

**THE CONSTRUCTION OF THE BROWNS BAY VESSEL**

A Thesis

by

**CHRISTOPHER FRANCIS AMER**

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Approved as to style and content by:

  
\_\_\_\_\_  
J. Richard Steffy  
(Chairman)

  
\_\_\_\_\_  
D.L. Hamilton  
(Member)

  
\_\_\_\_\_  
Nancy J. Dyer  
(Member)

  
\_\_\_\_\_  
Vaughn M. Bryant  
(Head of Department)

December 1986

**ABSTRACT**

The Construction of the Browns Bay Vessel.

(December 1986)

Christopher Francis Amer, B.A., Simon Fraser University

Chairman of Advisory Committee: Mr. J. Richard Steffy

During the spring of 1985, under the auspices of Parks Canada, I conducted a post-excavation examination of an early-19th-century British naval vessel. The vessel was found by local divers in Browns Bay, a small inlet on the north shore of the St. Lawrence River, thirty miles from the eastern end of Lake Ontario. During 1966 and 1967, the boat was excavated and raised by the National Historic Sites Service (NHSS) of the Canadian Department of Indian Affairs and Northern Development (now the National Historic Parks and Sites Branch of Parks Canada). The 54-foot-long hull was conserved and put on display in the St. Lawrence Islands National Park at Mallorytown Landing, Ontario, Canada.

The fieldwork centred on a comprehensive examination of the boat's hull and artifactual material from the excavation site. Research was undertaken on the history and development of the vessel type with the purpose of identifying the hull and determining the reasons for its loss in Browns Bay.

The craft had been previously tentatively identified as a British gunboat. However, uncharacteristic hull features and the lack of evidence for a gun suggested alternate uses for the boat and revealed extensive modifications to the hull.

Wreck plans were prepared from measurements recorded in 1985 and measurements and drawings made by NHSS staff during 1966-68. The wreck plans and an earlier set of hull lines were used to reconstruct the appearance of the boat after her refit. The reconstruction was graphically depicted by two perspective views of the hull.

The hull design and shape of the Browns Bay Vessel can be compared to representations and depictions of "flat-bottomed boats" designed and built by the British during the 18th century, as well as those of British gunboats in operation on the Great Lakes during the early 19th century. The hull, built prior to 1820, would have been originally outfitted to be rowed and sailed. After 1820, it was modified and predominantly used as a cargo carrier propelled solely by sails. After a long commercial career, the vessel was evidently abandoned.

## ACKNOWLEDGEMENTS

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Others who provided information and assistance were: Kevin Crisman, David Lyon, Stan McClellan, and Walter Zacharchuck.

Nigel Hart drew up the reconstruction drawings and offered many helpful suggestions regarding the reconstruction of the vessel. Carol Piper provided me with many drawings. Their help was greatly appreciated.

Very special thanks go to my father, Donald W. Amer, for his artistic contributions, and for the many hours he spent with me discussing boat construction and rigs. His ideas and comments were well received.

I wish to thank the members of my graduate committee: Mr. J. Richard Steffy and Dr. D.L. Hamilton of the Nautical Archaeology program at Texas A & M University, and Dr. Nancy J. Dyer of the Department of Modern Languages.

Finally, I owe a great debt of thanks to my wife, Marzena J. Amer, for her constant support and encouragement during the seemingly endless months of field work and writing.

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## CHAPTER I

### INTRODUCTION AND BACKGROUND

#### INTRODUCTION

In 1966, the National Historic Sites Service (NHSS) of the Canadian Department of Indian Affairs and Northern Development (now National Historic Parks and Sites Branch of Parks Canada), as a supplement to its archaeological program on land, began an underwater survey of marine wrecks in the Lake Ontario - St. Lawrence River region. The Service was informed by divers from the Kingston - Brockville area of the existence of a wreck located in Browns Bay, a small inlet on the north shore of the St. Lawrence River, thirty miles distant from the eastern end of Lake Ontario (McKennon, 1973: 3; Zacharchuck, 1968: 85) (Fig. 1).

The existence of the vessel had been known for a long time. One "old-timer" recalled, "When I was a youngster we used to go skating in Browns Bay in the winter time, and if the ice was clear of snow and the moon was full, you could see a ship frozen in the ice with its copper fasteners shining like gold!" (Zacharchuck, 1969: 1, manuscript) (Fig. 2). The wreck had been used for years as a

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The style and format of this thesis are those followed by the International Journal of Nautical Archaeology and Underwater Exploration.

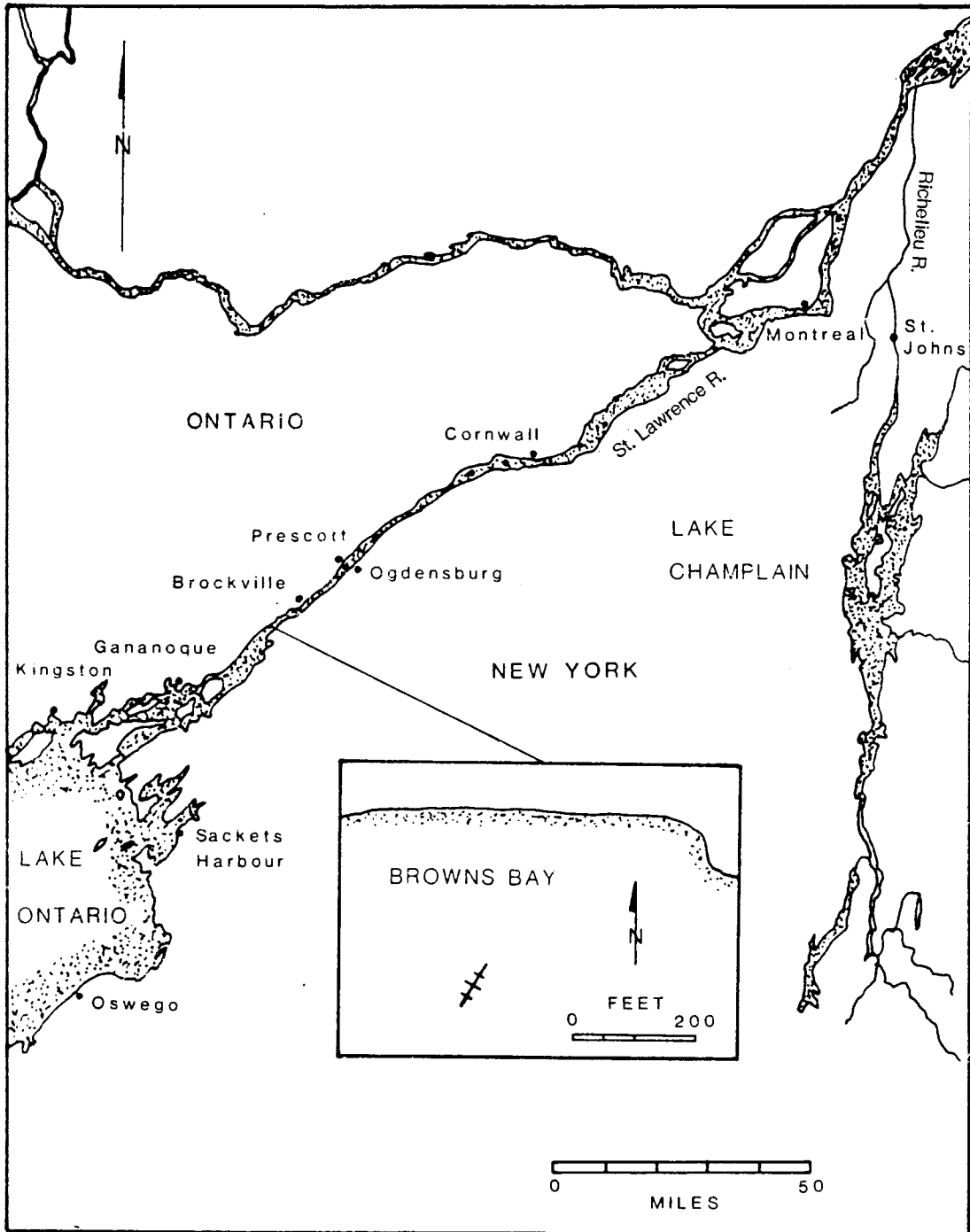


Figure 1. Location of Browns Bay Vessel. (Drawing by author.)

swimming and hunting platform, and as a site where an amateur diver could scrounge a copper nail or two (Austin, 1975: 1) (Fig. 3).

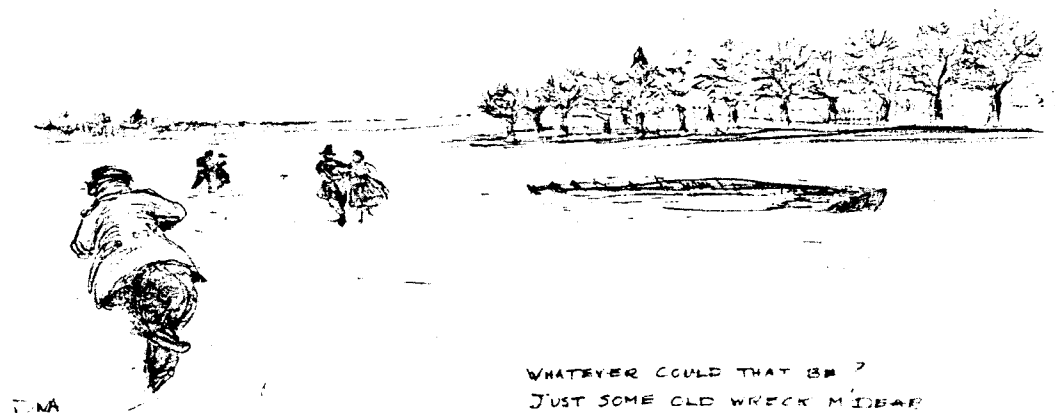


Figure 2. "Whatever could that be?" (D.W. Amer.)

The site was investigated that same year, and the hull tentatively identified as that of a British gunboat based on comparisons with late-18th- and early-19th-century plans of British gunboats. However, some features, such as a centreboard, did not correspond with the plans studied. The historical importance of the vessel was nevertheless recognized, and the site was excavated and recorded. The following year the hull was raised and

moved to nearby Mallorytown Landing, where it was preserved and put on public display (Zacharchuck, 1968: 85-94).

In 1985 I conducted a field investigation at Mallorytown Landing to restudy the vessel and record the construction of its hull. If the hull did represent that of a 19th-century British gunboat, it would be the only one in existence, and, therefore, would present a unique opportunity to study the construction of one of these vessels.

The presence of features in the hull of the Browns Bay Vessel which were uncharacteristic of British gunboats of that period--a centreboard, a wide-blade rudder, a heavy keelson--and an apparent lack of evidence for a gun, added additional significance to the study by implying alternate uses for the vessel and extensive modifications to the hull.

This thesis will concentrate on the construction of the vessel's hull and subsequent modifications to its entirety. The boat's appearance in the 19th century will be reconstructed from structural evidence on the hull, and its tonnage will be calculated. Historical background will also be given on the development and uses of this hull type by the British in the 18th and early 19th centuries.

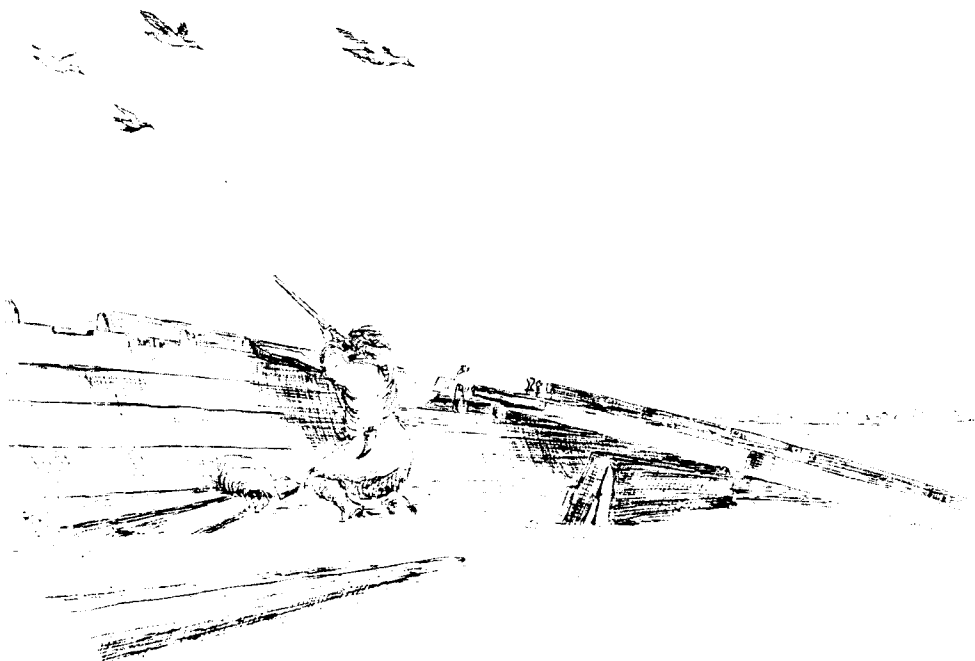


Figure 3. The Hunter (D.W. Amer.)

No vessels of this type have been found in Britain. (Lyon, 1985, pers. comm.). In North America, only two other British naval vessels from that period have been identified and investigated. Around the turn of the century a wreck described as an "Old British Gunboat" was raised in the Thames River, Ontario. It is believed to have been one of General Proctor's ships which were scuttled during the British retreat from the American forces under General Harrison in 1814. A photograph and a brief description are all that could be found relating to the

Vessel (Curwood, 1909: 212-213) (Fig. 4).



An Old British Gunboat Discovered in the River Thames.

Figure 4. "An Old British Gunboat Discovered in the River Thames." (J. Curwood, 1909: 213.)

The other British naval vessel which has been investigated is the brig Linnet. Originally named Niagra, she was built by the Royal Navy at Isle-aux-Noix shipyard during the winter of 1813-1814. The brig was surrendered to the American squadron at the battle of Plattsburgh Bay in 1814. She ended her days laid up with the rest of the U.S. fleet at Whitehall, finally sinking at anchor. Her remains were investigated in 1981 by a team working with the Champlain Maritime Society (Cohn, 1984: 60-63).

In Lake Champlain, several U.S. naval vessels from the War of 1812 have been investigated. These include the

schooner Ticonderoga, a converted steamboat hull (Crisman, 1983), and the brig Eagle (Cohn, 1984; Crisman, 1984). A 73-foot-long gunboat was also investigated along with the remains of the other wrecks in the Poultney River. This hull is "the only known example of a U.S. Navy gunboat from this time period" (Cohn, 1984: 66). When the vessel's remains have been fully examined, a comparative study of that gunboat and the Browns Bay Vessel could answer many questions with regards to the construction and use of these boats built in different countries for a similar purpose.

None of the merchant hulls from the 19th century which have been investigated in the Great Lakes and St. Lawrence River appear to have been converted from naval vessels. The schooners Hamilton and Scourge provide evidence for the opposite conversion; that is, from merchant to naval hulls. Launched at Niagara in 1811, the Lord Nelson was captured a year later by the Americans under the Embargo Act of 1812. The vessel was taken into the U.S. Navy, renamed the Scourge, and refitted for naval service. A similar fate awaited the Diana, a merchant schooner built at Oswego in 1809. She was sold into the U.S. Navy, renamed the Hamilton, and refitted (Cain, 1983: 36-65). Both schooners foundered in a squall on August 10, 1813. The hulls were located in 1975 near the west end of Lake Ontario and photographically surveyed in 1980 and 1982.

In 1978 and 1980, two merchant sailing vessels were

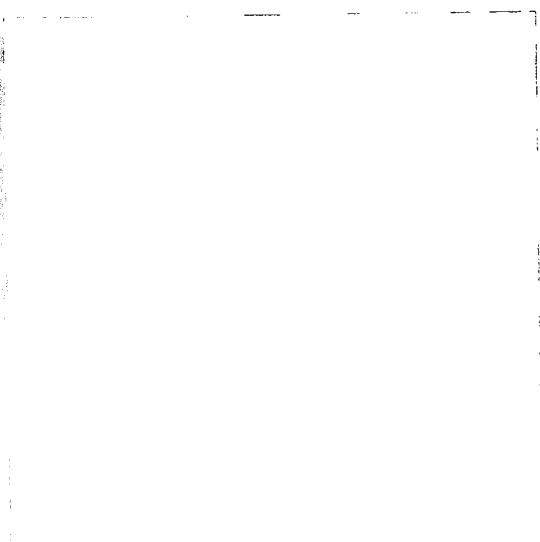
surveyed in Lake Champlain. Both are of a hybrid sailing canal barge type. The General Butler, surveyed in 1980, is an 88-foot-long schooner-rigged ship, built in Essex, New York, in 1862. She is a lightly built vessel, with a large keelson, transom stern and a retractable centreboard. The hull is fastened with iron (Cohn, 1984: 25-29). A second vessel of the same type but slightly smaller was examined in 1978. It has many similar features to that of the General Butler, but is thought to have been built earlier. Features include a barn-door-type rudder and a chain lanyard for operating the centreboard (Cohn, 1984: 31-37).

In 1984, the remains of the Great Lakes centreboard schooner Lillie Parsons were examined where she lay in the Brockville Narrows on the St. Lawrence River. Built at Tonawanda, New York, in 1868, the 131-foot-long hull lies inverted on the bottom of the river (SOS, Ottawa, 1984). The planks of her pivotted centreboard are edge-joined with iron drift bolts, and she has other features which can be compared to those on the Browns Bay Vessel.

Farther upstream in St. Lawrence Islands National Park lie the remains of a 60-foot-long sailing boat thought to have been built around 1868. A survey was conducted by Parks Canada in 1984 which determined that the vessel had a centreboard passing through the keel and the keelson, and had ceiling planking and a single mast (Ringer, 1984, manuscript).

Although British and American naval vessels from the War of 1812 are represented along with 19th-century merchant ships and converted merchant hulls, no shipwreck remains have yet been identified as those of a flat-bottomed boat or a British gunboat. Of the eleven vessels listed above, seven were identified through historical documents by their launching, career, or loss.

Documents identifying the Browns Bay Vessel or documenting its loss in Browns Bay have not been found. She may have been one of the British gunboats active on the Canadian waterways during or after the War of 1812, (Beattie, 1967: 123-127). There are unconfirmed tales of a boat having been abandoned in Browns Bay by a smuggler named Patterson during the 19th century. Although the vessel has not been positively identified nor its history confirmed by documents, the design and shape of the boat can be compared to those of a previously studied hull type.



## **HISTORICAL BACKGROUND**

At the beginning of the Seven Years War, the British Navy developed a boat type especially designed to be used in amphibious operations to load and unload troops and equipment. The origin of these expeditions, which were sent against the French coast, lay in William Pitt's belief that such diversionary campaigns would occupy French naval and military resources and find a useful role for the British home army, minimizing their continental commitments. Other British forces could then operate against French overseas possessions. The flat-bottomed boats, or "flat boats" as they came to be called, were probably developed from the launch, the largest type of boat normally supplied to warships (Pearsall, 1984: 207-208). The type appears to have been conceived earlier in the 18th century (Fig. 5), but the first record of the building and use of flat-bottomed boats occurs during the Seven Years War. The man apparently responsible for this innovation was George, Lord Anson, First Lord of the Admiralty, also considered "the Father of the Navy". The reforms in the Navy Anson instigated included the classification of ships in service into six different rates, and the creation of a permanent Corps of Marines to maintain discipline aboard ship and to be used for land actions (Keegan and Wheatcroft, 1976: 17).

In 1758, flat-bottomed boats were carried across the English Channel aboard specially modified transports and

used to land a small British military force in France in support of Frederick II of Prussia. Each boat was rowed by 24 men and carried a tactical unit of troops across the shallows to the beaches of the French coast near Cherbourg (Pearsall, 1984: 208-215).

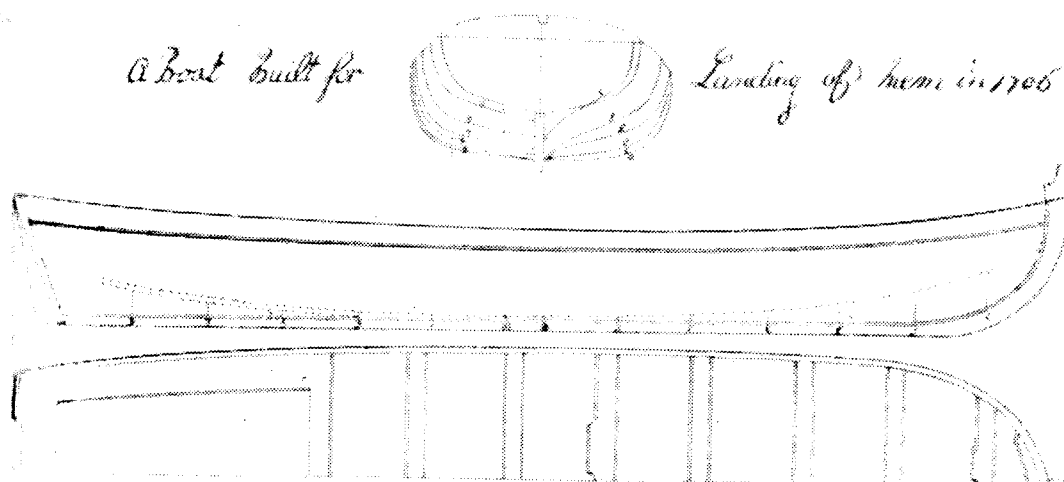


Figure 5. "A Boat built for Landing of Men in 1706."  
(Courtesy of the National Maritime Museum.)

Harrassed on her home shores and losing control of the sea, France surrendered her colonies one by one. In 1762 she drew Spain into the struggle as her ally. The same year the full potential of the flat-bottomed boat type was realized during the British invasion of Havana, the centre of Spanish power in the Caribbean (Fig. 6). In the largest combined operation of the Seven Years War, an invasion force of 16,000 troops was landed on the beaches to lay siege to the city's defenses with the support of a formidable naval force. Lord Anson appears to have been

the driving force behind the planning and preparations for the Havana campaign (Syrett, 1970: xiii).



Figure 6. Troops being conveyed in "flat-bottomed boats" in the entrance to Havana Harbour. (Syrett, 1970: 236-237.)

The boats used in the landing were described as "clinker-built, of shallow draught, thirty-eight feet long, and eleven feet wide" (Syrett, 1970: 4). Each was "arranged for fifty or sixty men; their shape is somewhat similar to that of the long boats which men of war generally carry, but they are much larger and have flat bottoms for the purpose of getting closer to shore" (Syrett, 1970: 54). Several of the boats were also "fitted with shields to carry guns" and used to offer covering fire during the assault (Syrett, 1970: 29-30).

During the American War of Independence and the French Revolutionary and Napoleonic Wars, other versions of the same hull type were built as gunboats from the start. By the beginning of the 19th century, the French and the Danes had developed shoal draft vessels for the purpose of landing troops and carrying armament. The French twice attempted to invade Britain using this type of craft. Both tries were thwarted, in 1758, by the destruction and dispersal of the French fleet in Toulon, and in 1804 when Napoleon decided instead to attack Austria (Mahan, 1984: 141-144; Whipple, 1978: 124-125). The Americans, too, had developed shallow draft gunboats for use in lakes and rivers and for harbour defense. These craft, however, were not intended to operate in support of military movements like the British and French designs (Chapelle, 1949: 189-208).

By 1760, Britain had gained possession of French Canada and with it secured control of the fur trade, France's greatest economical asset and interest in North America. Using the combined forces of army and navy, Britain gained control of the St. Lawrence River, the main route to the heart of the country, with successful amphibious assaults on Louisbourg in 1758 and Quebec the following year. The surrender of Montreal in September, 1760, put an end forever to the French possession of Canada (Mahan, 1984: 140-141).

Britain immediately realized the importance of the

Great Lakes and St. Lawrence River system, not only as a convenient route for commerce, but as a vital communication link and supply route for military posts at the western end of the lakes. In 1763, the Provincial Marine Department was established. This naval force, under the control of the British military, was formed to provide defense for the colonies along the waterways. The force consisted of the remainder of General Amherst's fleet of gunboats built the year before the British conquest. They were described as:

. . . some forty-five feet long, ten foot beam and were about five feet deep amidships. . . floated on a loaded draft of about two feet, exclusive of keel. The bows and sterns were decked for a few feet, but the central part of the hulls were open, with seats for six or eight groups of rowers. They were propelled by lug-sails or sweeps, six or eight oars a side (Cuthbertson, 1931: 101).

The boats had been used as an auxiliary force to assist the work of the military.

Far from being an effective naval force, the few unarmed shallow-draft gunboats operated by the service were used mainly for moving troops and public stores, along with civilian passengers and private merchandise around the colonies (Beattie, 1967: 4).

During the Revolutionary War, these few craft were the sole means of moving trade goods within the British colony in Canada. In order to prevent malcontents from the American colonies from entering Canada, and to further prohibit trade with the warring American colonies, the

British government began stringent supervision of all channels of trade and required all goods to be shipped on existing naval vessels. The few boats available, however, were unable to cope with the needs of commerce. The restrictions were lifted in 1785, but the fleet continued to be inadequate as a naval force (Cuthbertson, 1931: 120-127).

With the beginning of the War of 1812, the necessity of defending the lines of communication on the Great Lakes and St. Lawrence River was pressed home once again. The Provincial Marine Department, unable to cope with the task, was replaced by the Admiralty Lakes Service under the direct authority of the British Admiralty. In March, 1813, Lieutenant James Lucas Yeo was appointed to the command of the newly formed Service. Yeo saw the value of establishing a force of shoal draft vessels able to navigate the often shallow and variable waterways of Canada. They were propelled by sails and sweeps, and each had one gun in the bow. Of the boats, Captain J.E. Irwin, Assistant Quarter Master General, wrote:

They are calculated for the calms so prevalent in the Lake Ontario, and by taking prompt advantage of such a moment, one of the Boats in question could tease and cut up the largest vessel in such a way as to force it to shift its station, if not to perhaps capture it (Beattie, 1967: 9).

These boats, operating out of Kingston, Prescott and Gananoque, were to "provide convoy services for all supply laden batteaux, as well as performing a constant scouting

service in the Thousand Islands to ensure open communication between Kingston and Montreal (Beattie, 1967: 12) (Fig. 7).

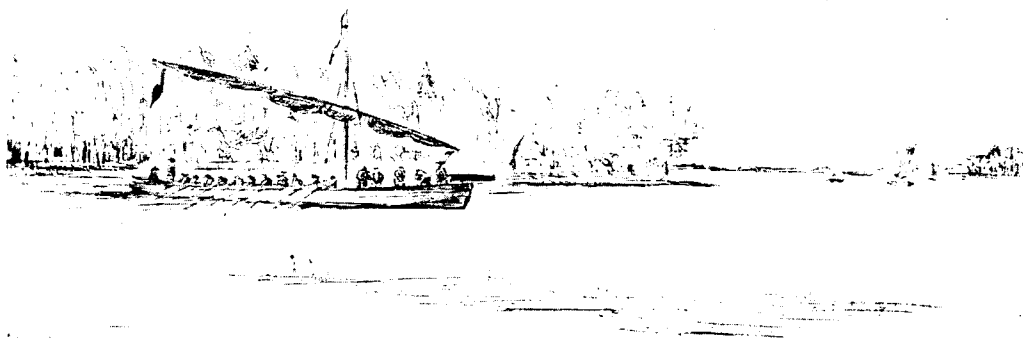


Figure 7. Gunboat on the St. Lawrence River.  
(D.W. Amer.)

To build up his squadron, Commodore Yeo purchased a few small commercial craft. For the most part, however, he had boats built locally by Canadian shipwrights until 1814, and by Admiralty men thereafter (Fig. 8). The British had so much difficulty getting materials and equipment from the coast to their established shipyards at Kingston and York (now Toronto) that they had the frames of some vessels prepared in England and shipped (Chapelle,

1949: 249; Cuthbertson, 1931: 189). This procedure was not new. The British had begun having vessels sent "in frame" from England as early as 1776, when they established their base at St. Johns on the Richelieu River (Chapelle, 1949: 104).

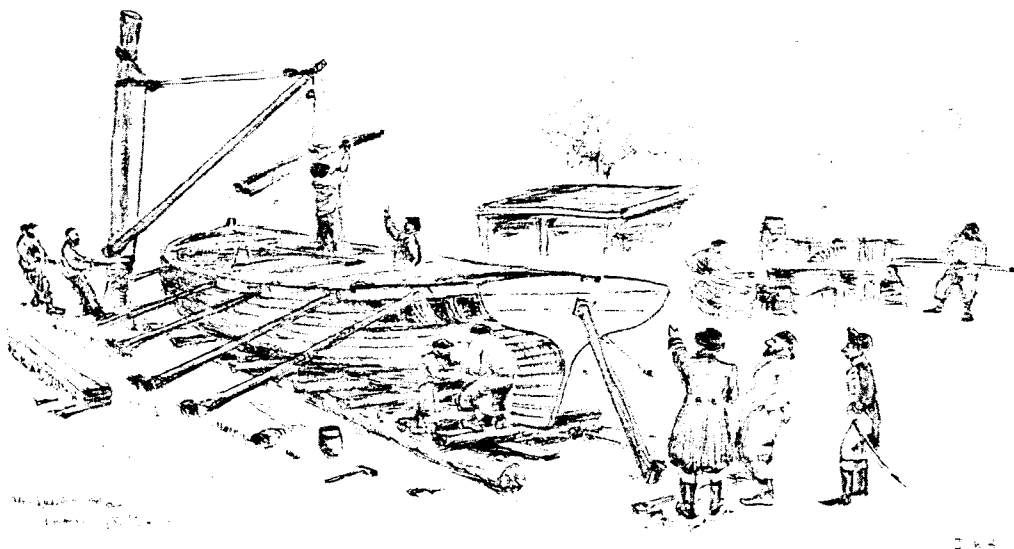


Figure 8. A flat-bottomed boat being built.  
(D.W. Amer.)

