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ORIGINAL ARTICLE

Durham Boat—Defining a Vernacular Watercraft Type

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Abstract Durham boats were a vital part of eastern North American inland transportation during the 18th and 19th centuries, but are underrepresented in the archaeological record. The discovery of a 19th-century shipwreck in Oneida Lake, New York, that closely resembles historical Durham-boat descriptions allowed for an analysis of this vernacular vessel type. The Oneida Lake shipwreck is fully described and compared to primary historical accounts to establish it as an archaeological example of the Durham-boat type.

Extracto Los barcos Durham fueron una parte vital del transporte interior del este de Norteamérica durante los siglos XVIII y XIX, pero están subrepresentados en el registro arqueológico. El descubrimiento de un naufragio del siglo XIX en el Lago Oneida, estado de Nueva York, que se parece mucho a las descripciones históricas de barcos Durham, permitió realizar un análisis de este tipo de embarcación vernacular. El naufragio del Lago Oneida se describe por completo y se compara con los datos históricos principales, para establecerlo como un ejemplo arqueológico del barco tipo Durham.

Résumé Les Durham étaient des bateaux constituant une part essentielle du transport continental de l'Amérique du Nord aux 18e et 19e siècles. Ils sont malgré cela sous-représentés dans les relevés archéologiques. La découverte, dans le lac Oneida à New York, d'une épave du 19e siècle ressemblant de près aux descriptions historiques des Durham, a donné lieu à l'analyse de ce type de bâtiment vernaculaire. L'épave du lac Oneida est intégralement décrite et comparée aux principaux récits historiques à disposition pour déterminer qu'il s'agit d'un exemple historique d'un type de bateau dit Durham.

Keywords inland waterways · ship construction · 19th century · New York · Great Lakes

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Introduction

Durham boats were instrumental in the economic development of the Mid-Atlantic and Great Lakes regions during the 18th and 19th centuries. These long, slender boats could each transport more than 20 tons (18 metric tons) of raw materials and finished products along the shallow rivers of New York, Pennsylvania, New Jersey, Delaware, Ontario, and, eventually, Wisconsin (Fig. 1), allowing the development of iron, salt, and other industries, and the expansion of

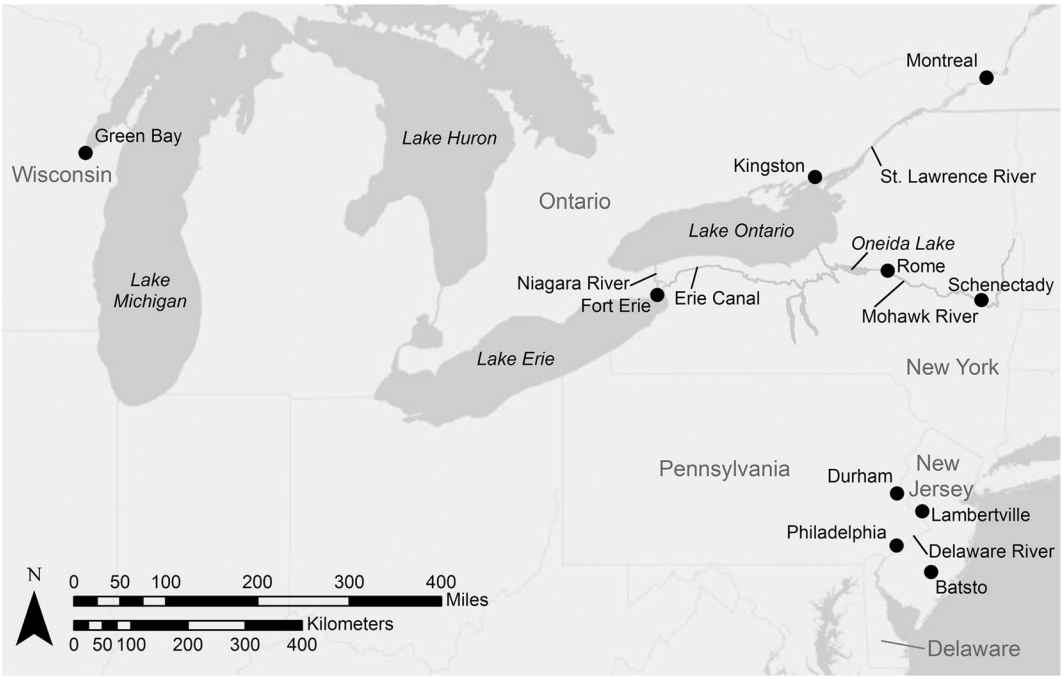

Fig. 1 Locations discussed in the text. (Map by Ben Ford, 2017.)

