket and were held in place by brass nails, which were driven into the wood via a nail setter. The wear plates prevented the wood from expanding and splintering. Based on naval illustrations of similar carronade carriage beds (figs. 41 and 42), the sockets were added to take turn spikes to maneuver the gun from left to right. However, the two-piece construction of the Arch Cape carriage bed required a pair of sockets instead of the single central socket shown in the contemporary illustrations.

The muzzle of ACC Oregon Carronade A was sealed with a tompion. (fig. 43) Wooden tompions, generally made of a softer wood such as pine, were placed in the muzzle to keep moisture out of the bore. This allowed the gun to remain loaded for short periods without the gunpowder becoming ruined due to rain or seawater penetration.. Once the tompion was removed from ACC Oregon Carronade A, a ball of heavy twine was discovered (fig. 44), likely a ball of waddage. There were no charges or shot in either gun, indicating that the schooner was not expecting action while in the Oregon

Territory. ACC Oregon Carronade B was not sealed with a tompion, resulting in the bore being heavily concreted (fig. 45).

Post-Wreck Events

Certain artifacts found in association with the Arch Cape carronades could be evidence of the salvage efforts of crewmembers and local settlers following the wrecking of USS *Shark.* Among the artifacts collected in the area during the 2008 excavation season were lengths of chain (fig. 46), an eyebolt with two chain or ‘D’ shackles. (fig. 47)

The shackles had screw pins and one shackle was attached with a Kenter joining-shackle. It is unlikely that these pieces were part of the gun tackle used to secure the carronade to the ship and prevent sliding. The use of chain over rope in tackle arrangements was more prevalent on ships during the mid-to late 19th century. It could be that this arrangement was used to drag parts of the wreckage and guns above the high water mark, an act performed by Midshipman Simes in Howison’s final report and later, by the Tillamook pioneers.

The strongest possibility, however, is that it is mooring tackle, likely for an old buoy or a small ship anchor, and therefore unrelated to the wreck of USS *Shark*. The presence of the eyebolt is compelling evidence that it was used for the anchoring of a buoy with the chain shackle arrangement.

In 1854, when the early Tillamook pioneers stripped the wreckage of the schooner *Shark* for the useable iron, bolts and knees, it is likely an iron wedge was used in removing these pieces. Heavy iron wedges, like the example found in 2008 (fig. 48), were commonly used by blacksmiths for cutting metal. If the wedge is associated with the salvaging of *Shark*'s iron, it was probably left behind during the transportation of the materials.

Other associated objects concreted to the guns, which include the engraved copper bolt and a large iron nail, were probably used in the construction of the ship itself and were lost during its dismantling in the years following the wreck.

Conclusion

The Arch Cape artifact assemblage represents but a fraction of what was lost with USS *Shark* in 1846. Though small, the analysis of these finds has supplemented the historical record of the schooner as well as aspects of 19th-century gunfounding in Great Britain and the United States. *Shark* was carrying both British and American-made 18-pounder carronades at the time of its wreck. The British gun is a classic design, most commonly associated with the Napoleonic Wars, and was supplied by Wiggin & Graham to the Board of Ordnance in the autumn of 1805. Though it lacks any identifying marks, the second gun is likely an American model and it is similar to the gun recovered in 1898. The characteristics are comparable to those featured on contemporary U.S. naval plans for 18-pounder carronades.

The analysis also provided information about British gunfounders of the period, specifically the problematic relationship between Wiggin & Graham and the Board of Ordnance. Despite the widened scope of this study, which included naval armament lists and letters from the Ordnance Office, the service career of No. 1271 between its founding in 1805 and its placement aboard USS *Shark* remains a mystery. The research did, however, offer insight into the allocation of naval guns around 1805, especially in regard to the shipyard at Chatham and its handlings of other Wiggin & Graham carronades.

This study is by no means comprehensive and further consulting of potential resources should further expand upon the theories presented. It is imperative that the

Arch Cape carronade and capstan recovered in 1898 be preserved so scholars and historians can ask new questions of the assemblage. The second half of this work focuses on the conservation of the Arch Cape artifacts for this reason. The archaeological conservation of the materials must be reviewed as a chain of events that culminated from the recovery of the guns from the Arch Cape coastline. The first step in this evaluation, however, is to look at how marine environments affect different archaeological materials, both organic and non-organic.

5. THE CONSERVATION OF IRON FROM MARINE CONTEXTS

Archaeological metals recovered from marine contexts provide the conservator with unique and often demanding challenges. The harsh environment of the seafloor transforms the materials into conglomerations of marine growth and sediments called concretions. Depending on the activity of the metal and the burial environment, the artifact will undergo various corrosion processes, reverting back to more stable oxides, carbonates, chlorides or sulfides. Once removed from that marine environment, the artifact is exposed to oxygen, humidity and other factors that can accelerate the corrosion processes. With iron, for example, chlorides are incorporated in the corrosion products when recovered from environments containing chlorides. The iron chlorides react with atmospheric oxygen and moisture to oxidize and produce a hydrochloric acid, which will re-attack any surviving metal. These chlorides must be removed or inactivated. Thus, the skills of the conservator are required the moment any metal artifacts are recovered.

The initial treatment and storage can often determine whether or not the original form and surface of the artifact can be successfully preserved.

The primary treatment for most metal artifacts is electrolysis, although softer metals, such as lead, benefit from other treatment options. In cases where the metal does not survive and only a void remains in the concretion, the artifact can often be “remade” through casting procedures. The role of the archaeological conservator, however, is not merely limited to the treatment and stabilization of artifacts. Cleaning, documentation and analysis of the artifacts are equally important responsibilities. Throughout this multifaceted process of conservation, a wealth of new data emerges that may not have been evident during the field excavation. For that reason, the conservator serves not only as a technician but also a laboratory archaeologist.

The metal from the Arch Cape artifact assemblage consists primarily of iron and cast iron, along with some cupreous objects of brass and copper. This chapter will explore techniques used in the conservation of these metal types, from mechanical cleaning, to electrolysis and consolidation. Since the majority of the archaeological metal survived, casting procedures will not be discussed.

Iron Corrosion in Marine Environments

Although iron may be the most common metal recovered from archaeological sites, it is also the most difficult to conserve due to the ease and variability of the corrosion processes. In regards to iron artifacts from marine contexts, the most prevalent iron corrosion products are ferrous sulfide, magnetite, ferrous hydroxide and iron chlorides.[123] Iron artifacts that convert to ferrous sulfide will become a blackish sludge within the mold of the concretion and can often only be replicated through casting. On the other hand, artifacts that mineralize through magnetite oxidization will retain their structural integrity and surface detail. As mentioned earlier, the corrosion process of iron recovered from a marine context will often continue and accelerate once exposed to

[123] Hamilton 2010, 42.

moisture and oxygen. This exposure can cause the ferrous compounds of the iron to oxidize to a ferric state, which can disfigure and ultimately destroy the artifact. Proper storage and initial treatment can help prevent the irreversible effects of ferric oxides.

Iron chlorides present the greatest threat to recovered archaeological iron and it is imperative to remove or stabilize them early into the conservation process. Depending upon the artifact itself and its burial environment, metal conservation generally involves one or more of the following procedures: mechanical cleaning, chemical cleaning, chemical reduction, electrolytic reduction and casting. For the conservation of the Arch Cape iron and cast iron, mechanical cleaning and electrolytic reduction were the two primary procedures used.

With any metal, ferrous or nonferrous, it is necessary to properly document the artifacts before conservation can begin. X-ray analysis of a concretion, for example, can help prepare a conservator for artifact identification and potential voids for casting. By maintaining a data record of detailed illustrations, photographs, measurements and notes, future conservators can evaluate the methods used and look at alternative approaches if re-treatment is required. Furthermore, if a particular artifact should not survive the conservation process, a record will exist to provide the archaeologist with any pertinent information on the nature of the object.

Mechanical Cleaning

Extensive mechanical cleaning is often required for iron artifacts recovered from marine sites due to the dense buildup of encrustation. Mechanical cleaning is a prelude to other treatments but in some cases, it is the only treatment for objects that are too fragile and corroded to undergo any other conservation process. After mechanical cleaning, these sensitive materials can be consolidated with a synthetic resin. With larger objects, a hammer and chisel can be used along cleavage lines to detach the encrustation without endangering the artifact. With smaller or delicate artifacts, pneumatic air scribes allow for more precision when removing encrustation. Once the artifact is placed in electrolysis, the evolution of hydrogen bubbles at the surface of the iron will loosen and remove any remaining encrustation.

The removal of encrustation on carronades, for example, can present complications due to the accumulation of concretion within the bore. A hammer and chisel can only remove so much of the encrustation from around the muzzle. Caliber-specific tube drills are an efficient but expensive option. In some cases, an iron or steel rod can be ground to a chisel-like point and punched through the layers of concretion, creating a hole through the bore in which a center auxiliary anode can be established in an electrolytic bath. Once again, the hydrogen evolution in the bore will loosen and remove the encrustation.

Electrolysis

Evaluating the artifacts after de-concretion is a necessary step in determining the next appropriate means of conservation. With the Arch Cape assemblage, the majority of the iron artifacts retained much of their metal core and surface. This enabled them to undergo electrolytic reduction without any significant changes in their form or dimensions. However, some of the artifacts, such as the iron lengths of chain, retained their shape but the surviving metal was very weak and fragile. A process such as electrolytic reduction could potentially alter the original form or even destroy the artifact. In this case, an alternative approach is to stabilize the delicate artifact in an aqueous solution of sodium sesquicarbonate. Ideally, the treatment will diffuse out the chlorides and allow for the artifact to be consolidated using a solution such as microcrystalline wax. However, the treatment is often not successful with weak metals.

Electrolytic reduction is the most effective way of removing chlorides from metals, especially iron, and involves the establishment of an electrolytic cell, which includes a vat with two electrodes, the anode and the cathode, as well as a solution known as the electrolyte. In the case of the Arch Cape artifact assemblage, the electrolyte was a 2-5% solution of sodium hydroxide and de-ionized water. Although de-ionized water can be used from the beginning of the process, it is not necessary or cost effective. Tap water can be used until the chloride levels fall to that of the local tap water. De-ionized water is often not employed until the final few electrolytic baths.

The electric current from an external direct current (D.C.) power supply is applied to create oxidation and reduction. Once the D.C. power supply has been set up, the iron artifact is connected by the negative terminal wire and clip, or cathode, to which positively charged metallic ions travel. At the cathode, reduction takes place and hydrogen is evolved. Surrounding the artifact is a screen of mild steel that is connected to the positive terminal, or anode, to which electrons, negatively charged ions or colloidal particles, travel. At the anode, oxidation occurs and oxygen is evolved.

During the process, various non-ferrous metal ions are reduced back to a metallic state, adding strength and stability for the long-term preservation of the artifact. In addition, chlorides are drawn from the metal, concentrated in the electrolyte and disposed of when the solution is changed. Chloride concentration monitoring of the electrolyte is important in determining the efficiency and success of electrolytic reduction process. This can be achieved through mercuric nitrate titration readings and silver nitrate tests, which will determine parts per million (ppm) chloride content. Alternatively, for water solutions, silver nitrate can be used to qualitatively test for the present of chloride ions. With iron, it depends upon the oxidation state of the iron corrosion products as to whether or not the chlorides can be reduced. If the corrosion products are in a ferric state, the most the conservator can expect is the mechanical cleaning of the corrosion layers by hydrogen evolution. In a ferrous state, it is not possible to convert the iron corrosion products back to a metallic state. It is, however, possible to convert ferrous corrosion products to magnetite, which preserves the original form and dimensions.

Chemical Treatment & Final Sealant

Once the iron has reached a low chloride level, preferably 20 to 30 ppm, it is removed from electrolysis and placed into a series of boiling rinses using either reverse osmosis or de-ionized water. This not only removes any residual sodium hydroxide and insoluble oxide sludge but it lowers the overall chloride level of the artifact. The size of the artifact generally determines the cycle of rinses but at a minimum, three separate boiling-cooling rinses are required over a three day period. The carronades, for example, underwent a ten-day rinse cycle, with the water changed out each morning.

Following any conservation treatment, it is necessary to ensure the surface of the conserved iron is more corrosion resistant and sealed off from the atmosphere. With iron, a dilute tannic acid is the preferred chemical treatment. While the iron is still hot from the boiling rinses, the artifacts are immediately coated with a 10% solution of tannic acid. This chemical treatment forms a layer of ferrous tannate on the surface of the iron that is more corrosion resistant than the cast iron of the carronades. Furthermore, the treatment imparts a more appealing black finish to the surface of the Cast iron. A second coating is applied an hour after the first, with a third and possibly fourth coating the following day. In order to achieve a dark black color, the tannic coats must be allowed to oxidize.

The final process that any iron artifact undergoes is the surface sealant. The iron is placed into a bath of molten microcrystalline wax, at a temperature between 325^{o} F to 350^{o} F (163^{o} C to 177^{o} C). The wax penetrates the surface pores of the cast iron. Any water present in the artifact is boiled off and the air pockets expand, causing the air to bubble off the iron. The iron is allowed to cool overnight before the process is repeated the following day. Each day, it is imperative that the temperature be raised to 350^{o} F (177^{o} C) to ensure the water in the iron is vaporized. This cycle of heating and cooling ensures that the wax penetrates into the iron, driving of the residual air and water. In the last cycle, the carronade is allowed to solidify in the wax and when next heated, it is removed as soon is the wax is molten enough at 195^{o} F to 200^{o} F (90^{o} C to 93^{o} C). This ensures that the maximum amount of wax is left on the surface of the carronade and any voids are filled. As soon as it can be lifted out, all excess wax is removed by wiping it down with rags. The microcrystalline wax will form a resistant layer on the surface of t he iron that further slows the onset of any potential corrosion.

Notes on the Conservation of Cupreous Metal

Apart from iron, the Arch Cape artifact assemblage consisted mostly of cupreous metal in the form of copper and brass. Due the noble nature of cupreous metals, artifacts subjected to the harsh underwater conditions will often survive intact, whereas iron will often completely oxidize. Cupreous metals will, however, react with the marine environment to form cuprous chloride, cupric chloride, cuprous oxide and the green- and blue-colored cupric carbonates, malachite and azurite.[124] The two most commonly encountered corrosion products, cuprous chloride and cuprous sulfide, can be harmful to the artifact if not treated properly.

[124] Hamilton 1976, 74.

Cupreous metals are generally conserved using the same methods as iron conservation. The artifacts can be mechanically cleaned of marine encrustation using the tools described above, as was the case with the Arch Cape assemblage, but an alternative approach with cupreous metal is soaking the artifacts in a solution of 5 to 10% citric acid. However, this approach is not effective if enough chlorides are present. Electrolysis of cupreous metals was carried out in the same manner as described above for iron, using a 2% solution of sodium hydroxide as the electrolyte. After a series of boiling rinses to remove any residual chemicals, the cupreous artifacts can be polished and treated with benzotriazole (BTA), which has become a general practice in the conservation of cupreous metals.

By soaking the artifact in 1 to 2% BTA dissolved in ethanol after stabilization, a barrier is formed between the cuprous chloride and moisture of the atmosphere. Ethanol aids the solution in penetrating any cracks or crevices in the metal. The treatment leaves a corrosion resistant film on the surface of the cupreous metals. A final sealant of microcrystalline wax or a clear acrylic lacquer is then applied.

6. THE CONSERVATION OF WOOD FROM MARINE CONTEXTS

When archaeological wood is recovered from a marine environment, the primary objective of the conservator is to remove the water and dry the wood. The water, however, acts as a bulking agent to the wood, physically supporting what remains of the cell structure and preventing the collapse of the wood remains. Thus, the challenge lies in either incorporating a material into the degraded wood that will consolidate and add that same mechanical strength in place of the water, which will need to be removed by a method preventing any shrinkage or distortion to the wood, or removing the water in some manner that prevents the surface tension of any evaporating water from warping, cracking or shrinking the wood. Prior to choosing a method, the soluble salts in the waterlogged wood must be lowered substantially to avoid any adverse affect during or after treatment.

The conservator has a variety of treatment methods at their disposal, which have developed over the years using different materials as bulking agents. The most common of these treatments for the first option includes polyethylene glycol, rosin in acetone, sugar, and silicone oils. For the second option, either a solvent drying or freeze drying approach. Again, the conservator’s role is not limited to the treatment and stabilization of the archaeological wood but includes measurements, wood sampling and cleaning, which, in the case of the Arch Cape wood, involved the use of ammonium citrate to remove the iron corrosion.

The wood from the Arch Cape artifact assemblage consists primarily of the two surviving carriage beds, which absorbed much of the iron corrosion product from the attached carronades. Other examples include the wooden tompion extracted from the muzzle as well as natural samples of driftwood and pine remnants found in the concretion. The conservation of other organics, such as leather and rope, will also be discussed in this chapter since the treatments used were the same. All organics were conserved using silicone oils.

Waterlogged Wood From Marine Environments

Wood remains that have endured a considerable period of time in a marine environment become the target of bacterial action, which causes degradation in the cell wall components. Water-soluble substances, such as starch and sugar, as well as other materials like mineral salts, and coloring and tanning agents, are generally the first to be leached from waterlogged wood.[125] The cellulose in the cell walls will eventually disintegrate as well, leaving behind a vulnerable lignin network to structurally support the wood remains. The lignin structure and the absorbed water will preserve the shape of the wood, as long as the remains are kept wet. Once the waterlogged wood is exposed to the atmosphere, the excess water will evaporate, causing the collapse of the remaining cell walls and the distortion and shrinkage of the archaeological wood. Shrinkage, unlike collapse, is to some extent reversible upon rehydration of the wood.

[125] Hamilton 2010, 24.

Once recovered from a marine environment, archaeological wood should not be immediately immersed in fresh water. The cell walls act as semi-permeable membranes, preventing the mixing of salt and fresh water.[126] The salinity differences between the water inside and outside of the wood cells will cause an osmotic pressure differential, which can lead to capillary tension collapse. This can be avoided by a gradual introduction of fresh water, with the recovered wood initially placed in a solution of 50% fresh water and 50% saltwater. The rate of subsequent fresh water introduction is dependent on the size of the artifact. Generally, the more bulk an artifact has, the slower the process will be. The end result of the fresh water immersion is the total desalination of the artifact, which is a necessary step in the conservation of any waterlogged wood from a marine context. As with iron, mercuric nitrate titration readings and silver nitrate tests can be used to monitor the salt content prior to changing the fresh water rinses. While this is ideal in practice, most artifacts are delivered to the conservation lab in either fresh or salt water. If in salt water, the only option is to place the object in fresh water if no salt water is available.

When waterlogged wood is associated with metal, such as the iron Arch Cape carronades attached to the carriage beds, the corrosion salt products can often become deposited within the wood structure. This intrusion of metallic salts typically accounts for the discoloration of the wood, such as the orange staining from the leaching of the iron corrosion products. The wood effectively becomes "petrified" by the deposition of the iron corrosion products in the wood. In addition to the unaesthetic result, the iron

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[126] Rodgers 2004, 42.

compounds contained in the wood can often interfere with treatments such as polyethylene glycol, and therefore must first be removed as much as possible. In regards to the larger wood pieces of the Arch Cape artifact assemblage, the carriage beds were placed into baths of 2% ammonium citrate solution. The chemical reacts with the iron in the wood and removes it. By removing the iron staining, the natural color of the wood will be restored, making it easier to see the wood’s natural features. While the staining was removed from the bed pieces, the natural brown color was also leeched out to a degree, resulting in a drab grayish tone.

Dehydration and Treatment of Wood

Following the desalination of the archaeological wood, as well as the removal of any iron corrosion salts, a material should be chosen to incorporate into the wood structure. In the case of the Arch Cape assemblage, silicone oil was used to treat the wood. In order to allow for the deep penetration of the polymers, however, the absorbed water should be removed entirely. This can be achieved through a series a dehydration baths, beginning with a solution of ethanol and de-ionized water, and working toward baths of fresh acetone. The exchange of water and acetone can be a lengthy process but if the dehydration process is rushed, the archaeological wood may be damaged. The Arch Cape wood went through a lengthy chemic dehydration consisting of 10 baths of six weeks each: 25% ethanol/75% de-ionized water, 50% ethanol/50% de-ionized water, 75% ethanol/25% de-ionized water, 2 baths of 100% ethanol, 25% acentone/75%

ethanol, 50% acetone/50% ethanol, 75% acetone/25% ethanol, and 2 baths of 100% acetone.