During the war the gunboat fleet, while performing the duties envisioned by Yeo, operated in support of naval operations and supported troop movements and campaigns. After peace was declared in 1814, the gunboats were engaged once again, in the routine freighting and trans-

porting activities they had performed prior to the outbreak of hostilities. Finally, in 1815, the gunboat flotilla was officially decommissioned and the fleet laid up (Beattie, 1967: 24-25).

The Rush-Bagot Agreement of 1817 between the British and American governments restricted the presence on the Great Lakes of armed vessels from each country to one ship of under 100 tons burthen and armed with one 18- pound gun. However, the British fleet, although laid up, was maintained and occasionally overhauled between 1823 and 1830. Some gunboats were used briefly during the Canadian Rebellion of 1838, in the Thousand Islands region of the St. Lawrence River, which had become a haven for "brigands and outlaws who made their presence a nuisance to the transportation system of the St. Lawrence River" (Beattie, 1967: 35). Most of the gunboats from Commodore Yeo's fleet appear to have been broken up prior to 1838 or sold by auction in 1836 (Cuthbertson, 1931: 207).

## CHAPTER II

### INVESTIGATIVE TECHNIQUES

#### THE SITE

The Browns Bay Vessel had sunk onto a sandy bottom of Browns Bay, 300 feet from shore in approximately six feet of water, deep enough for the water to cover most of her hull structure. Much of the structure high on the hull was then either removed or destroyed by natural and human activity.

No direct evidence was found of early salvage. It is likely that desirable items, such as mast and rigging elements, as well as other fittings which would have been easily accessible, may have been removed by salvors. The shallow water also allowed recovery of personal possessions from within the hull. Few personal artifacts were found during the excavation.

Soon after she sank the combined action of the river current and her own weight would have caused the hull to settle into the sandy bottom, the keel finally coming to rest on a hard clay and boulder layer (Zacharchuck, 1981, manuscript). The part of the hull that was covered by sand was not subjected to the destructive effects of mechanical and intensive biological degradation.

The action of ice in the river probably loosened and removed the timbers remaining above the river bottom. Some timbers were carried away while others, including

some deck beams and knees, transom, rudder and the upper part of the centreboard, fell to the bottom and were quickly buried. The shell of the hull, lacking the support afforded by the beams and transom, opened under its own weight and hastened the reburial process. Finally, only the highest parts of the vessel--the stem, sternpost and centreboard trunk--remained above the river bottom. Over time, the upper extremities of these members succumbed to rot induced by constant waterlogging and drying as the river rose and fell with the seasons.

#### **NATIONAL HISTORIC SITES SERVICE EXCAVATION AND RAISING OF THE VESSEL**

Since its rediscovery by divers in the 1950s, pieces of the hull have fallen prey to souvenir hunters. The rudder, salvaged in 1957 by a local diver, was later turned over to NHSS; however, other ship accoutrements including chainplates, thole pins, eye-bolts, the mast clamp and deck fasteners, were not returned for recording (Zacharchuck, 1969, manuscript).

Eight hundred hours were spent by the NHSS divers in excavating and recording the hull structure. Sand was cleared from within the hull using water dredges, trash pumps and water jets. Loose timbers and artifacts were raised. Using a grid system, a plan of the exposed hull structure was drawn, and hull details were photographed. A number of hull fittings and artifacts were recovered

from within the hull. Artifacts recovered amidships included two fragments of chainplates as well as two forelocked eye-bolts (Fig. 9).

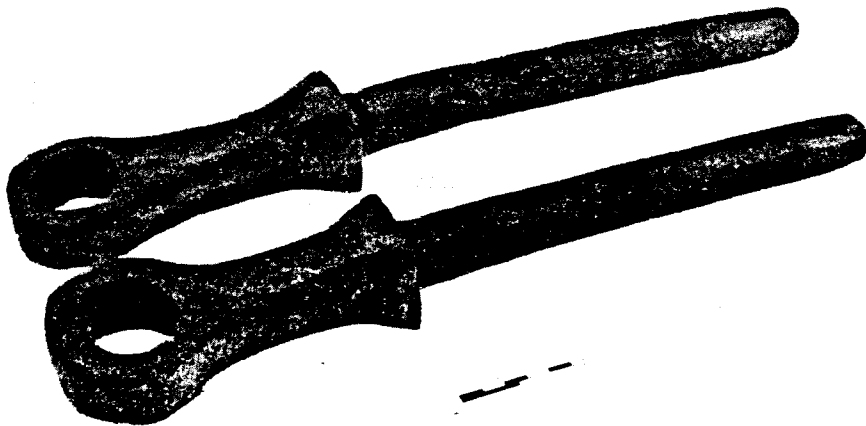


Figure 9. Forelocked eye-bolts from the midship beam of the Browns Bay Vessel. (Photo by the author.)

The bolts are identical to two bolts fastened through the midship beam. One eye-bolt is stamped with a British broad arrow denoting naval origin (Fig. 10). Also recovered amidships were three single sheave blocks, their shells cut from a single block of wood, and a sheave (Fig. 11).

Other artifacts included a caulking hammer, a chisel, a whetstone, a leather boot and two shovels, which were recovered from the forward sections of the hull.

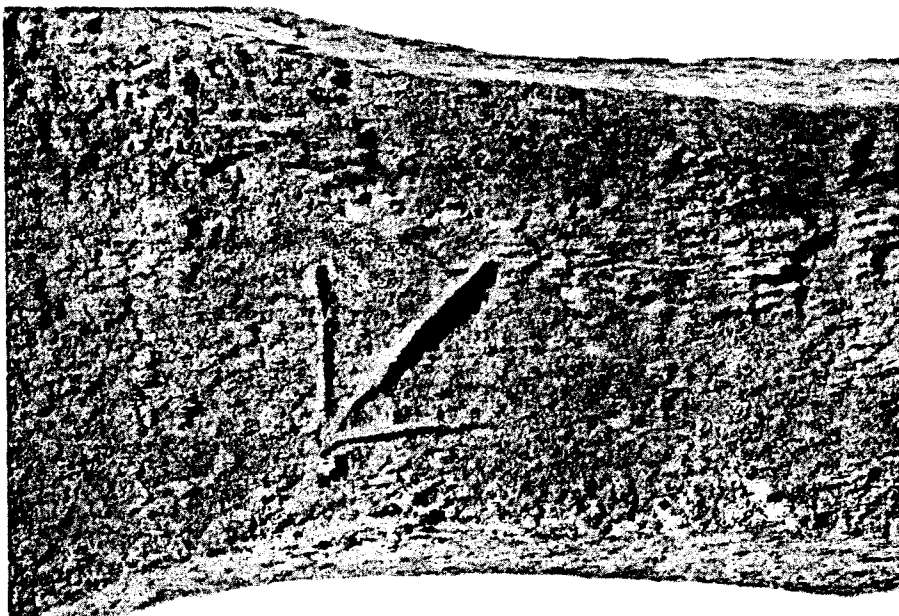


Figure 10. Broad arrow stamped in an eye-bolt from the Browns Bay Vessel. (Photo by author.)

The stern area yielded several two-pronged forks with bone handles, a pewter plate, a bottle, two iron pot lids and a cast iron stove door bearing the name of a New York manufacturer (Fig. 12). Part of the stove was located outside the hull. Several clay pipe fragments were also recovered. One pipe stem bears the name J. Nimmo, Glasgow, a man known to have been making pipes in Glasgow in 1861, though a man of the same name may have been making pipes as early as 1822 (Zacharchuck, 1981, manuscript).

A quantity of 19th- and 20th-century cartridge primers found within the hull attests to the wreck's

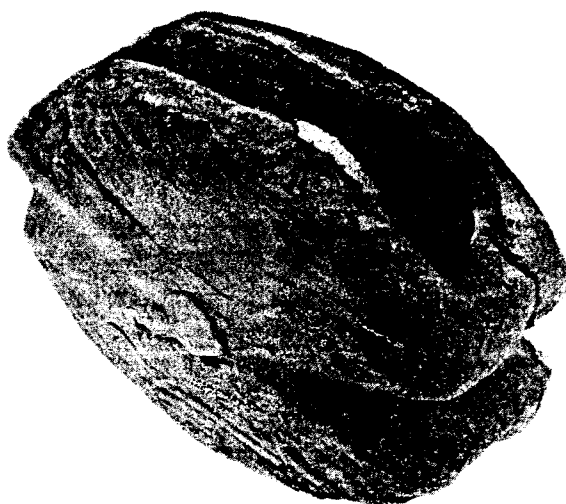


Figure 11. Pulley block from the Browns Bay Vessel.  
(Photo by the author.)

having been used as a hunting platform since her sinking.

During the spring of 1967, a wooden cradle was prefabricated and fitted over the wreck. Six slings were passed through tunnels cut through the clay beneath the hull. The structure was made buoyant and towed 2-1/2 miles upstream to Mallorytown Landing. There the structure, weighing an estimated 22 tons, was lifted from the water and set on a gravel pad (Fig. 13).

Cleaning and recording of the hull took several weeks, during which time it was kept wet by using an overhead sprinkler system. Scale drawings were made of the boat's major features, measurements taken to determine the lines



Figure 12. Cast iron stove door from the Browns Bay Vessel. (Photo by the author.)

of the vessel, and numerous photographs taken to record hull details (Fig. 14). The thick layer of tar which covered the exterior planks was removed to allow the wood to absorb the preservative during conservation treatment (Zacharchuck, 1968: 87-93).

A bath was constructed around the vessel and 11,000 gallons of polyethelene glycol solution (P.E.G. 1000 and P.E.G. 1450) added to completely immerse the hull. The solution was heated during winter, and circulated by electric mixers. By November, 1968, the hull timbers had absorbed an estimated 16,000 pounds of Carbowax (Wilson, 1963, unpublished). In the spring of 1969, the vessel was

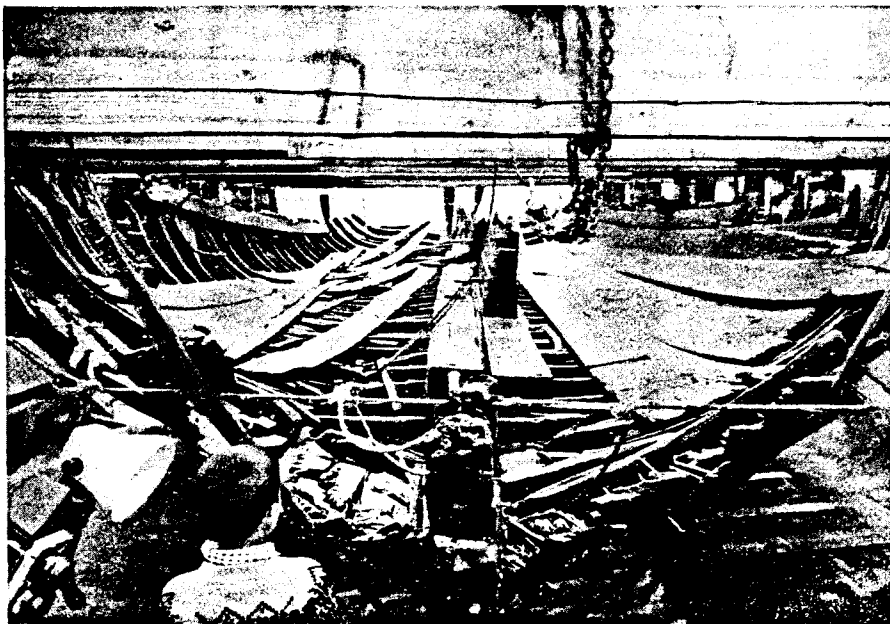


Figure 13. The hull of the Browns Bay Vessel slung beneath a cradle, soon after raising. (Courtesy of Archaeological Research Division, National Historic Parks and Sites Branch, Parks Canada.)

removed from preservative treatment and moved to the St. Lawrence Islands National Park nearby, where it was put on public display (Zacharchuck and Rick, 1969: 11).

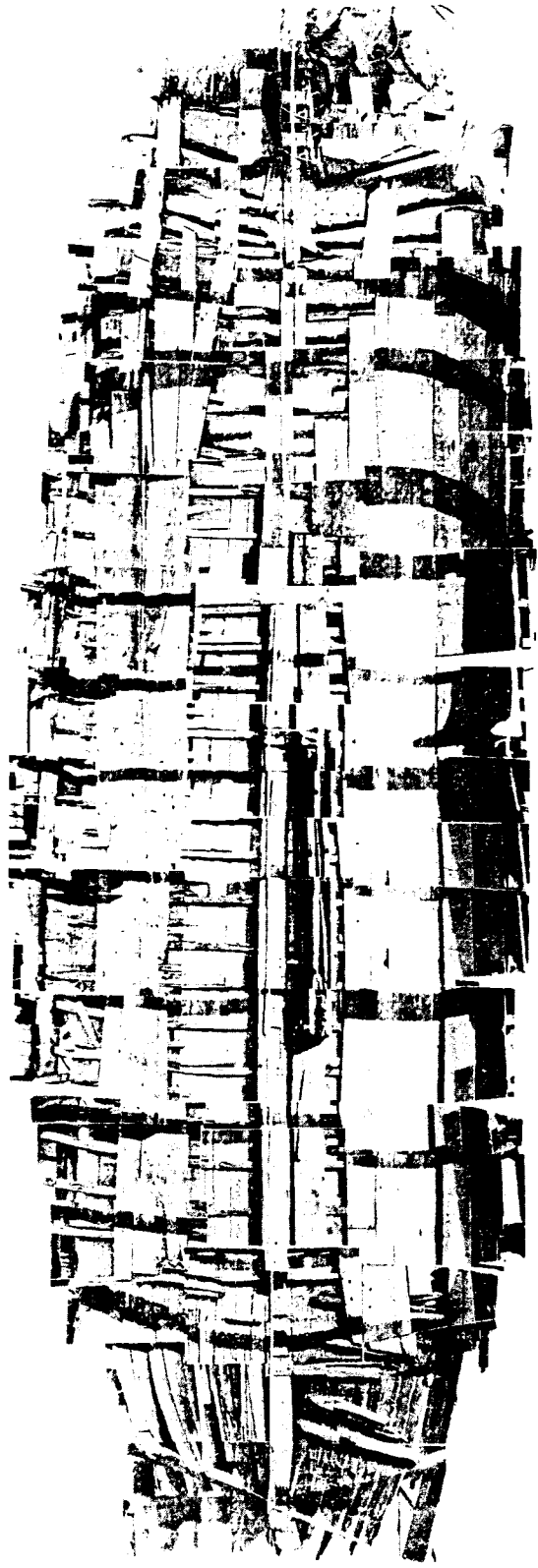


Figure 14. Photomosaic of the Browns Bay Vessel in 1968. (Courtesy of the Archaeological Research Division, National Historic Parks and Sites Branch, Parks Canada.)

## VESSEL ON DISPLAY

The vessel is housed in a 90 foot long by 30 foot wide building, which rests on wooden pilings about 8 feet above the St. Lawrence River on the east side of a spit of land. The hull is supported in a wooden cradle shaped to conform to the reconstructed hull line (Wilson, 1968, unpublished). The building is unheated and allows for free circulation of air around the vessel through vents in the floor and roof, as well as through two doorways, which are open when the exhibit is open to the public. The lack of artificial climate control and a humid environment are thought to have been somewhat beneficial in preventing rapid drying of the timbers which would cause uncontrolled dimensional changes (Murdock, 1985, manuscript: 4-5).

The building is open to the public from spring to fall. The vessel can be viewed along its starboard side and bow from behind a waist-high partition which extends the length of the hull. An interpretive display placed along either side of this walkway highlights the history of British gunboats on the Lakes and illustrates the excavation and raising of the boat. The most interesting features of the hull are pointed out in the display and highlighted with spotlights, which contrast sharply to the otherwise subdued lighting.

Despite the proximity of the public to the exhibit, no cases of vandalism have been reported (Murdock, 1985, manuscript: 19). An expansion of the interpretation pro-

gram is currently in the planning stage, and will include a display of several of the artifacts recovered with the hull.

#### **THE VESSEL IN 1985**

When the hull was first examined in the spring of 1985, it was in generally good condition despite being displayed out of the water in an uncontrolled environment with no ongoing conservation maintenance program. All major timbers were represented on the hull, which was fairly complete up to the tops of the frames. Generally the port side survived to a greater extent than the starboard side, and the central portion was in better condition than the bow and stern.

The keel and keelsons (original and refitted one) were well represented along with much of the bow and stern structure. The upper extremities of both bow and stern timbers were missing, having been broken and eroded, leaving the lower half of the posts scarfed and fastened to the keel. The stern knee, while firmly fastened to the keel and stern post, was severely affected by dry rot. The transom was in place, suspended from the ceiling by wires and attached to the hull by the starboard plank ends which were nailed to it. The port planks were eroded short of the transom. The rudder was attached to the stern with one pintle and wires.

Only the lower few planks of the bow were fastened to

The stempost. The remainder were broken or eroded short of the rabbet. The port plank ends were in a better state of preservation than those of the starboard planks. The bow was only lightly covered with sand and had been subjected to the removal of many nails by souvenir hunters prior to excavation.

Farther aft, hull planks in the port side remained attached to the frames as high as the timber heads, while the upper three starboard planks were missing. In many places of the hull, the double layer of planking had pulled away from the frames. Warping had also caused the two layers of planks to separate in several places.

Frames in the bow and stern did not fare well; many were damaged or absent. Square frames were generally represented in their entirety. Each frame was composed of a floor timber and two sets of futtocks. One set of futtocks was sawed off at the top of the transition plank during the service of the vessel, while the remaining futtocks extended to the deck level. The floor timbers and futtocks exhibited varying degrees of shrinkage and damage. Dry rot was evident on many timbers. The starboard arms of several floor timbers were fractured near the inboard ends of futtocks. Due to the presence of ceiling, it could not be determined if a similar pattern existed on the port side.

Ceiling on the port side was well represented, and planks were solidly attached to frames. An exception to

this was in the bow and stern and along the keelson and centreboard beam, where the planks were either badly eroded or displaced. Only four ceiling planks remained attached to the frames on the starboard side. Several planks were loosely fitted over the portion of the starboard portion of the frames.

Two deck beams with lodging knees attached were in their approximately original positions on the hull, and were suspended from the ceiling by wires. One lodging knee remained attached to the hull.

Several timbers were stored beneath the hull. These included two knees, plank and futtock fragments and several unidentified fragments. The upper pintle and an iron rod, which served to attach the pintle and gudgeon on which the rudder pivoted, also rested beneath the hull. Two heavily eroded sections of the starboard wale, the upper, aft section of the centreboard, and several ceiling planks were stored within the hull on the port ceiling.

Numerous copper nails and rivets that fastened the hull together were very stable. Iron fastenings and fittings were in solid condition, although many showed evidence of active corrosion.

After the initial preservation of the hull, there was only a limited amount of monitoring over the years. In the fall of 1985, a team from Parks Canada and the Canadian Conservation Institute performed a visual and physical examination of the hull. They concluded that while

the overall condition of the hull was good and appeared reasonably stable, severe shrinkage and warping had affected many of the timbers. Dry rot had probably developed during the service period of the vessel. Moisture content of timbers from various areas on the hull were as follows: hull planks and keelson, 9.5 to 11.0%; frames, 8.25 to 10.0% and ceiling 9.0 to 15.5% (Murdock, 1985, manuscript).

Testing of two samples revealed that P.E.G. impregnation of a plank was "quite reasonable," while that of a frame was rather low, with little penetration to the interior of the wood (Johns and Sims, 1985, manuscript). It was noted as "surprising that there is not more corrosion activity [of the metal] considering the high relative humidity levels that would be present during the spring and summer" (Murdock, 1985, manuscript: 13).

#### **METHOD OF RECORDING**

The hull was documented during fourteen days between March 31 and June 1, 1985. Most of the 105 hours of recording was done by the author alone, a situation which often consumed an inordinate amount of time to perform tasks which could have been performed quickly with a larger crew.

The first four days were spent making an inventory of the remains, noting general observations and taking basic measurements of major structural elements on the hull. A

100-foot fibre tape was strung down the centreline of the vessel to serve as a baseline to which other hull measurements could be related. Photographic equipment and techniques of photo recording were tested.

For two days in April, the author was joined by Kevin Crisman, who assisted in taking body sections and recording hull details. Prior to taking the body sections, the floor positions were consecutively numbered from bow to stern, and all but two of the starboard ceiling planks were removed to gain access to the hull planking. It was decided to record sections along the starboard side because the port sections had previously been measured during the hull recording in 1967. The starboard sections could verify the sections recorded on the port side and provide additional information on the hull construction. When the sections were converted to a body plan, they would serve to verify the existing lines.

A string was stretched along the approximate centreline of the vessel and levelled. This acted as the base plane to which the sections could be related. Strings were stretched to opposite timber heads, perpendicular to the base line, where sections were to be taken (Fig. 15). These were levelled and a tape was run along each string. The lowest point of each plank overlap was located by measuring the distance vertically to the cross hull string and horizontally to the base line. The point was then plotted directly on gridded paper at a 1-1/4 inch to 1

foot scale. Details such as plank thickness, molded dimension of frame timbers, ceiling planks and fastenings were recorded and added to each section drawing. The drawings were later photographically reduced to a 1 inch to 1 foot scale, to be consistent with previous drawings.

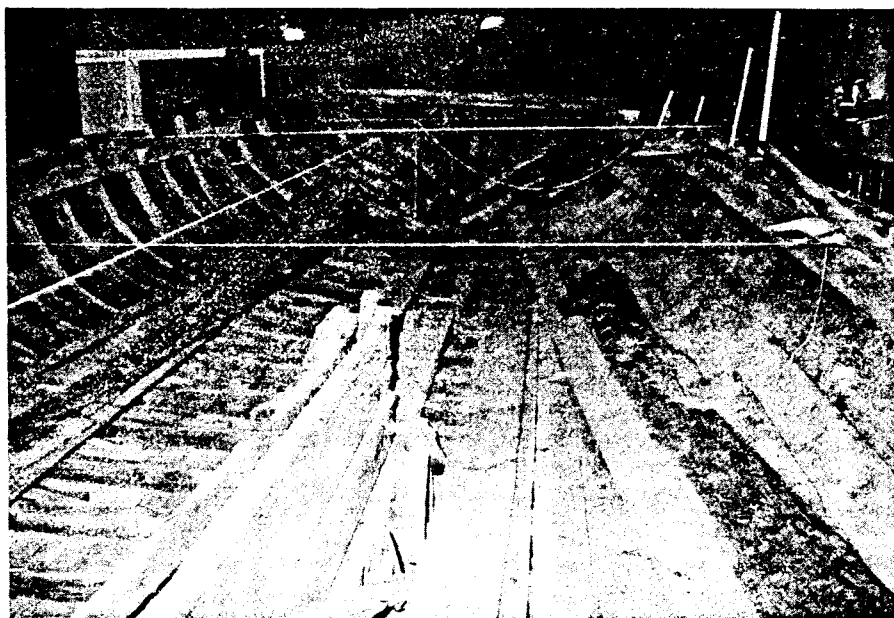


Figure 15. The stern of the Browns Bay Vessel showing levelled strings used for taking hull sections. (Photo by the author.)

During the last eight recording sessions, the sections were completed and located along the baseline and the hull further documented. Measurements were either recorded in tabular form or converted directly to scale drawings, which were then annotated. Where drawings had previously been made, existing dimensions were checked, and additional information added directly to photocopies or blue-

lines of the drawings. The revised wreck plan (Fig. 16) was produced in this way by adding information to and redrawing the underwater wreck plan.

Numerous photographs were taken to supplement the measurements and aid in the study of the vessel's construction. A 500-watt floodlight and Strobolar 880 flash unit were used to illuminate the hull, as natural light was not adequate. The hull was photographically recorded using 35mm black and white film and colour slides. The many photographs, taken during the raising and recording of the vessel in 1967, were also consulted.

The last visit of the season was spent recording the loose timbers stored in and under the hull, double checking information previously gathered for errors or omissions, replacing the starboard ceiling planking, and removing all survey and recording equipment from the building. Wood samples were taken during a subsequent session in the spring of 1986 (see Appendix A).

Since the vessel was built by shipwrights using the English system of measurement, all dimensions are in feet and inches.

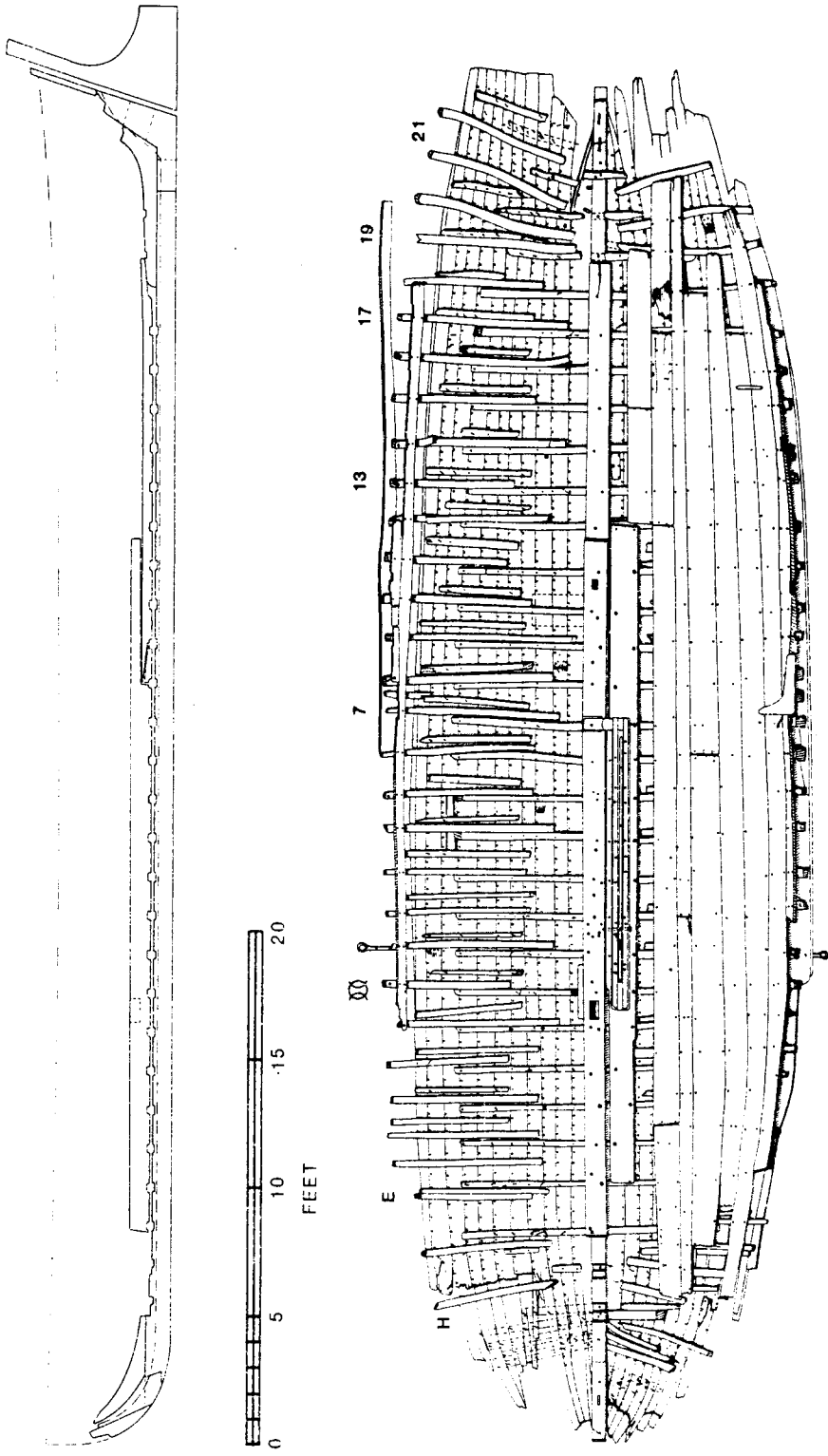


Figure 16. The revised wreck plan of the Browns Bay Vessel. (Drawing by the author and C. Piper.)

## CHAPTER III

### THE CONSTRUCTION OF THE VESSEL

#### THE KEEL

The single-piece keel measures 49 feet, 3-1/2 inches from the fore end of the stem scarf to the keel scarf at the heel of the sternpost. Cut from straight-grained white oak (Quercus spp.), the keel averages 8-3/4 inches moulded, but thickens to 12 inches at its fore end at the stem assembly attachment. It is sided 6 inches at its upper surface and narrows to approximately 4-1/2 inches at the bow and stern.

The upper surface is flat and is notched to receive 26 floor timbers. The notches range in depth from 3/4-inch to 1-1/2 inches, varying from 2-1/4 to 3-1/2 inches in length; most of the notches are 3 to 3-1/2 inches long. Each notch was fashioned by sawing across the keel to the desired depth, then chopping or splitting out the intervening wood. Notches were cut on approximately 18-inch centres.

Because of the integral nature of the keel, floor timbers and keelson, direct observation of the upper face of the keel could be made only at the forward two floor locations. At frame locations G and H, a second, shallower notch had been cut forward of the forward face of each floor notch (Fig. 17). These notches measure 1 inch deep by 3 inches long at G, and 2 inches deep by 5 inches

long at H. Between them the keel's moulded dimension increases to 10 inches, and forward of H to nearly 12 inches. The forwardmost notch is pierced by two 5/8-inch iron bolts, one of which protrudes above the keel, its peined end almost level with the upper surface of the apron (see Appendix B for nail and bolt descriptions).



Figure 17. The notched upper surface of the keel of the Browns Bay Vessel at frames G and H. (Photo by the author.)

The keel is flat to the after side of floor timber 13, whose after face butts the forward end of the stern knee. Aft of frame 13, the upper surface of the stern knee is notched to receive the floor timbers.