agricultural production. As these colonies-turned-states began to alter their rivers, Durham boats became the first canal boats in regions that were largely defined by their canals during the first half of the 19th century. These boats also played a short but important role in U.S. history. When the Continental Army under George Washington crossed the Delaware River, both in retreat and later to attack Trenton in 1776, the soldiers were carried by Durham boats (Rees 1998, 2000). Their use in these large troop movements illustrates the substantial numbers of Durham boats present along the Mid-Atlantic rivers at the time.

While Durham boats have played an important role in North American history, there are no previously identified archaeological examples, and they are rarely described in historical accounts. Like bateaux and other vernacular watercraft of the period, Durham boats were so common as to nearly escape notice. Unlike bateaux, however, Durham boats have not been discovered in archaeological contexts. For that reason the remains of a 62.5 ft. (19.1 m) long boat lost in Oneida Lake, New York, are significant, as they likely represent a Durham boat.

Use, Description, and Spread of Durham Boats

Durham boats are often associated with Robert Durham and the Durham Furnace of Bucks County, Pennsylvania. Many historians credit Robert Durham or one of his employees with developing this vessel type during the period from the 1730s through the 1750s as a way to move iron ore and products on the Delaware River (Anderson 1917; Bining 1933; Dunbar 1937; Brewington 1947; Tunis 1973; Davis 1975; Hager 1987; Rees 2000). While it is likely that Durham boats were in use by the 1730s, there is no record of a Robert Durham employed at the Durham Furnace (Anderson 1917:304; Frackenthal 1937; Hulan 1986:66). The Robert Durham story seems to have been propagated by Abraham Haupt (Houpt) in the 19th century and entered the documentary record in 1876, when William Davis published the results of an interview with Haupt in the first edition of *History of Bucks County, Pennsylvania* (Davis 1975; Hulan 1986:66). Whatever its specific origins, the Durham boat appears to have been developed along the Delaware River during the 18th century to haul bulk cargoes, such as iron and flour, to Philadelphia and other markets along the river. The design likely did not spring from a single individual, but developed from earlier designs and continued to evolve as the vessel type was adapted to local conditions throughout Pennsylvania, New Jersey, Delaware, New York, Ontario, and Wisconsin.

At approximately 60 ft. (18.3 m) long, 10 ft. (3 m) at the widest point, 3 ft. (0.9 m) deep, and capable of carrying nearly 20 tons (18 metric tons), Durham boats were the primary large cargo boats of the Mid-Atlantic and Great Lakes regions' inland waterways prior to the advent of the Erie and other canals. While too large for portage and requiring too much draft for the shallowest creeks, these vessels were well suited for operating in rivers such as the Delaware and Mohawk. Their large cargo capacity also made them more efficient than bateaux, which were more common on routes that required portaging or navigating rapids. If the bateau was the pick-up truck of the 18th century, the Durham boat was the tractor trailer (Lord 2003:1).

Relatively few detailed contemporary descriptions of Durham boats exist. The earliest account identified comes from Lewis Evans, who described a 1755 Delaware River Durham boat as "trough-like, square above the heads and Sterns sloping a little fore and aft: generally forty to fifty feet [12.2–15.2 m] long, six or seven [1.8–2.1 m] wide and two feet nine inches or three feet [0.8 or 0.9 m] deep and drawing twenty to twenty-two inches [0.5–0.6 m], when loaded" (Rees 2000:20). Two of the best early 19th-century descriptions are boatbuilder contracts from Canada. While these vessels were government contracts and were designed for operation on the St. Lawrence River and Lake Ontario, they are explicitly identified as Durham boats. The first contract was for 30 Durham boats to be built by John Blackwood at Kingston:

> Each Boat to be fifty Eight feet [17.7 m] long Measured at the Bottom, Eleven feet [3.4 m] broad and three feet [0.9 m] in depth. The bottoms of the said Boats to be made with Oak and the lower Streaks of Oak, the Upper Streaks of Pine, and the Knees of the said Boats to be Made with Iron, each boat to have one mast, a boom & a Gaff and Bowsprit, with one Steering Oar & Eight rowing Oars. Six or Seven feet [1.8–2.1 m] of the head of each Boat to be Covered for the purpose of Sheltering the Boatmen. (Blackwood 1814)

The second contract was for 10 Durham boats to be built during the same winter at Montreal by Nathan Allen and David Sears:

> Each Boat to be fifty feet [15.2 m] long, Eleven feet broad & Three feet [0.9 m] in height. The Bottoms of the said Boats to be constructed with Elm or Oak, the Lower Streaks to be of Oak and the Upper Streaks to be of pine. The Knees for the said Boats to be made of Cedar or Tamarack Wood ... with one mast, a boom and bowsprit to each Boat and one Steering Oar and Eight rowing oars to each boat. (Allen 1814)

Hough (1880:134), quoting John M. Duncan from his *Journal of Travels in 1818–1819*, describes another St. Lawrence Durham boat of the same period:

> The Durham Boats of the St. Lawrence are similar to those on the Mohawk. In smooth water they use sail or oars, but are forced up the rapids by incessant and laborious exertions with the pole. They are generally navigated by Natives of the United States. The one in which I sailed in May, was according to the information of the Captain, 62 feet [18.9 m] in keel, and 11 feet 4 inches [3.5 m] in beam. She carried about 26 tons (24 metric tons), and drew only 28 inches [0.7 m] of water, which sunk her gunwale within a few inches of the water; and to defend us in passing through rapids, a couple of stout planks, about a foot in breadth, were nailed along the sides; a precaution which, as we afterwards experienced, was no more than needful.

During his travels in 1807 and 1808, Christian Schultz (1810) drew a sketch of a Durham boat on the Mohawk River, and the boat is very similar to those described in Canadian waters (Fig. 2). Schultz's drawing, as well as the use of different types of wood for the bottoms of the vessels built at Kingston and Montreal, suggest that these boats were flat bottomed with a distinct angle between the sides and bottom, a hull shape often referred to as "hard bilges." Similarly, Schultz places the mast forward of midships, and his description indicates that the mast was removable. It is also worth noting that Shultz's sketch of a Durham boat shows it with a sloping stem, similar to a spoon bow. This bow shape would have been useful in beaching the boat.

Schultz (1810) goes on to describe Durham boats being propelled with setting poles. The poles were 18–22 ft. (5.5–6.7 m) long and weighed 10–12 lb. (4.5–5.4 kg), with a metal spike on one end and a wooden knob, called a button, on the other. The boats were also outfitted with 18 ft. (5.5 m) long oars to assist in traveling downstream and to propel