After dehydration, the archaeological wood should be transferred quickly to the silicone oil solution while still saturated with acetone. A cross-linker is added to set the silicone oil up for curing. The cross-linker chosen for much of the Arch Cape assemblage was methyltrimethoxysilane (MTMS). Depending on the artifact and material, the ratios of silicone oil to cross-linker can be adjusted accordingly. Higher silicone oil ratios, for example, will result in more flexibility but a softer and often darker surface. This is preferred when treating wood, cordage, leather and textiles. A higher cross-linker ratio, such as 20%, results in more rigidity and lightness, both in weight and color.[127] This is preferred when treating certain woods and glass.

Once transferred to the silicone oil/MTMS mixture, the wood should remain submerged in the polymer solution throughout the duration of the treatment. Generally, the size of the artifact will determine the length of the treatment. With smaller artifacts, a vacuum-assisted acetone/polymer displacement may be used in the process, which involves placing the storage vat into a vacuum chamber. By maintaining a pressure sufficient enough to evolve small bubbles from the artifact, the exchange of acetone for polymers can occur without risk of distortion or cellular collapse. Once bubbling has ceased, the wood will remain in a reduced pressure environment for some time, again depending on the size and condition of the artifact.

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[127] Dewolf 2004.

It is important to remove any excess polymer solution from the artifact after treatment, otherwise, a thick, disfiguring layer of cross-linked silicone oil will form on the surface. The excess oil is removed either by patting it with a dry rag or placing it on a screen over an empty container to collect any reusable solution. The artifact should then be exposed to a catalyst, in which case dibutyltin-diacetate (DBTDA) was used for the majority of the Arch Cape assemblage. The catalyst can either be applied topically or in vapor form. The latter requires the artifact be placed in a closed container with a dish containing a small volume of DBTDA. The container is then heated to 125^{o} F (52° C) in a furnace, causing the DBTDA to vaporize and cure the silicone oil in the wood. By exposing the artifact to a vapor, there is much less chance of over-polymerizing certain areas of the artifact surface.

After allowing the artifact to sufficiently air out, the final step in the process involves the mechanical cleaning of any catalyzed polymer or extraneous material from the wood. The end result of the silicone oil treatment should be a very naturally colored wood artifact that undergoes little to no dimensional changes during the process. Although the treatment is not reversible, the wood is typically stable and does not require the close environmental controls as other treated woods.

Notes on the Conservation of Leather and Cordage

Non-wood organics encompass a broad category of materials that include all artifacts produced from plant fiber, plant byproducts, animal tissue and bone. There are, however, enough similarities in terms of treatment within these materials to group them together. Apart from wood, the Arch Cape artifact assemblage consisted of examples of leather sheathing and breeching rope, as well as smaller organics such as vegetal fibers, animal hair and a feather. While wood, leather and bone are among the most durable of the organic archaeological materials, even the most delicate non-wood organics, such as textiles and cordage, can survive centuries if buried under the right circumstances. These materials are all carbon-based organic fibrous polymers.

The survivability of these organics, whether buried in the ground or the ocean floor, is based on the state of equilibrium reached with the site of burial. Although the material will continue to slowly decompose, anaerobic decomposition is much less efficient than the aerobic respiration used by surface level bacteria and air-breathing animals.[128] Oxygen, pH and Eh levels in a marine environment, as well as the presence of tannins or metallic salts, can complicate decomposition. Decomposition can also depend on the amount of interstitial water present at the burial site, which, in the case of a marine context, demonstrates preferential preservation. The site formation process of the material burial is often as complex as the study of the organic material itself. Therefore, for the purpose of this section, it is more efficient to discuss organic materials by their similarities of treatment, rather than looking into the formation and decomposition of each type of material as done with wood and metal.

As with any artifact recovered from a marine environment, it is imperative to first remove the bulk of soluble salts present in the material before beginning treatment. This

[128] Cronyn and Robinson 1990, 16-17.

can be achieved in the same manner as discussed above with wood. When dealing with archaeological leather, it is also important to wash the artifact in order to remove any ingrained dirt. A soft brush or water jets are simple and effective means of mechanical cleaning, and avoid the risk of damaging the leather's collagen fibers by chemical cleaning. Stain removal is up to the discretion of the conservator. The leather samples from the Arch Cape assemblage were part of the sheathing that covered the breeching rings and therefore, absorbed the iron corrosion products. The samples were soaked in a 2% solution of ammonium citrate for two to three hours before rinsing under running water to remove all chemical residues. Although the process of treating the leather with silicone oil is very similar to the treatment outlined for waterlogged wood, the direct application of the catalyst onto the surface of the leather provides the best results, as opposed to a vapor form.

Cordage includes all types of cellulosic rope, line and cannon shot wadding, and though these materials are very delicate and unlikely to survive in the archaeological record, several examples were recovered from the 2008 excavation. In addition, hydrolysis and biotic attack typically leave cordage recovered from a marine environment in need of consolidation and structural support. This can be accomplished with a suitable synthetic resin. Fortunately, the samples from the Arch Cape assemblage, especially the ball of twine recovered from the bore, were structurally sound.

In order to remove any pitch or tar from the rope, the sample can be soaked in acetone. For iron staining, a 5% solution of oxalic acid works efficiently within a matter of hours. Any remaining stains can be removed using 5% EDTA disodium.[129] Both the cordage and leather samples were dehydrated using the same series of ethanol and acetone baths described above before being treated with silicone oil.

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[129] Hamilton 2010, 35-6.

7. THE CONSERVATION OF THE ARCH CAPE ARTIFACT ASSEMBLAGE: SUMMARY OF PROCEDURE AND RESULTS

Based on this general understanding of the different techniques and practices that can be employed to conserve materials recovered from a marine context, the following section will provide a summary of the chosen techniques, procedures and results for the conservation of the Arch Cape artifact assemblage. Although the assemblage consists of two carronades and carriage beds, the procedures were the same for both artifacts.

As previously mentioned, it is important to thoroughly document the artifacts before beginning conservation. This is achieved through radiography, photography, illustrations, and measurements. Maintaining a data record for each individual artifact is also essential in detailing the conservation process itself. Upon arrival to Texas A&M University's Conservation Research Laboratory, the concreted Arch Cape carronades were first scanned using a Konica Minolta 3D-Digitizer. The three-dimensional scans (figs. 49 and 50) will allow for the replication of the concretion forms using Styrofoam molds.

Carronades: Mechanical Cleaning and Carriage Removal

The Arch Cape carronades were heavily concreted with conglomerations of sand, beach stone and iron corrosion product. Prior to any treatment, these layers of concretion first needed to be removed. A hammer and chisel were initially used along cleavage lines to detach large pieces of encrustation without endangering the artifact. (fig. 51)

Upon reaching the cast iron surface of the carronade and the wood of the carriage bed, pneumatic air scribes were employed to ensure the concretion was removed with more precision and with less risk of damaging the original surfaces of the artifacts. (fig. 52) At this point, mechanical cleaning progresses at a much slower rate but as the true form of the gun and its carriage is revealed, a careful combination of hammers, chisels and air scribes can be used to expedite the process. It was also during this stage that any organic materials were removed from the concretion and placed into tap water to remain hydrated. These included larger pieces of unassociated wood, such as driftwood and roots, as well as smaller objects such as vegetal fibers, animal hairs and bird feathers.

The accumulation of concretion within the bore of the carronade presented a challenge during the mechanical cleaning stage. The muzzle of ACC Oregon Carronade A, for example, was plugged by the wooden tompion, preventing any buildup of concretion inside the bore. In this particular situation, the tompion needed to be removed in order for it to undergo its own specific treatment. The exposed outer surface between the tompion and the muzzle was first sheered off using a hand rope saw to remove the lip of the plug. A 3/8 in (9.5 mm) hole was then bored into the center of the tompion to determine its depth using a bore scope (152 mm in depth from the muzzle). Next, a quarter of the tompion was extracted using a reciprocating saw. Plastic wedges were then inserted around the remaining tompion, freeing it from the sides and allowing its removal.

Once the tompion had been extracted from the muzzle, a ball of twine was located about 381 mm from the face of the muzzle (fig. 53). The cordage was removed by simply pulling on the line attached near the wad. Behind the wad, black sand filled the bottom 45% of the bore. The gun was then elevated and the bore was flushed out with water. The sediment was collected through a series of screens reducing from 1/4 to 1/16 inch (6.35 mm to 1.6 mm). The total contents removed consisted of just over 2.5 l of black sand. Samples of sand were collected but nothing else of interest was found. The cordage was then placed into a container of de-ionized water to remain hydrated.

With ACC Oregon Carronade B, however, there was no tompion, meaning the bore was fully concreted. A hammer and chisel was first used to remove as much of the encrustation from in and around the muzzle as possible. Grinding the end of an iron rod to a chisel-like point, a 25 mm hole was then punched through the layers of concretion using a hammer. Although the front 25% of the bore was very dense concretion, the remainder was soft black sand, similar to Carronade A, and was able to be flushed out with water by elevating the rear of the gun. The hole will allow for the placement of a center auxiliary anode, and the evolution of hydrogen in the bore will loosen and remove much of the remaining encrustation. Before the guns could be placed into electrolytic baths, they needed to be separated from their respective carriage beds.

The carronades were secured to the carriage beds by a lug bolt that traversed through the loop on the underside of the gun and the joint chock of the carriage bed. In order to free the carronades from their beds, the lug bolts needed to be extracted. For both guns, a reciprocating saw was used to carefully cut through the bolt between the joint chock and the carronade (fig. 54). For ACC Oregon Carronade B, this had to be performed on both sides of the gun. Once the bolt sections were extracted, any concretion still adhering the guns to their beds could be removed. Using a pair of heavy-duty straps and a forklift, the guns were then lifted free from the beds.

While sections of the lug bolt were cut away during the removal of the guns from the beds, both guns still retained a bolt section inside the loop. Using thin chisels, picks and long air scribe styluses, the concretion around the bolt was gradually removed on either side before the section could be dislodged using a hammer and a punch.

At this stage, any final mechanical cleaning with pneumatic air scribes can be performed on the carronade prior to electrolysis, especially inside the loop and on the underside. This process can reveal important information about the guns, such as the maker’s mark and serial number associated with ACC Oregon Carronade A. Later, if deemed necessary, the severed bolt can be welded back together and sanded to appear in their original condition.

Carronades: Electrolysis

As previously stated, electrolytic reduction is the most effective way of removing chlorides from metals, especially iron. The evolution of hydrogen also works to loosen and remove any remaining encrustation, particularly in inaccessible areas such as the bore of ACC Oregon Carronade B. The carronades were placed into a specially designed steel vat holding 250 gallons of the chosen electrolyte, a 5% solution of sodium hydroxide (10 kg) and de-ionized water, although tap water could have initially been used. Each carronade was connected by a series of negative terminal wires and clips, to which the positively charged metallic ions travel and hydrogen is evolved. The positive terminal, or anode, is connected to the steel vat itself, which surrounds the carronade. At the anode, oxidation occurs and oxygen is evolved.

Chloride concentration monitoring was achieved through mercuric nitrate titration readings on a weekly basis. With ACC Oregon Carronade A, for example, the electrolyte was changed out a total of four times from 26 July 2010 to 14 March 2011, once every other month (Table 2). Upon every other change out of solution, the carronade was lifted from its vat and mechanically cleaned to remove any loosened encrustation. In addition to electrolysis loosening concretion, weaker portions of cast iron can flake off as hydrogen bubbles escape any imperfections in the metal. This can result in minor exfoliation of the original surface. Exfoliation can also be caused by applying too high a current during the early stages of electrolytic reduction. Once the chloride readings reached a level of 32-28 ppm, the carronade was removed from the vat and prepared for chemical treatment and final sealant.

Carronades: Chemical Treatment and Final Sealant

Once removed from electrolysis, the carronade was placed into a series of boiling rinses using de-ionized water, which not only removes any residual sodium hydroxide but lowers the overall chloride level of the artifact. The carronade underwent a twenty-day rinse cycle, with the water changed out every other morning. In order to maintain a more corrosion resistant surface to the cast iron, a 10% solution of tannic acid was applied to the carronade while the metal was still hot from the boiling rinses. A second coating was applied an hour after the first, with a third and fourth coating the following day. Due to the surface scarring on Carronade A associated with the electrolysis, a fifth a final coat was applied on the third day.

As mentioned earlier, the final process that any iron artifact undergoes is the surface sealant. The carronade was placed into a bath of molten microcrystalline wax, at a temperature of 325^{o} F (163^{o} C). The gun was allowed to cool overnight before the process is repeated the following day. This cycle of heating and cooling ensures that the wax penetrates into the iron, driving off the residual air and water. The microcrystalline wax forms a water-resistant layer on the surface of the carronade and fills up any voids, slowing the onset of any potential corrosion. For a larger artifact, such as the carronade, the process took roughly two weeks. The gun was removed from the wax at 180^{o} F (82^{o} C) and aesthetically cleaned to remove any excess wax.

Despite some surface scarring due to electrolysis and imperfections in the cast iron, the final result with Carronade A is still aesthetically pleasing due, in part, to the black color of the tannic acid. The identifying features, such as the English broad arrow and maker's mark, are well defined and legible, which is essential if future analysis will take place. With guns intended for outside display, conservators will often plug the touch hole and fill the bore completely with microcrystalline wax. The wax forms an impervious seal that is easily removed by placing the gun in a vat of boiling water and melting the wax out. This procedure was not carried out with Carronade A, however, as it is the intention of the conservator to produce a facsimile of the original wooden tompion to use in plugging the bore.

Notes on Associated Metal Artifacts

Several artifacts, including the heavy iron wedge, lengths and chain and the spike, were concreted separately from the carronades. These concretions were x-rayed prior to undergoing any mechanically cleaning to identify the artifacts and assess their condition. In order to minimize any damage to the objects, the encrustation was removed carefully using only pneumatic air scribes. In regards to the wedge and spike, the state of the metal was structurally sound and after mechanical cleaning, these underwent the same electrolysis and chemical treatment as the carronades. With the chain link fragments, however, much of the original iron was very fragile and weak and a more intensive process such as electrolysis could perhaps further damage the metal or destroy the artifacts entirely.

As an alternative treatment, the fragments were put into a sodium sulfite solution, sealed and placed into a warming oven at 140^{o} F (60^{o} C). This process converts the iron corrosion compounds to magnetite, and the chlorides are transferred to the solution and removed with each bath change.[130] Following five sodium sulfite baths, the fragments were rinsed thoroughly and boiled in de-ionized water. As with the other iron artifacts, the chain link fragments were coated with three layers of tannic acid and by immersion in microcrystalline wax.

Cupreous artifacts, such as the inscribed bolt and copper nails, were stable enough to undergo electrolysis. After boiling in de-ionized water, the pieces were polished and treated with a 2% BTA/ethanol solution. This not only forms a protective barrier between any remaining cuprous chloride and moisture in the atmosphere but it retards any subsequent corrosion and maintains the aesthetic value of the polished copper. This treatment preceded the final sealant of microcrystalline wax.

Carriage Beds: Disassembly

With the carronades lifted from their respective carriage beds, any remaining metal components needed to be removed from the carriages prior to treating the wood. These elements included the aforementioned breeching rings and breeching eyeplates, carriage tackle eyebolts, elevating screw plates and various plating pieces. The objects underwent electrolysis in smaller vats and were conserved in the same manner as the carronades with tannic acid and microcrystalline wax.

Each carriage bed was constructed using two pieces of white oak and held together by four long iron bolts and yellow pine dowel. In order to extract the bolts, a hammer

[130] Hamilton 2010, 80.

and pin were used to drive them through the carriage. The joint chock was attached to the bed by four squared-headed chock fastening bolts and proved much more difficult to remove. Using a hand grinder, the bolt heads were first ground down to a flat surface. Then using the drill press, a range of drill bits were used to bore through the bolts, starting with ½ inch and progressing in size. Once both the top and undersides were drilled out to the extent of the bits, a hammer and pin were used to punch out the remainder of the bolts. These bolt fragments, along with the long bolts, were individually treated using the methods for iron conservation described above.

With all bolts extracted, the seam line running the length of the bed was worked with a variety of tools and wedges of differing widths to gradually separate the two wood halves. Once the two carriage bed halves were separated, the joint chock, gudgeon and slide bolt were lifted as a single unit and placed into a circular vat for electrolysis.

Carriage Beds: Pre-Treatment and Dehydration

Since the carriage bed pieces had been exposed to the cast iron of the carronade and related metal components, the iron corrosion salt products became deposited within the wood structure, resulting in the orange discoloration of the wood. As mentioned earlier, the iron compounds can interfere with the treatment and therefore must be removed beforehand. The carriage halves were placed into baths of 2% ammonium citrate for a period of six months. The wood was rotated each month and the solution changed out on the third month. The chemical treatment reacted with the iron to remove it from the wood but as a result, the color was leeched out as well, resulting in a drab, grayish coloration.

With the removal of the iron corrosion products and desalination of the wood, any absorbed water must be removed to allow for the deep penetration of the silicone oil. The carriage halves, in addition to other wood fragments and organic materials, were placed into the series of ten dehydration baths described earlier.

Carriage Beds: Silicone Oil Treatment

Following dehydration, the carriage bed pieces were quickly transferred to a silicone oil solution. The 80% silicone oil mixture consists of 66% SFD1 and 34% SFD5, and an addition of 20% MTMS as a cross-linker, measured by volume. The difference between SFD1 and SFD5 is in the molecular weight but the formula is standard at the Conservation Research Laboratory and is ideal for the treatment of most organics, including wood, leather, rope and textiles.[131]

Once transferred, the wood remained submerged in the polymer solution throughout the duration of the treatment. As previously mentioned, the size of the artifact will determine the length of the treatment and the carriage beds will remain in solution for 6-8 weeks. Upon removal, any excess polymer solution will be cleaned from the carriage halves before a catalyst (DBTDA) will be applied topically, due to size constraints. Smaller wood artifacts in the assemblage were catalyzed by exposure to the catalyst in

[131] Dewolf 2004.

vapor form. The silicone-treated beds should prove to be much more dimensionally stable when compared to other wood conservation techniques. As opposed to a polyethylene glycol treatment, which is corrosive to all metals, the use silicone oil will allow for the return of the original metal components to the carriage beds without risk of interfering with the treatment. Silicone oil has even been shown in tests to be a suitable sealant on iron.

Notes on Associated Organic Artifacts

Much of the smaller organic material, including fibers, animal hairs and bird feathers, was extracted during the initial mechanical cleaning of the carronades and allowed to desalinate before undergoing dehydration and a silicone oil treatment. Other examples, primarily the leather and rope pieces, had to be removed from the carronades and carriage beds in a much more delicate manner. The surviving leather sheathing, for example, was still attached to the breeching rings. Using dental tools and a scalpel, the seam line was carefully worked loose in order to separate the leather from the ring.

While the examples of leather sheathing were, more or less, structurally sound, the breeching rope was particularly fragile and had to be extracted from the carronade in segments. Some of the pieces, including the rope grommet from the carriage tackle eyebolt of Carronade A, were heavily stained from the iron corrosion product. After desalination, the objects were rinsed in a solution of EDTA and ammonium citrate, and although much of staining was removed, there was still some orange coloration after the objects were taken out of dehydration.

After dehydration, the leather and rope artifacts were treated with the same silicone oil formula as the wood. This formula was used to treat all organics in the Arch Cape assemblage. Upon removal, any excess polymer solution was cleaned both mechanically and using MTMS, which also removed some of the orange coloration. The artifacts were then exposed to the catalyst (DBTDA) in a vapor form for a week.

The polymer passivation treatment proved to be an adequate consolidant for the Arch Cape organic artifacts, especially the leather, rope and small wood samples. The leather sheathing, for example, emerged with a slightly brighter tone than before treatment, giving it an aesthetically pleasing dark brown color. Having absorbed iron salts from its exposure to the breeching ring, the sheathing was rigid and tough prior to treatment. Upon completion of the treatment, the leather was more flexible while maintaining good tensile strength. There was also very minimal shrinkage associated with the silicone oil treatment. The small wood samples generally had the same results as the leather sheathing, though with a bit more orange staining from the heavy leeching of iron corrosion products.