The lower surface of the keel is gouged and abraded, and in some places split, a consequence, no doubt, of many

years of active service, and of the drying of the wood after raising. At least thirty iron bolts are in evidence along the lower surface. Both 5/8-inch and 3/4-inch bolts are represented, and the lower ends of those visible are peined. Several bolts are recessed 1/2-inch to 1-inch, the holes sealed by wooden plugs. Near the aft end of the keel, some bolts protrude 1 or 2 inches and are bent aft. It is estimated that there are ten more bolts extant along the keel, but these are hidden by timbers of the supporting cradle.

Two 1/2-inch wooden stopwaters bisect the table of the heel scarf. These prevented the scarf seams from shifting, and deflected water running along the seams, thus preventing it from entering the hull.

A rabbet was cut approximately 2 inches below the keel's upper surface for fitting the garboard strakes of the inner, original planking. In the bow, the rabbet begins its upward sweep following the curve of the stem. Aft, the rabbet joins that of the sternpost approximately 6 inches aft of the keel/heel scarf. The rabbet is 1-inch wide and 1/2-inch deep.

Only in the bow was a rabbet provided for the exterior garboard strakes. Elsewhere, the exterior garboards butted the moulded faces of the keel.

The moulded faces of the keel near the bow are bisected by four treenails and two bolts. A 1-inch treenail appears to have been driven across a crack while two

others may have been inserted to replace knots. Two 3/4-inch iron bolts bisecting the moulded surfaces of the keel held together and strengthened the keel where it had split aft of the lower seam of the stem scarf. A 1-5/8 inch treenail, located between the two bolts, plugged a hole, probably once used to facilitate hauling the vessel (Fig. 18).

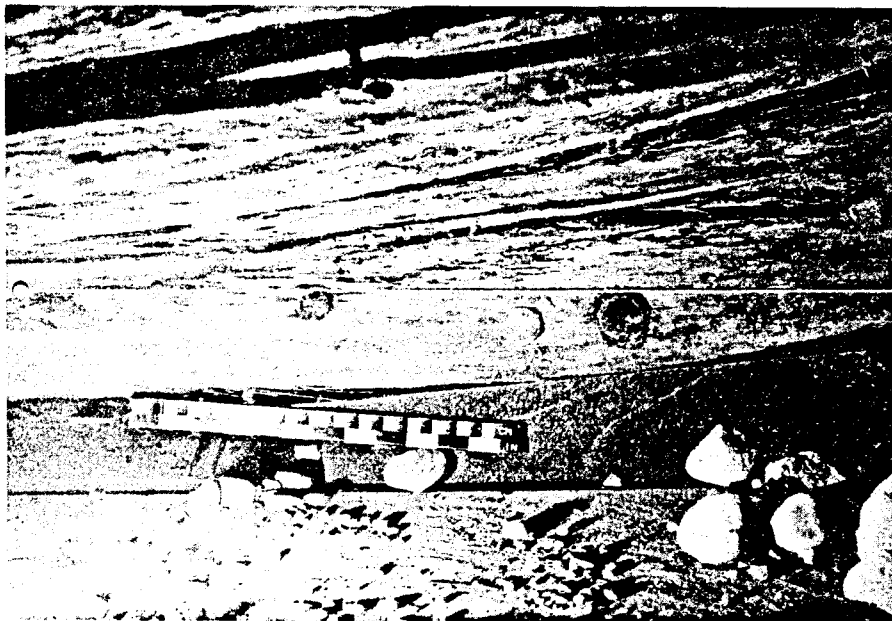


Figure 18. A view of the starboard side of the Browns Bay Vessel's keel, near the bow, showing bolts and treenails. (Photo by the author.)

A rectangular wooden block was inserted into the lower starboard side of the keel between frames 14 and 15. Measuring 15 inches long by 2-3/4 inches vertically and 1-1/2 inches wide, it was fastened by iron nails and the seams were caulked. It, no doubt, represents a repair to

the keel.

### THE STEM

The stem consists of a stempost and an apron. Only the lower 3 feet of each timber have survived, representing over half of the original height of the stem (Fig. 19).

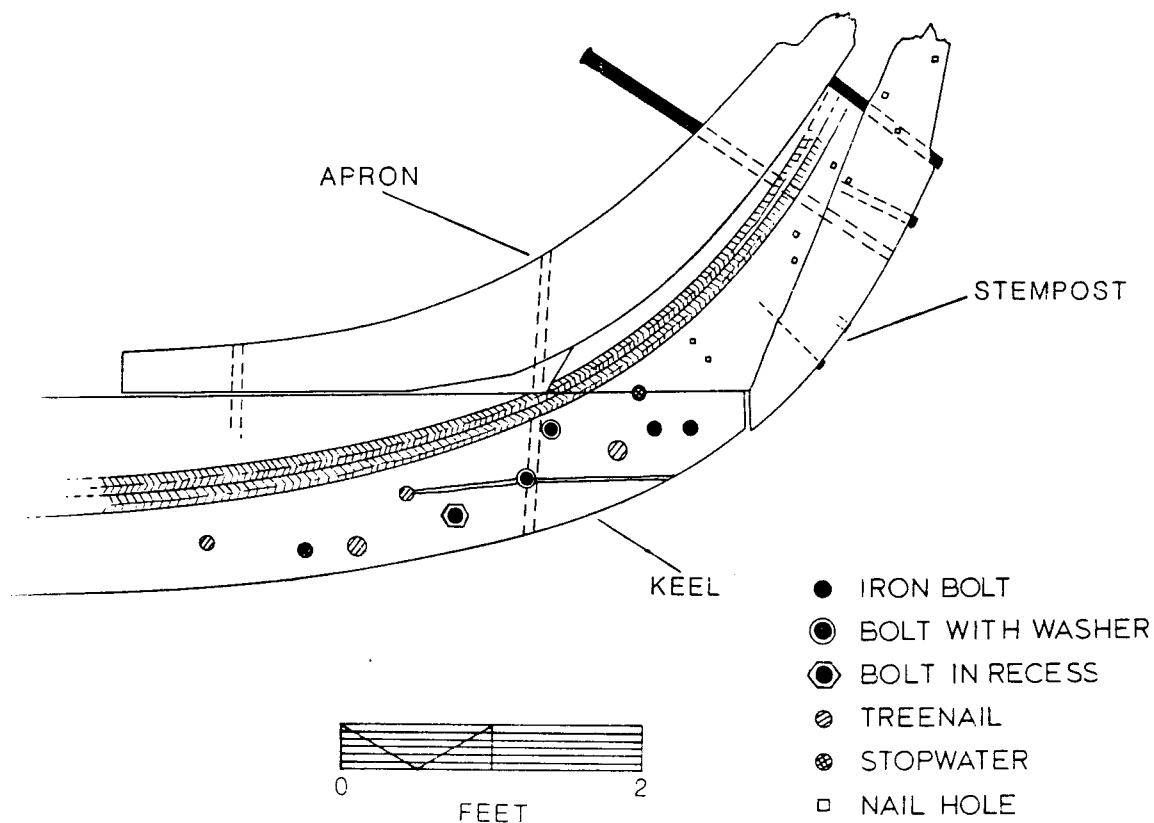


Figure 19. The stem of the Browns Bay Vessel.  
(Drawing by the author and C. Piper.)

The stempost survives to a length of 3 feet, 9 inches. Its moulded dimension decreases from 10 inches at the base

to less than 8 inches near its upper extremity. It is sided 5-1/2 to 6 inches at the inboard face, but narrows at its forward edge to 4-1/2 inches. Fashioned from straight-grained white oak (Quercus spp.), this important timber has split along the grain for much of its extant length (Fig. 20). The split bisects several nail holes on



Figure 20. The starboard side of the stem of the Browns Bay Vessel showing a split in the stempost. (Photo by the author.)

the port side, the presence of which apparently set up a line of weakness along the grain. Nail holes on both moulded surfaces suggest a sheathing may once have been fastened to the stempost to strengthen and protect its aging structure, as was done in the stern.

The forward face of the stempost arches gracefully

upward from the keel, where the curvature begins. A similar curve describes the inboard face, although apparently the two faces converge towards the eroded upper extremity of the remains. The V-shaped rabbets follow this curve within an inch of the inner surface.

The stempost is joined to the keel by an elaborate scarf having both horizontal and vertical tables (Fig. 21). Four iron bolts clamp the scarf athwartships: three 3/4-inch bolts peined over 1-1/4 inch washers, and a 3/4-

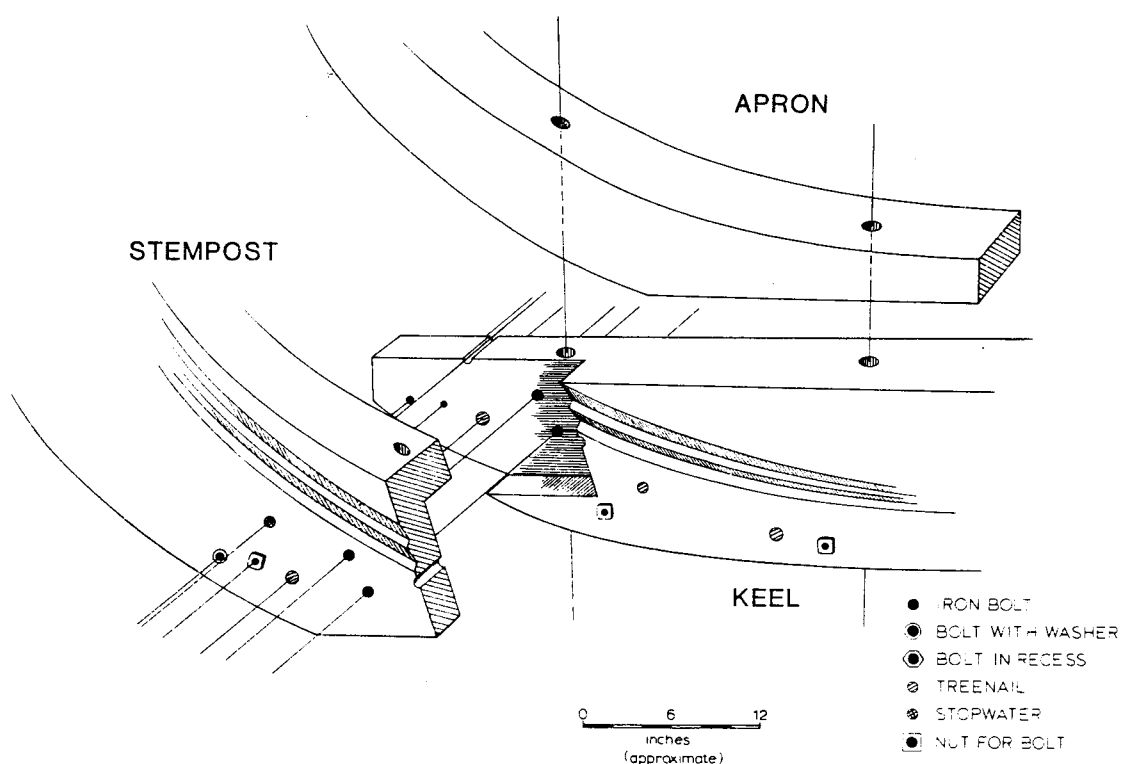


Figure 21. Exploded view of the stem scarf of the Browns Bay Vessel. (Drawing by C. Piper.)

inch threaded bolt with a 1-1/4 inch square nut, which was probably a later addition to strengthen the structure. A 1-1/4 inch treenail with a cross cut into its starboard end also bisects the scarf (Fig. 22) (see Appendix B for nail and bolt descriptions).



Figure 22. Detail of the starboard side of the Browns Bay Vessel's stem scarf showing stopwater (upper right). (Photo by the author.)

Stopwaters in the form of 1-inch treenails, were installed at horizontal and vertical seams. As at other scarf locations, the seams were heavily caulked and tarred.

The apron forms the final locking element of the stem. This timber, cut from naturally curved white oak (Quercus spp.), is broken off 4 feet, 6 inches from its

aft end. It is sided 5-1/2 to 6 inches, while the moulded dimension thickens from 3 inches at its aft end to 6 inches atop the stempost. The forward face sits against and mirrors the interior curve of the stempost, while the after 18 inches of the timber is flat to facilitate seating atop the keel. At the transition from curve to flattened base a space was formed, as the stempost has a greater moulded dimension than the keel at that point. A bolt used to fasten the apron to the keel passes through this space (see Fig. 19, p. 40).

The apron is fastened to the keel by two 3/4-inch peined iron bolts, which pass vertically through both timbers and was attached to the stempost by iron peined bolts and drift bolts. Four iron bolts are evident in the remains. A 5/8-inch bolt bisects the sided surfaces of the stem, its outboard end slightly protruding from the eroded forward face of the stempost, while its inboard end is peined flush with the surface of the apron. The inboard end of a 3/4-inch bolt projects approximately 9 inches above the surface, suggesting the attachment of another member. Two 5/8-inch drift bolts were driven from the forward face of the stem into the apron. A wooden plug in the eroded forward face suggests the presence of a third drift bolt.

No other fastenings appear on the apron. Although cant frames butted the apron, they were apparently not fastened to this timber.

## THE STERN

The stern of the vessel is more complete than the bow. Surviving timbers include the heel, sternpost, stern knee and transom (Fig. 23).

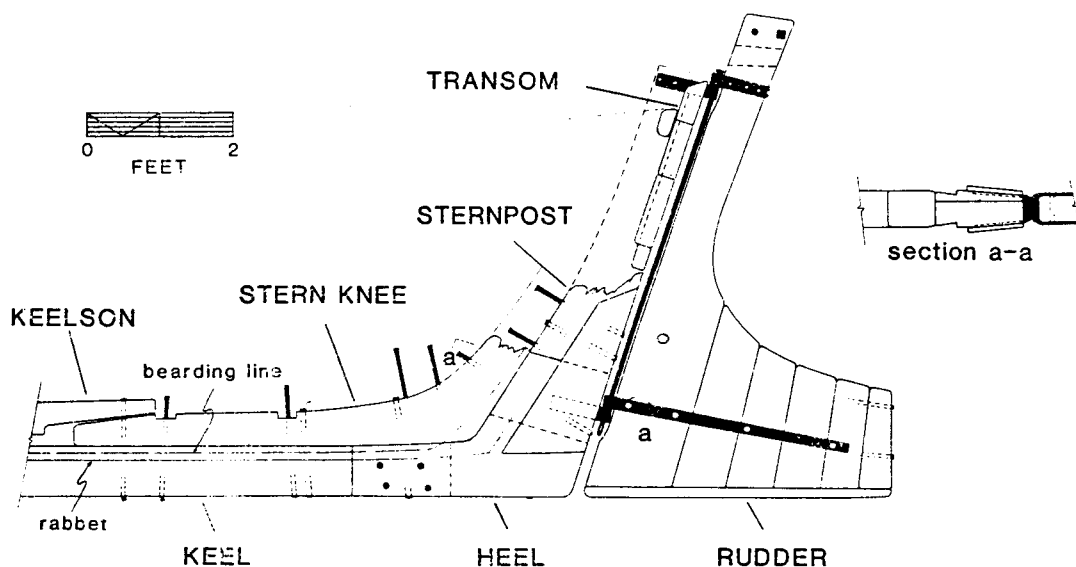


Figure 23. The stern of the Browns Bay Vessel. (Drawing by A.E. Wilson [Parks Canada], and the author.)

The heel, cut from naturally curved white oak (*Quercus* spp.), extends the length of the keel and forms the connection between that timber and the sternpost. A vertical flat scarf joins the heel to the aft end of the keel. The scarf has 15-inch-long tables with 2-3/4 inch nibs. It is fastened by four 3/4-inch iron bolts which bisect the moulded surfaces of the scarf; they are peined alternately over 1-1/4 inch washers from port and starboard. A heavy layer of pine tar was applied to the

seams, and two 1/2-inch stopwaters had been inserted at intervals along the seam (see Appendix A for caulking and tar analysis). The hole for one stopwater was drilled off centre, so that the inserted stopwater did not completely bisect the seam.

The sided dimension of the heel decreases along its 3-foot length from 5-1/2 inches at the scarf to 4-1/2 inches at the rudder. It is moulded 8-1/2 inches at the scarf.

The vertical arm of the heel is 1 foot, 11 inches long and terminates at its upper end in a vertically placed scarf, which facilitates attachment of the sternpost (Fig. 24). The shipwright cut the 1-foot-long tables of the scarf at a slight angle to the grain of the timbers to prevent splitting, and to give more bearing surface to the scarf. He also offset the scarf seam to one side, allowing a 1-inch upper nib on the port side and a 2-1/4 inch lower nib to starboard. One of the bolts fastening the stern structure terminates near the bottom of the scarf, but is clear of the scarf seam. Apparently stopwaters were not considered necessary in this scarf.

The sides and forward seam of the scarf were not examined due to the presence of a panel of oak sheathing covering either side of the sternpost. From incomplete observation, mostly by touch, it was concluded that the seams were caulked and the scarf fastened in a manner similar to that of the keel/heel scarf.



Figure 24. The heel/sternpost scarf of the Browns Bay Vessel. (Photo by the author.)

The lower gudgeon, located 16 inches above the base of the keel, further strengthened the scarf. The 2-inch wide and 1/2-inch-thick iron straps were fitted into rebates cut into each side of the sternpost at the scarf. The straps of the upper gudgeon, recovered with the rudder, have similar dimensions and are 10 inches long. Holes spaced 2-1/2 inches along the straps suggest that it was fastened to the sternpost using nails or rivets.

The surviving length of the sternpost is 2 feet, 6 inches, or approximately half its reconstructed height of 5 feet, 3 inches. It is moulded 10 inches near its broken extremity, and appears to be approximately 13 inches moulded at its lower end. On its aft surface, it is sided 4 inches at the scarf, 5 inches at the surviving upper end and rakes aft at an angle of 18 degrees. The sternpost is secured to the stern knee by 5/8-inch and 3/4-inch bolts with peined ends. Five bolts are in evidence in the remains. A square rabbet for seating the ends of the original hull strakes was cut along either side of the sternpost near its forward edges.

The port and starboard surfaces of the sternpost are sheathed with 3/4-inch-thick oak boards (Fig. 25). Each plank is 2 feet, 4 inches in length along its after edge, which follows the rake of the sternpost, and 2 feet, 7 inches along its forward edge. They are 15 inches wide at the bottom and 6 inches at the top. Both port and starboard boards are heavily fastened with wrought iron nails, 32 in the port plank and 27 in the starboard. A 3/8-inch wooden plug appears in the port board.

In January, 1986, an attempt was made to remove the starboard plank to gain access to the stern structure. The plank, however, was held solidly by the nails, and could not be removed.

The sheathing protected the ends of the outer layer of hull planking which butted against it, thereby forming a



Figure 25. A view of the starboard oak plank covering the stern construction of the Browns Bay Vessel. (Photo by the author.)

smooth transition aft to the sternpost. It also served to cover and protect the structure aft of the termination of the hull planks and to strengthen the sternpost scarf.

The stern knee of larch (Larix spp.), and seated atop the keel, served as a support between the keel and sternpost (Fig. 26). This important timber was chosen for its natural curvature, which was matched to the rake of the forward surface of the sternpost--approximately 34 degrees. The surfaces of the knee are severely eroded and

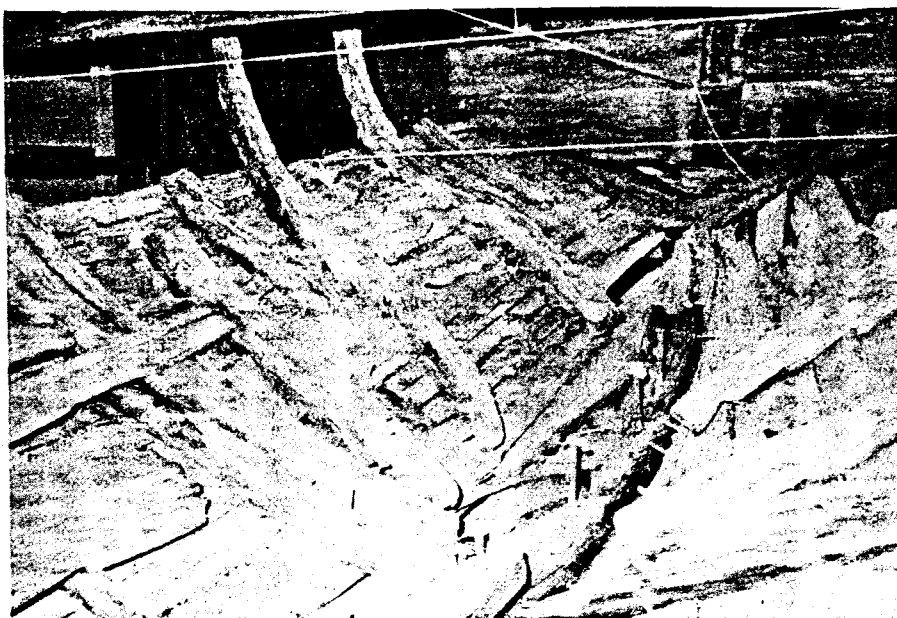


Figure 26. The stern knee and timbers in the starboard quarter of the Browns Bay Vessel. (Photo by the author.)

much dry rot is evident. The base survives along its entire 5 foot, 6 inch length, while only the lower 18 inches of the vertical arm remains. The upper end appears to have been broken off, possibly at the same time as the sternpost. It is moulded 3-1/2 inches at its forward end, 8 inches where the timber begins its upward sweep, and 7 inches near its eroded upper extremity. The knee is sided 6 inches.

The aft end of the keelson is notched over the forward 14 inches of the stern knee. A 5/8-inch peined iron bolt passes through the keelson, knee and keel, clamping them together.

Notches cut into the upper surface of the knee at frame locations 19 and 20 are of similar dimension to those in the keel; their purpose was to seat the floors in the stern. Peined 5/8-inch bolts project 3-1/2 inches and 6 inches above the centre of each notch at frames 19 and 20. Two 5/8-inch iron bolts aft of frame 20 suggest fastenings for timbers at those locations. The inboard ends of bolts attaching the stern knee to the sternpost indicate the moulded dimension of the knee to a point at least a foot above the eroded extremity.

#### **TRANSOM**

The transom is essentially complete (Fig. 27). At its widest point it is 7 feet, 6 inches and measures 2 feet, 9 inches in height. It is made up of three planks, each 3-1/2 inches thick, which are edge-joined by two 5/8-inch iron drift bolts. The bolts pass vertically through all three planks and are peined at their ends. A lower 2-1/2 inch-thick plank is fastened to the one above by 1-inch treenails.

The upper edge of the transom is finished with a forward sloping bevel approximating the vessel's sheer. Two and one-half inches below this, a row of 1/4-inch iron nails diagonally enter the inboard face of the structure. These appear to have been used to secure deck planks to the transom. The plank ends rested on two 2-inch by 4-inch timbers which extended the full width of the stern

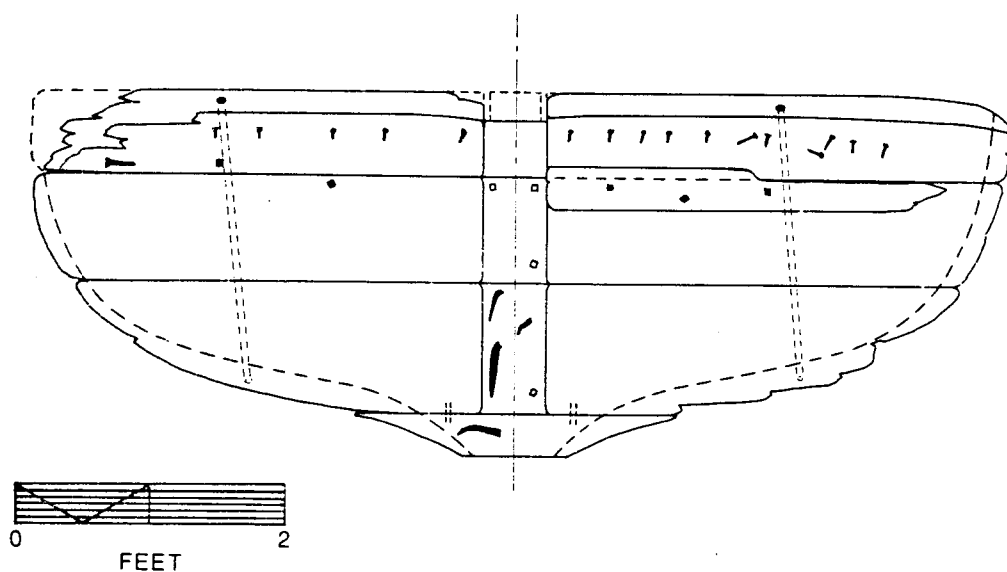


Figure 27. Inboard view of the transom of the Browns Bay Vessel. (Drawing by A.E. Wilson and the author.)

below the nails. Only the port support timber remains.

The outboard edges of the transom are bevelled and form a graceful curve from the sternpost to deck level, thus defining the shape of the stern. Both inner and outer layers of hull planks terminate flush with the aft edge of the transom. Unlike the practice followed lower in the stern, the plank ends apparently were not protected, leaving the end grain exposed. The inner, original planks were fastened to the transom with copper nails, while 5/16-inch wrought iron nails held the outer plank ends in place.

A 6-inch-wide by 1-1/2 inch deep mortice vertically

bisects the inboard face of the transom. The sternpost was let into this groove and the transom fastened to the post with 1/4-inch shovel-nosed iron nails driven from the aft side (see Appendix B for nail description). Photographs taken in 1967 show a badly fragmented upper section of sternpost still attached to the transom (Fig. 23).



Figure 28. 1968 photograph of the transom showing attached sternpost fragments. (Courtesy of the Archaeological Research Division, National Historic Parks and Sites Branch, Parks Canada.)

These fragments were not available for study in 1985. Evidence indicates the upper 3 feet of the aft side of the sternpost was cut out to allow the aft face of the transom to sit flush with the lower part of the sternpost.

The upper 2 inches of the transom were cut out within the sternpost mortice to allow the upper gudgeon straps to pass through the transom and be fastened to the post. Evidence suggests that two vertical slots had originally been cut through either side of the mortice for the straps, and that the intervening wood had later broken away. The length of the gudgeon straps defines the minimum moulded dimension of the sternpost at its head as 6 inches.

#### **THE FRAMES**

Ceiling covered much of the interior of the vessel in 1985. Access to the frames was afforded by temporary removal of much of the ceiling on the starboard side, along with two planks of the port ceiling. The lack of ceiling at the bow and stern allowed these areas to be studied.

A total of 36 frames was partially represented on the hull: 3 cant frames, 31 square frames, 1 half frame and a V-shaped floor timber. Lines of nails in the bow planks indicate positions for an additional 3 cant frames, and there is evidence for a second half frame in the stern. The vessel, therefore, had a total of 40 frames.

Twenty-seven floor timbers were set into notches along the upper surface of the keel and stern knee. Positioned on 18-inch centres, each floor timber was fastened by a single bolt drifted through the keelson, the floor timber and the keel, and peined at either end. Exceptions to this occur at frames I, 20 and 21, where floor timbers were fastened in position by two bolts. The dimensions of the floor timbers vary from 2-1/2 to 3-1/2 inches sided and 3-1/2 to 4-1/2 inches moulded.

Two limber holes were cut into each floor timber between frames F and 18 (and at G to I, although these timbers are no longer present), one on each side of the keel (Fig. 29). The 2-1/2-inch-wide holes were formed by

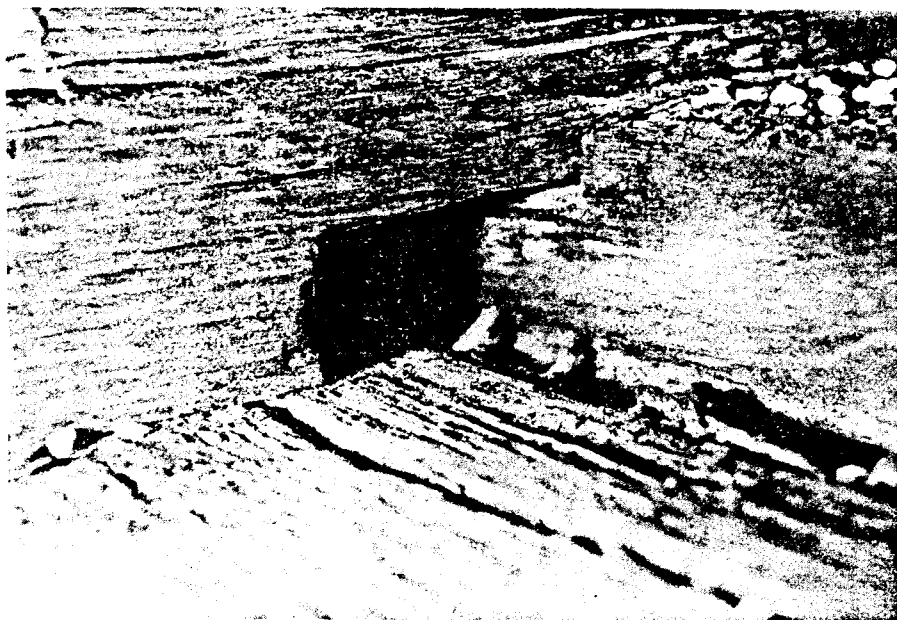


Figure 29. A limber hole in a floor timber of the Browns Bay Vessel. (Photo by the author.)

two parallel 1-inch deep saw cuts placed 5 to 6 inches to either side of the timber's centreline; the intervening wood was then knocked out with a chisel or similar tool. Two passages were formed when the floor timber was fitted into the notch in the keel; the sides of the keel formed the inboard sides of the passages.

The tenth frame aft of the stem is the midship frame, designated  $\text{Q}$  (Fig. 30). Situated 18 feet aft of the bow, this frame indicates the point of maximum breadth on the hull. It was a common shipbuilding practice at the time to place the midship frame in the forward 1/3 of the hull.