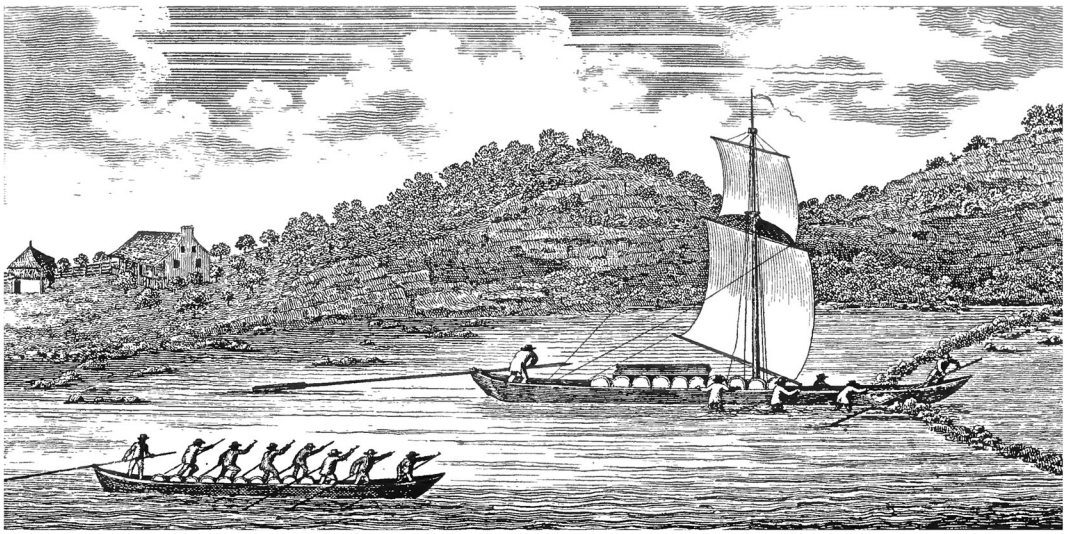

Fig. 2 A Durham boat passing through a wing-dam on the Mohawk River. The vessel in the foreground is a large bateau (Schultz 1810:7–8).

them in open water (Anderson 1917:297–298). The use of the setting poles attracted graphic descriptions from historical chroniclers:

> The men, after setting their poles against a rock, bank or bottom of the river, declining their heads very low, place the upper end or button against the back part of their right or left shoulders, (according to the side on which they may be polling) then falling down on their hands and toes, creep the whole length of the gang-boards [walking boards], and send the boat forward at considerable speed. The first sight of four men on each side of a boat, creeping along on their hands and toes, apparently transfixed by a large pole, is no small curiosity, nor was it until I observed their perseverance for two or three hundred yards, that I became satisfied they were not playing some pranks. (Schultz 1810:4)

Describing Durham boats on the St. Lawrence River, Canniff (1869:141) quotes an unnamed primary source and gives a slightly different description of polling:

> The chief instrument of steerage is a pole ten feet [3 m] long, shod with iron, and crossed at short intervals with small bars of wood like the feet of a ladder; the men place themselves at the bow, two on each side, thrust their poles into the channel, and grasping successively the wooden bars, work their way toward the stern, thus pushing on the vessel in that direction.

In 1839 Henry Francis Ainslie painted St. Lawrence River Durham boats being towed by a steamboat, an early version of the consort system that became common in Great Lakes shipping by the end of the century (Ainslie 1839).

John A. Anderson was one of the first historians to critically analyze the history and development of Durham boats in his article "Navigation on the Delaware and Lehigh Rivers" (Anderson 1917). Anderson drew much of his information from interviews with Wilson Lugar, who was approximately 78 years old in 1917 and one of the last Durham-boat operators on the Delaware River. Anderson described Durham boats:

> In section, the sides of the Durham boat were vertical, for the most part, with slight curvature to meet a like curvature of a part of the bottom, which, for the most of its width, was flat. Lengthwise, the sides were straight and parallel until they began to curve to the stem and stern posts, as some 12 or 14 feet [3.7–4.3 m] from the ends, where the decks fore and aft, began, the rest of the boat being open. The partly rounded form of the hull preserved at the ends, instead of being hollowed, as was usual in the Indian canoe. ... The ordinary length was 60 feet [18.3 m], although shorter boats were built, and, in some instances, the length was extended to even 66 feet [20.1 m], with sometimes a foot or two [0.3–0.6 m] added to the ordinary width of 8 feet [2.4 m]. The usual depth, from top of gunwale to the twelve-inch [30.5 cm] keel

> plank, was forty-two inches [1.1 m], with additional height of some ten inches [25.4 cm] at the ends, this and other minor features depending upon the fancy of the builder. The draft, light, was from three and a half to five inches [8.9–12.7 cm], and loaded, about twenty-eight inches [71.1 cm]. (Anderson 1917:296–297)

While noting that length, proportions, height of the ends, sharpness of the ends, and curvature of the hull varied among builders, Anderson (1917:297–298) went on to detail that the aft deck was often inclined slightly backward and the foredeck was cambered, both to shed water away from the interior. He also noted that the 12 in. (30.5 cm) wide keel plank was "part of the hull," suggesting that the vessel had slightly thicker hull plank running its length, rather than a true keel. Traction for pushing the boat upstream was provided by walking boards, approximately 12 in. (30.5 cm) wide, laid across the thwarts. The walking boards could be turned on side to form splashboards when descending rapids and removed to facilitate unloading bulk cargoes (Anderson 1917:297–298). Additional propulsion was provided by a sail mounted on a 33 ft. (10.1 m) tall removable mast with a 33 ft. (10.1 m) long boom. Along common routes there were also iron rings bolted to rock faces to allow ropes to be used to pull the boat forward. Steering was provided by a 33 ft. (10.1 m) long steering oar (Anderson 1917:297).