Similarly, the rope grommet was heavily stained from the iron corrosion products prior to treatment. Although much of the orange staining was removed, the rope was still rather dark in color following treatment. There was little flexibility to the rope but the tensile strength was very good and there was no associated shrinkage. The treatment also brought out the fine details of the serving wrap that covered the grommet.

Conclusion

When exposed to the harsh conditions of a marine environment, as the Arch Cape carronades had been for over 150 years, cast iron will often degrade to a very soft and structurally unsound state. Fortunately, the combination of colder water and the shell of concretion that formed around the guns and carriages helped to protect the metal and organic materials from corroding or deteriorating away. Once this layer of concretion was removed and the guns and metal components separated from their carriages, the surviving ferrous and non-ferrous metals were durable enough to undergo the more rigorous treatment of electrolytic reduction. Though there was some exfoliation of the cast iron during E.R. with Arch Cape Carronade A, the electrolysis was an overall successful approach and the resultant products were well stabilized while also maintaining aesthetic, archaeological and historical integrity.

With the ferrous artifacts, tannic acid was applied to the surface to make the iron more corrosion resistant while also adding an appealing black finish. With cupreous artifacts, the surface was first buffed and polished for aesthetic appeal before being treated with a BTA solution to maintain the polished appearance. All metal artifacts were then sealed using microcrystalline wax.

The surprising amount of organics that survived added an element of complexity to the conservation process of the Arch Cape assemblage. From the larger wooden carriage pieces to the smallest animal hairs and fibers, silicone oil was chosen as the preferred treatment for the materials. The silicone oil solution was successfully applied to the organic artifacts in all states of preservation, with little to no shrinkage or distortion to the objects. The artifacts retained much of their natural color, tensile strength and flexibility.

After desalination was completed, much of the organic assemblage was dehydrated in a series of solvent baths that culminated in two successive immersions in acetone. Due to the corrosion of the iron products, some of the artifacts were heavily stained and were successfully cleaned using an ammonium citrate solution prior to dehydration. However, the leeching of tannins during the process did dull the natural color of the wood.

The smaller wooden artifacts that were conserved using silicone oil were then exposed to a catalyst in vapor form before being mechanically cleaned of any hardened polymer. Larger artifacts, such as the carriage beds, had the catalyst applied topically. This use of the same polymer passivation on organic artifacts of various sizes achieved similar success as a result of the conservation process.

REFERENCES

Alexander, A. 1846. *A History of Colonization on the Western Coast of Africa.* Philadelphia: W.S. Martien.

Allen, G.W. 1929. *Our Navy and the West Indian Pirates.* Salem, MA: Essex Institute.

American State Papers: Naval Affairs I: 616, 1819.

American State Papers: Naval Affairs I: 804, 1822.

American State Papers: Naval Affairs III: 58, 1827.

Army and Navy Chronicle 1: 18 June 1835.

Army and Navy Chronicle 5: 3 August 1837.

Army and Navy Chronicle 5: 14 September 1837.

Army and Navy Chronicle 10: 30 April 1840.

Astoria Daily Budget, 28 August 1909.

Astoria Evening Budget, 7 January 1924.

Audubon, L. 1894. *The Life of John James Audubon, the Naturalist.* New York: G.P. Putnam's Sons.

Baker, H.A. 1983. *The Crisis in Naval Ordnance.* London: National Maritime Museum.

Boston Recorder 6: 26 January 1822.

Boston Recorder and Religious Telegraph 13: 22 August 1828.

Beehler, W.H. 1890. "The United States Navy and West India Piracy, 1821-1825," *Frank Leslie's Popular Monthly* 29: 2-16.

Blackmore, H. 1986. *Gunmakers of London 1350-1850.* York, PA: George Shumway Publisher.

Bradlee, F.B.C. 1922. *The Suppression of Piracy in the West Indies, 1820-1832.* Salem, MA: Essex Institute.

Burney, W. and W. Falconer, 2006. *New Universal Dictionary of the Marine 1815.* Annapolis: Naval Institute Press.

Campbell, R.H. 1961. *Carron Company.* Edinburgh: Oliver & Boyd.

Canney, D. 2001. *Sailing Warships of the U.S. Navy.* Annapolis*:* Naval Institute Press.

Caruana, A. 1997. *History of English Sea Ordnance Volume II: The Age of the System 1715-1815.* Rotherfield, England: Jean Boudriot Publications.

Chapelle, H. 1935. *The History of American Sailing Ships, Volume 46.* New York: W.W. Norton & Company.

Chapelle, H. 1998. *The History of the American Sailing Navy: The Ships and Their Development.* Old Saybrook, CT: Konecky & Konecky.

Christian Register, 15 October 1824.

Christian Register, 11 February 1832.

Cleere, H., D.W. Crossley, and B.C. Worssam. 1985. *The Iron Industry of the Weald.* Leicester, England: Leicester University Press.

Coggeshall, G. 1858. *Thirty-six Voyages to Various Parts of the World, Made Between the Years 1799 and 1841.* New York: George Coggeshall.

Cohen's Lottery Gazette and Register, 14 January 1825.

The Corp of Royal Engineers. 1850. *Aide-mémoire to the Military Sciences*. Vol. 2. London: J. Weale.

Cronyn, J.M. and W.S. Robinson. 1990. *The Elements of Archaeological Conservation.* Hove, England: Psychology Press.

The Daily Astorian, 12 April 1989.

Dennon, J. 1989. "The Schooner Shark's Cannon," *Clatsop County Historical Society Quarterly* 9: 3-13.Elvin, J.G.D. 1983. *British Gunfounders 1700-1855.* Greenwich.

Dewolf, H. 2004. "Conservation Research Laboratory Instructions: Polymer Passivation (Silicone Oil) Conservation Treatment," based on a report by Helen Dewolf, 26 May 2004. College Station: Texas A&M University.

East India Company Ordnance Purchases. L/AG/1/5/25, Oriental and India Office Collections. London: British Library.

Elvin, J.G.D. 1983. *British Gunfounders 1700-1855.* London: J.G.D. Elvin.

Emmons, G.F. 1853. *The Navy of the United States, From the Commencement, 1775 to 1853.* Avon, CT: Gideon & Co.

The Episcopal Watchman 1: 29 November 1828.

Ffoulkes, C. 1937. *The Gun-Founders of England: With a List of English and Continental Gun-founders from the XIV to the XIX Centuries.* Cambridge, England: Cambridge University Press.

Hamilton, D.L. 1976. *Conservation of Metal Objects from Underwater Sites: A Study in Methods.* Austin: Texas Antiquities Committee Publications.

Hamilton, D.L. 2010. *Methods of Conserving Archaeological Material from Underwater Sites.* College Station: Texas A&M University.

Himes, G. 1913. "Letters by Burr Osborn, Survivor of the Howison Expedition to Oregon, 1846: Reminiscences of Experiences Growing out of Wrecking of the United States Schooner Shark at Mouth of Columbia on Eastward Voyage of Expedition," *The Quarterly of the Oregon Historical Society*, 14: 355-65.

Howison, N.M. Letters to George Abernethy. 11 September 1846, 13 September 1846, 1 December 1846, 19 February 1847. *George Abernethy Correspondence, MSS 929.* Portland: Oregon Historical Society Research Library.

Howison, N.M. 1913. "Report of Lieutenant Neil M. Howison on Oregon, 1846," *Oregon Historical Quarterly* 14: 1-60.

"HMS *Modeste* on the Pacific Coast 1843-47: Log and Letters," *Oregon Historical Quarterly* 61: 408-36.

Hussey, J.A. 1962. *The History of Fort Vancouver and Its Physical Structure.* Portland: Washington State Historical Society & National Park Service.

James, C. 1810. *A New and Enlarged Military Dictionary, Volume 2.* London: T. Egerton.

James, W. and F. Chamier. 1837. *The Naval History of Great Britain: From the Declaration of War by France in 1793 to the Accession of George IV.* London: R. Bentley.

John, A.H., ed. 1951. *Minutes relating to Messrs. Samuel Walker and Co., Rotherham, Ironfounders and Steel Refiners, 1741-1829.* London: Council for the Preservation of Business Archives.

Kell, J.M. 1900. *Recollections of a Naval Life, Including the Cruises of the Confederate States Streamers "Sumter" and "Alabama."* Washington D.C.: The Neale Company.

Kennard, A.N. 1986. *Gunfounding and Gunfounders: A Directory of Cannon Founders from Earliest Times to 1850.* London: Arms & Armour Press.

Lavery, B. 1987. *The Arming and Fitting of English Ships of War, 1600-1815.* Annapolis*:* Naval Institute Press.

Lavery, B. 1989. *Nelson's Navy: The Ships, Men, and Organisation, 1793-1815.* Annapolis*:* Naval Institute Press.

Letters from the Ordnance Board, 1805-1806. ADM 1/4017, Admiralty, and Ministry of Defense, Navy Department: Correspondence and Papers, 1660-1976. Kew: Public Records Office.

Lowe, T. 1846. *Private Journal Kept at Fort Vancouver Columbia River by Thomas Lowe Hudson Bay Coy.* British Columbia: British Columbia Archives.

Lynch, W.F. 1851. *Naval Life; or, Observations Afloat and On Shore.* New York: C. Scribner.

Marshall, D. 1984. *Oregon Shipwrecks.* Hillsboro, OR: Bindford & Mort.

McArthur, L.A. and L.L. McArthur. 2003. *Oregon Geographical Names*. Portland: Oregon Historical Society Press.

The Mechanics' Magazine, Museum, Register, Journal, and Gazette 1120: 25 January 1845.

Merk, F. 1995. *Manifest Destiny and Mission in American History.* London: Harvard University Press.

The Military and Naval Magazine of the United States 1: March 1833

The Military and Naval Magazine of the United States 1: May 1833.

The Military and Naval Magazine of the United States 2: February 1834

Miller, E.G. 1954. “Pioneer Woman’s Husband Saved Ship’s Gun for Cannon Beach,” *Astorian Budget*: 7.

Mooney, J.L. 1976. *Dictionary of American Naval Fighting Ships.* Vol. 6. Washington D.C.: Government Printing Office.

Morison, S.E. 1967. *“Old Bruin” Commodore Matthew C. Perry.* New York: Little, Brown & Co.

Murray, J. 1871. *The Principles and Practice of Modern Artillery: Including Artillery Material, Gunnery and Organization and Use of Artillery in Warfare.* Princeton: Princeton University Press.

New York Sentinel and Working Man’s Advocate, 14 August 1830.

Niles’ Weekly Register 20: 26 May 1821.

Niles’ Weekly Register 21: 26 January 1822.

Niles’ Weekly Register 22: 11 May 1822.

Niles’ Weekly Register 22: 22 June 1822.

Niles’ Weekly Register 23: 21 December 1822.

Niles’ Weekly Register 23: 1 February 1823.

Niles’ Weekly Register 23: 15 February 1823.

Niles’ Weekly Register 24: 20 March 1823.

Niles’ Weekly Register 26: 17 April 1824.

Niles’ Weekly Register 26: 12 June 1824.

Niles’ Weekly Register 27: 4 December 1824.

Niles’ Weekly Register 28: 9 July 1825.

Niles’ Weekly Register 30: 11 March 1826.

Niles’ Weekly Register 31: 2 September 1826.

Niles’ Weekly Register 31: 2 December 1826.

Niles' Weekly Register 31: 16 December 1826.

Niles' Weekly Register 32: 4 August 1827.

Niles' Weekly Register 34: 19 July 1828.

Niles' Weekly Register 34: 2 August 1828.

Niles' Weekly Register 41: 17 September 1831.

Niles' Weekly Register 41: 21 January 1832.

Niles' Weekly Register 41: 11 February 1832.

Niles' National Register 56: 27 July 1839.

Niles' National Register 58: 16 May 1840.

Niles' National Register 61: 25 December 1841.

Orcut, A.M. 1951. *Tillamook: Land of Many Waters.* Hillsboro, OR: Bindford & Mort.

Oregon Spectator 1: 3 September 1846.

Oregon Spectator 1: 15 October 1846.

Padfield, P. *Guns at Sea.* New York: St. Martin's Press, 1974.

Palmer, M.A. 1987. *Stoddert's War: Naval Operations During the Quasi-War with France, 1798-1801.* Columbia, SC: University of South Carolina Press.

Papers of Sir Charles Middleton, first Baron Barham. MID 9/2/16, 20, Private Papers. London: National Maritime Museum.

Perry, M.C. Letters to S. Thompson. 31 March and 9 May 1821. M148, R26, Officers' Letters. Washington: National Archives.

The Polynesian 3: 10 October 1846.

Records of Ordnance Office, Portsmouth. Letters Received, 1805 December – 1806 June. WO 55/2031, Ordnance Office and War Office: Miscellaneous Entry Books and Papers, 1568-1923. Kew: Public Records Office.

Records of Ordnance Office, Portsmouth. Minutes, issued and received, 1812 April – 1814 March. WO 55/2236, Ordnance Office and War Office: Miscellaneous Entry Books and Papers, 1568-1923. Kew: Public Records Office.

Register of in-letters to the Board of Ordnance, April-June 1805. WO 45/70, Ordnance Office and Office of the Commander in Chief: Reference Books to Correspondence, 1783-1870. Kew: Public Records Office.

Register of in-letters to the Board of Ordnance, October-December 1805. WO 45/72, Ordnance Office and Office of the Commander in Chief: Reference Books to Correspondence, 1783-1870. Kew: Public Records Office.

Returns of ordnance on H.M. Ships. ADM 160/154, Ships' Armaments and Ordnance Stores. Kew: Public Records Office.

Robinson, W.S. 1981. "First Aid for Marine Finds," *Handbooks in Maritime Archaeology* 2: 29.

Rodgers, B.A. 2004. *The Archaeologist's Manual For Conservation: A Guide to Non-Toxic, Minimal Intervention Artifact Stabilization.* Basel, Switzerland: Birkhäuser.

Rollins, M. and N. Crombie. 2008. "Loose Cannons," *The Oregonian*: A1, A4.

Ross, W. 2008. "Sands of Time: Rapid Erosion along the Oregon Coast is Exposing Long-Hidden Relics," *The Register Guard*: A1, A7.

Roth, R. 2011. "Governor's Cannon." *Turks and Caicos National Museum.* http://tcmuseum.org/projects/

Saturday Evening Post, 9 September 1826.

Saturday Evening Post, 21 April 1827.

Saturday Evening Post, 29 August 1829.

Schroeder, J. 2001. *Matthew Calbraith Perry: Antebellum Sailor and Diplomat.* Annapolis: Naval Institute Press.

Scientific America, 1 July 1868.

Shark Broadside, 1846. *Document No. 13,010*. Salem: Oregon State Archives.

Southern Literary Messenger 7: May and June 1841.

Statham, E.P. 1910. *Privateers and Privateering.* London: Hutchinson & Co.

Stockton, R.F. 1856. *A Sketch of the Life of Co. Robert F. Stockton.* New York: Derby & Jackson.

Survey of Stores and Arm[s] (Navy), 1818. WO 55/1749, Ordnance Office and War Office: Miscellaneous Entry Books and Papers, 1568-1923. Kew: Public Records Office.

Trumpet and Universalist Magazine, 4 October 1828.

Tucker, S. 1989. *Arming the Fleet: U.S. Navy Ordnance in the Muzzle-Loading Era.* Annapolis: Naval Institute Press.

United States Statutes III: 596, 1819.

West Indies (Returns), 1810-1817. WO 44/350, Ordnance Office and War Office Correspondence, 1682-1873. Kew: Public Records Office.

Woolwich Proof Books. Monograph 56, Armouries Library. London: National Maritime Musuem.

Wright, E.W. 1895. *Lewis & Dryden's Marine History of the Pacific Northwest.* Portland: The Lewis & Dryden Printing Company.

APPENDIX A

FIGURES

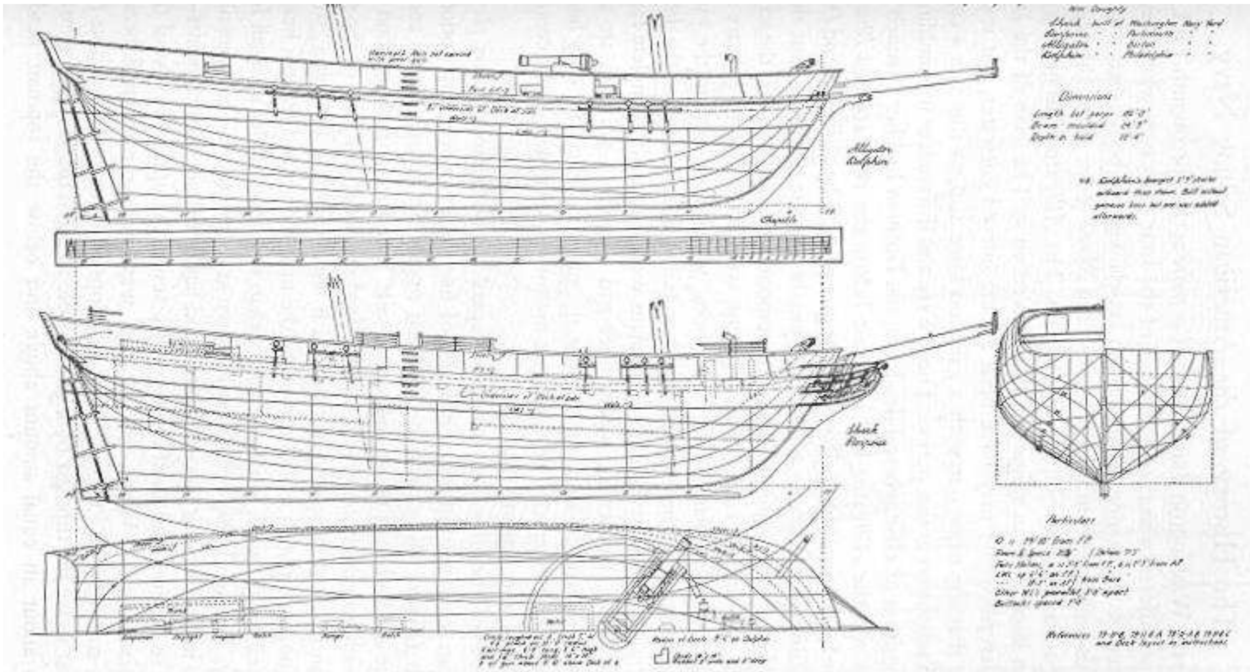


Figure 1. Plan for schooners *Shark, Alligator, Dolphin* and *Porpoise.* (Canney 2001, 180)

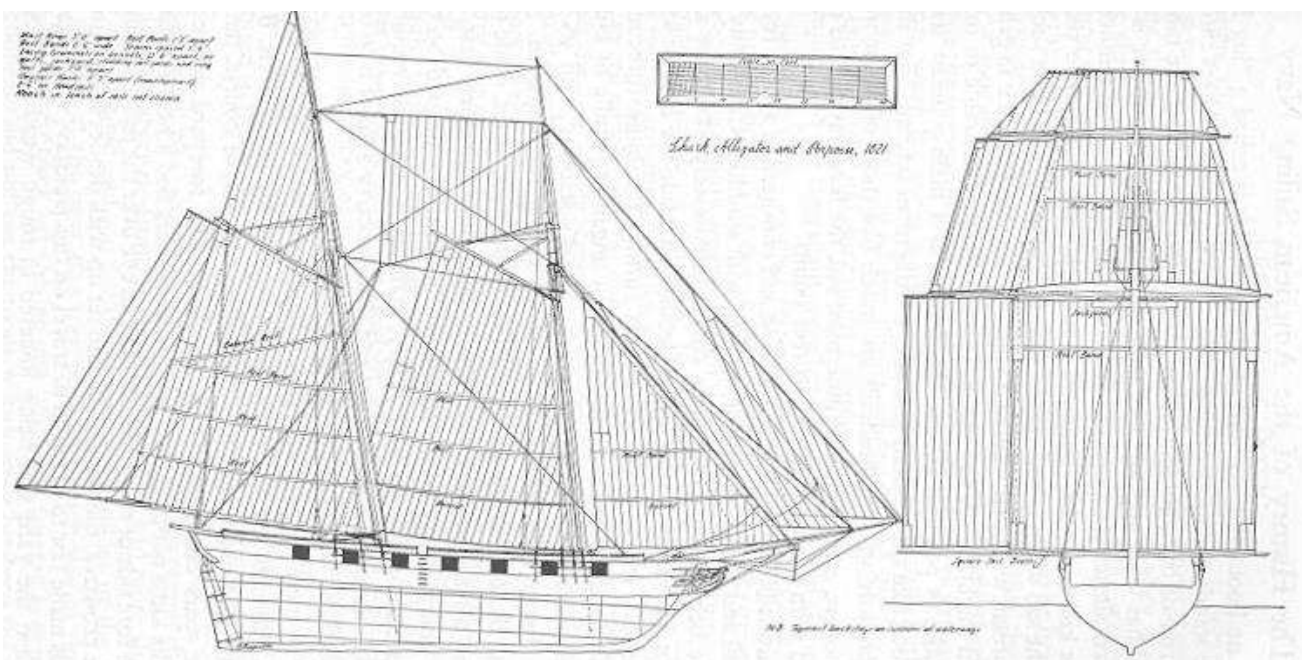


Figure 2. Sail plan for schooners *Shark, Alligator, Dolphin* and *Porpoise.* (Canney 2001, 180)