The inboard 5 inches of the starboard side of the midship floor timber were cut away during, or subsequent to, the refit (Fig. 31). Part of an added keelson was cut out at this frame, and a section of the original garboard removed.

This appears to have been done to provide access to the bottom of the vessel at its lowest point in order to facilitate the removal of bilgewater (Zacharchuck and Rick, 1969: 10). The midship floor timber and floor timbers 1 to 7 were cut through on the <sup>Port</sup> ~~starboard~~ side to facilitate the installation of a centreboard.

Floor timbers vary in length, but average about 11 feet throughout the central hull between frames F and 18. Floor timber heads are located approximately at the turn of the bilge, and are either thinned or finished with a butt end. The eighth strake is fastened to the floor

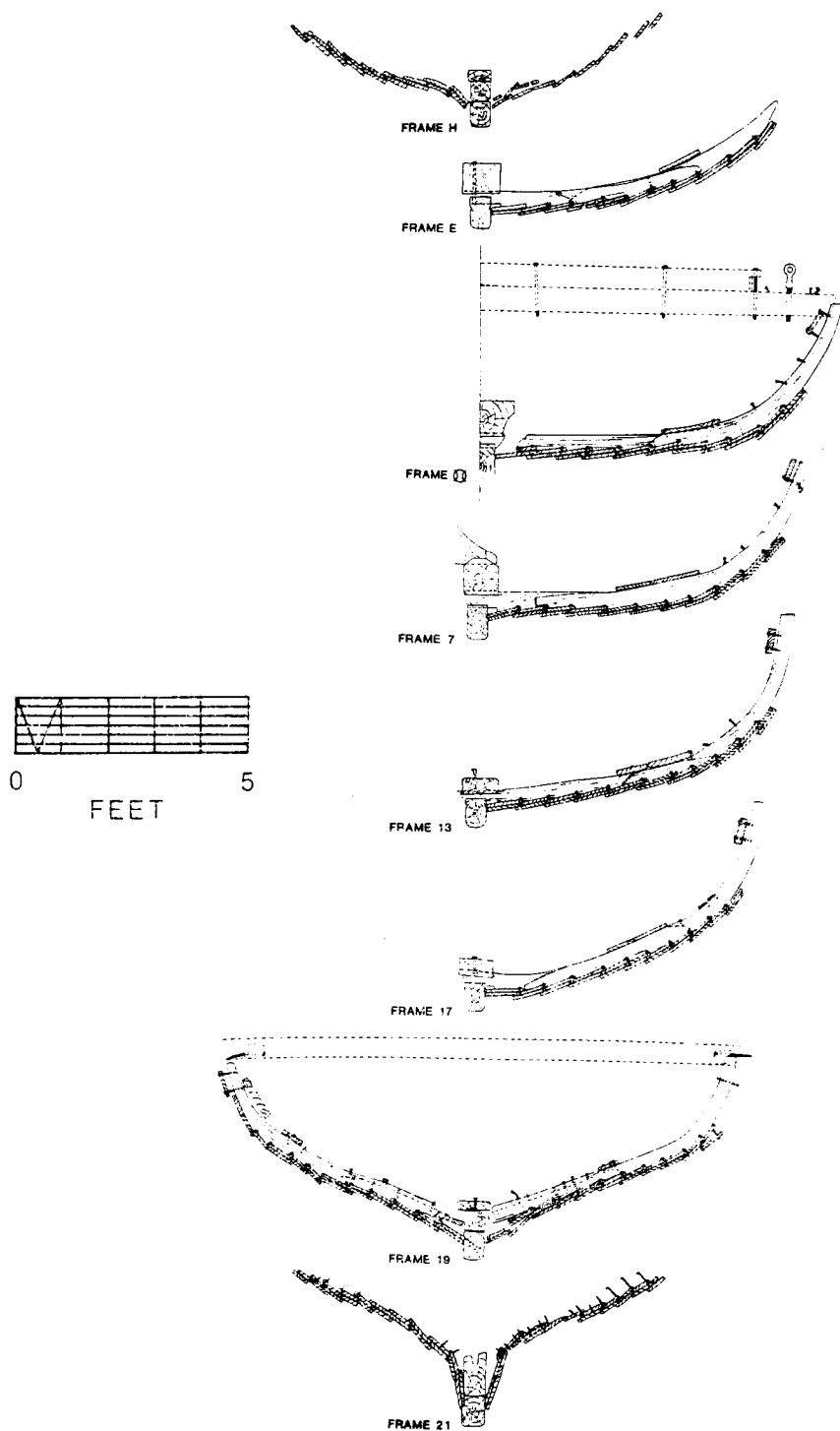


Figure 30. Section views of the Browns Bay Vessel's hull. (Drawing by the author and K. Crisman.)

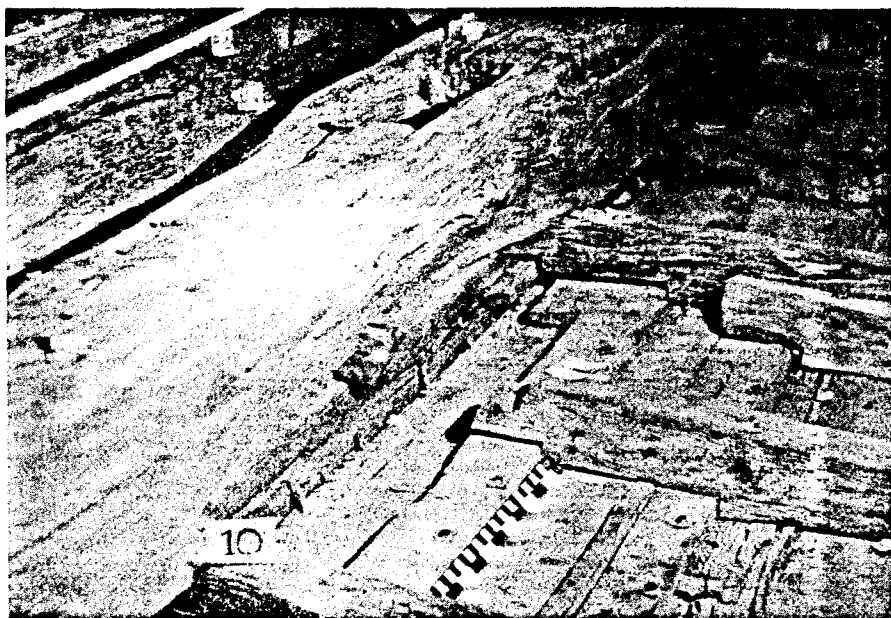


Figure 31. View of cut midship floor timber, starboard garboard and gouged out keelson. Note cut out garboard from the inner planking layer and nails terminating in side of keel. (Photo by the author.)

heads with copper rivets and clenched copper nails. Elsewhere on the inboard surfaces of the floor timbers, the clenched ends of copper nails and the tips of iron nails indicate the method of plank attachment.

Three cant frames are still in place on the port side of the stem (Fig. 32). Their inboard ends abut the apron, but are not fastened to it. Lines of copper nails indicate positions for three cant frames forward of them. The information is less complete on the starboard side due to extensive deterioration of the hull planks, but evidence indicates a comparable number of cant frames on that side.

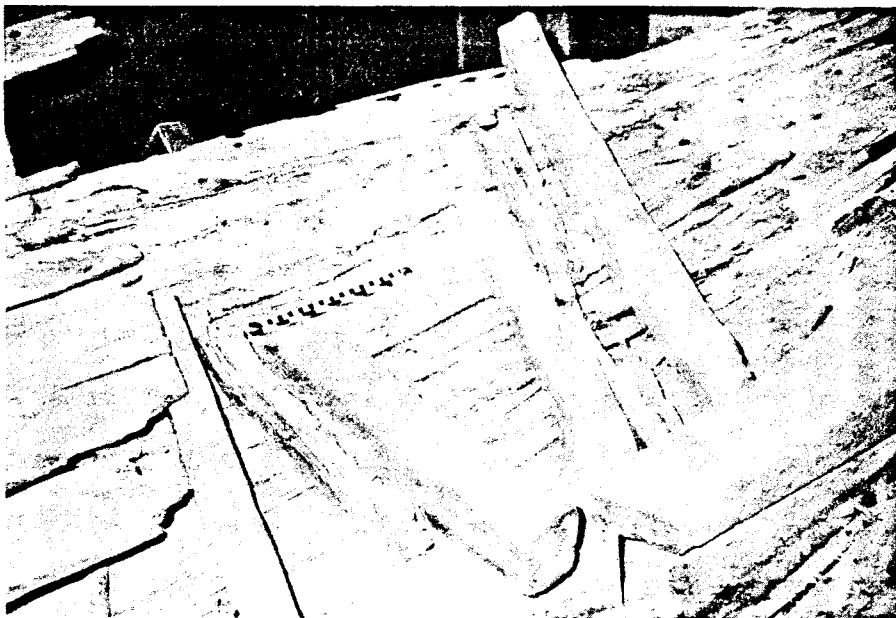


Figure 32. Extant cant frames in the port bow of the Browns Bay Vessel. (Photo by the author.)

Limber holes apparently were not provided in the cant frames, perhaps because inexact fit of the cant frames against the apron and garboard would allow sufficient passage of water.

In the stern, wood fragments and lines of nail holes attest to the presence of floor timbers at frames 20 and 21. Floor timber 21 was canted to cross the line of planks at a right angle to their run. Frames 22 and 23 were half frames, although no evidence of their lower end attachment to the stern knee is visible on its badly deteriorated surface.

A loose V-shaped floor timber, recovered during the

excavation, appears to fit further aft. The arms rise at an angle similar to that of the lower part of the transom, and the outboard surface of each arm is notched to seat clinker planks. A badly eroded 6-inch-wide by 1-1/2 inch-deep mortice, vertically bisecting one face, suggests that the floor timber was once fastened to the forward face of the stern knee. A single 3/8-inch nail hole bisects the fore and aft faces of the base.

Twenty seven original futtocks survive on the starboard side between frame F and 19. Two futtocks are located at frames G and H and four futtocks are present between frames 19 and 21, making a total of 33 futtocks per side. Moulded and sided dimensions are similar to those of the floor timbers: sided 2-1/4 to 3 inches and 3 to 4 inches moulded. Futtocks are placed between floor timbers, which they overlap by as much as 3 feet. Distances from the heel of each futtock to the midline of the keel varies from 25 to 42 inches, but averages around 35 inches.

The upper ends of the original futtocks were sawn off at the eleventh strake, the uppermost clinker plank, which formed the transition from the clinker-planked lower hull to the carvel planks of the vessel's sides (Fig. 33). This modification was made presumably during a refit, when a second set of futtocks was added. The ends of many of the futtocks are severely eroded and several have split along the grain. The exterior surface of each futtock is

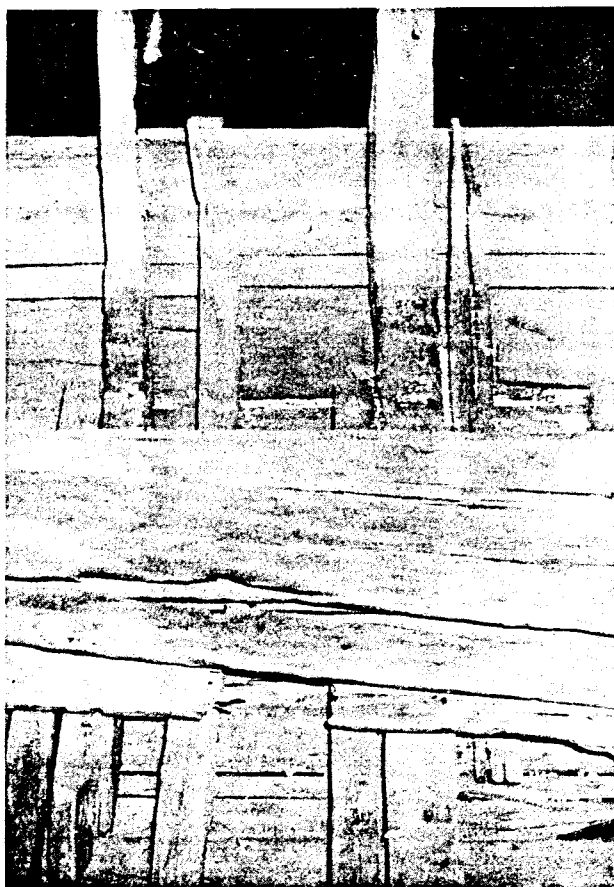


Figure 33. View of original futtocks which were cut off at the 11th strake. (Photo by the author.)

notched to seat the clinker planks, and the clenched ends of copper nails show on the inner surfaces.

Five pairs of S-shaped futtocks were erected aft of frame 19 during the original construction of the vessel. The remains of five futtocks on the starboard side of the stern and two on the port are still extant. Fastenings on the inboard sided surface near the upper end of two fut-

tocks suggest attachment for the starboard shelf clamp.

Futtocks from the subsequent refit are represented on the starboard side by 27 timbers between frames G and 19. These futtocks are generally more robust than those of the original construction, sided from 3 to 4-1/2 inches and moulded 4 inches at the heel and 3 to 3-1/2 inches at the head. Futtocks were inserted against the aft side of floor timbers from frames D to 19, but were not fastened to them. Spaces of 1 to 2 inches were thereby left between added futtocks and original futtocks. Forward of frame D, the heavier futtocks were placed forward of the floors and original futtocks.

The heels of the futtocks between frames F and 19 range from 11 to 44 inches from the midline of the keel, but average about 27 inches. At several locations the shipwright chose longer futtocks whose heels extended to within 18 inches of the keel, possibly to provide added strength to the central cargo-carrying area of the hull. The outboard end of each futtock extends to the gunwale. Holes of 5/8-inch diameter, which bisect the sided faces of several futtocks near their heads, once held bolts for securing lodging knees to the futtocks and chainplates for attaching shrouds. These occur on adjacent frame elements on port and starboard.

The exterior sided face of each futtock was notched to seat the clinker planks up to strake 11. Above that, the outer surface was dubbed flat to seat the carvel planks

(Fig. 34). Plank attachment to these futtocks was by 1/4-inch iron nails which were not clenched. Shelf clamps were fastened to the inboard surfaces of the futtocks 4 to 5 inches below the timber heads, with 1/4-inch to 3/8-inch iron nails; the ceiling was fastened using nails of similar dimension.

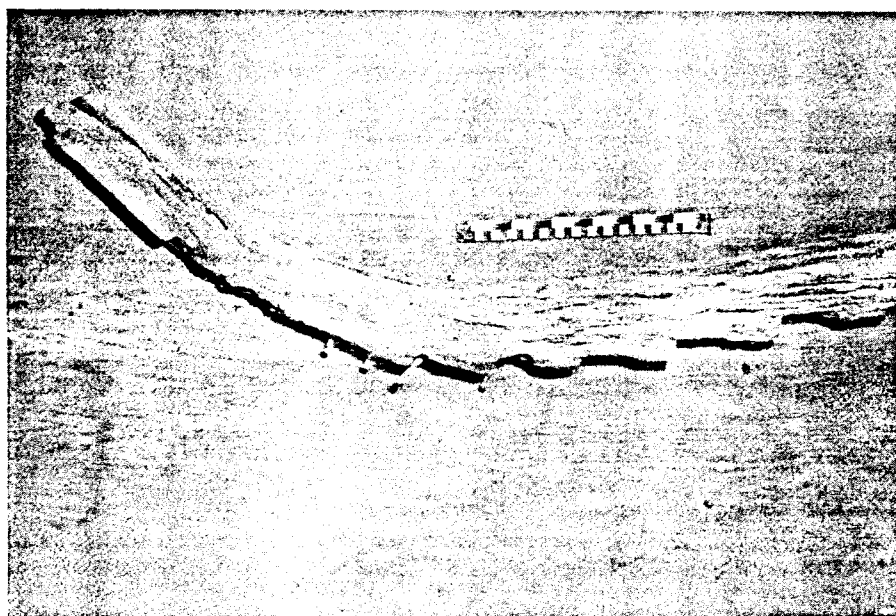


Figure 34. Futtock from the refit, removed from the Browns Bay Vessel. Note notches to seat clinker planks and upper end (left) dubbed flat. (Photo by the author.)

All frame timbers examined had been cut from naturally curved stocks, although the curve of the grain did not always exactly match that of the frame component. Floor timbers and futtocks were generally white oak (Quercus spp.); however, one futtock from the refit was identified as ash (Fraxinus spp.).

### EXTERNAL PLANKING

The hull was double clinker-planked up to the eleventh strake. Outer clinker strakes were fitted against those of the inner layer and fastened through to the frames. Above the eleventh strake, the sides of the hull were planked with carvel strakes applied in a single layer. Therefore, while both sides of the carvel strakes were available for study, only the inboard surfaces of the inner clinker strakes and the outer surfaces of the outer strakes could, for the most part, be observed.

In 1967, a section of the hull was cut from the starboard side containing the garboard and three strakes, as

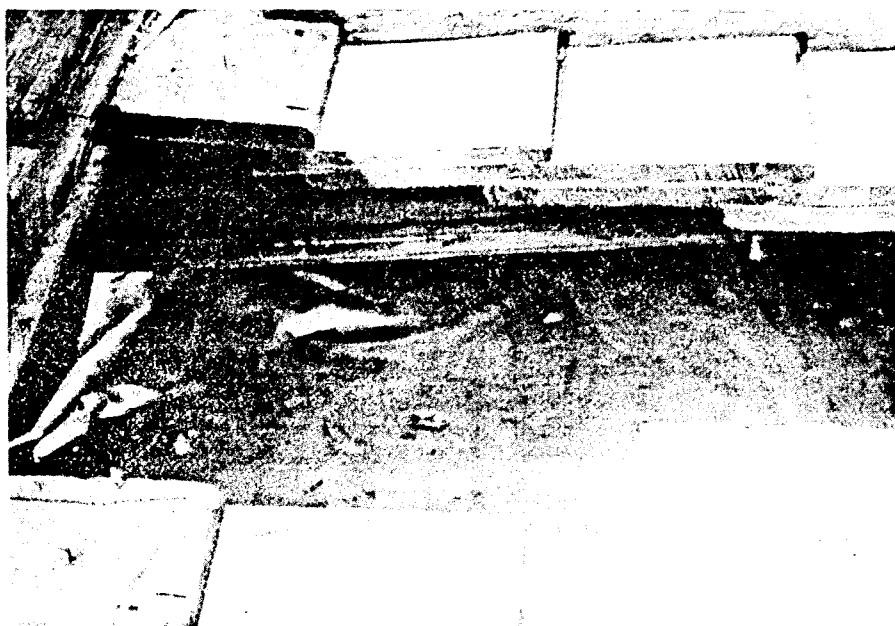


Figure 35. View of the double layer of clinker planking and starboard side of keel where a section of the hull was cut out in 1968. (Courtesy of the Archaeological Research Division, National Historic Parks and Sites Branch, Parks Canada.)

well as part of the floor timber at frame 10 (Fig. 35). This allowed simultaneous study of both plank layers amidships and direct access to the starboard side of the keel. It also affirmed that the wood of the planks amidships was quite sound.

The planks in the bow have not fared as well. Only the garboard strakes remained fastened in the stempost rabbets. The ends of the other strakes are severely eroded and most of the inner strakes have broken well aft of the stempost rabbet. A similar situation is found in the stern, where only the port strakes survive as far aft as the transom. Planks on the port side remain attached to the frames up to the timber heads, while only the clinker planks are represented on the starboard side.

#### **INNER PLANKING STRAKES**

The garboard strakes are 9 inches wide and one inch thick. Their inboard edges are shaped to fit into the keel rabbets amidships and into the stempost rabbets in the bow. At the stern, the shipwright was obliged to twist the garboards almost 90 degrees from the hull's flat bottom to seat them in the sternpost rabbets. Garboards were fastened to the keel with using 3/16-inch square copper nails driven through the strakes at 6-inch intervals and into the upper edge of the keel rabbet.

The outboard edge of each strake is lapped under and fastened to the second strake with 3/16-inch copper nails

riveted over similarly spaced square copper roves. Each strake is also fastened to each floor timber using a 1/4-inch shovel-nosed nail, which is clenched over the floor timber's inboard face (see Appendix B for nail description).

The seam between each garboard strake and the keel rabbet is filled with a fibrous material, while at the stem, a thick layer of pine tar mixed with hog bristles and other fibres fills the space between the garboard and the apron (see Appendix A).

In two places the garboards had been modified. On the starboard side, where the midship floor timber was cut away, the inboard half of the garboard had been cut and removed for a length of 26 inches (see Fig. 31, p. 58). The outboard half of both inner and outer port garboards, as well as half of the second strakes, had been cut through for a length of approximately 11 feet when the centreboard was installed.

Strakes 2 to 10 are of clinker construction; that is, each strake overlaps the upper, outboard edge of the strake below it by approximately 1-1/4 inches and is riveted to it. Each strake is approximately 3/4-inch thick and is also fastened to each floor timber or futtock by a 1/4-inch copper nail. The strakes are generally wider amidships than at their ends, except for the second strake, which remains 8 to 9 inches wide throughout its length. Amidships widths range from 8-1/2 to 9-1/2 inches

while the plank ends vary from 4-3/4 to 8-inches wide. Ends of strakes near the turn of the bilge were found to be narrower than those of strakes further inboard.

The forward ends of the strakes once terminated in the stempost rabbet. In the stern, each second strake seats in a square rabbet cut into the sternpost. The third strake begins the outward flare to the transom, while strakes 4 to 10 terminate flush with the aft side of the transom, and are fastened to it with 1/4-inch copper nails.

Due to the lengths of strakes required to plank the hull, many in excess of 55 feet, the shipwright had to make each strake from more than one plank (Figs. 36 and 37). Three scarfs were observed in the starboard strakes, each a flat vertical scarf approximately 4 inches long and fastened by a number of rivets (Fig. 38). As one of the scarfs was partially obscured by frame members, it is likely that more scarfs are present which are completely covered by frames.

The eleventh strakes (S11 and P11) form the transition from the clinker-planked lower hull to the carvel-planked sides of the vessel. Each transition strake is made up of several planks butt joined at frames, and widths narrow progressively from 8 inches amidships to 6 inches in the stern. The lower edge of each strake laps the strake below, while the upper edge of both inner and outer transition strakes abut the lower edge of strake 12, the

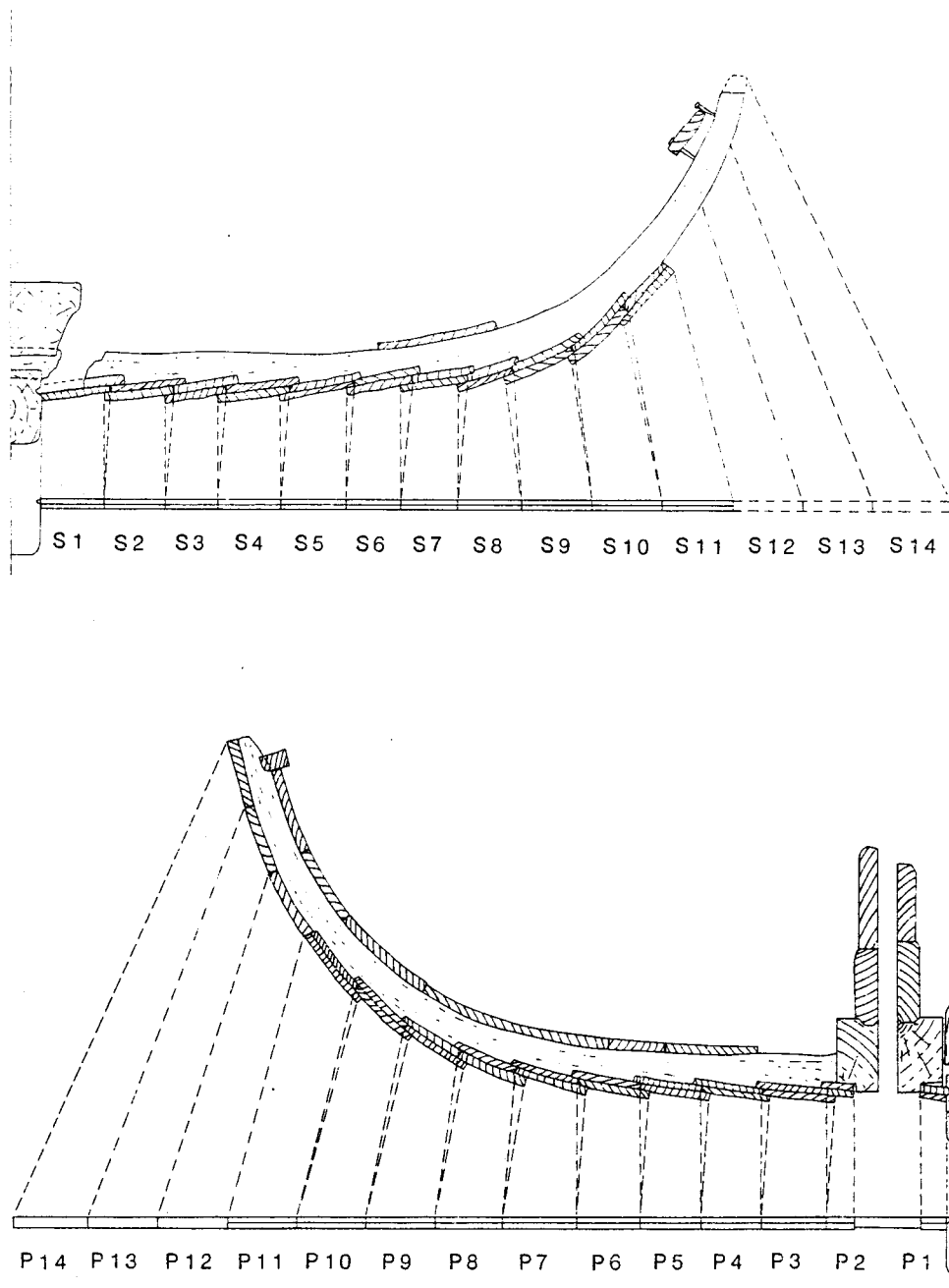
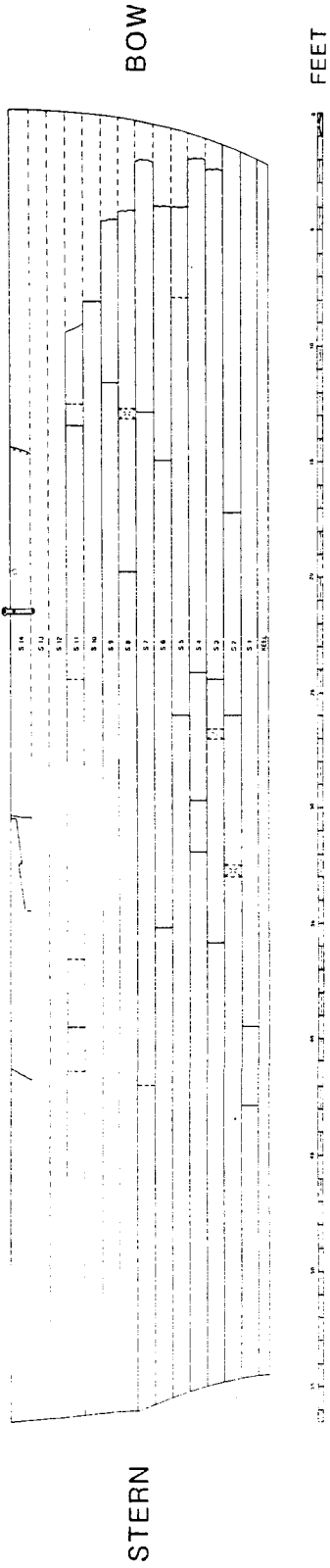


Figure 36. The development of the strake plans from the curved hull of the Browns Bay Vessel. Starboard (top) and port (bottom). (Drawings by the author and C. Piper.)

# STARBOARD STRAKE PLAN



# PORT STRAKE PLAN

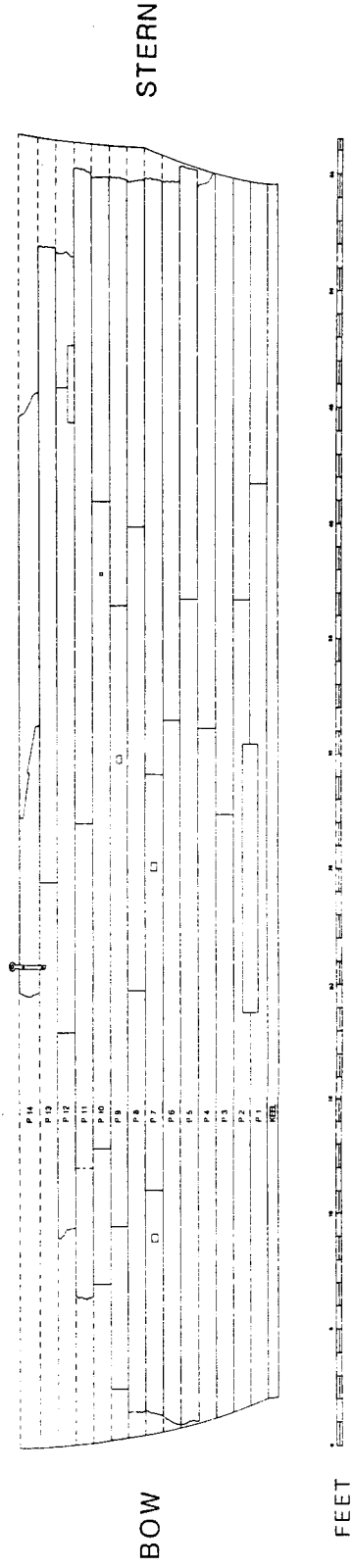


Figure 37. Strake plans of the Browns Bay Vessel. Starboard (top) and Port (bottom). (Drawings by the author and C. Piper.)

lowest carvel strake.