Thus outfitted, a Durham boat could have a crew of three (Anderson 1917:297) to nine (Schultz 1810; Rees 1998), always an odd number, with one man steering. The working life of these men would have been fairly austere:

> The furniture was of the most limited character. A large iron pot, with a side hole near the bottom for draught, served as a cook stove, with pieces of flat iron to hold the pan [on top]. There was a coffee-pot and a water bucket, and for each member of the crew a tin cup and plate and a knife and fork, and for all, the unfailing gallon jug of whiskey, from which, an old boatman stated, drinks were taken only at certain places. The men slept on "barn feathers" or straw, in the forward cabin, when the weather did not admit of sleeping in the open. (Anderson 1917:298).

One of the "certain places" was Dram Rock, at the foot of Wells Falls near Lambertville, New Jersey, where upbound crews would stop to refresh themselves (Anderson 1917:285). Today a popular rapids, Wells Falls contains the remains of an early wing dam built to increase water depth for Durham and other boats.

Durham boats eventually spread to Wisconsin by the 1820s, but retained many of their original characteristics. John Wallace Arendt described the Durham boats that he built at Green Bay during the 19th century as 45–60 ft. (13.7–18.3 m) long, 10–12 ft. (3–3.7 m) wide, 2.5 ft. (0.8 m) deep, and drawing 18–20 in. (45.7–50.8 cm) while carrying 25–30 tons (23–27 metric tons) (Arendt 1894). Arendt's Durham boats were built with 18 in. wide oak bottom planks. Oak was also used for one strake of planks above the turn of the bilge before transitioning to pine planks. The vessel was framed with 3 × 3.5 in. (7.6 × 8.9 cm) timbers and 4 × 5 in. (10.2–12.7 cm) thwarts spaced 9 ft. (2.7 m) apart. The ends of the vessel extended 8 ft. (2.4 m) from the stem and sternposts, the rest of the vessel being straight sided. The ends also rose slightly above the sides of the middle of the vessel. As with eastern Durham boats, both ends were decked. The Wisconsin Durham boats also had 2 × 4 in. (5.1 × 10.2 cm) coamings attached to the upper inside surface of the sides to increase strength and freeboard. These boats were equipped with 14 in. (35.6 cm) wide walking boards, 15 ft. (4.6 m) long setting poles, a mast and sail, and a towline. The Wisconsin Durham boats had a 20 ft. (6.1 m) long steering oar that pivoted on a socket or pin mounted on the sternpost. The oar was arched so that the inboard end of the oar was 3 ft. (0.9 m) above the deck when the boat was loaded. A crew of seven, a steerman plus six on the setting poles, worked these vessels (Arendt 1894).

Several historians have attempted to define the characteristics of Durham boats, the best being Robert Hager (1987) and Marion Brewington (1947). Others include Dunbar (1937), Rees (1998), and Tunis (1973). Similar to the primary accounts, the secondary descriptions vary slightly. As with any vernacular vessel type, regional variations and idiosyncratic building traditions can account for some of the variation evident in the primary and secondary historical descriptions of Durham boats. For example, Anderson noted that

> Mr. Lugar informed the writer that, at one time, he had, as an assistant in his work as a carpenter, a man from the Mohawk who knew the boats on that river, and who stated that they differed materially in size and model from the Delaware

Durham boat, the latter having partly rounded bottom, while the bottom of the Mohawk boat was flat. (Anderson 1917:305–306)

Complicating the description of Durham boats as a type and the identification of the Oneida Lake shipwreck is that there are no known archaeologically identified examples of Durham boats, although, as discussed below, the Deadman Bay III Wreck (66M15A3) from Kingston, Ontario, may be an example of this type of vessel (Moore 2008). However, from the historical record an outline of the type is evident. A Durham boat would be expected to be 45–60 ft. (13.7–18.3 m) long, 8–12 ft. (2.4–3.7 m) in beam, and 2–3.5 ft. (0.6–1.1 m) deep from the gunnel to the bottom (Table 1). The bilges are expected to be hard, with a nearly flat bottom. The hull is expected to be double ended, though not necessarily symmetrical, largely open, though possibly decked at the ends, and should have evidence of a single mast. It is likely that hardwoods were used for the bottom, while the sides were made of softwoods, and based on the construction methods of the time the entire vessel was fastened with iron nails and bolts.