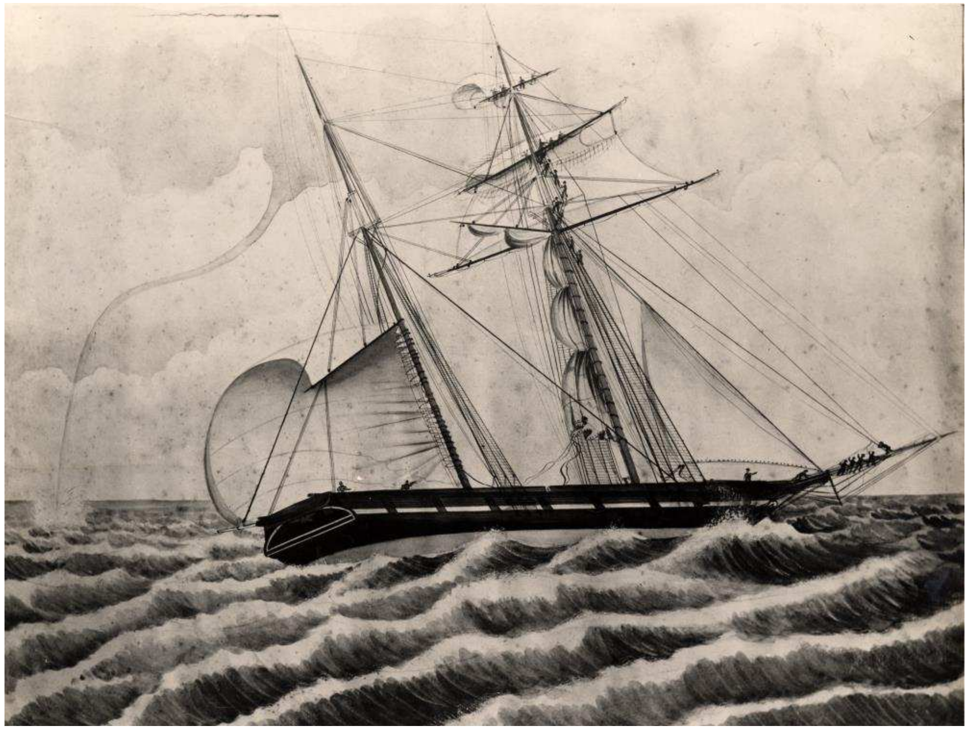
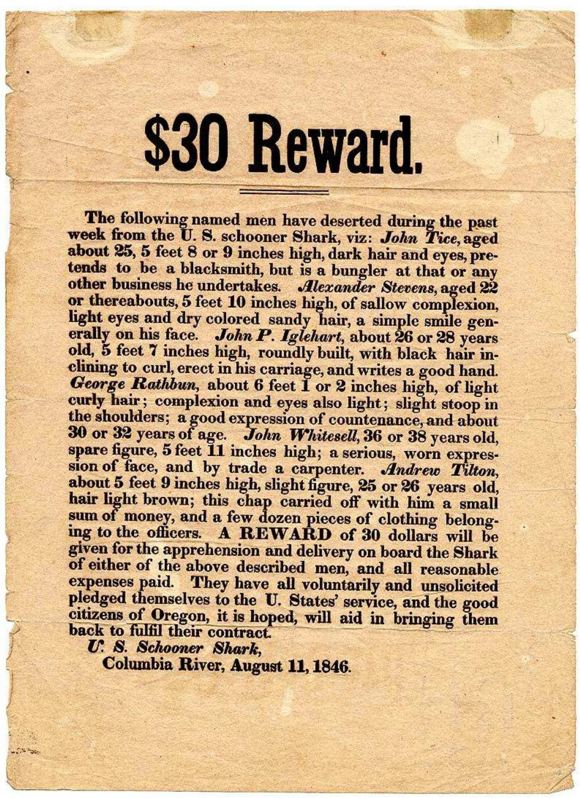


Figure 3. The schooner *Shark* in 1822. (The Mariner's Museum, Catalog No. PN594)



$30 Reward.

The following named men have deserted during the past week from the U. S. schooner Shark, viz: *John Tice*, aged about 25, 5 feet 8 or 9 inches high, dark hair and eyes, pretends to be a blacksmith, but is a bungler at that or any other business he undertakes. *Alexander Stevens*, aged 22 or thereabouts, 5 feet 10 inches high, of sallow complexion, light eyes and dry colored sandy hair, a simple smile generally on his face. *John P. Iglehart*, about 26 or 28 years old, 5 feet 7 inches high, roundly built, with black hair inclining to curl, erect in his carriage, and writes a good hand. *George Rathbun*, about 6 feet 1 or 2 inches high, of light curly hair; complexion and eyes also light; slight stoop in the shoulders; a good expression of countenance, and about 30 or 32 years of age. *John Whitesell*, 36 or 38 years old, spare figure, 5 feet 11 inches high; a serious, worn expression of face, and by trade a carpenter. *Andrew Tilton*, about 5 feet 9 inches high, slight figure, 25 or 26 years old, hair light brown; this chap carried off with him a small sum of money, and a few dozen pieces of clothing belonging to the officers. A REWARD of 30 dollars will be given for the apprehension and delivery on board the Shark of either of the above described men, and all reasonable expenses paid. They have all voluntarily and unsolicited pledged themselves to the U. States' service, and the good citizens of Oregon, it is hoped, will aid in bringing them back to fulfil their contract.

U. S. Schooner Shark,
Columbia River, August 11, 1846.

Figure 4. Shark Broadside, 1846. (Oregon State Archives, Document No. 13,010)

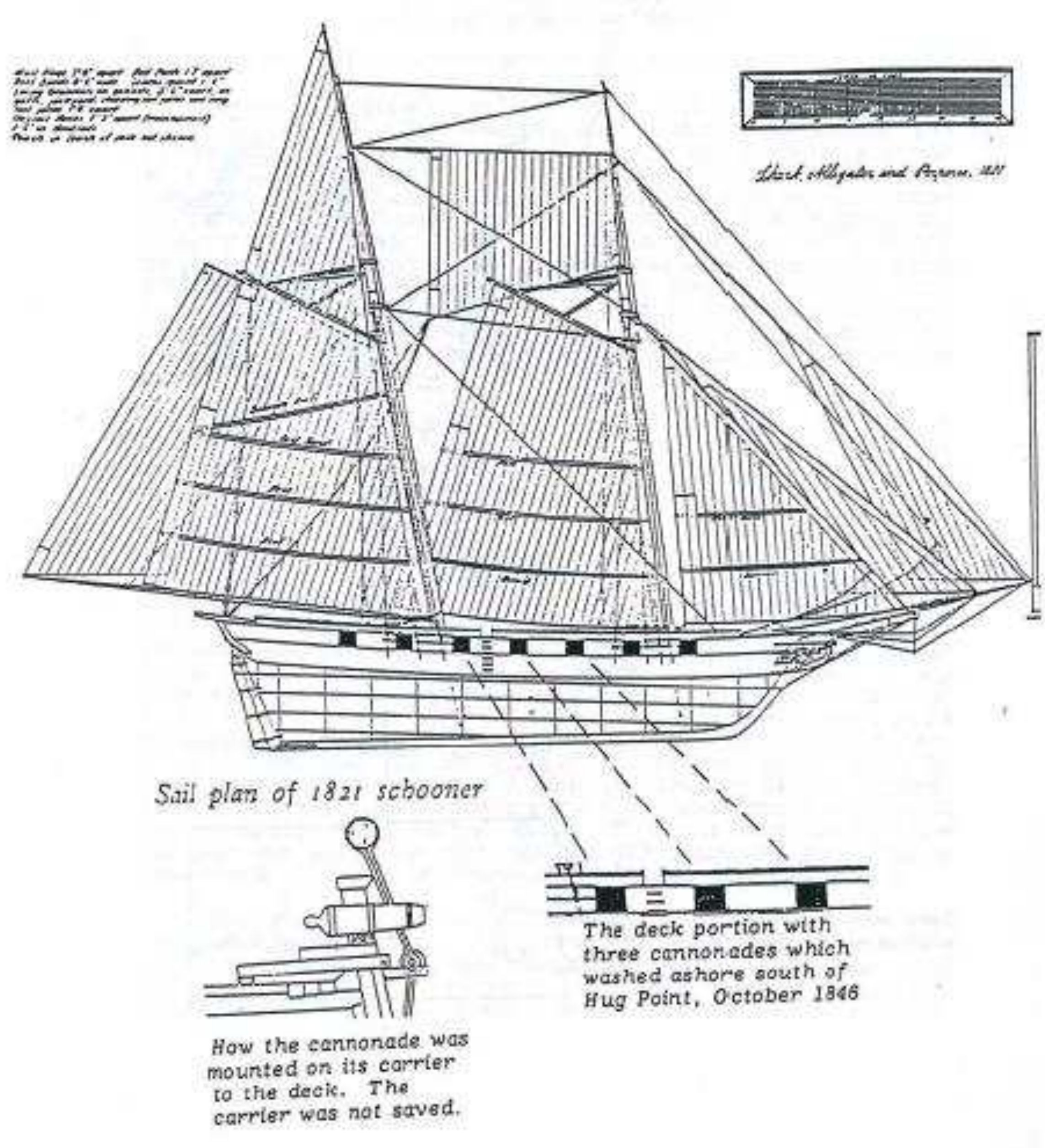


Figure 5. A diagram of the deck portion with three carronades attached. (Dennon 1989, 21)

Figure 6. George Luce and John Gerritse with the 18-pounder carronade circa 1898. (Misc. Oregon Stare Archives)

Figure 7. Mrs. Austin with carronade and first block mounting circa 1898. (Misc. Oregon State Archives)

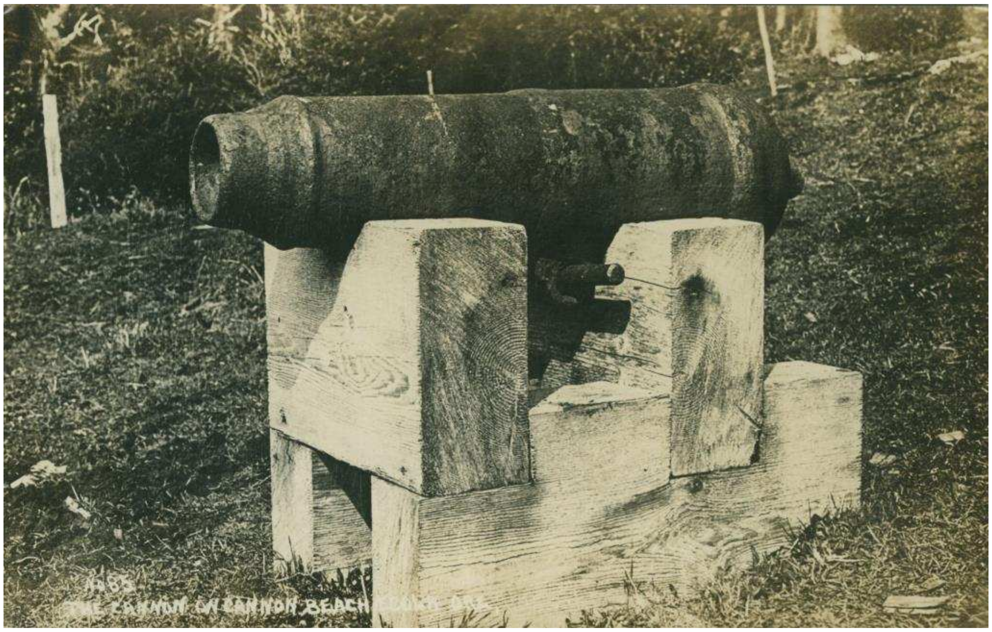


Figure 8. Carronade on second block mounting. Date unknown. (Misc. Oregon State Archives)

Figure 9. The carronade along with the capstan, chock and cleat. Date unknown. (Misc. Oregon State Archives)

Figure 10. The carronade and capstan alongside Highway 101. Circa 1960. (Misc. Oregon State Archives)

Figure 11. The carronade and capstan at the Cannon Beach Historical Society. (Misc. Oregon State Archives)

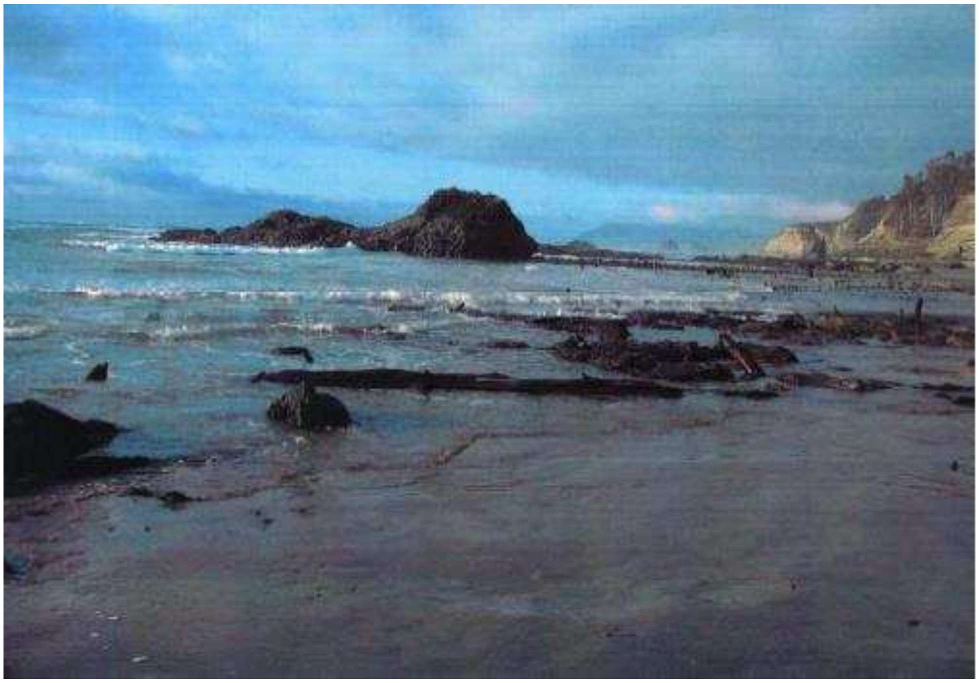


Figure 12. Arch Cape beach, looking north, with the first carronade in foreground by tide line. (Griffin 2008)

Figure 13. The hauling of the first carronade further up the beach. (Griffin 2008)

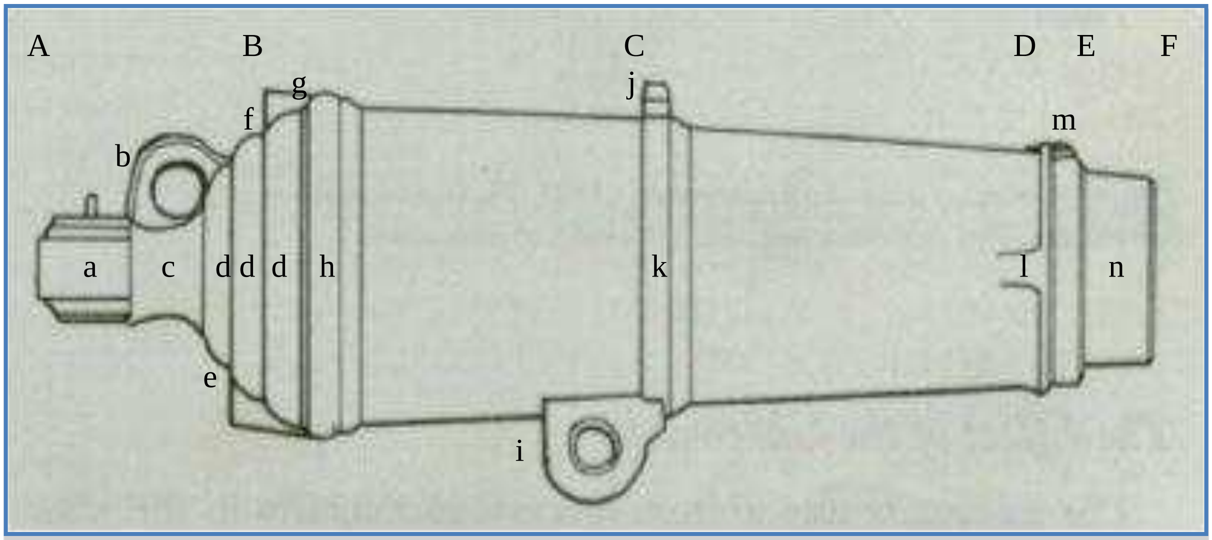
Figure 14. ACC Oregon Carronade A, pre-conservation. (Bajdek 2012)

Figure 15. ACC Oregon Carronade B, pre-conservation. (Bajdek 2012)

Figure 16. Length of chain. (Griffin 2008)

Figure 17. Double-linked length of chain. (Griffin 2008)

Figure 18. Metal pipe fragment and wood piece. (Griffin 2008)

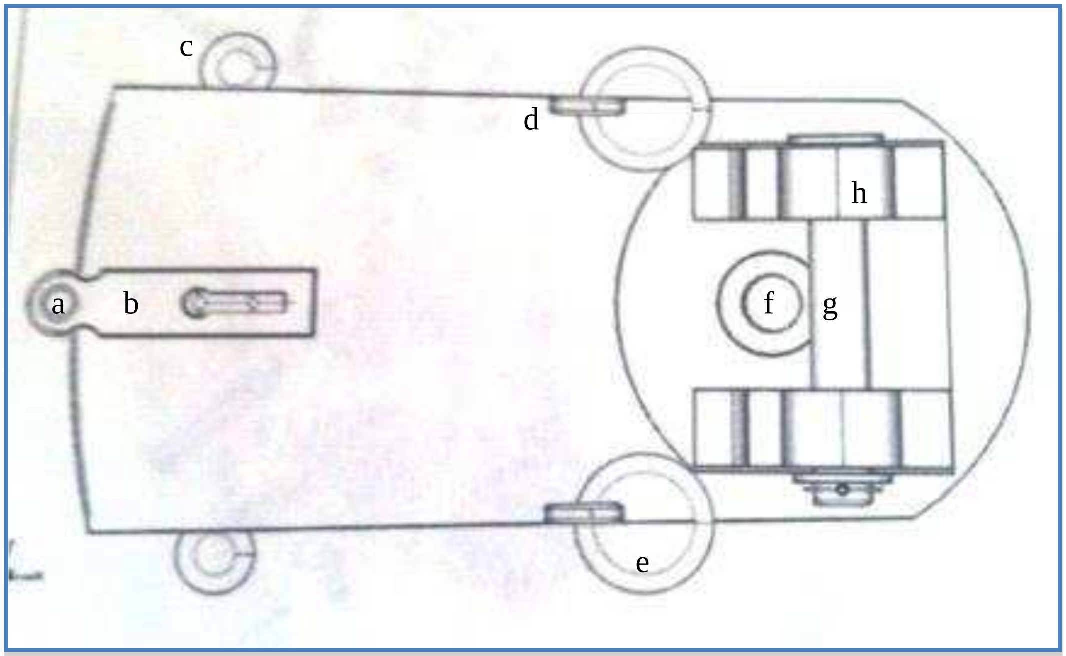


AB: Cascabel
BC: Reinforce
CD: Chase
DE: Muzzle
EF: Muzzle Cup

a: Elevating Screw Base
b: Breeching Ring
c: Neck
d: Breech Mouldings
e: Quoin Wedge
f: Aft Sight
g: Vent Hole

h: Base Ring & Ogee
i: Lug
j: Step Sight
k: Reinforce Ring & Ogee
l: Muzzle Astragal
m: Muzzle Sight
n: Nozzle