Figure 38. View of flat scarf in a clinker plank of the inner planking layer. (Photo by the author.)

Strakes 12 to 14 are of carvel construction and are fastened to the frames in a single layer. Only the central sections of the port strakes remain attached to the frames. The lower two strakes (P12 and P13) are 9 inches wide amidships and become progressively narrower towards the bow and stern. Strake 12 thickens from  $3/4$ -inch at its forward end to  $1\ 1/8$ -inch aft. The strake above, however, shows a reverse trend and thins from  $1\ 1/4$  inch at its forward extent to  $5/8$ -inch at the stern. Both strakes are made up of shorter planks butted over futtocks, their ends being fastened by three  $1/4$ -inch iron

nails (Fig. 39). The strakes are fastened elsewhere by two nails at each futtock. A plank 3 feet, 4 inches long and 3 inches wide is inset across the aftmost butt joint of strake 12, near its bottom edge.

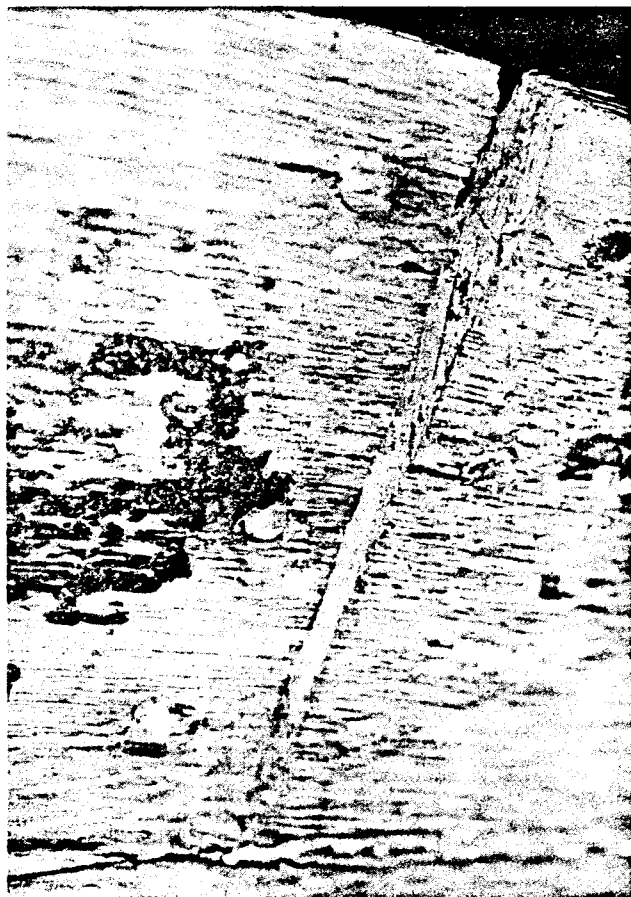


Figure 39. Butt joint of planks in a carvel strake.  
(Photo by the author.)

The chainwale (P14) is the heaviest of the carvel strakes. It retains a width of 10 inches along its extant length and a thickness of from 1-1/2 to 1-3/4 inches. The strake is made up of two planks joined by a hook scarf 4

feet long, which has 2-inch ribs and a 1-inch locking hook (Fig. 40). It is fastened to each futtock by two 1/4-to 3/8-inch iron nails except at the scarf, where 3 to 5 nails were used at each futtock.

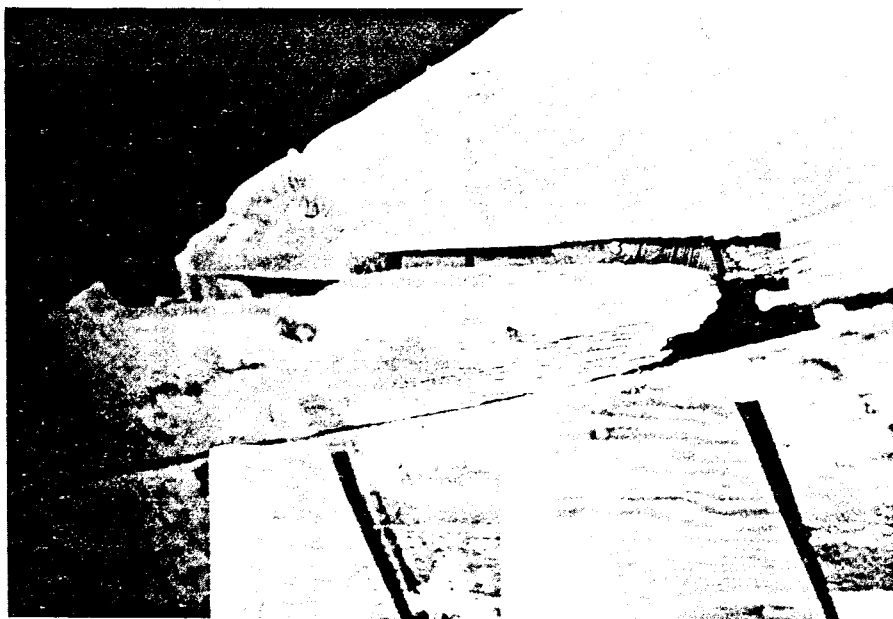


Figure 40. Hook scarf in port chainwale. (Photo by the author.)

A line of 1/4-inch square holes along the upper edge of the chainwale suggests the attachment of a timber along its upper edge. Bolt holes bisecting the inboard and outboard surfaces indicate locations for bolts and chainplates. One chainplate is still in place, fastened through the chainwale and futtock with a 3/4-inch threaded iron bolt and a 1-1/2-inch square nut. It is located approximately 2 feet aft of the midship beam on frame 1.

Fragments of the starboard chainwale were identified

from several eroded planks stored in the hull. The fragments were graphically reconstructed and repositioned on the hull, using bolt holes and nailing patterns as a guide. The surviving plank and plank fragments represent a 30 foot-long section, 9 to 10 inches wide and 1-1/2 inches thick. Evidence indicates that this strake was made up of two planks joined by a four-foot-long hook scarf and fastened in the same manner as the port chainwale. A third plank also went into the forming of the strake, as evidenced by an eroded butt end on the surviving plank (see Fig. 37, p. 69).

Iron nails, 1/4-inch square in section, project 2 to 2-1/2 inches along the chainwale's upper edge. Below this, several eroded holes indicate positions of bolts and at least one chainplate. The chainplate is still attached near the starboard head of frame 1 (see Fig. 16, p. 35).

#### **OUTER PLANKING STRAKES**

When the vessel was refitted, the shipwright applied a second layer of white oak (Quercus spp.) clinker strakes over the original planking. These were fastened to the frames with iron nails. The shapes and dimensions of the outer strakes parallel those of the inner strakes, but overlap each other by 1 to 1-1/2 inches.

The garboards are 7-1/2 to 8-1/2 inches wide and 1 inch thick. Except at the bow, the outer garboards were not fitted into rabbets. In the stern, the garboards and

the next two strakes extend beyond the sternpost rabbet and are fastened to the sides of the sternpost. The hood ends of the planks are protected by oak panels (previously described) which are fastened to each side of the sternpost. Amidships the garboards abut the sides of the keel and the seams are caulked (see Appendix A).

The outer garboards are fastened at their inboard edges to the inner garboards and to floor timbers using 3/16-inch iron nails. Many of the nails terminate in the side of the keel, perhaps as a substitute for clenching which was not used during the modifications to the vessel (Fig. 41). The inboard edge of the second strake laps the

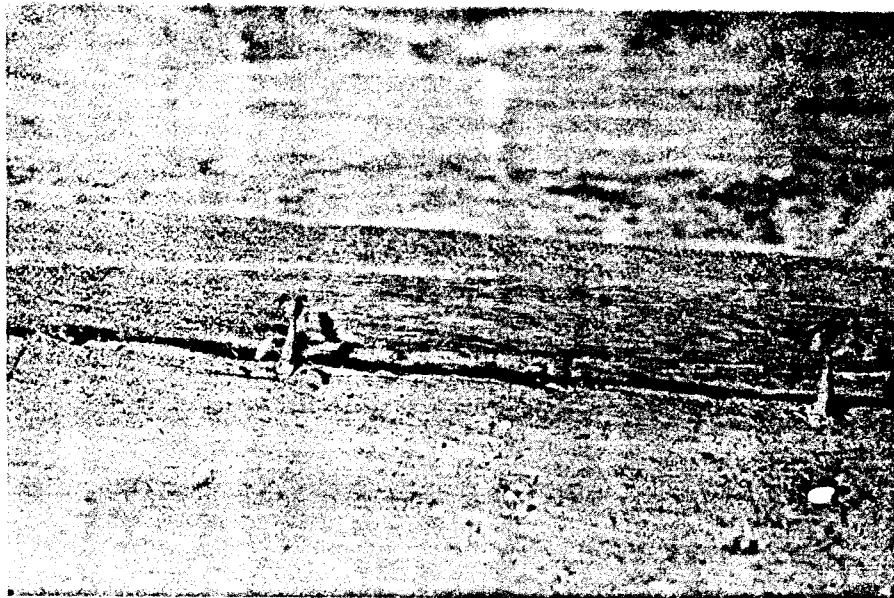


Figure 41. Detail of inboard ends of nails used to fasten the outer garboards to the hull. (Photo by the author.)

outboard edge of the garboard, and a 1/4-inch iron nail fastens both strakes at each floor position.

Strakes 2 to 11 follow the same pattern as the inner strakes, but are fastened to the frames with 1/4-inch iron nails. Strake widths amidships are similar to those of the inner strakes. However, widths at the bow and stern show less variation, ranging from 7 to 8-1/2 inches in the bow, and 6-1/2 to 7 inches in the stern. The third and fourth strakes are also thicker than either the inner strakes or the other outer clinker strakes. Both of these factors may reflect different practices followed by different shipwrights.

The forward ends of the strakes once fitted into the outboard rabbet cut into the sides of the stem, while in the stern, the strakes end flush with the aft ends of the inner strakes and the aft edge of the transom.

Strakes are made up of two to four planks butt-joined over frames (see Fig. 37, p. 69). Planks are fastened to frames by 1/4-inch iron nails, three at butt ends and two at other frame locations. A total of 56 planks were used to plank the outer hull up to the transition strake. A further 14 planks were probably used to complete the hull to the gunwales. Thus the vessel once contained approximately 70 planks in her outer hull layer.

Clinker planks range in length from less than 4 feet to 48 feet, with the majority being 14 to 30 feet in length. The shipwright would have chosen as long a plank

as was practical and available to make up the strakes. As the hull shape was already defined by the inner strakes and could be used to support the second layer, it was not as critical to use long planks in the outer layer. Short planks would be easier to acquire and were easier to fit on the hull, enabling less costly construction.

Planks on the port side are both less numerous and show less variation in length than those on the starboard side. While the first six starboard strakes are made up of two to four planks, several less than 7 feet in length, each of the first six strakes on the port side is made up of only two planks. This may have been an attempt on the part of the shipwright to compensate for the weakness created when the floor timbers and planks were cut through for the installation of the centreboard. Planks of the upper carvel strakes range in length from 10 feet to 32 feet.

The hull had been extensively sealed with tar during its years of service. A thick layer of tar remains between the inner and outer strakes (Fig. 42). Tar had been removed from the outer strakes prior to conservation of the hull in 1967, but tar deposits up to 1/2-inch thick remain under the centreboard beam. A sample of the black substance was identified as pine tar (see Appendix A).



Figure 42. View of tar layer between the inner and outer layers of clinker planks. (Photo by the author.)

#### INSERTS AND PLUGS

During the 1985 season, three rectangular wooden inserts were observed in the port strakes, P7 and P9, at the turn of the bilge. Each was set into the strake and nailed through to the inner planks, evidently to check splits in the outer strakes. A fourth smaller insert in P10 was used to replace a knot (Fig. 43). The space between the plug and the knot hole had been filled with tar and an X carved into the insert, similar to that on a treenail in the keel near the stem. No inserts appear on the starboard strakes.

Seven wooden dowels from 3/4-inch to 1-1/4 inch in

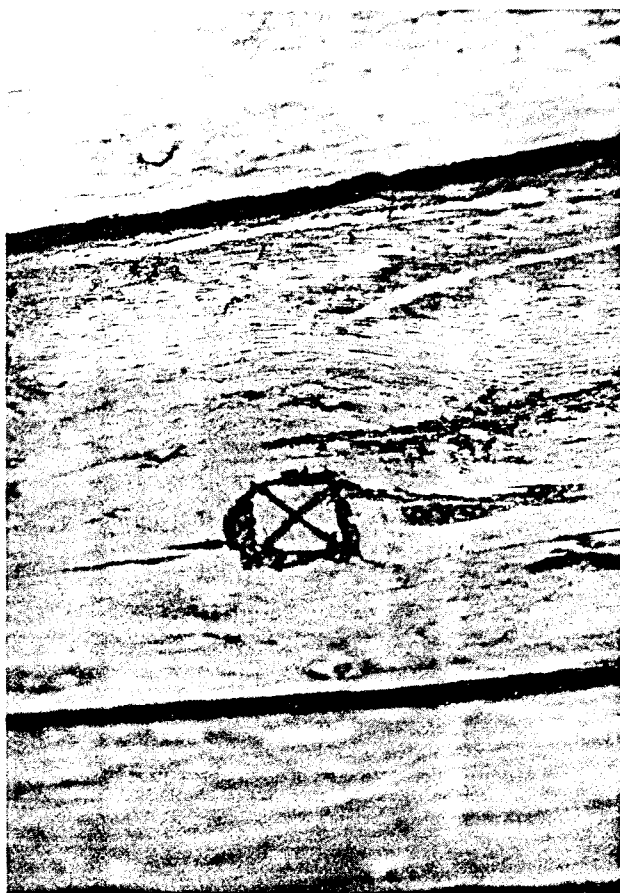


Figure 43. Detail of insert used to replace a knot in port outer strake 10. (Photo by the author.)

diameter protrude from the inboard surface of the hull planks. Five of these, in the stern, plug holes in the garboards and second strakes of both quarters (Fig. 44). At least two holes penetrate both planking layers. The evidence suggests that these were drain holes and that some were used prior to the vessel's being replanked. Farther forward between frames 13 and 14, a plug and a

hole in either garboard and a plug in S3 suggest a similar purpose.



Figure 44. Probable drain hole plugs in the starboard garboard and second strake at the stern of the Browns Bay Vessel. (Courtesy of the Archaeological Research Division, National Historic Parks and Sites Division, Parks Canada.)

### THE KEELSONS

The extant keelson is composed of two timbers installed at different periods in the vessel's history. Of the original keelson, only the aft section and aft end of the forward section remain. It is sided 10-1/2 inches, moulded 4-1/2 inches and is 16 feet, 10 inches long. The lower surface is notched to fit over the floor timbers and is secured to the floor timbers and keel with 5/8-inch iron drift bolts peined at either end. The aft end of the

keelson is thinned and overlaps the forward end of the stern knee, to which it is bolted. The forward section of the original keelson has been cut and removed forward of an 18-inch-long flat scarf, which joins it to the aft section (Fig. 45). Three iron nails fasten the forward 1-

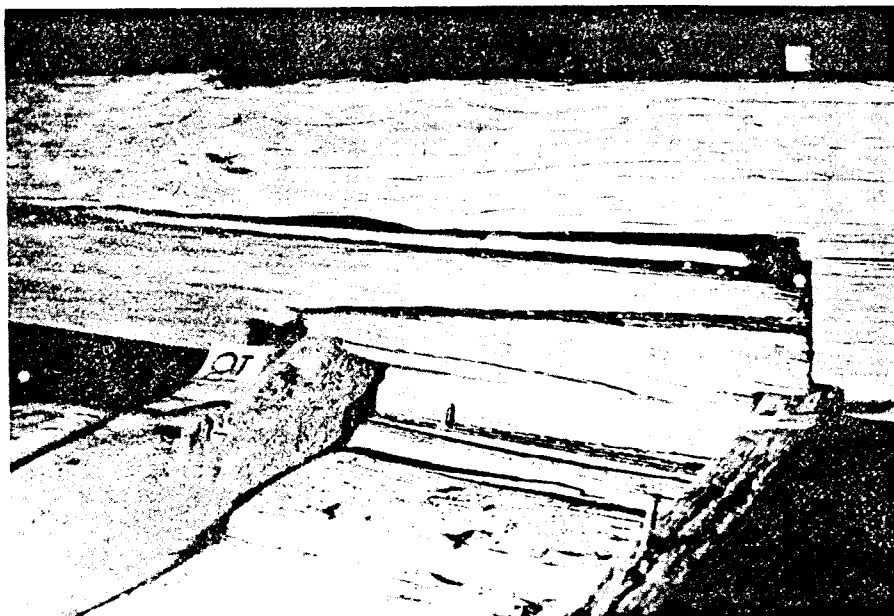


Figure 45. Scarf in the original keelson and the overlying section of the new keelson. (Photo by the author.)

inch nib of the scarf to the lower scarf table, while bolts at the two frame locations spanned by the scarf provide the main clamping of the scarf. In overall length, the original keelson would have been approximately 42 feet; its forward end apparently butted the aft end of the apron.

The new keelson section, which replaced the removed

original section, is a much heavier timber. Cut from straight-grained white oak (Quercus spp.), it provided greater longitudinal strength along the central part of the hull. The timber averages 9-1/2 to 10 inches square and is 27 feet, 5-1/2 inches long. The after end of the new keelson overlaps the forward end of the extant original keelson by six feet; the lower five inches is cut away to accomodate the fit (see Fig. 45). The overlapping keelsons, the floor timbers and the keel are clamped by a single iron bolt at each frame location. At its forward end, the new keelson terminates in a butt end, cut at a slight angle, 3 feet, 4 inches short of the apron. During the excavation, a timber of the same sided and moulded dimensions as the keelson was found between the forward end of the keelson and the apron. It was not fastened to the frames or the keel, and its presence was not explained (Zacharchuck, 1986, pers. comm.).

The port side of the keelson had been lined up with that of the keel, causing it to overhang the starboard side of the keel by 3-1/2 to 4 inches. This necessitated hollowing out the starboard underside of the keelson at the midship frame to provide access to the bilge. Between the midship frame and frame 10, the upper edges had been bevelled, probably to prevent splitting.

The underside of the new keelson is notched in the same manner as the original keelson, and is fastened at each floor timber by a 5/8-inch or a 3/4-inch iron drift

bolt, which is either peined or threaded to accept an 1-1/8-to 1-1/2-inch square nut. Although the evidence is inconclusive, it is suggested that a single bolt bisects the keelson, floor timbers and keel and clamps them at each frame location. A single 1-inch bolt was found to fasten the keelson at frame 6. Bolts used for attachment are within 6 inches of the port side of the timber to ensure penetration of the keel's 5-1/2- to 6-inch sided surface. Several bolts are also offset along the keelson to prevent the timber's splitting along the grain.

Of the total of 38 bolts and holes that penetrate the upper surface of the new keelson, evidently only 14 were used as fastenings. The locations of the remaining bolts and holes seem to bear no relationship to floor timber placement; several 3/4-inch bolts had been cut off flush with the lower surface of the timber. The timber may have had other uses prior to its integration into the hull of this vessel.

Between the midship frame and frame A, a rectangular mortice, the mast step, was cut into the upper surface of the keelson (Fig. 46). The 10-3/4 inches long by 5-1/2 inches wide and deep mortice was formed by augering a 1-3/4 inch hole at each of the mortices' four corners and chopping out the intervening wood. A second mortice, at frame 7, provides seating for a knee, which supports the aft end of the centreboard trunk. The knee is fastened in

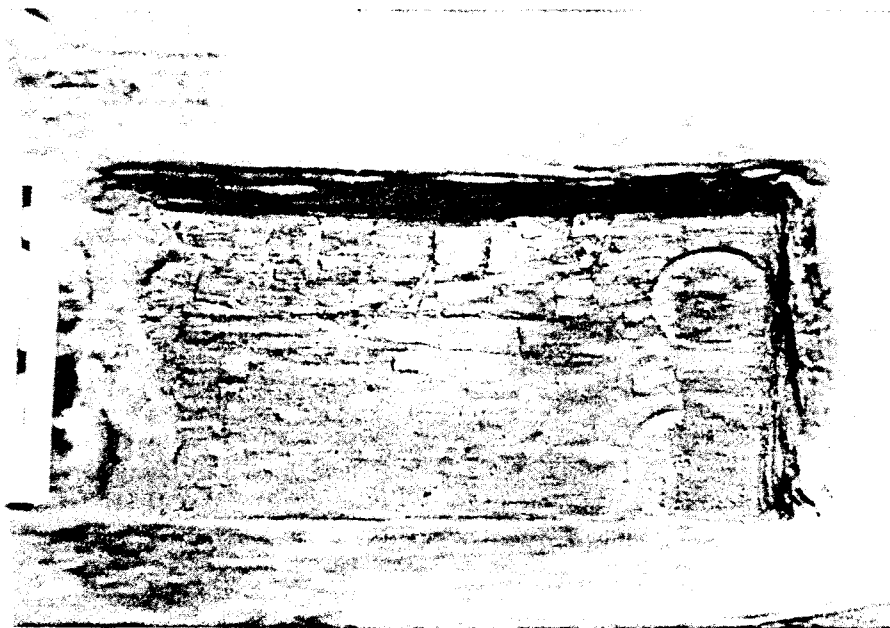


Figure 46. Detail of the mast step. (Photo by the author.)

place by the same bolt used for keelson and frame attachment. Five and one-half feet aft of the knee a 4-1/2-inch by 2-1/2-inch rectangular hole bisects the sided surfaces of the keelson overhang. It may reflect use prior to the timber's utilization on this vessel. The plugged mortice may also have provided a step for a pillar to support a beam, which evidently spanned the hull above that location.

#### CEILING

Sixteen ceiling planks or plank fragments were still attached to the frames in 1985. Most of the ceiling planking on the port side remained intact, although pieces

in the bow and stern were either missing or degraded (Fig. 47). Seven strakes were represented by thirteen planks,

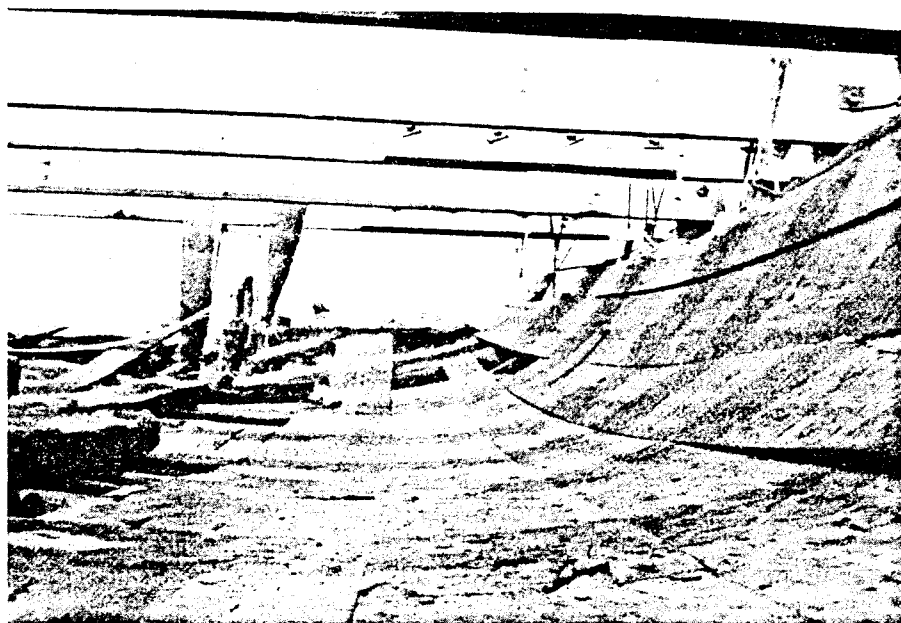


Figure 47. Ceiling planking on the port side of the Browns Bay Vessel. (Courtesy of the Archaeological Research Division, National Historic Parks and Sites Branch, Parks Canada.)

while the limber planks were missing. On the starboard side, only four planks remained attached to the frames, representing three strakes. It is estimated that the vessel once contained eight ceiling strakes per side.

Intact planks are between 6 and 13-1/2 inches wide, the width of each strake varying along its length according to its location on the hull. Planks average between 1 inch and 1-1/2 inches thick and vary in length from 4-1/2 feet to almost 40 feet, with three planks on

the port side over 38 feet long.

Planks are generally butt-joined at frames and fastened at each frame by one or two 1/4-inch iron nails. In one instance, the shipwright felt it necessary to increase the sided dimension of floor timber 12 near the keel to better support the ends of two port ceiling planks. He set a short plank on edge against the aft side of the floor timber and notched it over the first two hull strakes (Fig. 48).

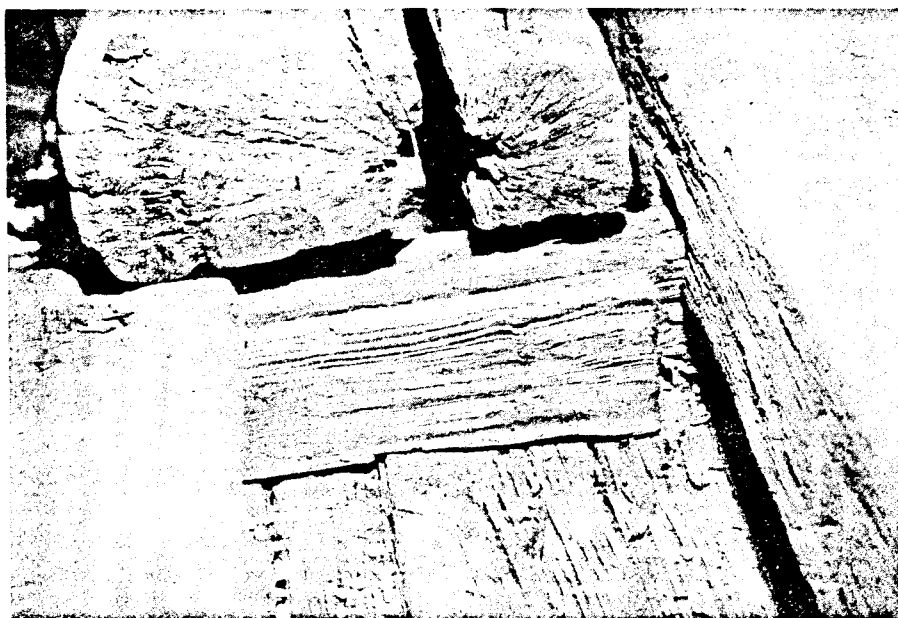


Figure 48. Detail of short plank set against frame 12, used to support ceiling plank ends. (Photo by the author.)

Ceiling planks were identified as white oak (Quercus spp.), and white pine (Pinus strobus) (see Appendix A). Some of the planks may have been reused, as

suggested by apparent fastening holes and cut-outs, which do not appear to match frame locations or hull features. The interior surface of many of the planks are heavily scored, but the source of the majority of the marks cannot be determined. An imprint which matched the shape of an iron stove recovered with the vessel was observed on the ceiling in the port quarter during an earlier study (Zacharchuck 1981, manuscript).

At least eight additional planks and plank fragments, probably belonging to the ceiling, had been either stored on the port ceiling or laid over frames to facilitate walking on the hull. The positions of these planks were not determined.

#### **SHELF CLAMPS**

The port and starboard shelf clamps were found to be well preserved for approximately half their length. The port shelf clamp extends from frame 2 to frame 18, a preserved length of 25 feet, 10 inches, while the starboard shelf clamp is 29 feet, 9 inches long and extends from frame A to frame 18. The after end of each shelf clamp terminates in a square cut while each forward end is broken. At least two and probably three sections were once abutted to form the estimated 54-foot-long shelf clamps which would have extended from the stem to the stern.

Each shelf is 5-1/2 to 6-1/2 inches wide and averages

1-1/2 to 2 inches thick. Each is fastened to each frame by two iron nails, 1/4-inch square in section, driven from inboard. Chainplates were once fastened through futtock heads and each shelf clamp with 5/8-inch iron bolts which were threaded on their inboard ends. Only the starboard chainplate at frame 1 is still attached to the shelf clamp. A 1-inch hole in the starboard shelf clamp, 21 inches forward of the chainplate, may have held a bolt for a second chainplate.

The upper surface of each shelf clamp was notched at intervals along its length to accept the ends of deck beams (Fig. 49). The notches range in length from 3-1/2

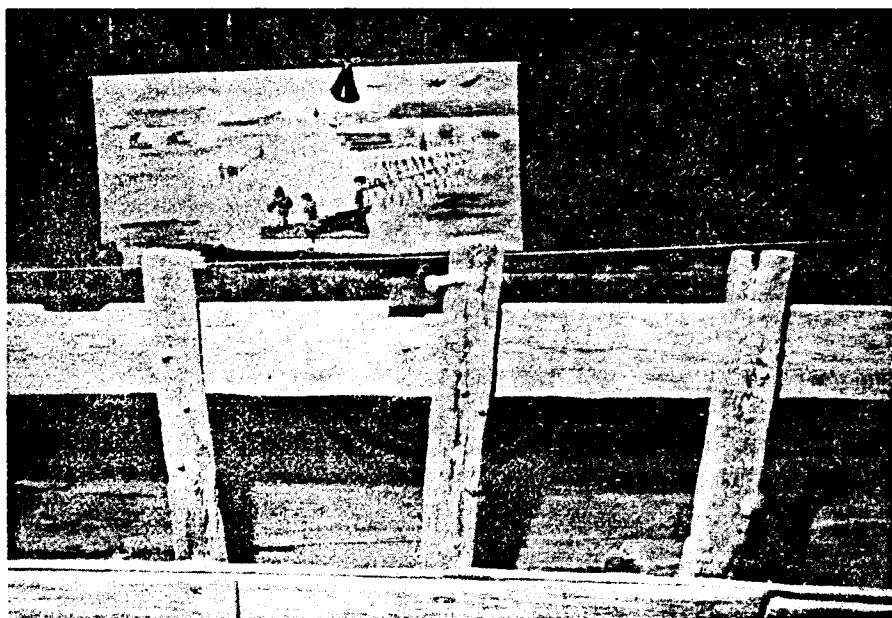


Figure 49. Beam notches in starboard shelf clamp.  
(Photo by the author.)

to 11-1/2 inches and are 1/2 to 1 inch deep. The dimen-

sions of opposing notches on port and starboard shelf clamps are similar, reflecting the dimensions of the beams they once supported. Between frames 10 and 11, short timbers, 2-1/2 inches high by 3 inches thick, are nailed to the upper surface of each shelf clamp. The upper surface of each timber is notched; their purpose was probably to compensate for beams whose dimensions did not reach the level of the deck (Fig. 50). A single short timber of similar dimensions on the port shelf clamp, although lacking a notch, may have served a similar function.

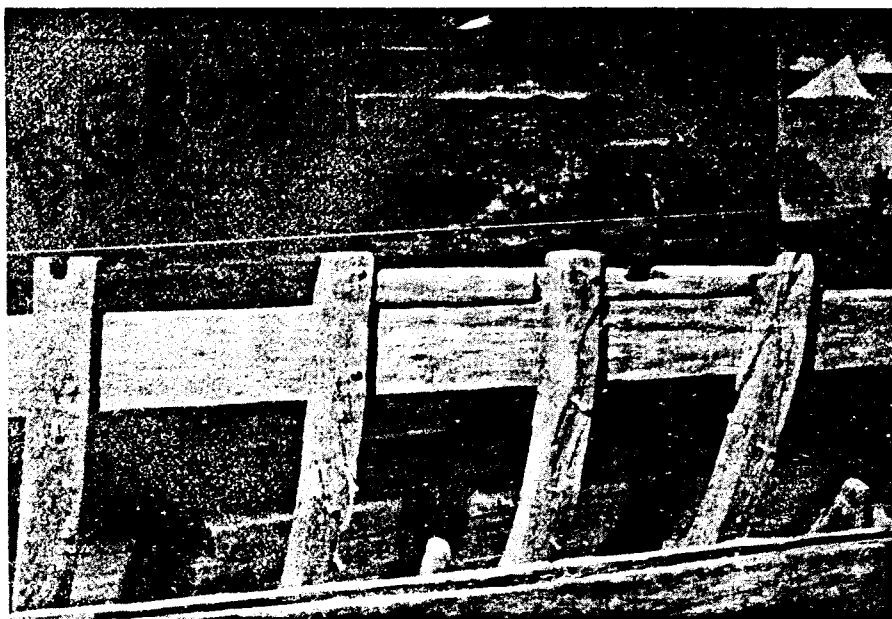


Figure 50. Short, notched timber between frames 10 and 12, used to support beam ends. (Photo by the author.)

## DECK BEAMS AND KNEES

There is evidence for seven deck beams or positions for beams on the vessel. Two complete beams were raised with the hull and placed near their original positions, one just forward of the midship frame and one in the stern. Between them, positions for five beams are indicated by notches in each shelf clamp. The length of shelf clamp notches suggests beams whose sided dimensions range from 3-1/2 to 11-1/2 inches (Table 1).

TABLE 1

Beam Dimensions

(Dimensions suggested by evidence are in brackets)

Beam Location at Frame	Sided in inches	Moulded in inches
A	11-1/4	6
7	(11)	(6)
11	(3-1/2)	(3-1/2)
14	(6-1/2)	(6)
15/16	(4-1/2)	(6)
17/18	(5-3/4)	(6)
20	6	6

The midship beam is a single white oak (Quercus spp.) timber 15 feet, 7-1/2 inches long, 11-1/4 inches sided and moulded 6 inches (Fig. 51). It is slightly curved throughout its length, and is 1-3/4 inches higher at the centre than at its ends. An 11-inch-long by 5-1/2-inch-

deep notch is cut out of the aft side of the beam at its centre.

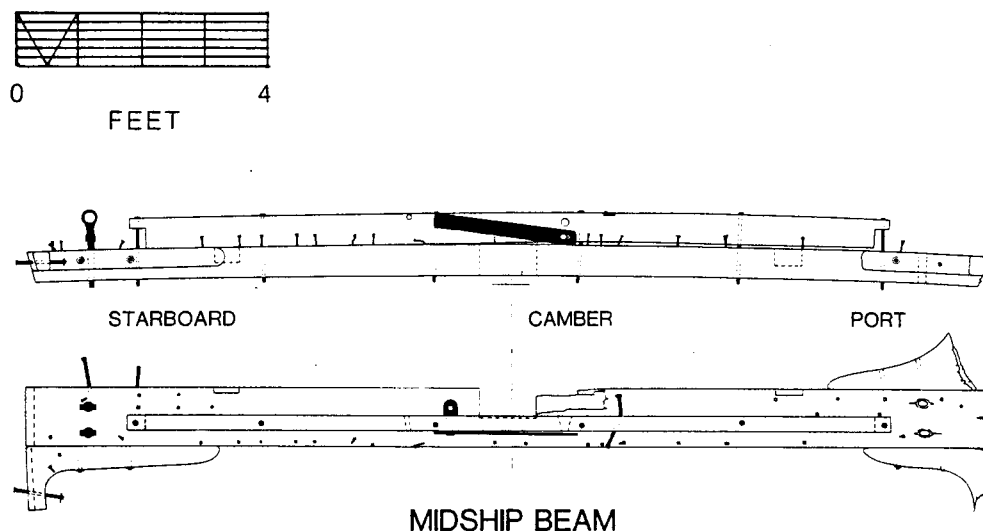


Figure 51. Midship beam of the Browns Bay Vessel. (Drawing by A.E. Wilson [Parks Canada].)

A 12 foot, 3-inch-long timber is fastened along the top of the beam with 5/8-inch iron drift bolts, 13 inches long. Placed just forward of the notch, the timber is 6 inches high and 3 inches wide. The lower corners of each end of the timber are cut out for a length of 3 inches, thereby forming an overhang at each end. Each overhang is bisected vertically by an iron drift bolt.

Centrally located on the forward face of the timber, an iron plate 27-5/8 inches long and 3 inches wide is fastened by 5/8-inch iron bolts, which project 3-1/2 inches aft of the timber. The aft end of each bolt is expanded and is vertically bisected by a square 7/8-inch

hole. The ends of an iron mast bracket were once fastened through these holes. The purpose of the mast bracket was to secure the mast to the beam within the mortice and against the reinforcing timber atop the beam, thus preventing movement of the mast when the vessel was under sail. The bracket was excavated with the vessel in 1966, but it subsequently disappeared from the site (Zacharchuck 1986, pers. comm.).

To either side of the mast support, a 5/8-inch iron bolt bisects the fore and aft faces of the upper beam timber. These may have fastened other support elements to the beam. Only the port bolt remains in the timber.

Directly to port of the mast notch, a mortice 14 inches long, 4 inches wide and 2 inches deep was cut from the upper after edge of the beam (Fig. 52). An 8-inch long notch had also been cut out of the aft face of the beam within the mortice. Centred above the forward end of the centreboard trunk, the mortice and notch appear to have served a function in the support of that structure. No evidence of fastenings was found within the eroded mortice.

A 5-inch by 3-inch deep mortice cut from the upper edge of the beam 3 feet from either end once supported fore and aft timbers called carlings. Neither mortice shows evidence of fastenings.

A line of 1/4-inch iron nails in the upper surface of the deck beam near its forward edge indicates the presence



Figure 52. Mortices in the aft edge of the midship beam. Note forward end of centreboard trunk (below beam). (Photo by the author.)

of a foredeck, while similar nails along its after outboard ends suggest that the vessel was at least partially decked amidships. The nails project approximately 2-1/4 inches above the surface of the beam.

Four eye-bolts were once secured near the ends of the beam. Two of these remain fastened near the starboard end (Fig. 53), while those from the port end are presently in



Figure 53. View of starboard side of the Browns Bay Vessel. Note the forelocked eye-bolts in the starboard end of midship beam and the chainplate attached to the starboard shelf clamp. (Photo by the author.)

the artifact collection of Parks Canada (see Fig. 9, p. 21). The 15-inch-long and 1-1/4-inch-diameter bolts were drifted vertically through the beam, and their lower ends secured by small iron wedges, called fore-locks, driven through slots in the shafts. The upper ends of the bolts extend 2-1/4 inches above the beam, becoming rectangular in section, and are bisected by 1-3/4 inch holes. At least one of the bolts is stamped with a British broad arrow, indicating government ownership.

Four lodging knees once secured the beam ends to the hull. The remains of the three grown knees are still

fastened to the fore and aft sides of the beam by 5/8-inch iron drift bolts. The outboard face of each knee is bevelled to ensure a tight fit against the inboard faces of the futtocks. The ends of the beam are similarly bevelled. Each knee was apparently fastened to a futtock by a 5/8 inch bolt peined over a 1-1/4-inch washer. One knee was identified as larch (Larix spp.).

A second white oak (Quercus spp.) beam was located about 6 feet, 6 inches forward of the transom above frame 20. It measures 11 feet, 2 inches long, 6 inches sided and 5-1/2 inches moulded. The beam has a very slight camber, and its ends are bevelled to conform to the shape and direction of the hull strakes at that location.

Unlike the midship beam, these beam ends are set directly against the hull planks. Knees are fastened to the forward face of the beam approximately 3-1/2 inches in from the beam ends. Each knee is fastened to the beam by two 5/8-inch iron bolts peined over 1-1/4 inch washers, and to futtock heads by similar bolts. The outboard face of the starboard knee is notched to fit over the inboard face of a futtock.

One-quarter inch nails and nail holes along the beam's length near its aft edge provide evidence for an after deck. Similar holes near the beam's forward edge within 2-1/2 feet of the ends and in the upper surface of the starboard knee suggest the presence of decks running along the sides of the vessel.

Two beam end fragments were identified from among the timbers stored beneath the hull. Both show evidence of having been sawn partially through and broken. The sided dimension of each beam is similar to notches in each shelf clamp and may indicate locations for these fragments forward of the extant stern beam. A knee is fastened to one beam.

Three other knees were recorded. One remains fastened to the futtocks on the aft side of a notch in the port shelf clamp. The bolt that would have secured the beam has been bent by a force applied horizontally and inboard to it. Two knees stored beneath the hull were recorded, but their positions on the hull were not identified.

#### **CENTREBOARD STRUCTURE**

The vessel was fitted with a swing-type centreboard designed to increase lateral resistance and reduce leeway while under sail. It was installed against the port side of the keelson and located aft of the midship beam (Fig. 54). The centreboard structure consists of three components: the beam, the trunk and the centreboard (Fig. 55).

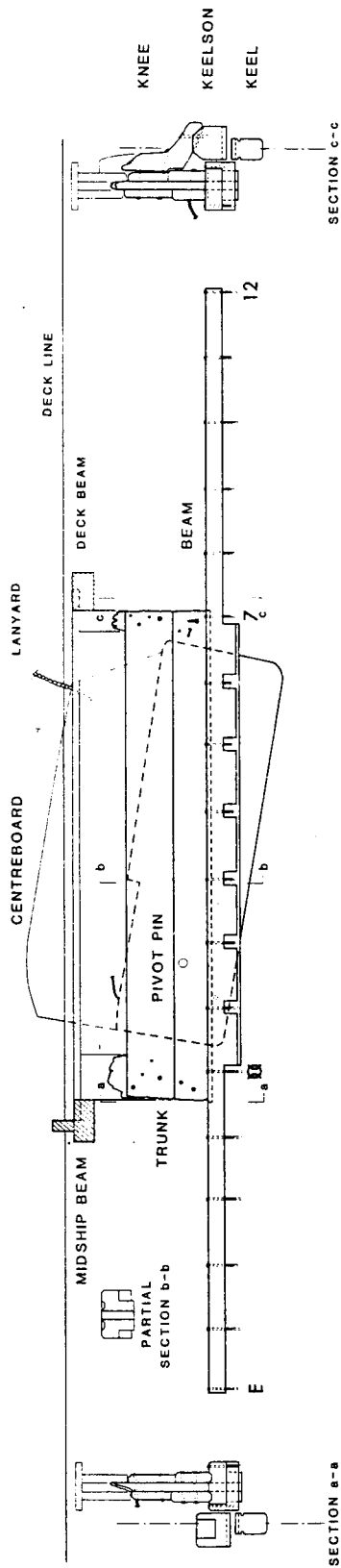
The centreboard beam is a single, straight-grained white oak (Quercus spp.) timber 26 feet, 2 inches long, which extends from frame E to frame 12. It is 12 inches wide for most of its length, but expands to 14 inches along the trunk between frame 7 and the midship frame.



Figure 54. View of centreboard trunk and new keelson. Note centerboard pivot pin projecting from starboard side of the trunk. Ceiling planing was removed to gain access to the hull. (Photo by the author.)

Between these frames, a slot 10 feet long and 3-1/2 inches wide has been cut vertically through the beam along its midline. Below this the floor timbers and hull planks have been cut to allow the centreboard to be raised and lowered through the hull. On either side of the slot, a shallow 3-inch-wide groove is cut into the upper surface of the beam to seat the lower edges of the planks, forming the sides of the trunk.

Between frame E and the midship frame, and frames 7 to 12, the lower half of the beam's 8-1/2-inches height has been cut away so that floor timbers can run beneath the



CENTREBOARD RECONSTRUCTION

Figure 55. Partial reconstruction of the centreboard structure of the Browns Bay Vessel. Reconstructed portions are in thin lines. (Drawing by the author, A.E. Wilson [Parks Canada] and C. Piper.)

beam. However, between frame 7 and the midship frame, where the floor timbers have been cut, the lower edges of the beam are notched to fit over the cut floor timber ends. The width of the lower  $3/4$ -inch of the beam is reduced to 8 inches in this location, thereby forming a rabbet into which the cut garboard and second strake fit. This method leaves the lower surface of the beam flush with the outer surface of the inner strakes. The seam is caulked from the outside and sealed with pine tar.

The entire centreboard assembly has been dislodged some 7 degrees to port, displacing the lower edge of the beam and splitting the wood forward and aft of the centreboard slot (Fig. 56). The split bisects a hole 2 inches in diameter and 1 inch deep, which had been augered into the lower surface of the beam forward of the slot. The purpose of the hole is unknown.

The ends of five  $3/8$ - to  $1/2$ -inch drift bolts, as well as four  $3/4$ -inch wooden plugs along the lower surface of the beam on each side of the slot, suggest fastenings for attaching the lower planks of the trunk to the beam.

The beam is fastened to the floor timbers with  $5/8$ -inch drift bolts and  $3/8$ -inch iron spikes. One drift bolt is used at each frame location near alternate edges of the beam, between frames D to A and 8 to 11, and along the port side of the beam beside the trunk. Bolt heads are seated against  $1-1/4$ -inch washers. Spikes fasten the ends of the beam and are used in the narrow space between the

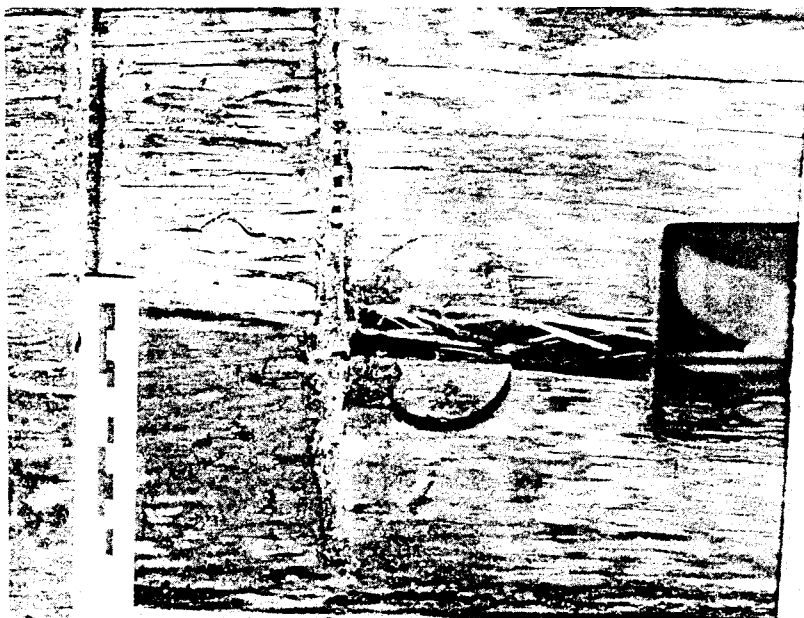


Figure 56. Detail of forward end of centreboard structure beneath hull. Centreboard (right), split centreboard beam (centre), cut inner layer of hull planks (to right of scale), and outer layer of hull planks (to left of scale). (Photo by the author.)

trunk and the keelson to secure the beam to floor timbers. Drift bolts, on 27-inch centres, fasten the centreboard beam laterally to the keelson. Each has been driven through the starboard side of the slot in the beam and angles up into the keelson.

The centreboard trunk is 11 feet, 9 inches long and 7 to 8-1/2 inches wide. Only the lower 2-1/2 feet of the structure has survived the ravages of time.

The trunk opening is framed at either end by vertical timbers or "end-blocks" whose lower ends are morticed into

the centreboard beam and terminate partially on top of a floor timber and partially on the base of the mortice. The forward timber measures 12 inches fore-and-aft, while the aft timber is half that dimension. Both "end-blocks" are 2-1/2 inches thick.

The sides of the trunk are formed by white oak (Quercus spp.) planks, which are edge-joined and fastened to the sides of the "end-blocks." Each plank, which extends the full length of the trunk, was plain sawn. A plain sawn log is cut completely through after it has been squared; with respect to labour and waste, it is the cheapest way to reduce logs to planks (Garyantes, 1944: 144).

The lowest planks of the trunk are approximately 10 inches wide and 3 inches thick, and are fastened by drift bolts into the shallow grooves in the upper surface of the beam. A 2-1/4-inch-thick plank fits atop each lower plank and is edge-joined to it by means of six 3/4-inch drift bolts having 1-1/8 inch heads at their upper extremities. Fastening holes in the upper edges of these planks indicate the presence of at least one more pair of higher planks. The width of the starboard plank is 10-1/2 inches, while that of the port plank is 13-1/2 inches.

The planks are fastened to the "end-blocks" by both 3/8-inch iron nails and 3/4-inch iron bolts with 1-1/4 inch threaded nuts. The nails appear also to have fastened timbers vertically across the planks as a further

support. One such support, a 2-1/2 by 2-inch timber, remains on the starboard side.

The trunk is secured to the keelson by a knee fastened to its starboard side near the aft end. The grown knee is fitted into a mortice in the top of the keelson and bolted through it. The knee's vertical arm is notched to fit tightly over the thick lower plank of the trunk and is bolted through the trunk by at least two bolts. The forward end of the trunk appears to have been braced by attachment to the mortice in the aft side of the midship beam.

The pivot pin, upon which centreboard swings, bisects the lower planks of the trunk. Located 39 inches from the forward end of the trunk, the pivot pin is 1-3/8 inches in diameter and has a 2-1/2 inch head. It is 13 inches long. A wedge appears to have been fitted through a hole bisecting the shaft near one end to prevent the pivot pin from working its way out of the trunk.

Two separate sections of the centreboard were studied during the 1985 season. One section measures 9 feet, 7 inches long, 1-1/2 inches thick and has a surviving width of 28 inches. It remains within the trunk, still attached to the pivot pin, which bisects the board about 2 feet from its upper end and 1 foot from its forward edge. Four planks, edge joined by 1/2- to 5/8-inch drift bolts, make up this section of the centreboard.

The aft section of the centreboard was identified from

among the planks stored on the port side of the hull (Fig. 57). It was found jammed within the centreboard trunk

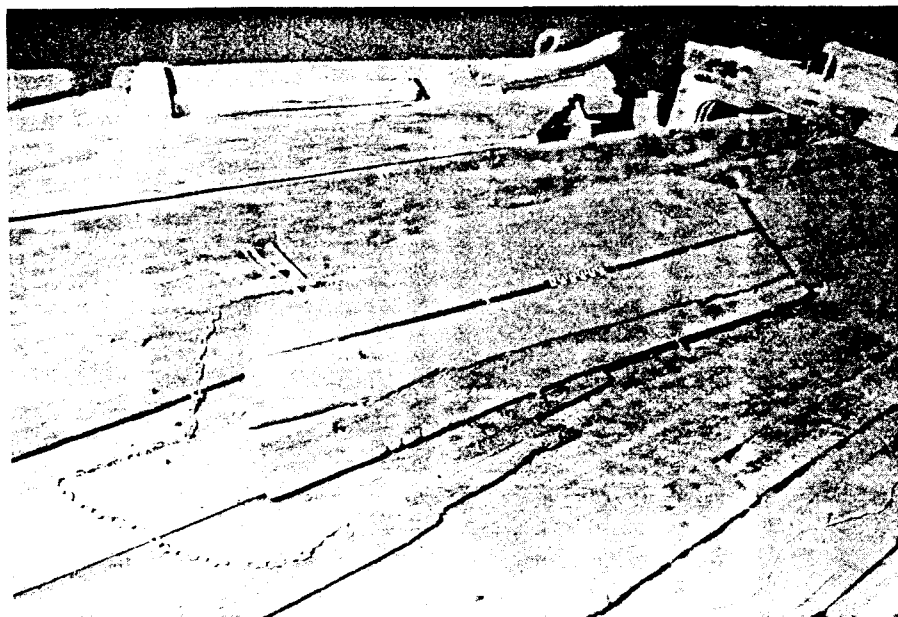


Figure 57. Broken section of the centreboard with attached chain lanyard. (Photo by the author.)

during the 1967 excavation of the vessel, but was subsequently removed (Zacharchuck, 1986, pers. comm.). The section is 9 feet long, 1-1/2 inches thick and approximately 2 feet wide. It is made up of two planks edge-joined by 1/2-inch drift bolts. One end is cut at an angle and the outer edge of one plank is bevelled. A 72-inch length of chain, made up of 1/2-inch links, is attached to an iron U-shaped bracket rivetted near the angled end of the board. This represents the lanyard,

used to raise and lower the centreboard.

The centreboard structure reconstruction (see Fig. 55, p. 97) is based on the best available evidence, and is discussed in the following chapter.

## THE RUDDER

The rudder survived in its entirety (Fig. 58). It measures 7 feet along the stock and 4 feet, 3 inches along the sole piece. The blade is made up of four 2-1/2 inch thick planks, and a plank which forms the transition to the stock, which is 4-1/2 inches thick at its lower end. These planks are edge-joined by 3/4-inch iron drift bolts, only one of which appears to pass through every component.

The rudder's lower edge extends the line of the keel, and has a 2-inch by 2-1/2-inch thick sole piece fastened to the bottom of the planks and stock with 3/8-inch iron nails. The upper edge of the blade forms a smooth curve to the stock.

At its head the stock is 8 inches fore-and-aft and 6 inches thick. A hole for the tiller was formed by cutting a 3-1/4-inch wide slot, 6 inches deep in the head, and inserting a shorter block at the upper end of the slot. The block is held in place by two 3/4-inch threaded bolts with 1-1/4-inch nuts alternately fastened on port and starboard.

Iron pintles, similar in construction to the gudgeons, are fastened near the upper and lower ends of the rudder

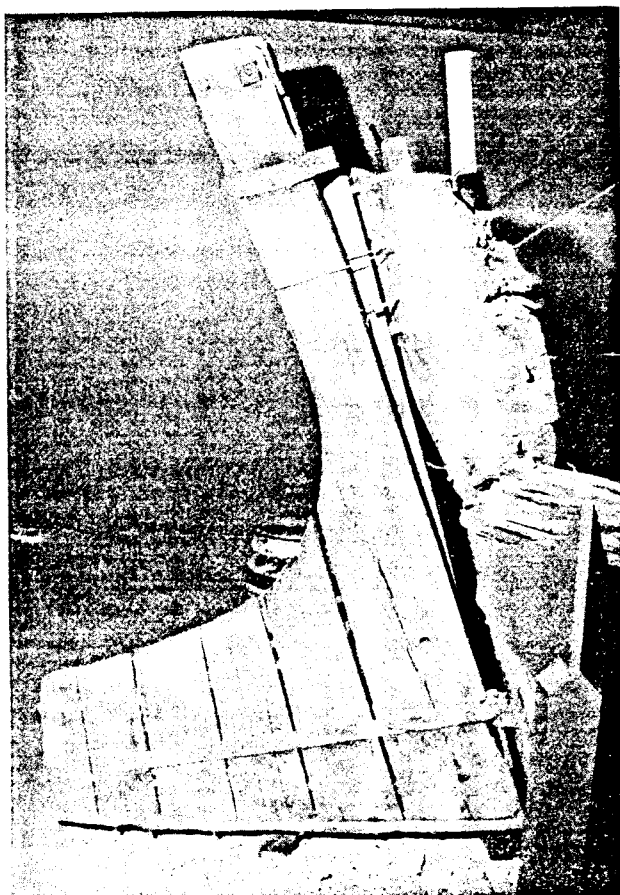


Figure 58. Starboard view of the rudder of the Browns Bay Vessel. (Photo by the author.)

by bolts which are peined over the straps. The upper pintle is 10-1/2 inches long and is fastened 1 foot below the rudder head, while the lower pintle extends practically the full width of the blade. A 1-1/4-inch diameter hole vertically bisects each pintle forward of the stock.

A 1-inch diameter iron rod, 5 feet, 4 inches long, was recovered with the rudder. To secure the rudder, the rod was passed through both pintles and gudgeons, thus allow-

ing the rudder to pivot.

A large head at its upper end prevented the rod from slipping down through the holes, while an iron wedge, inserted in a 1-1/2-inch-long slot in the lower end of the rod prevented it from lifting out of the holes (see Fig. 23, p. 45).

It is likely that during the vessel's period of service, a chain would have been attached to the rudder to prevent accidental loss if it were unshipped. No evidence for the chain or attachments exists; however, an eroded 1-1/4-inch hole in the rudder stock may have served the purpose of supporting the chain.

## CHAPTER IV

### INTERPRETATION, ANALYSIS AND CONCLUSIONS

During the 1985 study, it became evident that the vessel had once undergone an extensive refit. While leaving the basic shell unaltered in form, the refit changed almost everything else on the hull, thereby eradicating much information regarding the original appearance of the boat and its possible use or uses.

It has been suggested that the hull is that of a British gunboat from the early 19th century (Beattie, 1967: 123-127; Zacharchuck, 1968: 85). The identification is "based on general design and the presence of broad arrow markings on several fittings and blocks" (Zacharchuck and Rick, 1969: 11). The presence of copper fastenings on the hull suggested a date before 1820 (see p. 113) (Beattie, 1967; Canada. M.G. 12, Adm. 106, 1999; Canada, R.G. 8, Series 3, 31: 118-123). Documentary research revealed British gunboat, the Radcliffe, built in Kingston in 1817, whose general dimensions approximated those of the wreck (Beattie, 1967: 126). A plaque bearing the name of that gunboat now hangs at Mallorytown Landing as part of the exhibit.

Though the vessel may have been built as a gunboat from the start, no evidence for a gun or supporting structure was found on the hull. However, the original hull can be compared to representations and descriptions of the

standard types of British Admiralty flat-bottomed boats of the period. The flat-bottomed boats are described in contemporary documents as being clinker-built, of shallow draft, and designed with flat bottoms to allow them to get close to shore and beach readily (Pearsall, 1984: 208-214; Syrett, 1970: 4, 54). Flat-bottomed boats were probably developed from the launch which, in relation to a man-of-war's longboat (see Lavery, 1984: 122, Fig. 1), was "longer, more flat bottomed, and by rowing a greater number of oars is better adapted for going up narrow and shallow rivers" (Lavery, 1984: 123, 126). The launch was also favoured by many captains for amphibious expeditions because of its carrying capacity. The hull shape of the Browns Bay Vessel (Fig. 59) can be favourably compared to that of a launch c. 1800 (Lavery, 1984: 126, Fig. 1), and of "A Boat built for Landing of Men in 1706" (see Fig. 5, p. 11 ). The hull form also can be compared to what is known about British gunboats used on the lakes and waterways of Canada during the late 18th century (e.g. Chapelle, 1949: 94, Fig. 11b, RN gunboat 1776), and the early 19th century (e.g., Axeman and Caustic gunboats, built in 1815 [Canada. Public Archives. National Map Collection. P.R.O. 81203/44, Items 2 and 3]).