Figure 19. Standard British 18-pounder carronade diagram. (Bajdek 2012)



a: Train Tackle Eyebolt
b: Elevating Screw Plate
c: Carriage Tackle Eyebolt
d: Breeching Eyeplate
e: Breeching Ring
f: Gudgeon
g: Lug Bolt
h: Joint Chock

Figure 20: Carronade carriage bed diagram. (Bajdek 2012)

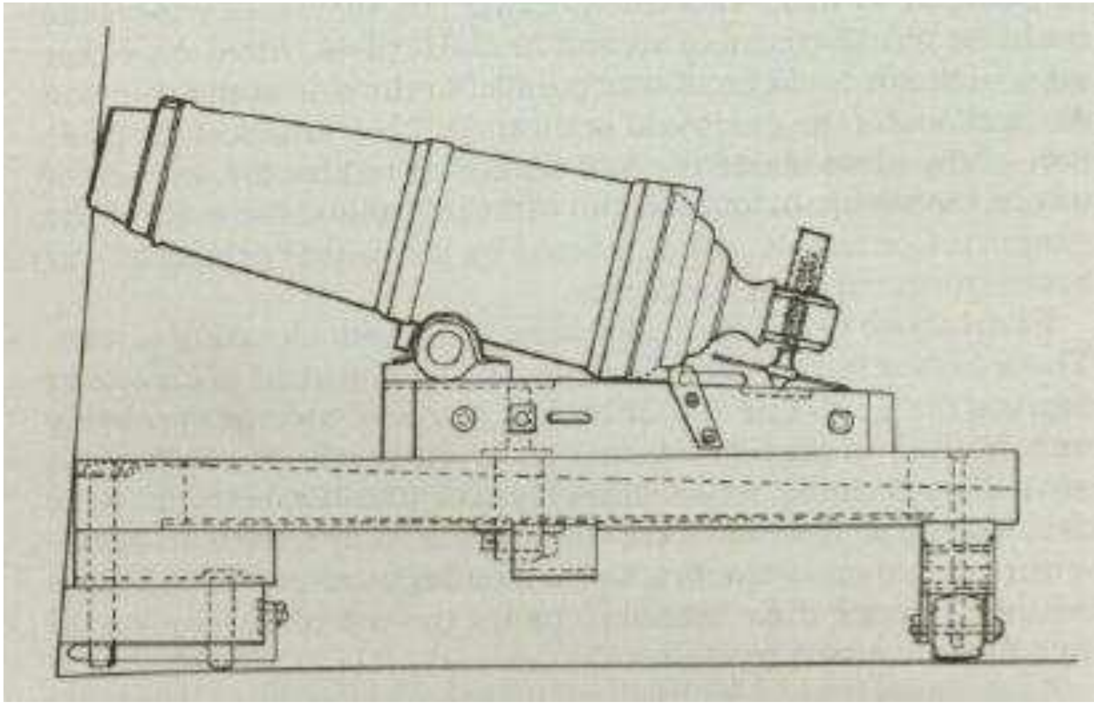


Figure 21. Standard carronade “bed-and-slide” arrangement. (Lavery 1987, 131)

Figure 22. ACC Oregon Carronade A, in process. (Bajdek 2012)

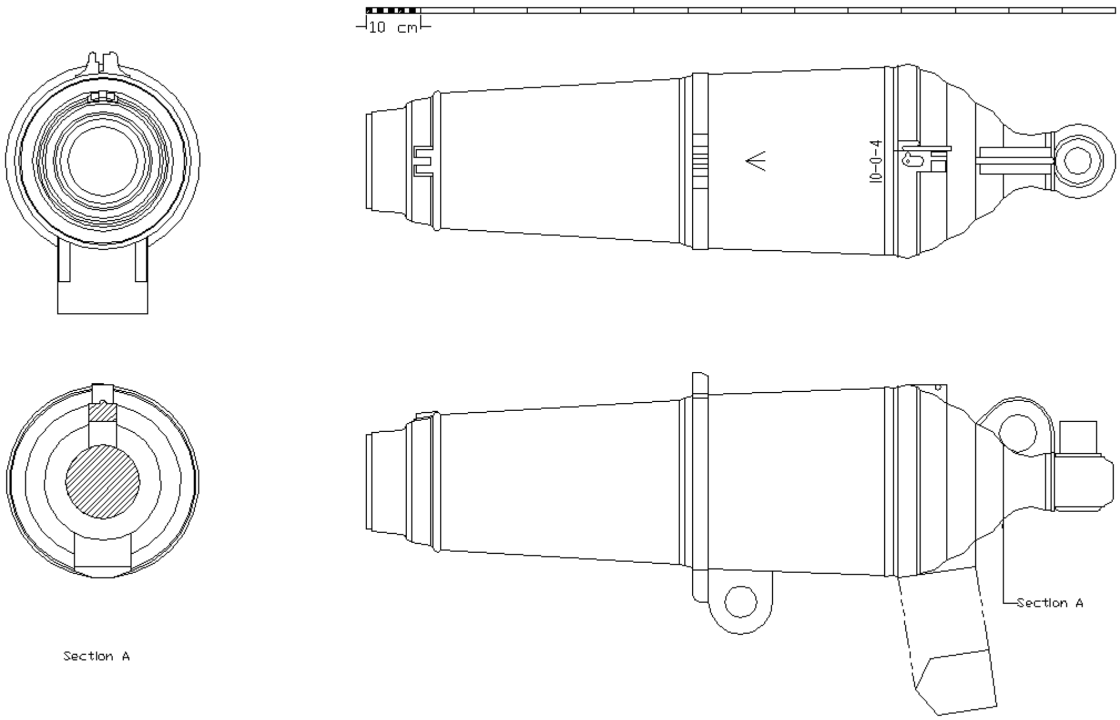
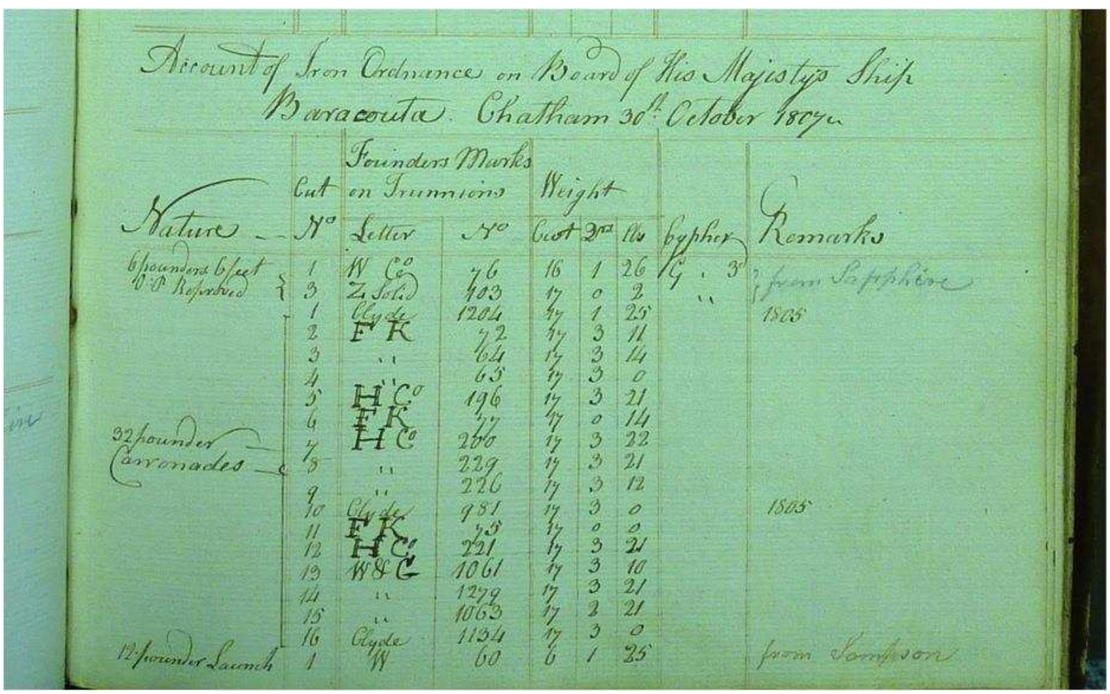


Figure 23. Scale drawing of ACC Oregon Carronade A. (Bajdek 2012)

Figure 24. English Broad Arrow. (Bajdek 2012)

Figure 25. The weight of the gun: 10-0-4. (Bajdek 2012)

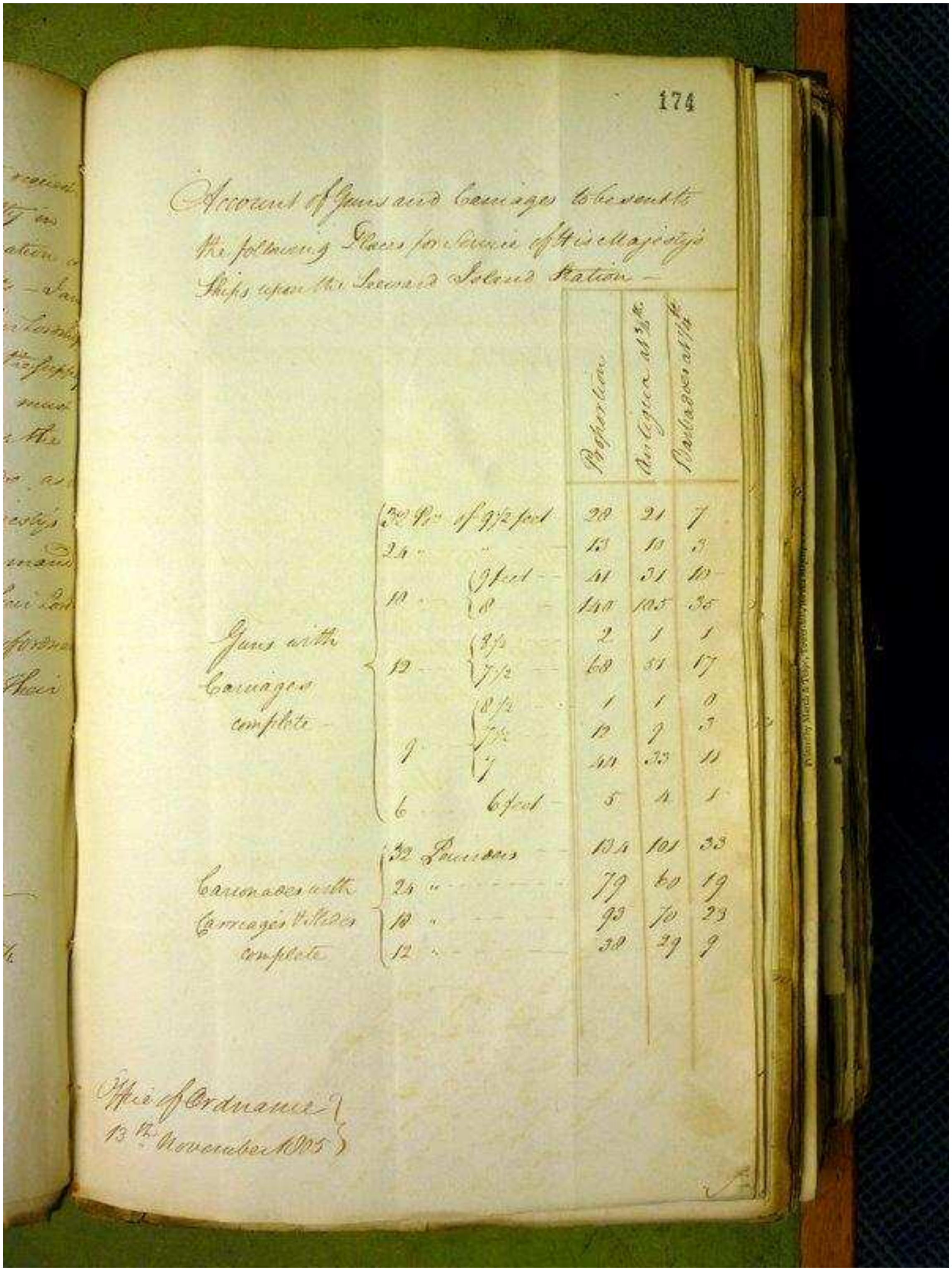
Figure 26. Maker's mark, caliber and serial number on underside of gun. (Bajdek 2012)



Account of Iron Ordnance on Board of His Majesty's Ship
Baracouta. Chatham 30th October 1807.

Nature	Gun No	Founders Marks on Trunnions: Letter	Founders Marks on Trunnions: No	Weight: Cwt	Weight: Qrs	Weight: lbs	Cypher	Remarks
6 pounders 6 feet V.P. Reported	1	W Co	76	16	1	26	G 3	from Sapphire
	3	Z Solid	403	17	0	2	..	
32 pounder Carronades	1	Clyde	1204	17	1	25		1805
	2	FK	72	17	3	11		
	3	..	64	17	3	14		
	4	..	65	17	3	0		
	5	H Co	196	17	3	21		
	6	FK	77	17	0	14		
	7	H Co	200	17	3	22		
	8	..	229	17	3	21		
	9	..	226	17	3	12		
	10	Clyde	981	17	3	0		1805
	11	FK	75	17	0	0		
	12	H Co	221	17	3	21		
	13	W&G	1061	17	3	10		
	14	..	1279	17	3	21		
	15	..	1063	17	2	21		
	16	Clyde	1134	17	3	0		
12 pounder Launch	1	W	60	6	1	25		from Sampson

Figure 27. Ledger of HMS *Baracouta* with W&G No. 1279. (ADM 160/154)



174

Account of Guns and Carriages to be sent to the following Places for Service of His Majesty's Ships upon the Leeward Island Station —

			Proportion	Antigua at 3/4ths	Barbadoes at 1/4th
Guns with Carriages complete —	32 Pr	of 9½ feet	28	21	7
	24 "	"	13	10	3
	18	9 feet	41	31	10
		8	140	105	35
	12	8½	2	1	1
		7½	68	51	17
	9	8½	1	1	0
		7½	12	9	3
		7	44	33	11
	6	6 feet	5	4	1
Carronades with Carriages & Slides complete	32 Pounders		134	101	33
	24 "		79	60	19
	18 "		93	70	23
	12 "		38	29	9

Office of Ordnance
13th November 1805

Figure 28. Tabular statement of equipment for West Indies fleet. (ADM 1/4017)

Figure 29. ACC Oregon Carronade B, in process. (Bajdek 2012)

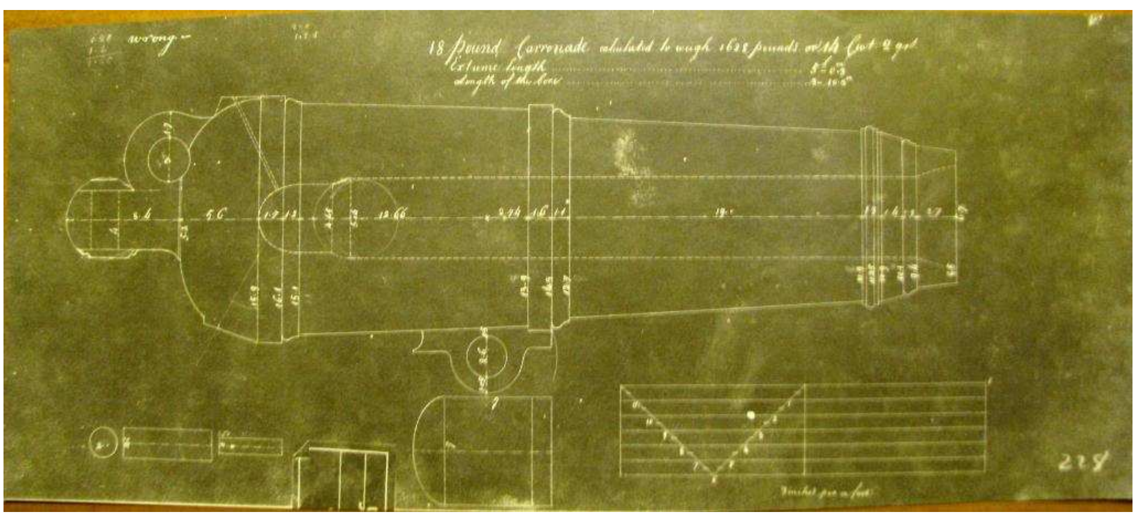


Figure 30. U.S. Navy plans for an 18-pounder carronade. (National Archives, No. 1268)

Figure 31. ACC Oregon Carronade A carriage bed, assembled. (Bajdek 2012)

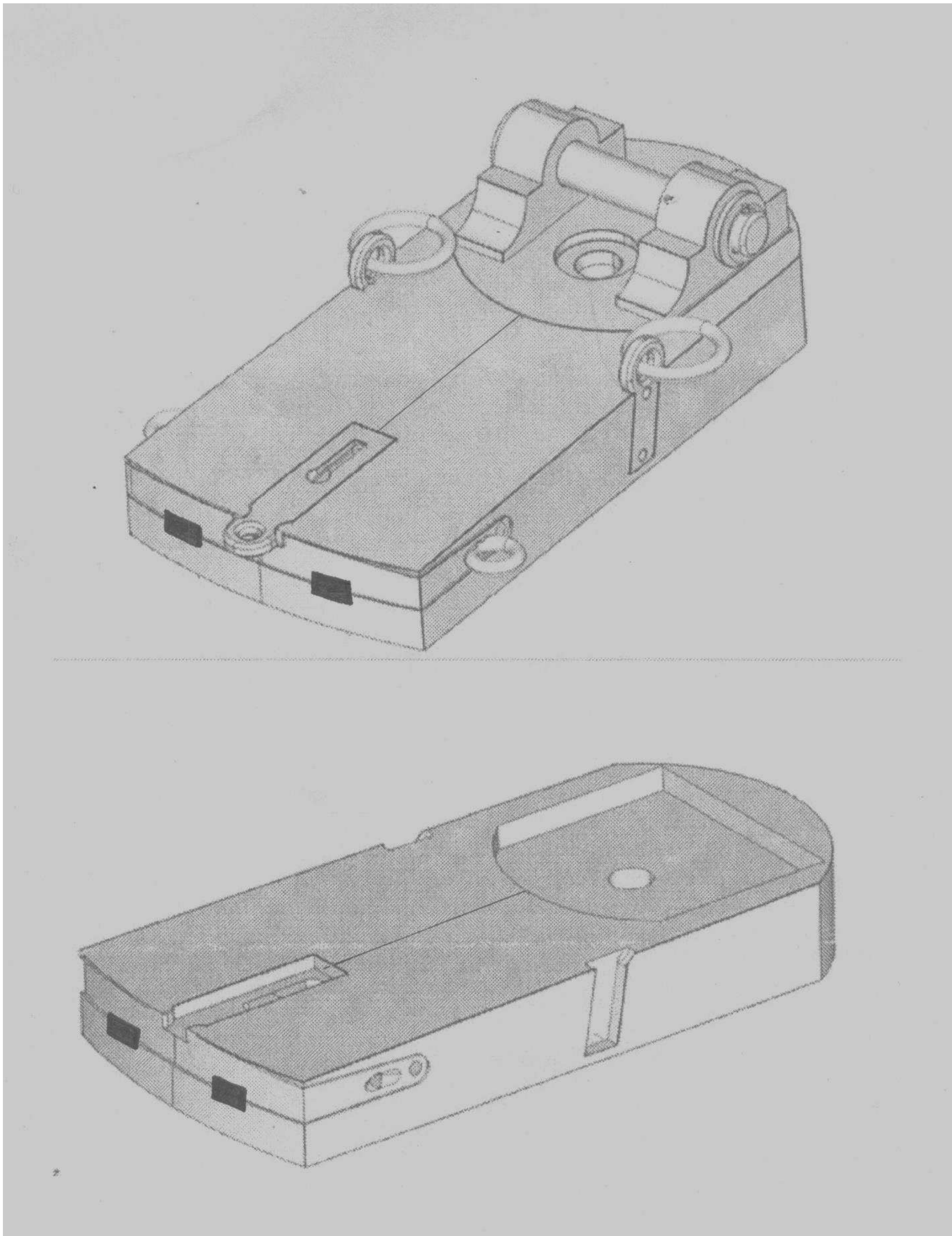


Figure 32. 1:10 scale drawing of ACC Oregon Carronade B carriage bed. (Bajdek 2012)

Figure 33. A copper bolt engraved with the letters ‘U.N.Y.’ (Bajdek 2012)

Figure 34. One half of carriage bed with exposed dowel. (Bajdek 2012)

Figure 35. Joint chock with chock fastening bolts and molded 18 pound designation. (Bajdek 2012)

Figure 36. One half of carriage bed with gudgeon, slide bolt and underside iron plating. (Bajdek 2012)

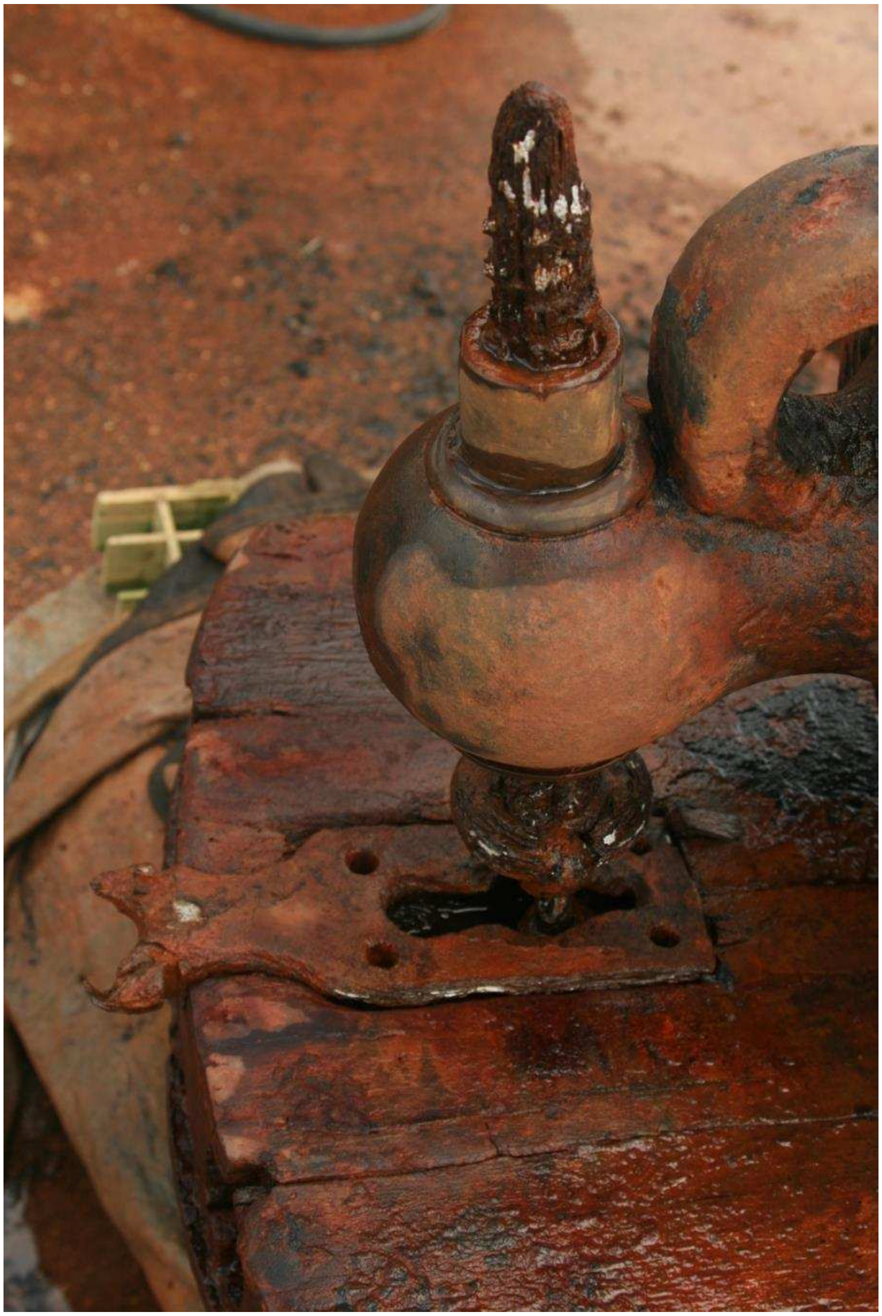


Figure 37. Elevating screw with screw handle and bearing plate. (Bajdek 2012)

Figure 38. Iron breeching ring with leather sheathing. (Bajdek 2012)

Figure 39. Carriage tackle eyebolt with rope grommet and wood plug (Bajdek 2012)

Figure 40. Spike sockets at rear of carriage with wear plate fragments and brass nails. (Bajdek 2012)

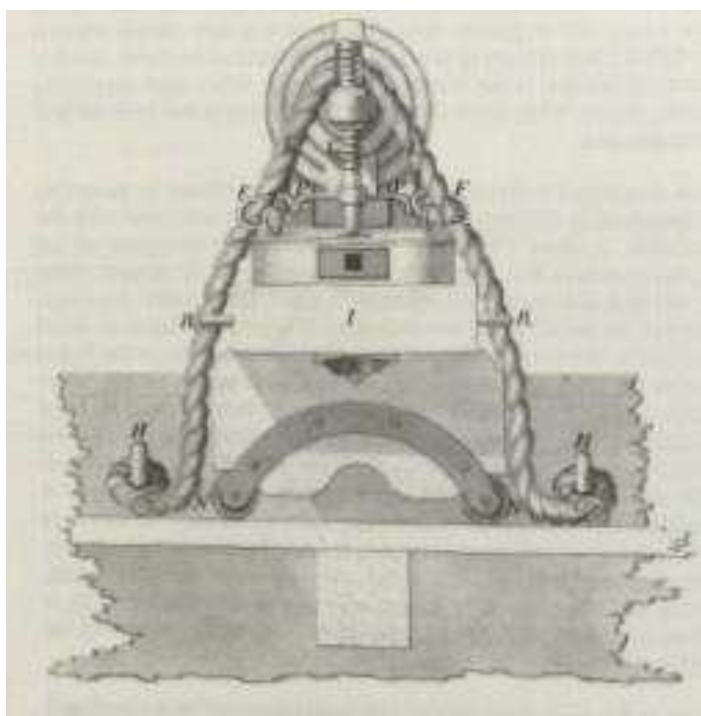


Figure 41. Carriage bed with central spike socket. (Caruana 1997, 323)

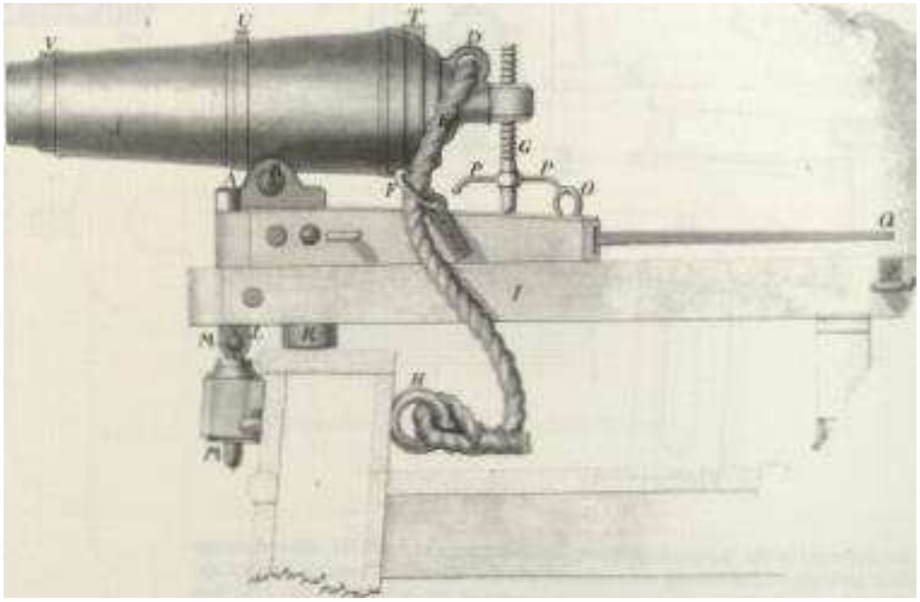


Figure 42. Carriage bed with turn spike inserted into spike socket. (Caruana 1997, 323)

Figure 43. Wooden tompion in situ. (Bajdek 2012)

Figure 44. Ball of heavy twine. (Bajdek 2012)

Figure 45. The concreted bore of ACC Oregon Carronade B. (Bajdek 2012)

Figure 46. Lengths of chain. (Bajdek 2012)

Figure 47. Mooring tackle. (Bajdek 2012)

Figure 48. Heavy iron wedge. (Bajdek 2012)

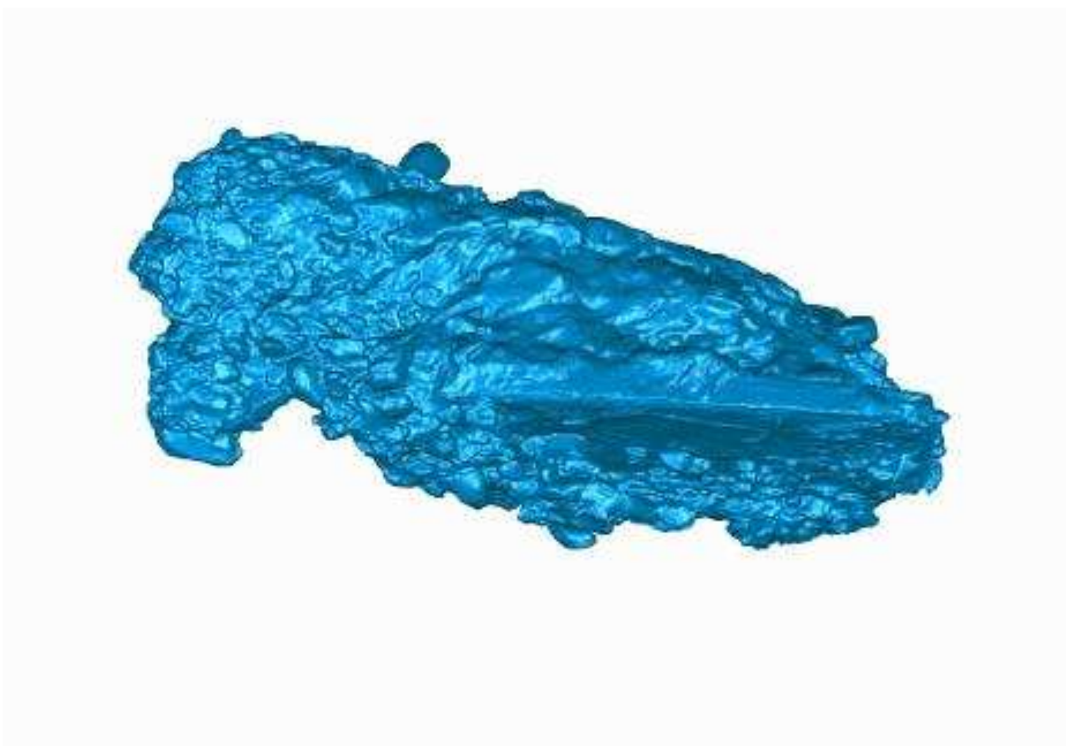


Figure 49. 3-Dimensional Scan of ACC Oregon Carronade A. (Bajdek 2012)

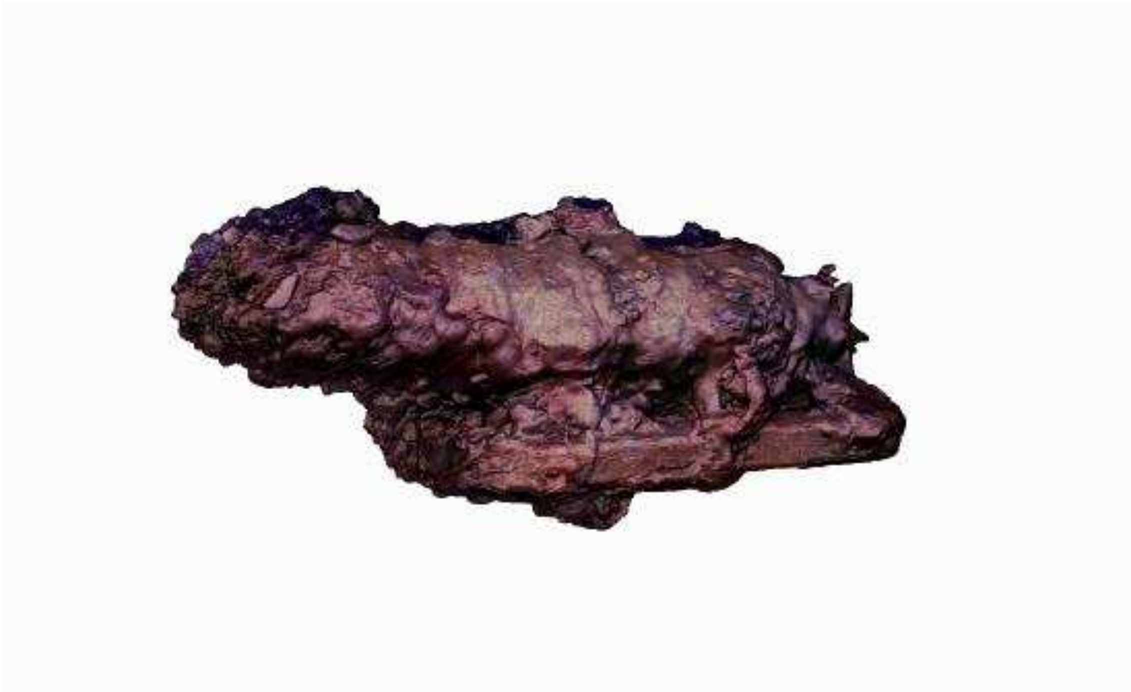


Figure 50. 3-Dimensional Scan of ACC Oregon Carronade B. (Bajdek 2012)

Figure 51. Hammers and chisels used to remove large pieces of concretion. (Bajdek 2012)

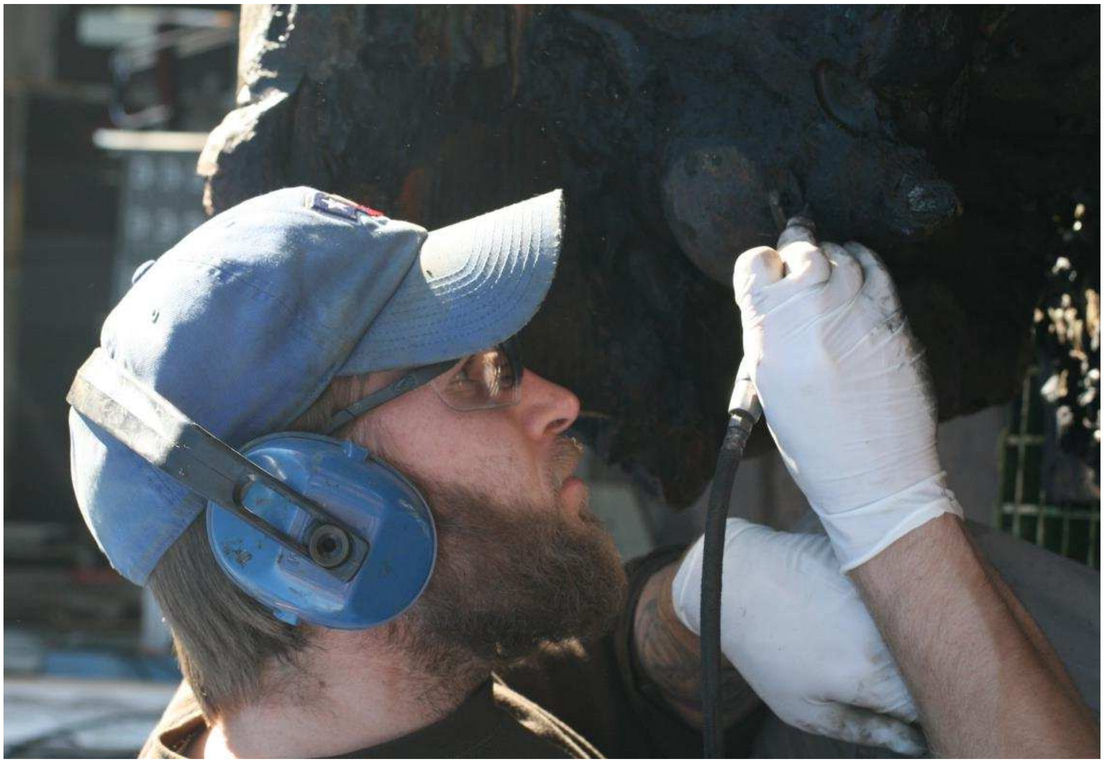


Figure 52. Pneumatic air scribe being used on surface of the gun. (Bajdek 2012)

Figure 53. Ball of twine inside bore of ACC Oregon Carronade A. (Bajdek 2012)

Figure 54. A reciprocating saw was used to cut through the lug bolt on ACC Oregon Carronade A. (Bajdek 2012)

APPENDIX B

TABLES

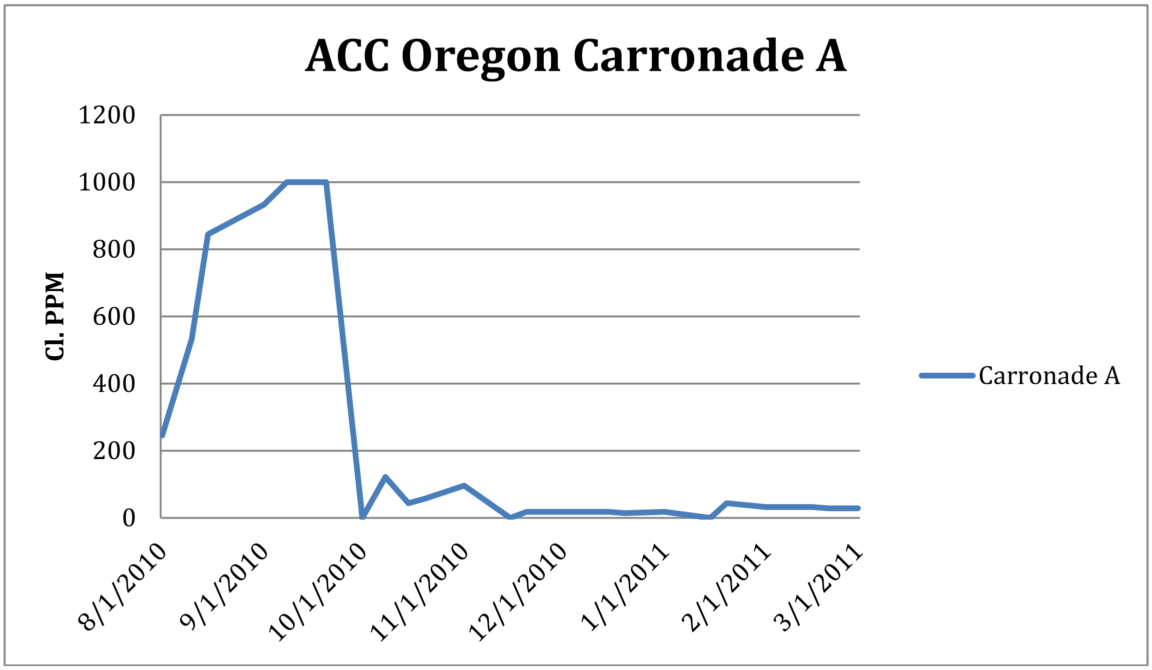
Table 1. Distribution of Wiggin & Graham Carronades Aboard British Warships as Recorded at Chatham Royal Dockyard, and in Coast Defense Batteries at Chatham and Sheerness, 1805-1812