When the vessel was overhauled and refitted, it changed from one propelled by oars and sail to a sailing vessel with a suitably strengthened hull. The features inherent in the clench-built hull--great longitudinal

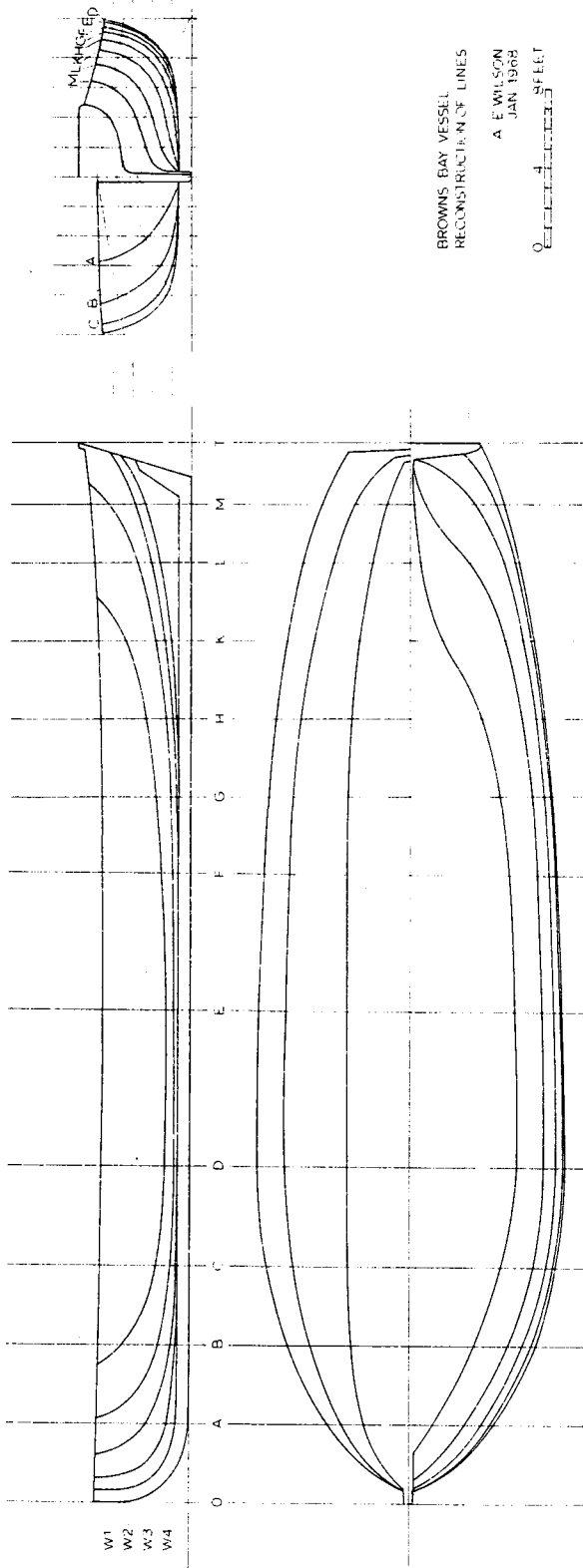


Figure 59. Browns Bay Vessel. Reconstruction of Lines. (Drawing by A.E. Wilson [Parks Canada] and C. Piper.)

BROWNS BAY VESSEL  
RECONSTRUCTION OF LINES

A. E. WILSON  
JAN. 1968

0 10  
FEET  
SHEET 4

C. PIPER 06.08.87 6144-86 1/2-10

strength, thin planking and light framing--were retained and enhanced during the refit. A second layer of strakes was fixed over the existing clinker strakes. The original futtocks were cut off at the 11th strake and the hull above that point apparently removed. Larger futtocks were added between floor timbers and existing futtocks and carried up to the sheer. To these were fastened three carvel strakes, the uppermost and thickest acting as a wale.

The original sides of the hull were probably also of carvel construction. Although most of the original futtocks were cut off short during the refit, some original futtocks in the stern were left complete. The outer faces of these were dubbed flat above the 11th strake, presumably to seat carvel planks. The outboard edges of the transom showed no evidence of notching above the 11th strake.

The combination of a clinker-planked bottom and carvel sides is shown in a plan of a gunboat built in Ipswich, England, in 1809 (Canada. Public Archives. National Map Collection. R.G. 24M, 78903/44, Item 5). While the gunboat shown in the plan is not as flat bottomed as the Browns Bay Vessel, it has 11 clinker strakes applied from keel to above the turn of the bilge and carvel sides. One of the carvel planks is a wale through which chainplates are fastened.

Shelf clamps, fastened to the inboard faces of the futtocks just below the sheer line, further strengthened the hull of the Browns Bay Vessel. These supported beams which stiffened the hull and supported decking. The forward section of keelson was removed and replaced by a timber of larger scantling. This timber was, no doubt, needed to add longitudinal strength to the flexible hull with the purpose of enhancing cargo carrying ability. The larger timber also accepted and distributed the weight of a large mast, which may have held a heavier press of sail than the vessel previously carried.

The nearly flat bottom of the vessel necessitated the addition of a centreboard to reduce leeway when sailing close to the wind. The swing-type centreboard was ideally suited to the navigation of shallow waters and beaching to load and unload cargo. When lowered it provided good lateral resistance for sailing. The reconstructed structure suggests an open-topped trunk extending to the level of the midship beam. Its forward end was set into a mortice in the aft side of the beam and its aft end was supported by a standard knee fastened to the keelson. The upper extremity of the aft end of the trunk also may have been secured to a deck beam which apparently spanned the hull just aft of the trunk (see Fig. 55, p. 97).

The 5 foot wide and 9-foot, 6-inch-long centreboard was operated by a chain lanyard attached near its aft lower end. When fully raised the board may have extended

some 15 inches above the top of the trunk.

Evidence suggests that the centreboard structure was installed at the same time as the keelson, but prior to the addition of the second layer of hull planking. The bottom of the centreboard beam ends flush with the exterior of the original strakes, which had been cut to fit snugly in the rabbet of the beam. The rectangular slot cut in the outer strakes, however, is significantly larger and there are no indications of cut marks on the underlying strakes. If the exterior strakes had been in place when the centreboard was installed, a single cut through both layers likely would have been used.

The fact that the centreboard appears to have been installed during conversion to a sailing vessel suggests a change in assignments for the vessel. As a flat-bottomed boat used for transporting and landing men and equipment, or a gunboat using a naval crew, a centreboard would not have been necessary. Manoeuvrability could have been provided by the oarsmen. A centreboard trunk and accompanying tackle might also interfere with the oarsmen.

A change in assignments could reflect a conversion to a cargo carrier manned by a civilian crew, but hired for military supply purposes (as a means of reducing operating costs), or to a purely commercial carrier. In either case, oarsmen could be eliminated and the hull structure modified for sailing.

Centreboards apparently were not used on flat-bottomed

boats or gunboats in Britain or North America, and do not appear on any available plans or descriptions of these vessels. The addition of a centreboard to the Browns Bay hull may imply a non-military conversion. The pivotted, swing-type centreboard was apparently developed in 1809, but did not become common in North America until after 1820 (Chapelle, 1949: 237).

The rudder may also have been part of the refit. Its shape does not conform to contemporary plans and illustrations showing rudders on naval vessels during the early 19th century. The wide blade would not have been necessary in a vessel where oarsmen could provide manoeuvrability, and it could be easily damaged during an engagement or in the event of grounding. However, for a sailing vessel often in confined waterways, the wide blade rudder was essential.

The space between the two layers of strakes, as well as the exterior of the outer strakes, was coated with a thick layer of pine tar. Documentary evidence indicates that Commodore Barrie, in 1820, requested information from the Admiralty on the application of tar to preserve the boats, a procedure that apparently had not been previously adopted (Canada. M.G. 12, Adm. 106, 1999). It wasn't until 1822 that Sir Robert Seppings provided directions on how to scrape the wood and apply warm tar (Canada. M.G. 12, F66, vol. 2: 79-83).

The modifications are characterized by the use of

wrought iron fastenings throughout. In 1820, the Admiralty was advised by one of its surveyors that "the expense of copper fastenings to ships employed on the Lakes is quite unnecessary, as the iron does not appear to be corroded in any degree as we have been accustomed to see it" (Canada. M.G. 12, Adm. 106, 1999). The presence of wrought-iron threaded bolts in the vessel also suggests a date after 1820 for the refit. Threaded bolts in shipbuilding use were introduced probably between 1820 and 1850 (Lyon, 1985: pers. comm.).

The above evidence would suggest that the modifications and subsequent repairs to the vessel occurred after 1820. Whether the work was performed while the vessel was still under Admiralty ownership or was done by a private individual is grounds for speculation. Some gunboats and other naval vessels evidently were sold and operated commercially.

In 1832, Commodore Barrie failed in an attempt to sell off the decaying fleet. Four years later, Mr. John Marks, naval clerk at Kingston, put up for sale "all the . . . ships and vessels, sloops, schooners, gunboats and boats remaining at the station. . . ten unfinished gunboats in good condition" (Preston, 1952: 96). Many of those sold were believed to have been operated for a long time commercially (Cuthbertson, 1931: 207).

The apparently late date of some of the artifacts found in the hull suggests a long period of use for the

vessel. Whether the modifications were done by a naval shipwright or privately for commercial use, a similar type of refit would be required to produce a vessel capable of carrying cargo and to be easily and economically operated by a small crew.

### TONNAGE

The tonnage of the Browns Bay Vessel can be estimated using a number of different methods, each yielding a different value. As the 19th-century formula for determining the tonnage of standard deepwater vessels is not appropriate, a slightly earlier formula was applied to the hull. This formula involves multiplying the keel length by the maximum breadth, and then multiplying the result by the hold depth and dividing by 94 (Steffy, 1980, unpublished). The Browns Bay Vessel has a keel length of approximately 50 feet, a maximum breadth of 15 feet, 6 inches to the inboard faces of the ceiling, and her depth of hold is approximately 3 feet, 6 inches. Thus:

$$\frac{50 \times 15 \text{ feet, 6 inches} \times 3 \text{ feet, 6 inches}}{94} = 28 \frac{81}{94} \text{ tons}$$

But even that formula was intended for deeper hulls, and in this case may reflect an inflated tonnage.

As the purpose of tonnage measurements is to determine the payload capacity of a vessel, it was decided to estimate the displacement of the vessel using the lines which had been taken off the hull soon after raising (see Fig.

59, p.108). From that figure and an estimate of the vessel's weight, a deadweight tonnage could be approximated.

H.M.S. Radcliffe, a British gunboat having similar overall dimensions to that of the Browns Bay Vessel, is listed as having a "light draft" of 1 foot, 9 inches forward and 2 feet, 2 inches aft (Canada. M.G. 12, Adm. 106, 1999). Using these figures for the Browns Bay hull and allowing about one foot of freeboard, an estimated 3 feet can be used for the "heavy draft." By applying the "trapezoidal rule" to the hull (Chapelle, 1971: 203-4), a displacement in fresh water of 38.8 long tons (39.4 metric tons) is then apparent.

The weight of the raised hull was estimated at 13 tons (Wilson, unpublished notes). I have estimated an additional five tons of wood and iron, including beams, decking, mast and rigging components and deck fittings for a total of 18 long tons. The tonnage (tons burthen is determined by subtracting the weight of the vessel and gear from the total displacement of the hull (Steffy, 1980, unpublished). Thus:

38.8 long tons
-18.0 long tons
-----
20.8 long tons

A slightly larger displacement value was assigned to allow for the thickness of the outer planking, which was not

included in the original displacement calculation as lines were drawn to the inner planks.

This figure, however, falls between tonnages calculated using the Government Tonnage and Carpenter's Tonnage formulae given by Captain Jesse Wells Church in his journal written around 1850 (Church, c. 1850: 4). The tonnage values estimated using these formulae respectively are 20.2 tons and 22.5 tons. It is apparent that she could have carried a full complement of seamen with supplies, possibly 40 or more marines and a bow gun. After her conversion to a merchantman, with a small crew and lack of armament, she would have carried less operating weight but the empty hold could now contain an additional 20 tons or so of cargo.

It must be remembered that these figures are only approximations, but they do indicate a vessel of shoal draft which could carry a substantial load.

#### **BALLASTING**

Ballasting of the vessel while under Admiralty ownership would be accomplished with "iron pigs." An account of ballast at the Naval Yard, Kingston, on 16 July 1816 lists "iron ballast for 20 gunboats at 12 tons each" (Canada. M.G. 12, Adm. 1, 2266: 483). Ballast might have been placed to trim the vessel by the stern. This would improve steering under sail and, if a gun was carried, it would help counteract its weight forward. During the 19th

century, a vessel under private ownership would have been ballasted with whatever was available to the owner, including stones and gravel.

#### DECKING AND HATCHES

Only two beams survived the ravages of time, ice, and salvors. The location and dimensions of each of the five missing beams between the two extant beams were determined by notches in the port and starboard shelf clamps and by lodging knees and bolt holes in the futtock heads (see Table 1, p. 89). While all beams apparently extended the full breadth of the vessel, it was unlikely that a vessel with such a long, shallow hold was completely decked.

The existence of nail holes in the upper surface of the midship beam suggests that the vessel had a foredeck from gunwale to gunwale (Fig. 60). The midship beam, which supported the after end of the deck, has an arch of 1-3/4 inches in 15 feet. This would have given a camber to the deck, enabling it to shed water. A small poop deck about 6 feet, 6 inches long ran from the transom to the extant beam in the stern. This beam had little or no arch to it, but the deck apparently sloped forward following the sheer line of the hull. However, there must have been some provision to direct excess water overboard.

Narrow walkways ran along either side of the hull, fastened at deck beams and along the top of the wale. Nail holes along the aft edge of the midship beam suggest

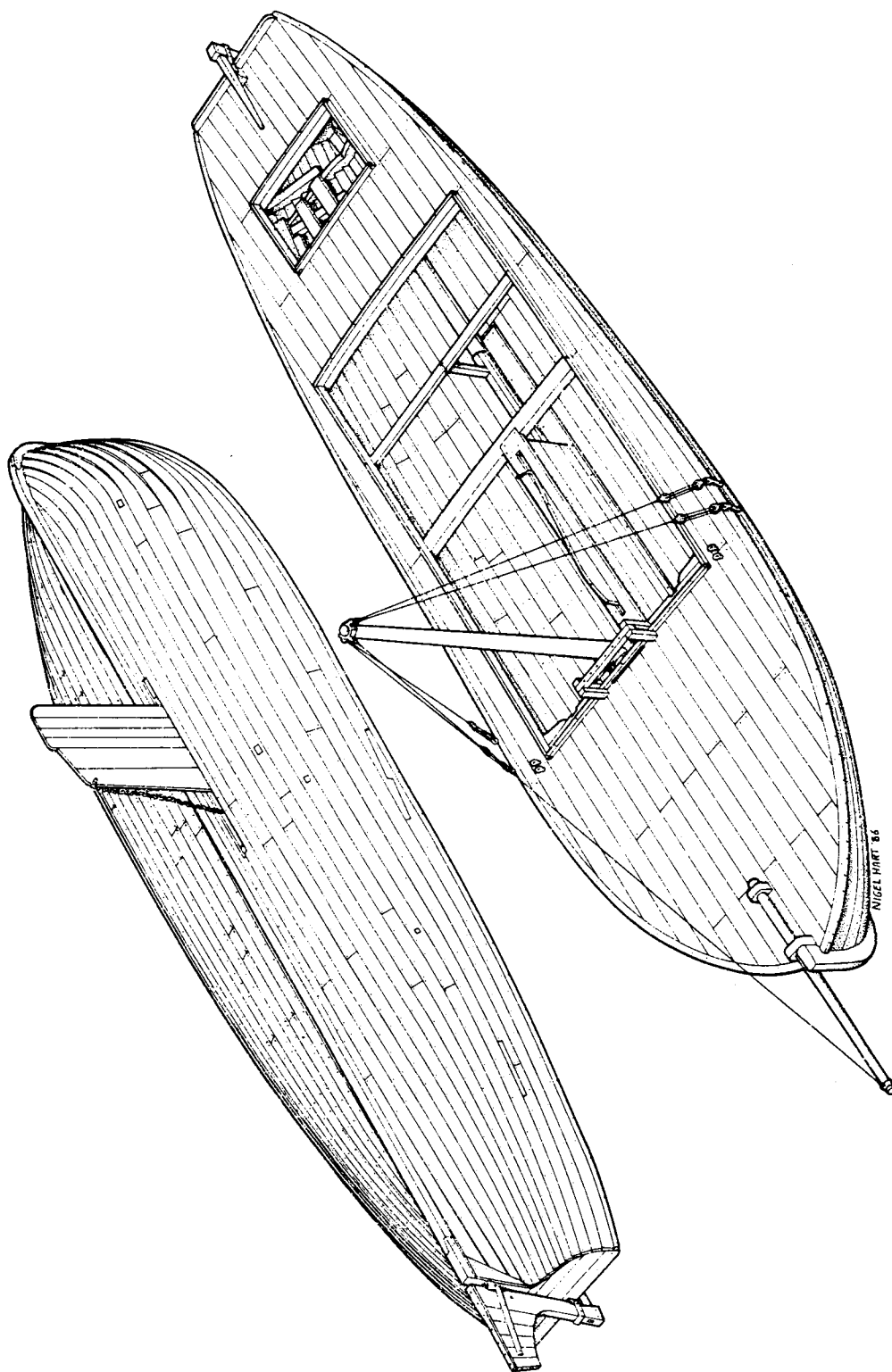


Figure 60. Reconstruction of the Browns Bay Vessel. (Drawing by N. Hart.)

a width of about 2 feet for the walkways. A thin caprail may have been fastened over the outboard edges of the planks at the wale.

A coaming may have run along the inboard edge of the walkways, outlining a large central hatch. The 12-foot-long timber, set atop the midship beam, likely formed the forward section of the coaming. Bolted overhangs at either end of the this timber could have secured the forward ends of the side coamings.

Protruding nails and eye-bolts in the midship beam suggest a deck plank thickness of approximately two inches.

Artifacts found in the stern of the hull related to the preparation and consumption of food suggest the presence of a small galley area (Zacharchuck, 1981, manuscript). It is likely that a bulkhead separated this area from the cargo hold, although no evidence for this was found. A small deck, running the full width of the vessel, may have existed between the galley and the main hatch, as evidenced by the positions for deck beams at frames 14, 15/16, and 17/18 (see Fig. 60).

#### **MAST, SPARS AND RIGGING**

The remains yielded scant information about the rig of the vessel after the refit and nothing about the original rig. Available evidence on the rigging of gunboats indi-

cates that a lateen rig was favoured in the early 19th century on British and American gunboats (Lyon, 1985, pers. comm.). This rig "required little gear and would interfere very little with the men at the sweeps" (Chappelle, 1935: 74) (Fig. 61). Contemporary illustrations of British gunboats with this rig often show a headsail set on a bowsprit (Fig. 62).

Excavated evidence indicates that a single mast was once stepped in the refitted keelson, one-third of the overall length from the bow. The mast was set against a mortice in the aft side of the main deck beam, and was clamped to the beam by an iron bracket which was secured to the timber situated atop the beam by flattened iron eye-bolts. The eye-bolts were let through this timber and their forward ends peined over a reinforcing iron strap.

Two iron chainplates, once used to secure the mast shrouds to the sides of the hull, are still attached to the futtock heads. Each is located approximately two feet aft of the maststep on port and starboard sides. Fragments of two more iron chainplates were recovered, but their positions on the hull have not been determined. On the reconstruction drawings, two chainplates per side have been used, both aft of the mast (see Fig. 60, p. 118).

Several iron fittings on the main deck beam suggest a function associated running rigging. These include four iron forelocked eye-bolts, secured through the main deck beam near either end, and two iron bolts set horizontally

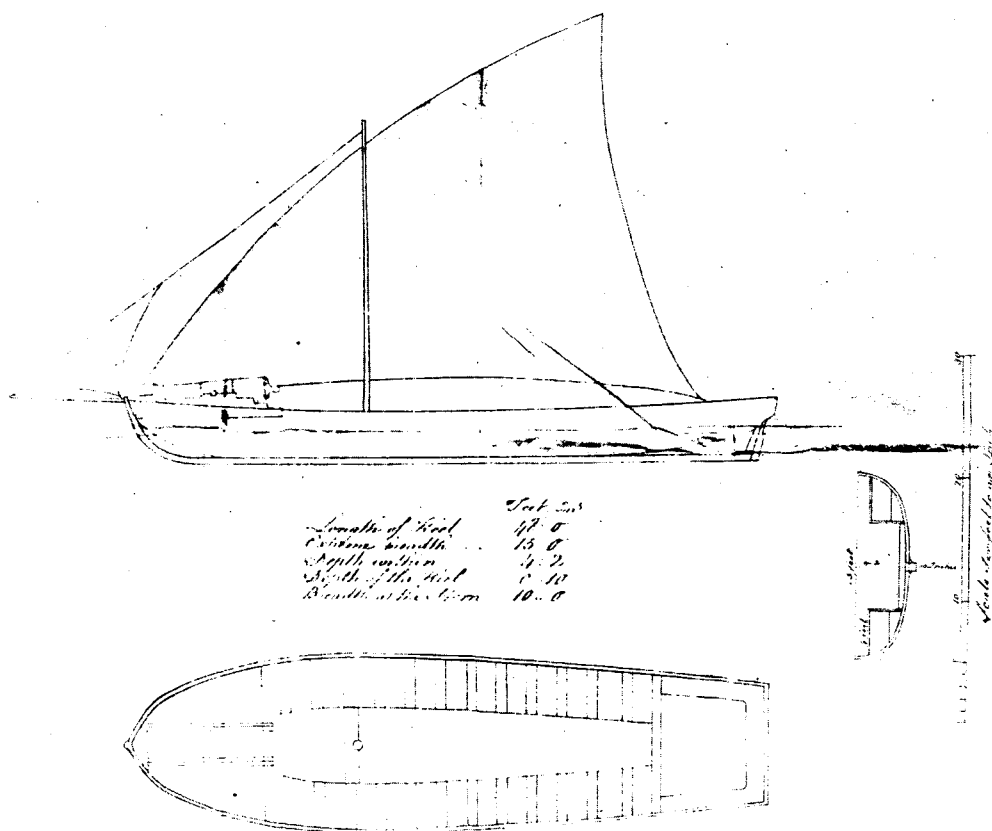


Figure 61. Plan of a lateen-rigged British gunboat used on Lake Ontario, c. 1794. (Courtesy of the Metropolitan Toronto Library Board, Q3-75a.)

through the timber atop the main deck beam on either side of the mast. The latter were possibly used to secure a pinrail for belaying lines. Several single sheave wooden blocks of varying sizes attest to the presence of running rigging but helped little in defining the rig.

The vessel, if refitted as a merchantman, would have been rigged to allow a smaller crew and easier handling.

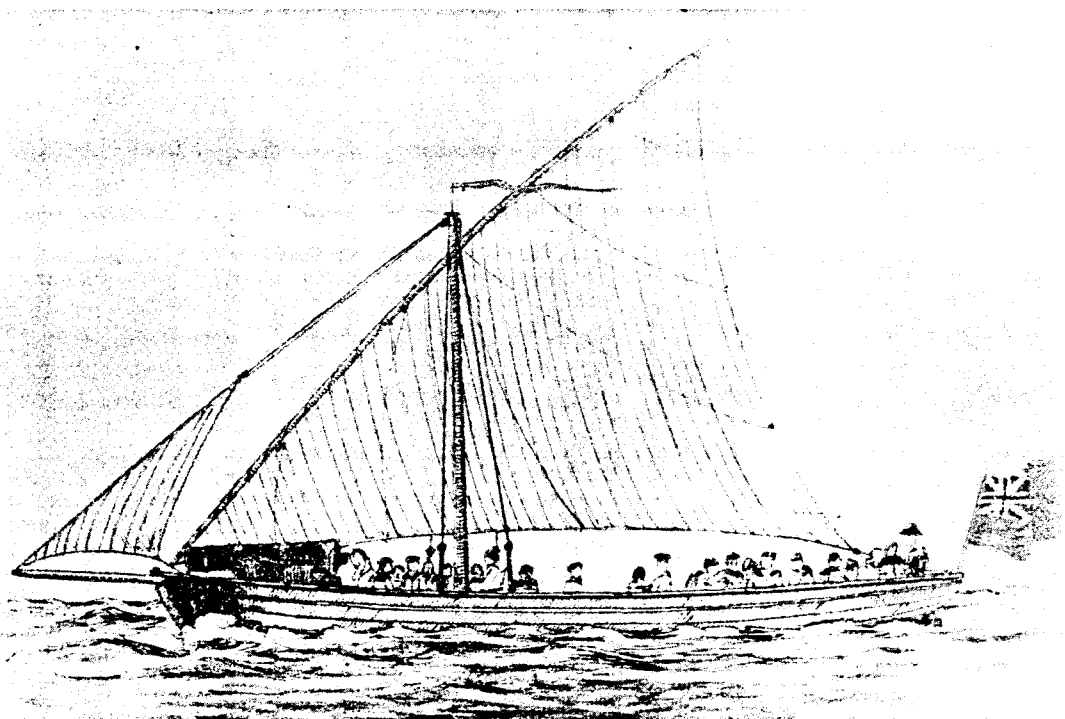


Figure 62. Lateen-rigged British gunboat, c. 1794, showing a headsail. (Courtesy of the Metropolitan Toronto Library Board, Q3-84a.)

Sudden squalls are characteristic on the Great Lakes and St. Lawrence River, and the ability to take in sail quickly was required. A fore-and-aft rig might be one solution to these requirements, and would provide facility of handling in entering and leaving restricted harbours or tacking and beating off a lee shore.

The use of fore-and-aft rigs on vessels on the Great Lakes and river systems of Canada came into general use on merchant vessels and on many naval vessels during the late

18th century. It was regarded as "most suitable for all classes of naval and commercial vessels" in the Collins Report of 1788 (Cuthbertson, 1931: 129, 227).

The 19th century, until about 1885, was a period of experimentation in watercraft construction and rigs in America. On the Great Lakes a vast fleet of mercantile vessels sprang into existence from both Canadian and American shores. Several fore-and-aft rigs became popular on small craft, including the lug, ketch, sloop, yawl and schooner rigs (Cuthbertson, 1931: 232-234). A single-masted boat operated by a small crew effectively and efficiently could have used a lug, lateen, or spritsail rig, although the possibility of other variations exists. The Browns Bay Vessel, being flat bottomed, would likely have been fitted with a headsail to facilitate coming about.

## CONCLUSIONS

The hull of the Browns Bay Vessel can be compared to representations and descriptions of Royal Navy flat-bottomed boats designed during the 18th and early 19th centuries, and to contemporary plans of British gunboats in operation on the Canadian waterways during the first half of the 19th century. The archaeological study of the hull demonstrated that it was a well-designed and well-built boat, light and flexible, yet strong and durable. The hull form is well suited to navigation in shallow or uncharted waters, for use as a floating gun platform, for transportation of men and goods, and for the landing of troops and equipment on beaches. She is a broad, shallow-draft craft with a slight sheer over her length, a transom stern and a wide, bluff bow.

The conversion, done after 1820, did not alter the hull form and thereby retained those features which made her a good military vessel. The elimination of oarsmen made her operation more economical. Her shallow draft made her a poor sailer, however, and this was partly compensated for by the addition of a centreboard and larger rudder.

She apparently had a long career beginning as one of His Majesty's naval boats, built around the time of the War of 1812, and most likely ending her days as a commercial cargo carrier. She was evidently abandoned in Browns

Bay around the middle of the 19th century, possibly after 1861.

The significance of the Browns Bay Vessel is vast. It is, at present, the only known Royal Navy flat-bottomed boat from the period of the War of 1812. The fact that the hull shows repairs and major modifications attaches additional significance to this unique craft. Little is currently known of the extent British naval vessels from that period in Canada were used after their military roles had ceased. Many were evidently broken up for their fastenings or were left to decay, while some were sold and apparently operated commercially. While the subject has been previously addressed (e.g., Beattie, 1967; Cuthbertson, 1931; Preston, 1952), the Browns Bay Vessel holds the only evidence for the continued use of such a boat.

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## APPENDIX A

## WOOD IDENTIFICATION FROM THE BROWNS BAY VESSEL

by Louis Laflèche, Microscopist,  
Conservation Division, Parks Canada, Ottawa.

1. Keel - white oak (Quercus spp.)
2. Heel - white oak (Quercus spp.)
3. Stempost - white oak (Quercus spp.)
4. Apron - white oak (Quercus spp.)
5. Sternpost - white oak (Quercus spp.)
6. Stern knee - larch (Larix spp.)
7. Transom plank (top plank) - white oak (Quercus spp.)
8. Floor (frame B) - white oak (Quercus spp.)
9. Floor (frame 12) - white oak (Quercus spp.)
10. Futtock (midship frame, original construction, stbd.)  
- white oak (Quercus spp.)
11. Futtock (midship frame, secondary construction, stbd.)  
- ash (Fraxinus spp.)
12. Futtock (frame 6, secondary construction, starboard)  
- white oak (Quercus spp.)
13. Futtock (location unknown) - white oak (Quercus spp.)
14. Garboard (inner layer, stbd.) - white oak (Quercus spp.)
15. Hull plank (inner layer, 9th from keel, stbd.) - white oak (Quercus spp.)
16. Hull plank (inner layer, 10th from keel, port) - white oak (Quercus spp.)
17. Hull plank (inner layer, 10th from keel, stbd.) - white oak (Quercus spp.)
18. Garboard (outer layer, stbd.) - white oak (Quercus spp.)
19. Hull plank (outer layer, 10th from keel, port) - white

- oak (Quercus spp.)
20. Chainwale (port) - white oak (Quercus spp.)
  21. Chainwale (stbd.) - white oak (Quercus spp.)
  22. Keelson (original construction, aft section) - white oak (Quercus spp.)
  23. Keelson (original construction, forward section)  
- white oak (Quercus spp.)
  24. Keelson (secondary construction) - white oak (Quercus spp.)
  25. Ceiling (2nd from keel, stbd.) - white oak (Quercus spp.)
  26. Ceiling (3rd from keel, port) - white oak (Quercus spp.)
  27. Ceiling (5th from keel, stbd.) - white pine (Pinus strobus)
  28. Ceiling (8th from keel, port) - white pine (Pinus strobus)
  29. Shelf clamp (stbd.) - white oak (Quercus spp.)
  30. Shelf clamp (port) - white oak (Quercus spp.)
  31. Midship beam - white oak (Quercus spp.)
  32. Lodging knee (aft face of midship beam, port) - larch (Larix spp.)
  33. Lodging knee (side unkown) - white oak (Quercus spp.)
  34. Centreboard beam - white oak (Quercus spp.)
  35. Centreboard trunk - (lower plank, port) - white oak (Quercus spp.)
  36. Centreboard (section in trunk) - white oak (Quercus spp.)
  37. Centreboard (loose section) - white oak (Quercus spp.)
  38. Knee (aft end centreboard trunk) - white oak (Quercus spp.)

**CAULKING AND TAR IDENTIFICATION FROM THE BROWNS BAY VESSEL**

by Joy Moyle, Conservation Technician,  
Conservation Division, Parks Canada, Ottawa

1. Caulking (inboard seam of garboard and stempost, starboard) - pine tar with hog bristles and wood fragments.
2. Caulking (between transom planks) - pine tar with unidentified fibres.
3. Tar (outer surface of hull plank) - pine tar.