Date of Return	Warship Type	Warship/Installation Name	Carronade Caliber	Serial Numbers
22 Aug 1805	Frigate	*Thetis*	18 pdr	855
21 Mar 1805	Gun Brig	*Fearless*	18 pdr	345-348
14 Jun 1805	Gun Brig	*Exertion*	18 pdr	832, 834
26 Jun 1805	Gun Brig	*Redbreast*	18 pdr	830, 831, 945
26 Jul 1805	Gun Brig	*Strenuous*	18 pdr	894, 907, 908, 953
31 Jul 1805	Gun Brig	*Starling*	18 pdr	839, 841, 842, 951
5 Nov 1805	N/A	Fort Pitt, Chatham	18 pdr	414, 415, 500, 502, 508, 519, 523, 526, 553, 554
22 Dec 1806	Ship Sloop	*Favorite*	12 pdr	27
12 Jun 1806	Brig Sloop	*Skylark*	24 pdr	915, 916, 918, 921, 966, 1079-1082, 1084-1087
8 Jul 1806	Schooner	*Woodcock*	12 pdr	258
21 May 1807	Post Ship (6th Rate)	*Cossack*	18 pdr 12 pdr	13 71
29 Jun 1807	Post Ship (6th Rate)	*Banterer*	32 pdr	1041
15 Oct 1807	Post Ship (6th Rate)	*Coquette*	32 pdr	1044
10 Jul 1807	Ship Sloop	*Sapphire*	32 pdr	1102
30 Oct 1807	Brig Sloop	*Barracouta*	32 pdr	1061, 1063, 1279
19 Nov 1807	Brig Sloop	*Nautilus*	32 pdr	1284, 1285
15 Dec 1807	Brig Sloop	*Sparrowhawk*	32 pdr	1101, 1157, 1158, 1209
15-27 Jun 1807	N/A	Sheerness Garrison and New Lines	18 pdr	555-557
22 Jan 1808	Ship of the Line	*Trident* (reduced armament)	24 pdr	73, 92, 97, 98, 100
20 Feb 1808	Ship of the Line	*Dictator*	18 pdr 32 pdr	840 809, 819, 871, 874, 884, 888-890
5 Mar 1808	Ship of the Line	*Victory*	32 pdr	1099

(Table 1. Continued)

Date of Return	Warship Type	Warship Name	Carronade Caliber	Serial Numbers
3 Jan 1808	Frigate	*Guerriere*	32 pdr	999-1003, 1005-1008, 1045-1048
14 Mar 1808	Frigate	*Aurora*	24 pdr	235, 265
20 Jan 1808	Brig Sloop	*Zenobia*	32 pdr	707
26 Aug 1808	Brig Sloop	*Ephira*	18 pdr	1037
7 Dec 1808	Brig Sloop	*Wildboar*	18 pdr	991
30 Mar 1809	Ship of the Line	*Standard*	32 pdr	714, 715, 872, 881
31 Jan 1809	Brig Sloop	*Opossum*	18 pdr	1038
8 May 1809	Brig Sloop	*Reynard*	18 pdr	987, 989, 994, 995
10 Jun 1809	Brig Sloop	*Bermuda*	18 pdr	979, 986, 988, 990, 992
18 Mar 1809	Gun Brig	*Bloodhound*	18 pdr	993, 1031
11 Jul 1809	Gun Brig	*Rebuff*	18 pdr	420, 421, 573
13 Jan 1810	Ship of the Line	*Eagle* (reduced armament)	32 pdr	708
15 Feb 1810	Frigate	*Cerberus*	12 pdr	1110
18 Jun 1810	Cutter	*Algerine*	18 pdr	232, 243
18 Jun 1810	Cutter	*Pioneer*	18 pdr	231, 512
18 Jun 1810	Cutter	*Pigmy*	18 pdr	244, 253, 560
15 Apr 1811	Ship of the Line	*Colossus*	18 pdr 32 pdr	562 710, 869, 882, 883
23 Oct 1811	Ship of the Line	*Princess Caroline*	12 pdr	77
24 Oct 1811	Ship of the Line	*Queen*	32 pdr	800
27 May 1811	Frigate	*Aquilon*	12 pdr 24 pdr	408 1183
16 Jul 1811	Frigate	*Orlando*	12 pdr	1253
21 Feb 1811	Brig Sloop	*Sheldrake*	24 pdr	312
13 May 1812	Ship of the Line	*Stirling Castle*	32 pdr	940
25 Jun 1812	Ship of the Line	*Ardent* (reduced armament)	24 pdr	855, 858, 967, 969
29 Jul 1812	Ship of the Line	*Warspite*	12 pdr	410
14 Mar 1812	Frigate	*Horatio*	32 pdr	939
24 Jan 1812	Brig Sloop	*Raleigh*	32 pdr	144
18 May 1812	Gun Brig	*Thrasher*	12 pdr	66

Table 2. Mercuric Nitrate Chloride Monitoring for ACC Oregon Carronade A



APPENDIX C

ACC OREGON CATALOG

Record Number: ACC Oregon A

Identification: 18-pounder British carronade

Material: Metal – Cast Iron

Tool Marks:

- Maker's Mark: W&G (Wiggin & Graham)
- Serial Number: No. 1271
- Caliber: 18 P
- Weight: 10-0-4
- British Broad Arrow

Dimensions:

- Length: 139.9 cm
- Diameter (Muzzle): 21.1 cm
- Muzzle Flare: 15.5 cm
- Weight: 509.9 kg

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (12 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.1

Identification: Wood fragment (possibly unassociated)

Material: Organic - Wood

Tool Marks: Square nail hole.

Dimensions:

- Length: 12.5 cm
- Width: 1.8 cm
- Weight: 14.5 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.2

Identification: Driftwood piece (unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length: 24.4 cm
- Width: 1.4 cm
- Width (Base): 4.5 cm
- Weight: 85 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.3

Identification: Plated pipe fragment with sleeve and clamp (unassociated)

Material: Metal – Copper-plated Iron

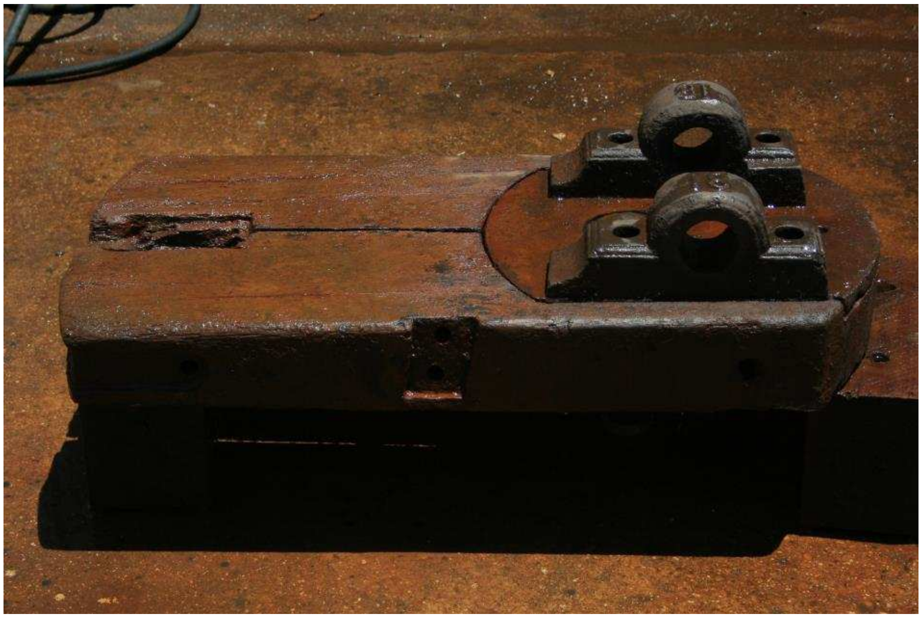
Tool Marks: N/A

Dimensions:

- Length: 10 cm
- Width: 2.2 cm
- Width (Clamp): 4.5 cm
- Weight: 180 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.



Record Number: ACC Oregon A.4

Identification: Carronade carriage bed

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length: 111 cm
- Width: 58.9 cm
- Thickness: 27.7 cm
- Weight:

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL ammonium citrate rinse: 2% ammoniumc citrate in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for large wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.1

Identification: Animal hairs and vegetal fibers

Material: Organic - Fibers

Tool Marks: N/A

Dimensions: N/A

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for hair: immersion in SFD1 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
  - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
  - Crosslinker: MTM (methoxysilane/methanol) 20 %
  - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.2

Identification: Carriage tackle eyebolt

Material: Metal – Wrought Iron

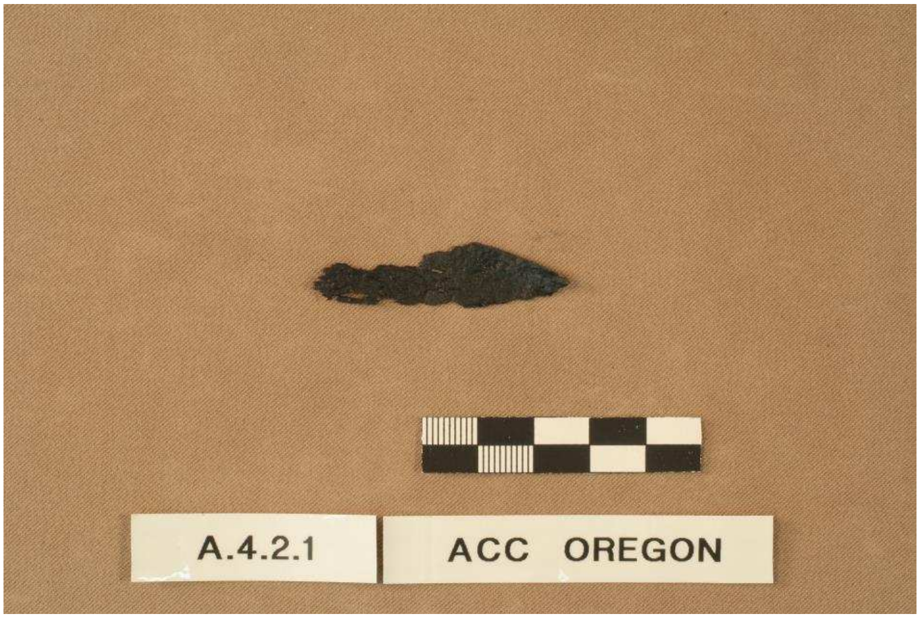
Tool Marks: N/A

Dimensions:

- Length: 14.8 cm
- Width: 3.7 cm
- Diameter (Eye): 3.4 cm
- Weight: 120 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.



Record Number: ACC Oregon A.4.2.1

Identification: Carriage tackle eyebolt fragment

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 4.5 cm
- Width: 1.2 cm
- Weight: 10 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.2.2

Identification: Cordage fragments

Material: Organic - Cordage

Tool Marks: N/A

Dimensions:

- Weight (Total): 0.54 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small rope: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: PR10 (or SFD1(80%) 80 %
    - Crosslinker: MTM (methoxysilane/methanol) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.2.3

Identification: Rope grommet with serving

Material: Organic – Cordage

Tool Marks: N/A

Dimensions:

- Length (1): 5.5 cm; Width: 2 cm; Weight: 16.9 g
- Length (2): 5.7 cm; Width: 2.5 cm; Weight: 21 g
- Length (3): 8.2 cm; Width: 1.8 cm; Weight: 22.9 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL oxalic rinse: 5% oxalic acid in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small rope: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: PR10 (or SFD1(80%) 80 %
    - Crosslinker: MTM (methoxysilane/methanol) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.2.4

Identification: Wood plug from carriage tackle eyebolt

Material: Organic - Wood

Tool Marks:

- Nail hole

Dimensions:

- Length: 7.4 cm
- Width: 3.5 cm
- Weight: 21.3 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.3

Identification: Breeching ring

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Diameter: 15.2 cm
- Thickness: 2.0 cm
- Weight: 720 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (5/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.3.1

Identification: Sheathing from breeching ring

Material: Organic - Leather

Tool Marks: N/A

Dimensions:

- Length: 14 cm
- Width: 3.1 cm
- Weight: 48.2 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small leather: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: PR10 (or SFD1(80%) 80 %
    - Crosslinker: MTM (methoxysilane/methanol) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.4

Identification: Elevating screw plate with partial train tackle eyebolt

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 24.3 cm
- Width: 8.5 cm
- Weight: 800 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (5/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.5

Identification: Breeching ring with attached breeching eyeplate

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Diameter (Ring): 14.9 cm
- Thickness (Ring): 2.0 cm
- Length (Eyeplate): 13.3 cm
- Width (Eyeplate): 6.8 cm
- Weight: 1200 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (5/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.5.1

Identification: Sheathing fragments from breeching ring

Material: Organic - Leather

Tool Marks: N/A

Dimensions (Largest Example Only):

- Length: 11.7 cm
- Width: 2.7 cm
- Weight: 13.4 g
- Total Weight: 37.4 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small leather: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
  - Polymer: PR10 (or SFD1(80%) 80 %
  - Crosslinker: MTM (methoxysilane/methanol) 20 %
  - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.5.2

Identification: Breching rope fragments

Material: Organic - Cordage

Tool Marks: N/A

Dimensions:

- Length (Left): 2.1 cm; Width: 0.8 cm; Weight: 1 g
- Length (Right): 4.3 cm; Width: 1.3 cm; Weight: 6.7 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small rope: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: PR10 (or SFD1(80%) 80 %
    - Crosslinker: MTM (methoxysilane/methanol) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.6

Identification: Breeching eyeplate

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 12.7 cm
- Width: 6.4 cm
- Weight: 460 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (2/4 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.7

Identification: Rear carriage plating

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 46.4 cm
- Width: 7.7 cm
- Weight: 400 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (5/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.8

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

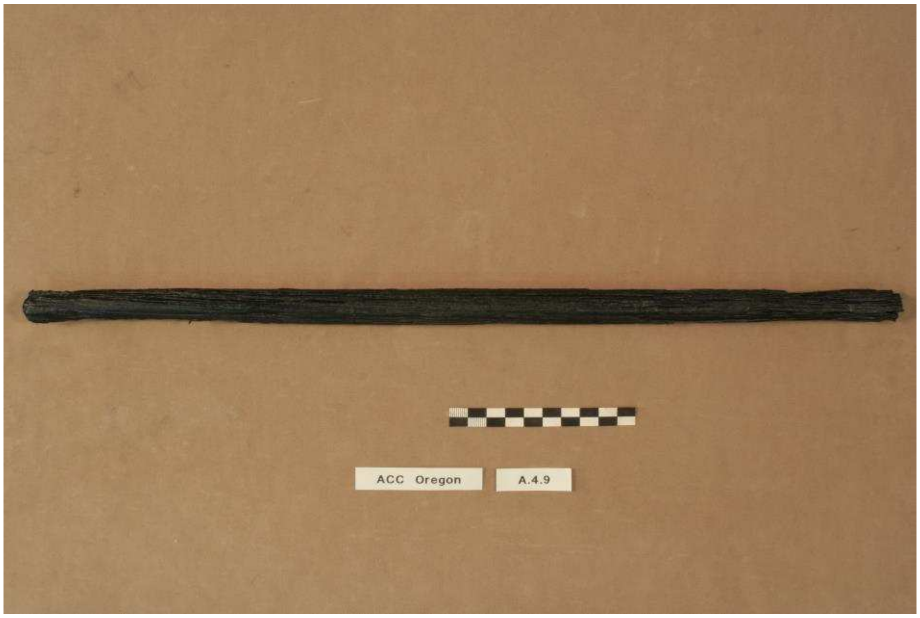
Tool Marks: N/A

Dimensions:

- Length: 33.2 cm; Width: 1.6 cm; Weight: 220 g
- Length (Fragment): 8.3 cm; Width: 1.3 cm; Weight: 10 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.



Record Number: ACC Oregon A.4.9

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

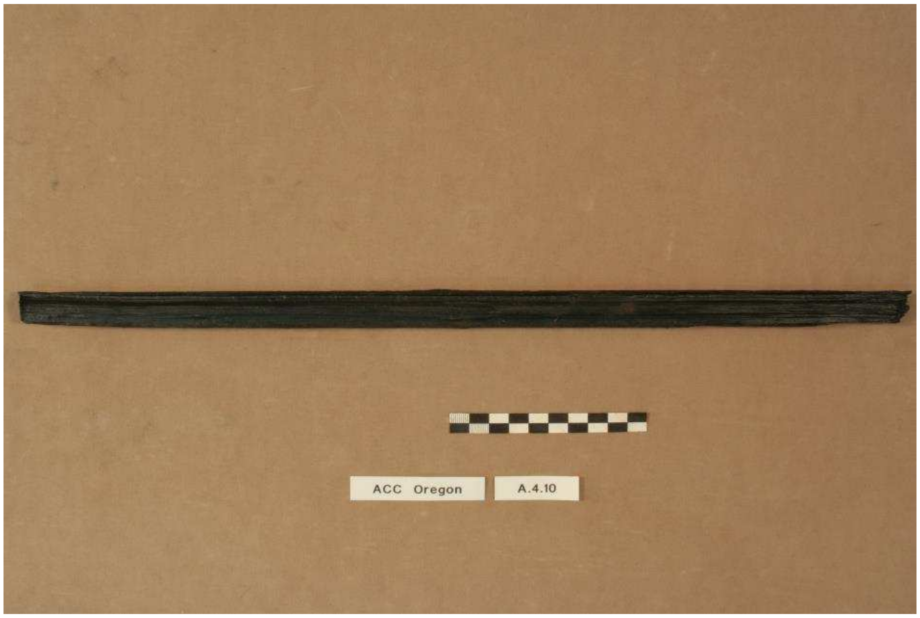
Tool Marks: N/A

Dimensions:

- Length: 46 cm
- Width: 1.9 cm
- Weight: 720 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^o F. Removed from wax at 180^o F.
- Aesthetic cleaning: Excess wax removed.



Record Number: ACC Oregon A.4.10

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 44.6 cm
- Width: 1.9 cm
- Weight: 240 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.11

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 43.1 cm
- Width: 1.8 cm
- Weight: 660 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.12

Identification: Bolt fragments from elevating screw plate

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length (Left): 4.5 cm; Width: 0.9 cm; Weight: 8.7 g
- Length (Right): 3.4 cm; Width: 0.7 cm; Weight: 5.6 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.13

Identification: Wear plates from left rear spike socket

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length (1): 9.2 cm; Width: 3.4 cm; Weight: 72.5 g
- Length (2): 8.2 cm; Width: 3.3 cm; Weight: 58.5 g
- Length (3): 8.7 cm; Width: 3.4 cm; Weight: 77.8 g
- Length (4): 9.4 cm; Width: 3.4 cm; Weight: 75.4 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.13.1

Identification: Nails

Material: Metal – Copper

Tool Marks:

- Tool Marks: Dented heads from nailset

Dimensions:

- Length (1): 3.6 cm; Width: 1.1 cm; Weight: 4.8 g
- Length (2): 2.8 cm; Width: 0.7 cm; Weight: 2.25 g
- Length (3): 3.7 cm; Width: 1.3 cm; Weight: 5.25 g
- Length (4): 3.2 cm; Width: 0.7 cm; Weight: 2.75 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Polishing
- Put in 2% Benzotriozole (BTA)
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.14

Identification: Wear plates from right rear spike socket

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length (1): 9.1 cm; Width: 3.4 cm; Weight: 41.7 g
- Length (2): 7.0 cm; Width: 3.35 cm; Weight: 52.8 g
- Length (3): 8.2 cm; Width: 3.3 cm; Weight: 59.4 g
- Length (4): 7.4 cm; Width: 3.25 cm; Weight: 46.9 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.14.1

Identification: Nails

Material: Metal – Copper

Tool Marks:

- Tool Marks: Dented heads from nailset

Dimensions:

- Length (1): 3.4 cm; Width: 1.2 cm; Weight: 5 g
- Length (2): 3.7 cm; Width: 1.3 cm; Weight: 5.6 g
- Length (3): 2.4 cm; Width: 0.7 cm; Weight: 2.2 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Polishing
- Put in 2% Benzotriozole (BTA)
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.15

Identification: Undercarriage plating

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 32.8 cm
- Width: 4.2 cm
- Weight: 334.5 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.16

Identification: Chock fastening bolt heads

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length (1): 3.8 cm; Width: 2 cm; Weight: 102.2 g
- Length (2): 4.1 cm; Width: 1.7 cm; Weight: 129.8 g
- Length (3): 3.7 cm; Width: 1.9 cm; Weight: 175.3 g
- Length (4): 4.0 cm; Width: 1.9 cm; Weight: 88.8 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.17

Identification: Gun carriage fragments

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length:
- Width:
- Weight:

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.4.18

Identification: Chock fastening bolts fragments

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length (1): 12.9 cm; Width (1): 2.8 cm; Weight (1): 180.4 g
- Length (2): 9.1 cm; Width (2): 2.7 cm; Weight (2): 130.8 g
- Length (3): 7.5 cm; Width (3): 2.6 cm; Weight (3): 157.5 g
- Length (4): 8.5 cm; Width (4): 2.9 cm; Weight (4): 141.3 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.4.19

Identification: Joint chock, gudgeon and slide bolt

Material: Metal – Cast Iron, Iron and Brass

Tool Marks:

- Caliber: “18” embossed on joint chock

Dimensions:

- Length: 47.8 cm
- Width: 36.8 cm
- Height: 39.9 cm
- Weight: 62.1 kg

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.5

Identification: Muzzle tompion

Material: Organic - Wood

Tool Marks:

- Hole on either side for rope retrieval

Dimensions:

- Length: 17.8 cm
- Width: 12.1 cm
- Diameter: 21.1 cm
- Weight: 1692.7 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
  - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
  - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
  - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.5.1

Identification: Muzzle tompion fragments

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Total Weight: 4.4 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.5.2

Identification: Wood fibers and fragments associated with the removal of the tompion

Material: Organic – Wood and Fibers

Tool Marks: N/A

Dimensions:

- Weight (Total): 21.1 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.5.3

Identification: Ball of heavy twine

Material: Organic - Cordage

Tool Marks: N/A

Dimensions: N/A

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL oxalic rinse: 5% oxalic acid in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small rope: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: PR10 (or SFD1(80%) 80 %
    - Crosslinker: MTM (methoxysilane/methanol) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.6

Identification: Wood piece (possibly unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length: 24 cm
- Width: 5.9 cm
- Weight: 86.7 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.7

Identification: Driftwood piece or root fragment (unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length: 29 cm
- Width: 3.7 cm
- Weight: 206.4 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon A.8

Identification: Lug bolt

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length: 39 cm
- Width: 4.8 cm
- Weight: 4785.4 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (5/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon A.9

Identification: Wood fragments removed from between carronade sight (possibly unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length (Top): 6 cm; Width: 1.1 cm; Weight: 6 g
- Length (Middle): 7.2 cm; Width: 1.4 cm; Weight: 3.1 g
- Length (Bottom): 9.8 cm; Width: 1.8 cm; Weight: 7.2 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B

Identification: 18-pounder American carronade

Material: Metal – Cast Iron

Tool Marks: N/A

Dimensions:

- Length: 138.4 cm
- Diameter (Muzzle): 21.1 cm
- Muzzle Flare: 15.5 cm
- Weight: 509.9 kg

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (12 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.1

Identification: Wood fragments (possibly unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length (1): 1.3 cm; Width: 0.7 cm; Weight: 0.33 g
- Length (2): 3.6 cm; Width: 0.6 cm; Weight: 0.47 g
- Length (3): 6.8 cm; Width: 0.8 cm; Weight: 1.7 g
- Length (4): 9.3 cm; Width: 1.7 cm; Weight: 7.7 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.2

Identification: Heavy blacksmith's wedge (possibly unassociated)

Material: Metal – Iron

Tool Marks:

- Tool Marks: Triple line design on wedge blade

Dimensions:

- Length: 16.4 cm
- Width: 9.1 cm
- Weight: 2336 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.3

Identification: Lengths of chain (possibly unassociated)

Material: Metal – Iron

Tool Marks: N/A

Dimensions (Two Largest Examples Only):

- Length (1): 12.4 cm; Width: 3.5 cm; Weight: 153 g
- Length (2): 13.1 cm; Width: 3 cm; Weight: 113 g

Treatment:

- Mechanical cleaning
- Standard CRL Sodium Sulfite/Deionized (DI) water baths: 5
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.4

Identification: Mooring tackle (possibly unassociated)

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions (Largest Example Only):

- Length: 19.1 cm
- Width: 7.7 cm
- Weight: 549.8 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/2 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.4.1

Identification: Small wood fragments (possibly unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length (Top): 3.1 cm; Width: 0.1 cm; Weight: 0.03 g
- Length (Left): 1.5 cm; Width: 1 cm; Weight: 0.24 g
- Length (Middle): 2 cm; Width: 0.9 cm; Weight: 0.66 g
- Length (Right): 4 cm; Width: 1.3 cm; Weight: 2.6 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL oxalic rinse: 5% oxalic acid in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.5

Identification: Lengths of chain (possibly unassociated)

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length (Top): 11 cm; Width: 3.7 cm; Weight: 142.5 g
- Length (Bottom): 10.6 cm; Width: 3.5 cm; Weight: 157.6 g

Treatment:

- Mechanical cleaning
- Standard CRL Sodium Sulfite/Deionized (DI) water baths: 5
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.5.1

Identification: Tacks

Material: Metal – Copper

Tool Marks: N/A

Dimensions:

- Length (1): 2.7 cm; Width: 0.8 cm; Weight: 1.9 g
- Length (2): 2.8 cm; Width: 0.8 cm; Weight: 1.8 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Polishing
- Put in 2% Benzotriozole (BTA)
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.6

Identification: Disc weight (possibly unassociated)

Material: Metal – Lead

Tool Marks: N/A

Dimensions:

- Diameter: 8.1 cm
- Thickness: 0.8 cm
- Weight: N/A

Treatment:

- Did not survive pre-treatment

Record Number: ACC Oregon B.7

Identification: Spike (possibly unassociated)

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length: 10.9 cm
- Width: 1.8 cm
- Weight: 46.6 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.8

Identification: Bolt

Material: Metal – Copper

Tool Marks:

- Marker's Mark: U.N.Y. (United Navy Yard, Brooklyn, NY)

Dimensions:

- Length: 15.2 cm
- Width: 1.9 cm
- Weight: 296.3 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Polishing
- Put in 2% Benzotriozole (BTA)
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9

Identification: Carronade carriage bed

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length: 110.9 cm
- Width: 58.6 cm
- Thickness: 27.9 cm
- Weight:

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL ammonium citrate rinse: 2% ammoniumc citrate in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for large wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.9.1

Identification: Breeching eyeplate

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 12.5 cm
- Width: 6.8 cm
- Weight: 321.6 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.2

Identification: Breeching ring fragment

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 14.8 cm
- Width: 2.0 cm
- Weight: 324.5 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.2.1

Identification: Sheathing from breeching ring.

Material: Organic - Leather

Tool Marks: N/A

Dimensions:

- Length: 19.7 cm
- Width: 7.4 cm
- Weight:

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small leather: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: PR10 (or SFD1(80%) 80 %
    - Crosslinker: MTM (methoxysilane/methanol) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.9.3

Identification: Miscellaneous plating fragment

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 4.9 cm
- Width: 3 cm
- Weight: 13.2 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.4

Identification: Breeching ring with attached breeching eyeplate

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Diameter (Ring): 14.9 cm
- Thickness (Ring): 2.0 cm
- Length (Eyeplate): 13.9 cm
- Width (Eyeplate): 6.9 cm
- Weight: 1277.6 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325^{o} F. Removed from wax at 180^{o} F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.4.1

Identification: Sheathing from breeching ring

Material: Organic - Leather

Tool Marks: N/A

Dimensions:

- Length: 20.1 cm
- Width: 7.4 cm
- Weight:

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small leather: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
  - Polymer: PR10 (or SFD1(80%) 80 %
  - Crosslinker: MTM (methoxysilane/methanol) 20 %
  - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.9.5

Identification: Rear carriage plating

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 42.5 cm
- Width: 7.8 cm
- Weight: 345.7 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325 F. Removed from wax at 180 F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.6

Identification: Carriage tackle eyebolt

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 12.1 cm
- Width: 5.0 cm
- Weight: 200 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325 F. Removed from wax at 180 F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.7

Identification: Carriage tackle eyebolt

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 16.6 cm
- Width: 4.6 cm
- Weight: 92.4 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.8

Identification: Staples

Material: Metal – Copper

Tool Marks: N/A

Dimensions:

- Length (1): 1.7 cm; Width: 0.2 cm; Weight: 0.5 g
- Length (2): 1.4 cm; Width: 0.3 cm; Weight: 0.4 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Polishing
- Put in 2% Benzotriozole (BTA)
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.9

Identification: Wear plates from right rear spike socket

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length (Top Left): 8.6 cm; Width: 3.2 cm; Weight: 54.7 g
- Length (Bottom Left): 10 cm; Width: 3.2 cm; Weight: 96.9 g
- Length (Top Right): 10.4 cm; Width: 3.4 cm; Weight: 71.4 g
- Length (Bottom Right: 9.9 cm; Width: 3.5 cm; Weight: 88.3 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325□ F. Removed from wax at 180□ F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.9.1

Identification: Nails

Material: Metal – Copper

Tool Marks:

- Tool Marks: Dented heads from nailset

Dimensions:

- Length (1): 3.1 cm; Width: 0.5 cm; Weight: 4.5 g
- Length (2): 3.0 cm; Width: 0.5 cm; Weight: 4.2 g
- Length (3): 2.3 cm; Width: 0.5 cm; Weight: 2.8 g
- Length (4): 3.3 cm; Width: 0.5 cm; Weight: 4.4 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Polishing
- Put in 2% Benzotriozole (BTA)
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.10

Identification: Wear plates from left rear spike socket

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length (Top Left): 10.3 cm; Width: 3.5 cm; Weight: 65.8 g
- Length (Bottom Left): 11.1 cm; Width: 3.5 cm; Weight: 84.5 g
- Length (Top Right): 10.5 cm; Width: 3.4 cm; Weight: 76.7 g
- Length (Bottom Right)10.2 cm; Width: 3.4 cm; Weight: 82.5 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.10.1

Identification: Nails

Material: Metal – Copper

Tool Marks:

- Tool Marks: Dented heads from nailset

Dimensions:

- Length (1): 3.8 cm; Width: 1.3 cm; Weight: 5.5 g
- Length (2) 3.0 cm; Width: 0.5 cm; Weight: 2.5 g
- Length (3): 3.5 cm; Width: 1.1 cm; Weight: 5.1 g
- Length (4): 3.8 cm; Width: 1.3 cm; Weight: 5.9 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/5 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Polishing
- Put in 2% Benzotriozole (BTA)
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.11

Identification: Uncarriage plating

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 33 cm
- Width: 6.3 cm
- Weight: 670.9 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325 F. Removed from wax at 180 F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.12

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 44.6 cm
- Width: 1.8 cm
- Weight: 489.2 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.13

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 42.9 cm
- Width: 1.8 cm
- Weight: 350.6 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.14

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 42.4 cm
- Width: 2.1 cm
- Weight: 551.7 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.15

Identification: Long bolt through carriage

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 42.7 cm
- Width: 1.6 cm
- Weight: 329.8 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (1/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.16

Identification: Bolt fragments from elevating screw plate

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length (1): 9.3 cm; Width: 1.1 cm; Weight: 30.4 g
- Length (2): 8.5 cm; Width: 0.8 cm; Weight: 10.3 g
- Length (3): 9.3 cm; Width: 0.7 cm; Weight: 12.6 g
- Length (4): 6.7 cm; Width: 0.8 cm; Weight: 13.1 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.17

Identification: Miscellaneous plating fragments

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length (1): 3.9 cm; Width: 3.3 cm; Weight: 9.4 g
- Length (2): 5.9 cm; Width: 1.8 cm; Weight: 6.6 g
- Length (3): 6.0 cm; Width: 1.1 cm; Weight: 3.9 g
- Length (4): 3.5 cm; Width: 3.0 cm; Weight: 6.2 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.18

Identification: Elevating screw plate with partial train tackle eyebolt

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 24.1 cm
- Width: 8.3 cm
- Weight: 989.8 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.19

Identification: Chock fastening bolt heads

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length (1): 3.8 cm; Width: 2.4 cm; Weight: 148 g
- Length (2): 3.7 cm; Width: 2.3 cm; Weight: 159 g
- Length (3): 4.1 cm; Width: 2.4 cm; Weight: 222.6 g
- Length (4): 4.0 cm; Width: 1.9 cm; Weight: 139.7 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.9.21

Identification: Chock fastening bolts

Material: Metal – Iron

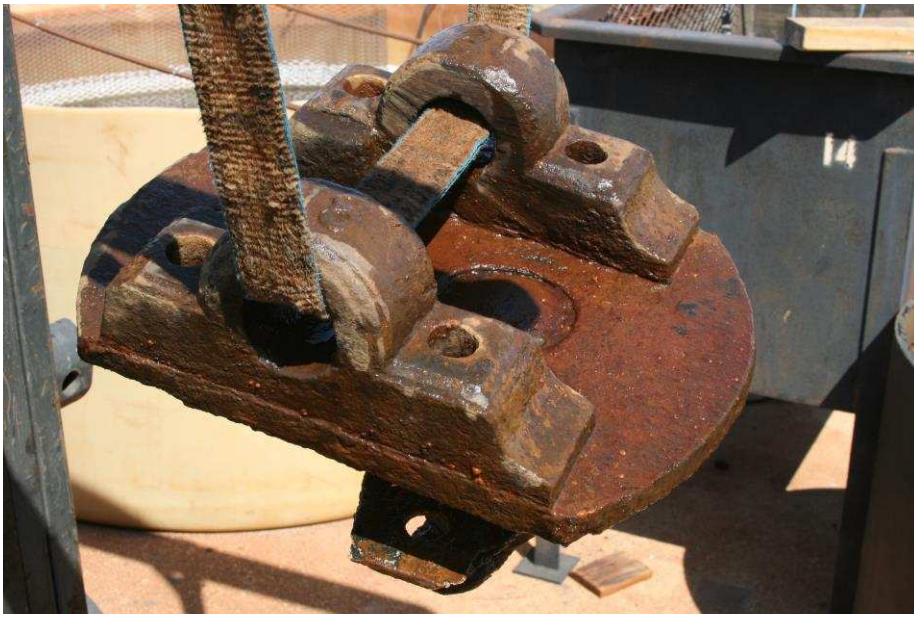
Tool Marks: N/A

Dimensions:

- Length (1): 17.3 cm; Width: 2 .6cm; Weight: 281.9 g
- Length (2): 14 cm; Width: 2.7 cm; Weight: 297.5 g
- Length (3): 16.7 cm; Width: 2.5 cm; Weight: 277.6 g
- Length (4): 17.1 cm; Width: 2.6 cm; Weight: 239.8 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.



Record Number: ACC Oregon B.9.20

Identification: Joint chock, gudgeon and slide bolt

Material: Metal – Cast Iron and Iron

Tool Marks:

- Caliber: “18” embossed on joint chock

Dimensions:

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.10

Identification: Breeching rope

Material: Organic - Cordage

Tool Marks: N/A

Dimensions: N/A

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL oxalic rinse: 5% oxalic acid in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small rope: immersion in PR10 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
  - Polymer: PR10 (or SFD1(80%) 80 %
  - Crosslinker: MTM (methoxysilane/methanol) 20 %
  - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.11

Identification: Root and driftwood fragments (unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions: N/A

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.12

Identification: Pine needle (unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length: 18 cm
- Width: 0.5 cm
- Weight:

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL oxalic rinse: 5% oxalic acid in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
    - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.13

Identification: Elevating screw pin

Material: Metal – Wrought Iron

Tool Marks: N/A

Dimensions:

- Length: 6.8 cm
- Width: 1.7 cm
- Weight: 54.7 g

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (3/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

Record Number: ACC Oregon B.14

Identification: Bird feather and vegetal fibers (unassociated)

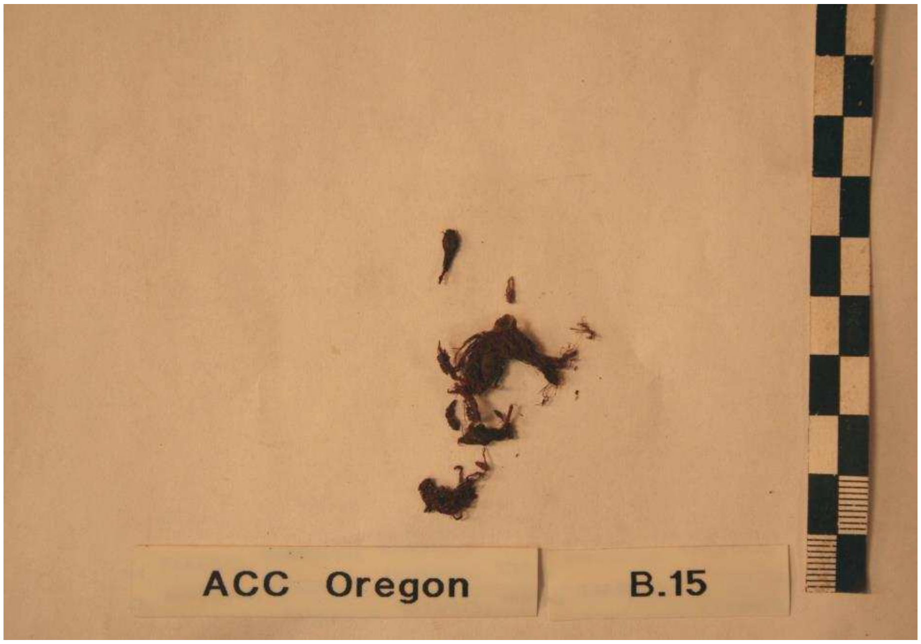
Material: Organic – Feather and Fibers

Tool Marks: N/A

Dimensions: N/A

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for hair: immersion in SFD1 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
  - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
  - Crosslinker: MTM (methoxysilane/methanol) 20 %
  - Catalyst: DBTDA (dibutyltin-diacetate)



Record Number: ACC Oregon B.15

Identification: Cordage fibers

Material: Organic - Cordage

Tool Marks: N/A

Dimensions: N/A

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for hair: immersion in SFD1 polymer and MTM, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
    - Polymer: Silicone oil (Q1) 80 %
    - Crosslinker: MTM (methoxysilane/methanol) 20 %
    - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.16

Identification: Pinecone scale (unassociated)

Material: Organic - Wood

Tool Marks: N/A

Dimensions:

- Length: 2.5 cm
- Width: 1.4 cm
- Weight: 0.52 g

Treatment:

- Mechanical cleaning: toothbrush and dental tools
- Standard CRL rinses:100% tap water, 100% Deionized (DI) water
- Standard CRL oxalic rinse: 5% oxalic acid in Deionized (DI) water
- Standard CRL dehydration: 75% DI water/25% ethanol, 50% DI water/ 50% ethanol, 25% DI water/75% ethanol, 100% ethanol, 100% ethanol 75% ethanol/25% acetone, 50% ethanol/50% acetone, 25% ethanol/75% acetone, 100% acetone, 100% acetone
- Standard CRL polymer passivation for small wood: immersion in SFD1/SFD5 polymer and MTMS, removal of excess polymer solution, exposure to DBTDA vapors, final mechanical cleaning to remove any catalyzed polymer or extraneous material
  - Polymer: Silicone oil (SFD1(66%) + SFD5(34%)) 80 %
  - Crosslinker: MTMS (methyltrimethoxysilane) 20 %
  - Catalyst: DBTDA (dibutyltin-diacetate)

Record Number: ACC Oregon B.17

Identification: Lug bolt

Material: Metal – Iron

Tool Marks: N/A

Dimensions:

- Length: 40.7 cm
- Width: 4.7 cm
- Weight: 5.7 kg

Treatment:

- Mechanical cleaning
- Electrolytic Reduction (ER): Low current density throughout (5/3 Amp/V)
- Standard CRL Boiling Rinses: 100% Deionized (DI) water
- Tannic acid coats
- In microcrystalline wax to 325° F. Removed from wax at 180° F.
- Aesthetic cleaning: Excess wax removed.

VITA

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"The Arch Cape Carronades: From USS *Shark* to Texas A&M", in *CMAC News & Reports* Vol. 3, No. 2, Fall 2012

Conference Papers: "The Conservation of the 18-Pounder Carronades from USS *Shark*", SHA Conference 2011

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