## APPENDIX B

## FASTENERS FOUND ON THE BROWNS BAY VESSEL

Both copper and iron fasteners were used in the original construction of the Browns Bay Vessel. Modifications to the vessel were characterized exclusively by the use of wrought iron fasteners. A representative sample of the hull fasteners was photographed and drawn during the present study.

Copper Fasteners

Cu. 1            Rivet, Square  
                   L: 2-3/16 in.  
                   W: 3/16-in.  
                   Rove: 7/8-in. by 3/4-in.

Cu. 2            Rivet, Square  
                   L: 2-1/8 in.  
                   W: 3/16-in.  
                   Rove: 5/8-in. by 3/4-in.

Copper rivets were used in the original construction of the vessel, in fastening the overlapping clinker planks. Cu. 1 and Cu. 2 illustrate two ways of attaching the rove to the rivet. Heads were mushroomed.

Cu. 3            Nail, Square  
                   L: 5-5/8 in.  
                   W: 1/4-in. tapering to 1/8-in.

The edges of the head taper downward, leaving a roughly square flat spot at the centre of the head. The shank is square in section, tapering to a point which is flattened.

One-quarter-inch copper nails were used to fasten the original hull strakes to the posts, transom, and frames. Nails fastening strakes to the frame components were clenched over the inboard surface of the floor or the futtock.

Cu. 4            Nail, Square  
                   L: 2-15/16 in.  
                   W: 3/16-in. tapering to 1/16-in.

The head is shaped in a manner similar to that of Cu.

3. The shank is square in section, tapering to a point which is flattened.

Copper nails, 3/16-in. in section, were used to attach the original garboards to the keel.

### Iron Fasteners

Fe. 1 Peined bolt, Round

L: 9-3/8 in.

W: 5/8-in.

Washer: 1-1/4 in. diameter

The bolt is corroded, but one end expands to over 11/16-inch. The opposite end is peined over an iron washer. It once possibly fastened a knee to either a futtock or a deck beam.

Peined iron bolts, (5/8-in. diameter and 3/4-in. diameter), were used during the original construction of the vessel, and fastened components during subsequent modification. They were used primarily in five ways: (1) to attach the keelson, frames, and stern knee to the keel, (2) to attach components in the stem and stern, (3) to fasten the scarfs of stem, keel, and stern structure, (4) to attach the centreboard beam to floor timbers, and (5) to fasten knees to beams and futtocks.

Fe.2 Threaded iron bolt, Round

L: 14 in.

W: 5/8-in. diameter

Washer: 1-1/4 in. diameter

Nut: 1-5/16 in. by 1-3/8 in.

The head is expanded to 15/16 of an inch, while the opposite end is threaded to accept a washer and a threaded nut.

The original location of the bolt is unknown. Threaded iron bolts (5/8-in. in diameter and 3/4-in. in diameter) were used exclusively during the refit in four ways: (1) to attach the replaced forward keelson section and the frames to the keel, (2) to attach a knee support to the centreboard trunk, (3) to fasten chainplates to the hull, and (4) to repair and strengthen weak or split hull components.

Iron drift bolts (not shown) were used primarily to edge join plank components on the transom, rudder, and centreboard structure. They were also used in conjunction with the peined bolts to attach the stem components.

## Fe. 3            Iron Nail, Square

L: 4-7/8 in.

W: 1/4-in. tapering to 1/16-in.

The edges of the head taper downward leaving a flat plane at the centre of the head. The shank is square and the tip appears to have been flattened.

This type of fastener was used mainly to attach plank components to the hull. Components included are outer layer of the hull planks, ceiling and shelf clamps, decking, and the rudder's sole piece.

## Fe. 4            Iron Nail, Square

L: 5-3/4 in.

W: 1/4- to 5/16-in.

The head has the same shape as that of Fe. 3, but is more substantial. The shank is square, and tapers to a flattened point, similar to that of Cu. 3.

This type of fastener was used primarily in three ways: (1) to attach the transom to the sternpost, (2) to fasten the strake ends to the stem and sternpost, and (3) to attach the ends of the centreboard beam to the floor timbers.

## Fe. 5            Nail, Square

L: 3-1/8 in.

W: 3/16-in. tapering to 1/16-in.

The nail is heavily corroded. The head is basically flat, although the corners appear to have been hammered to an angle. Two sides of the tip are flattened.

## Fe. 6            Nail, Square

L: 3-1/4 in.

W: 3/16-in. tapering to a point

The corners of the head angle downward, leaving a point at the centre of the head. The shank is square in section, tapering to a point.

The fastener type illustrated by Fe. 5 and Fe. 6 was used in three ways: (1) to attach the outer garboards to the inner garboards and keel, (2) to fasten the ribs of the scarf in the original keelson, and (3) to attach oak sheaths on the sternpost, and probably similar components to the stem.

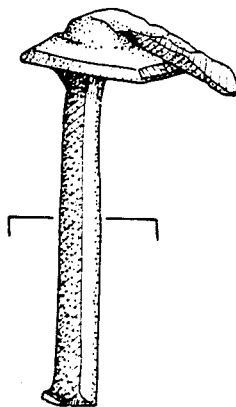
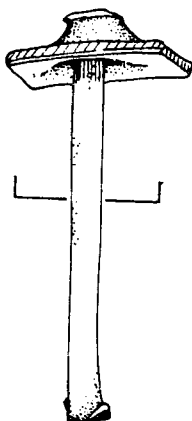
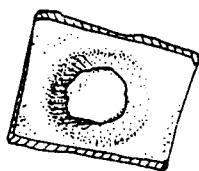
Fe. 7            Nail, Square

L: 2-1/16 in.

W: 1/8-in. tapering to 1/16-in.

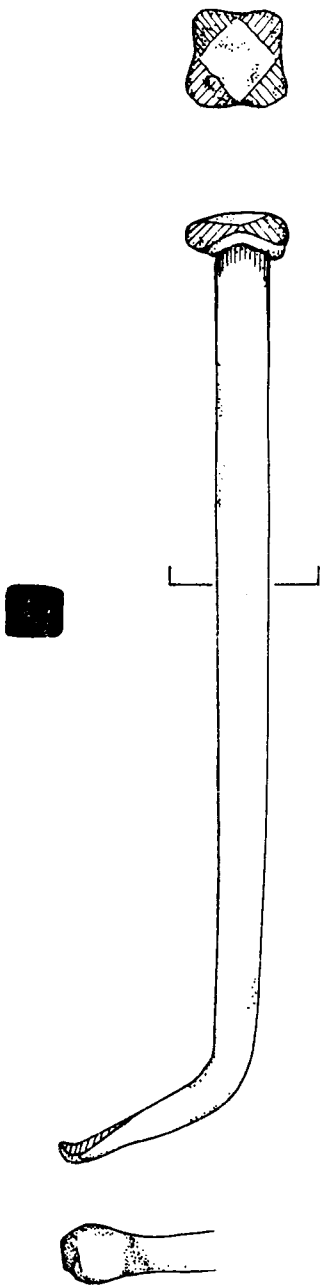
The head is heavily corroded, but appears to be similar to that of Fe. 6. The shank is square in section, tapering to a slightly flattened point.

This fastener type was likely used to attach small components within the hull.

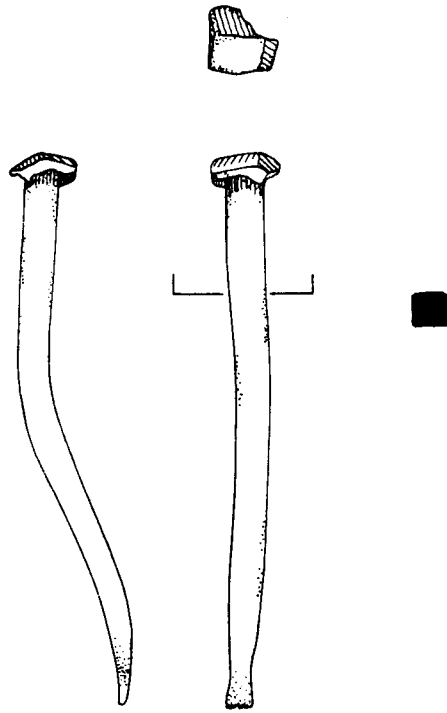


Cu. 1

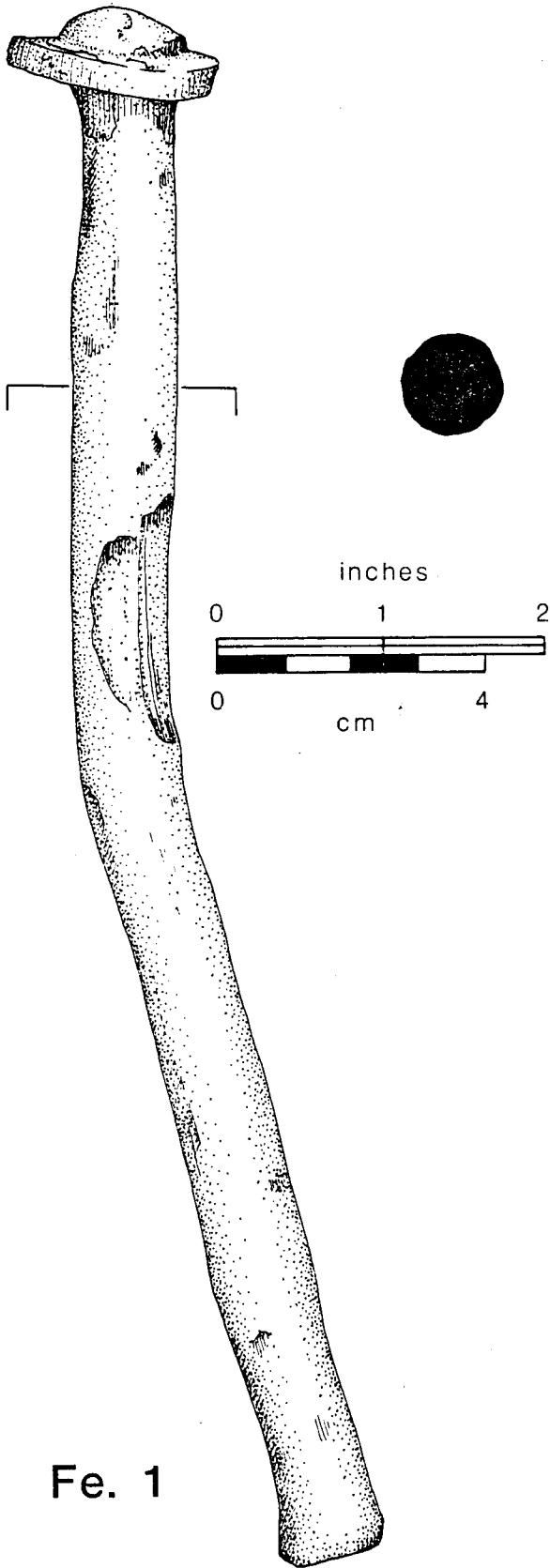
Cu. 2



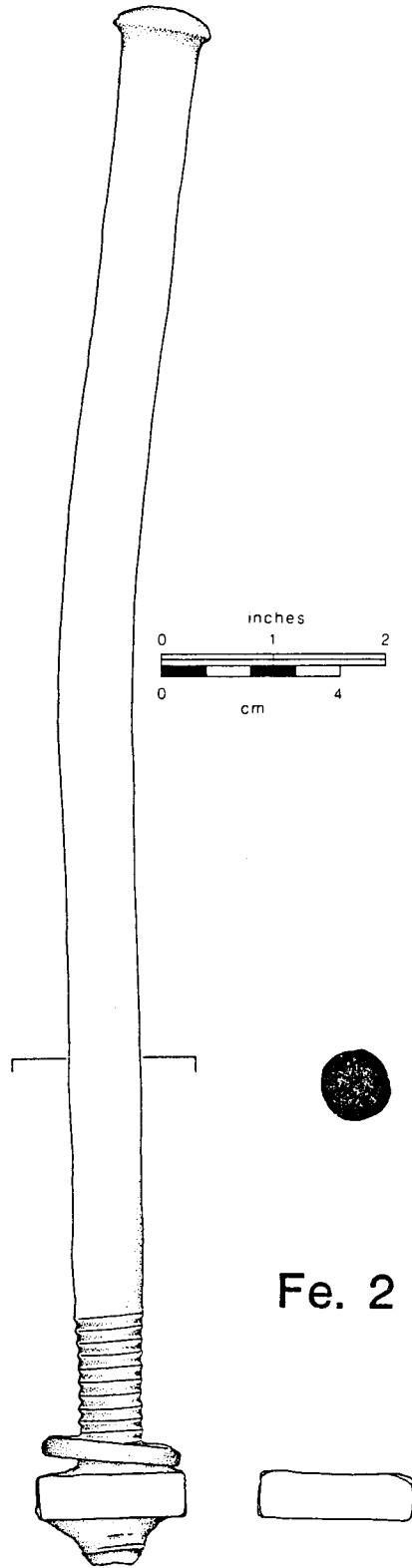
Cu. 3



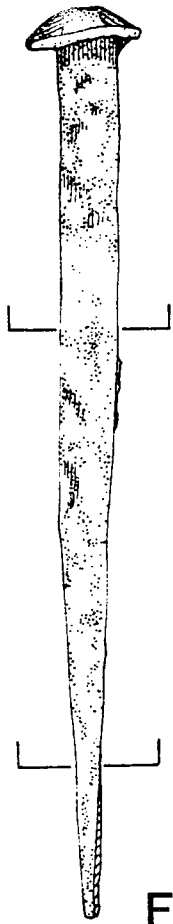
Cu. 4



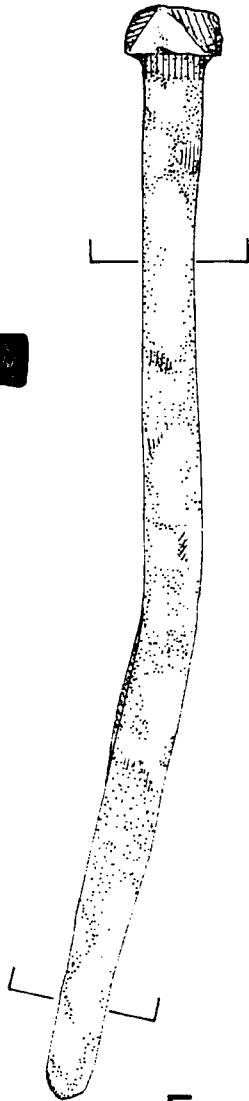
Fe. 1



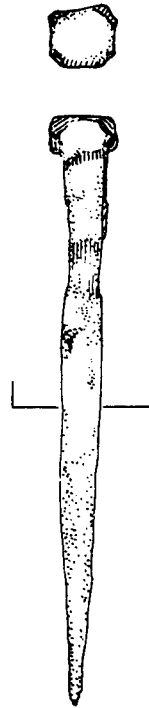
Fe. 2



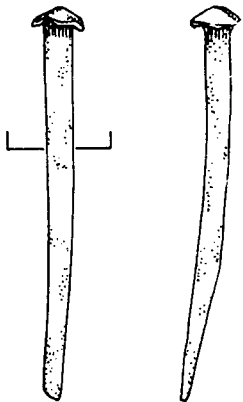
Fe. 3



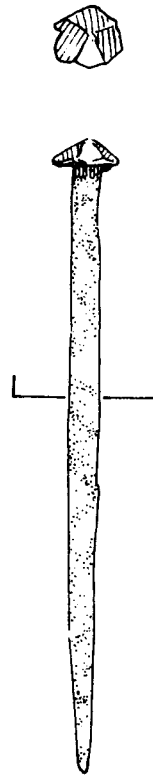
Fe. 4



Fe. 5



Fe. 7



Fe. 6

## APPENDIX C

## PRINCIPAL DIMENSIONS AND SCANTLINGS OF THE BROWNS BAY VESSEL

Length - between perpendiculars.....54 feet, 2 inches  
(16.51 meters)

- on keel (including heel)...52 feet, 3-1/2 inches  
(15.94 meters)

Breadth - moulded.....16 feet, 2-1/2 inches  
(4.88 meters)

- extreme.....16 feet, 5-3/4 inches  
(5.02 meters)

Height - from rabbet to sheer at midship  
frame.....3 feet, 10-1/2 inches  
(1.18 meters)

- to sheer at bow rabbet  
(estimated).....4 feet, 1-inch  
(1.27 meters)

- to sheer at stern rabbet.....4 feet, 2 inches  
(1.27 meters)

Depth of Hold.....3 feet, 6 inches  
(1.07 meters)

Draft - afore (estimated light  
draft).....1 foot, 9 inches  
(0.53 meter)

- abaft (estimated light  
draft).....2 feet, 2 inches  
(0.66 meter)

- afore (estimated heavy draft for  
burthen).....2 feet, 10 inches  
(0.86 meter)

- abaft (estimated heavy draft for  
burthen).....3 feet, 2 inches  
(0.96 meter)

Tonnage - displacement (Fresh water)...c. 38.8 long tons  
(c. 39.4 metric tons)

- burthen.....c. 20.8 long tons  
(c. 21.1 metric tons)
- Government tons.....20.2 tons
- Carpenter's tons.....22.5 tons

Length-to-beam ratio - (using length between perpendiculars).....3.29:1

- (using mean water line length..3.23:1

Keel - of white oak, sided 6 inches (0.15 meter), moulded 8-3/4 inches (0.22 meter).

Posts - of white oak

Frames - of white oak and ash. Floor timbers sided 2-1/2 to 3-1/2 inches (0.065 to 0.089 meter), moulded 3-1/2 to 4-1/2 inches (0.089 to 0.12 meter). Original futtocks sided 2-1/4 to 3 inches (0.057 to 0.076 meter), moulded 3 to 4 inches (0.076 to 0.10 meter). Futtocks from refit sided 3 to 4-1/2 inches (0.076 to 0.12 meter), moulded 3 to 4 inches (0.076 to 0.10 meter).

Hull Planking - of white oak, clinker planks 3/4-to 1-inch (0.019 to 0.025 meter) thick, carvel planks 3/4-to 1-1/4 inch (0.019 to 0.032 meter) thick, chainwale 1-1/2 to 1-3/4 inches (0.038 to 0.045 meter) thick.

Keelson - original of white oak, sided 10-1/2 inches (0.27 meter), moulded 4-1/2 inches (0.12 meter).

- added section of white oak, sided and moulded 9-1/2 to 10 inches (0.24 meter to 0.25 meter).

Ceiling Planking - of white pine and white oak, 1 to 1-1/2 inches (0.025 to 0.038 meter) thick.

Shelf Clamps - of white oak, 5-1/2 to 6-1/2 inches (0.14 to 0.17 meter) wide.

Deck Beams - of white oak.

## APPENDIX D

## GLOSSARY OF SHIP TERMS

- Amidships - The middle of a vessel.
- Apron - A piece of curved timber fixed behind the lower part of the stem, immediately above the foremost end of the keel.
- Ballast - Heavy material such as iron or stone, carried in a vessel's hold for the purposes of lowering her centre of gravity and increasing stability.
- Beam - The breadth or width of a vessel.
- Belaying - Fastening a rope by giving it several cross-turns alternately around each end of a cleat or pin; the term is chiefly used for running rigging.
- Block - A wooden device used to increase the mechanical power applied to ropes or to lead the running ropes to convenient positions for handling.
- Bolt - Cylindrical pin of iron for fastening and securing the different parts of the vessel.
- Burthen - The payload or cargo-carrying capacity of a vessel; the tonnage volume of the hold.
- Butt - The squared end of any plank in a vessel's side which unites with the end of another, continuing its length.
- Camber - A slight curve of a hull timber.
- Cant Frames - The frames at the ends of a vessel which are not perpendicular to the keel; those at the stem slant forward, while those at the stern slant aft.
- Carlings - Pieces of timber running fore-and-aft between the main transverse beams.
- Carvel - The method of construction whereby the strake edges are flush with one another, thus presenting a smooth surface.

- Caulking - The insertion of oakum into the seams and butts of planking to render them watertight.
- Ceiling - The inside planks of a vessel.
- Centreboard - A keel-like device which can be raised and lowered in a well for the purpose of adding keel area to a vessel.
- Chainplates - Metal fastenings for attaching mast shrouds to the sides of the hull.
- Chamfer - The flat surface created by slicing the square corners or edges of a timber.
- Clench nailing - A method of fastening in which nails are driven through the planks or timbers to be fastened and their ends bent back over the interior wood surface.
- Clinker-built - A hull constructed with relatively thin planking whereby the lower edge of each side plank overlaps the upper edge of the plank below it.
- Coaming - The raised borders of timbers fitted around the edges of hatches to prevent the entrance of water.
- Deadrise - The angle between the bottom of a hull and a horizontal plane.
- Deadweight - The carrying capacity of a vessel beyond its own weight.
- Deck beam - An athwartship timber that supports a deck.
- Depth of hold - The centreline distance between the top of the floor timbers and the top of the midship beam.
- Dipping Lugsail- A lugsail with tack secured well forward of the mast. The sail is set to leeward of the mast. When going about, the forward end of the gaff has to be dipped to the new lee side.
- Draft - The depth of a hull below the waterline.
- Drift bolt - An iron fastening which is driven into a hole drilled slightly smaller than the bolt diameter, thus gripping the wood by


pressure alone.

- End-blocks - Vertical timbers, which frame the ends of the centreboard trunk. One or both of these should run to the deck, thus preventing side sway.
- Eye-bolt - A bolt with a circular opening at one end. It is driven into the decks or sides of the vessel to act as a fastening point for tackles or ropes.
- Floor timber - The lowest, central timber of a frame, which crosses the keel and is bolted to it.
- Fore-and-aft rig - The arrangement of sails whose normal configuration is parallel to the keel.
- Fore-locked bolt - An iron bolt which is slotted near one end for an iron wedge to be inserted to secure the fastening.
- Frames - Single or composite structures mounted perpendicularly to the keel to strengthen and give shape to the hull. Comprised of floor timbers and futtocks.
- Freeboard - The vertical distance between the deck and the water-line or the surface of the water.
- Futtocks - The upper timbers of a frame.
- Garboard - The external planking strake that is closest to the keel on each side.
- Gudgeon - A metal bracket attached to the sternpost on which the rudder is hung by means of a pintle.
- Gunwale - The uppermost wale or strake on a vessel's side.
- Half Frame - A frame that does not cross the keel, but rises up from either side of it.
- Halyards - The ropes or tackle employed to hoist sails, booms and other top gear.
- Hatchway - An opening in the deck, usually square or rectangular in shape, which provides

access to the hold or space below.

- Heel - The after end of the keel and the lower end of the sternpost.
- Headsails - A general name for those sails which are situated between the foremast and bowsprit, and which influence the movement of the fore part of a vessel; e.g., the jib.
- Hood ends - The ends of the planks which are fitted into the rabbet of the stem or sternpost.
- Hull lines - A set of three drawings showing lines which describe the shape of a vessel.
- Keel - The backbone of a vessel, to which the stem, stern, frames, and garboards are attached.
- Keelson - An internal longitudinal timber, set atop the floor timbers directly over and parallel to the keel, which serves to reinforce the hull and which (on the Browns Bay Vessel) supports the heel of the mast.
- Lapstrake - (See Clinker-built).
- Lateen sail - A triangular fore-and-aft sail served to a long yard which is raised obliquely to the mast.
- Leeway - The lateral movement of a vessel to leeward of her course, or the angle which the line of her way makes with the keel.
- Limber Holes - Holes or notches cut in the floor timbers on either side of the keel to permit free passage of bilgewater to the lowest point in the vessel.
- Lodging Knee - A right-angle support piece fitted horizontally to strengthen the joint between deck beams and the sides of the hull.
- Lug rig - A quadrilateral sail bent upon a yard that crosses the mast obliquely.
- Maststep - A structure into which the foot of the mast is fitted, its purpose being to

distribute the weight of the mast over the keelson.

- Midship beam - The longest beam on a vessel. It is lodged between the widest frame of timbers.
- Midship Frame - The frame which determines the extreme breadth of a vessel, indicated by the symbol .
- Mortice - A cavity, usually rectangular, cut in the surface of one piece of timber to receive the shaped end of another piece and so form a joint.
- Moulded - The measurement of height or width as seen in the body plan of a vessel. The moulded breadth of a vessel is the measurement athwartship to the outer face of the frames.
- Pintles - Metal brackets attached to the rudder, similar to gudgeons on the sternpost. The brackets have a number of downward-pointing pins to engage the gudgeons, or a hole through which a rod can pass, forming a hinge for the rudder.
- Pivot Pin - A thick bolt which bisects the centre-board trunk and upon which the centre-board swings.
- Plank - An individual longitudinal timber attached to the outer frame faces.
- Port - The left side of the vessel when one is facing forward.
- Rabbet - A groove cut into the keel, stem, or sternpost into which the external planing is seated.
- Rove (Roove) - A small circular or a square plate placed over copper nails or rivets before clenching or peining.
- Running Rigging - All rigging used in hoisting, lowering, or trimming the sails of a vessel.
- Scantlings - The dimensions of any piece of timber with regard to its breadth and thickness in shipbuilding.

- Scarf (Scarph) - A lapped joint connecting two timbers or planks together.
- Sheave - The wheel or pulley in the mortice of a tackle block over which the rope runs.
- Sheer - The sweep or longitudinal curvature of a hull as seen from the side.
- Shelf Clamp - A strong piece of timber running the length of a vessel inside the timber heads, binding the timbers together and supporting the deck beams.
- Shrouds - Heavy ropes which brace the mast athwartships.
- Sided - The measurement across the outer frame faces or tops of longitudinal timbers.
- Sloop rig - A fore-and-aft rig. When rigged on hulls of the type described here, the mainsail is attached to a gaff above, to the mast on its foremost edge, and to a long boom below. One or two headsails are set.
- Spritsail rig - A fore-and-aft rig, whereby the sail is bent to a short mast and held up by a diagonal spar or sprit.
- Square Frame - A frame that is perpendicular to the keel and extends across both sides of the hull.
- Stanchion - An upright supporting post.
- Starboard - The right hand side of the vessel when one is facing forward.
- Stempost - An upward-curving timber attached to the forward end of the keel, and into which the two sides of a vessel's bow are united.
- Stern knee - A knee which reinforces the join between the keel and sternpost.
- Sternpost - A perpendicular timber secured at its lower end to the after end of the keel;-  
- its upper end supports the transom.
- Stopwater - A wooden dowel driven across the seam of a scarf to deflect water travelling

along the seam and to prevent the timbers from shifting.

- Strake - A continuous line of planks extending from the stem to the stern.
- Thwarts - The seats or benches of a vessel upon which the rowers sit to manage the oars.
- Tiller - A piece of timber fitted into the mortice at the head of the rudder for the purpose of moving it from side to side to steer the vessel.
- Tonnage - (See Burthen).
- Transition Strake - The strake which forms the transition between carvel planking and clinker planking in a combination carvel-planked and lapstraked vessel.
- Transom - The transverse timbers at the stern of a vessel which give shape to the quarters and form the stern.
- Treenail (Trunnel) - A wooden fastening used to join hull timbers.
- Trim - The way in which a vessel floats on the water in relation to her fore-and-aft line.
- Turn of the Bilge - The area of the hull where the bottom curves to the side.
- Wale - A thick planking strake which strengthens the side of a vessel.
- Watercourses - (See limber holes).

## APPENDIX E

## LETTERS OF PERMISSION

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*Hon. Secretary:* N. A. M. Rodger, MA, DPhil, FSA, FRHist.S,  
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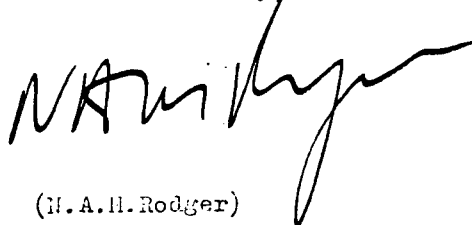
*Please reply to:* Hon. Secretary

*Date:* 9th April 1986

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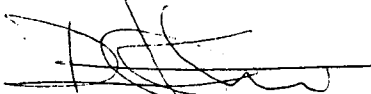
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We are happy to grant you permission to reproduce the gunboat  
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Yours sincerely,



David B. Kotin  
Head  
Canadian History Department.

sm

## VITA

Christopher Francis Amer

Born: August 5, 1951; Vancouver, British Columbia, Canada

Parents: Donald W. and Anne P. Amer

Education: University of British Columbia, 1969-1973, Anthropology  
Simon Fraser University, 1974-1975, B.A. in Archaeology

Address: 2882 G Cedarwood Drive, Ottawa, Ontario, Canada, K1V 7R1

Permanent Address: 225-28th Street, West Vancouver, British Columbia, Canada, V7V 4L7

Special Interest: Post-medieval small craft construction.

**Experience:**

1981 to present - Archaeological site assistant for the Archaeological Research Division of Parks Canada, Ottawa. Responsibilities in the field include underwater excavation and recording of sites, post excavation recording of timbers, and recovery and reburial of timbers to be recorded. Other responsibilities include archaeological report writing, cataloguing of all field photography, acquisition and maintenance of archaeological recording equipment, and transportation of field equipment. Field projects involved in while at Parks Canada are: Red Bay Archaeological Project (1981-1985), where Amer assisted in the excavation and recording of three Basque galleons and the remains of five smaller craft, including a 28-foot whaling chalupa; underwater survey around the Canso Islands, Nova Scotia; underwater survey of a submerged 19th-century bridge in the Rideau Canal at Jones Falls, Ontario; and mapping of an 18th-century French warship in Louisbourg Harbour, Cape Breton.

Spring 1981 - Assisted in a short survey of the remains of a steamboat in Caney Creek, Texas.

Summer 1980 - Member of TAMU graduate field school at Yorktown, Virginia. H.M.S. Charon Project.