Durham boats fitting this description diffused from the Delaware River along the major rivers of the Mid-Atlantic during the 18th century. They were present on New York waterways by the 1760s and became common by the 1780s and 1790s (Schultz 1810; Lord 1990). Durham boats reached western New York and were being used to haul cargoes up the Niagara River to Fort Erie, across the river from Buffalo, in 1799 (Guillet 1963:429–430). In central New York, Schenectady dominated the Durham boatbuilding trade, in large part due to its role as the major transshipment location on the Mohawk River (Yates 1902:121; Lord 1990). On Oneida Lake, Durham boats became common after 1803 when the Western Inland Lock Navigation Company opened its canal connecting Rome, New York, with Oneida Lake (Lord 2003). Farther north, Durham boats were in use on the St. Lawrence River between Kingston and Montreal by 1809 and continued to be used there and along the Rideau Canal until at least the 1830s (Canniff 1869; Anderson 1917:305). The vessel type also continued to spread across New York and the Great Lakes. They reached Seneca County, New York, in 1814 and were introduced to the Fox River in Wisconsin by John Penn Arendt in 1825 (Morrison 1876:43; Burridge 2001).

In all of these locations, Durham boats were primarily used for shipping bulk cargoes, often traveling in fleets of 100 vessels (Anderson 1917:299). Cargoes, such as flour, corn, wheat, iron, and whiskey, were shipped downstream on the Delaware River, with finished goods being brought back on the upstream journey (Brewington 1947:172). In northern New York, the vessels were often used to move salt from Syracuse to Lake Ontario, where it could be loaded onto larger vessels (Johnson 1877:61). Other New York Durham boats carried wheat, flour, and potash in bulk, as well as gypsum (Simms 1882:352). De Witt Clinton noted in his *Private Journals of 1810* that a Durham boat passing the locks at Rome drew "when full loaded, twenty-eight inches [71.1 cm] of water, and can carry a hundred barrels of potash or two hundred and forty barrels of flour" (Hager 1987:78). John Anderson (1917:296–297), who was very familiar with the operation of Durham boats, put the estimated cargo capacity slightly lower, with a boat 60 ft. (18.3 m) long carrying 150 barrels of flour or about 600 bushels of shelled corn.

Large Durham boats are generally described as carrying 15–20 tons (14–18 metric tons) of cargo downriver, though 2–5 tons (2–5 metric tons) was a more

Table 1 Summary of Durham-boat dimensions

Date	River	Length (Ft.)	Beam (Ft.)	Depth (In.)	Source
1755	Delaware River	40–50	6–7	33–36	Rees (2000:20)
1814	St. Lawrence	58	11	36	Blackwood (1814)
1814	St. Lawrence	50	11	36	Allen (1814)
1818	St. Lawrence	62	11.3	30–36	Hough (1880:134)
Ca. 1820	Mohawk	62.5	10	30	Oneida Lake Durham boat
Ca. 1830	Fox	45–60	10–12	30	Arendt (1894)
Ca. 1860	Delaware River	55–66	8–10	42	Anderson (1917:296–297)
Unknown	St. Lawrence	65.5	11.5		Moore (2008:Deadman Bay III Wreck)

common load. Some of the differences in capacity resulted from varying water depths, a significant factor in determining the load. The relationships between water depth and the cargo capacity of Durham boats became place names on the Mid-Atlantic landscape, with several rocks along the Delaware and other rivers named for the number of barrels of whiskey or flour that a Durham boat could safely carry when the particular rock was submerged. Direction of travel also affected cargo capacity. The boats carried significantly less upriver—approximately 2 tons (2 metric tons)—when they had to be worked with setting poles against the current. (Anderson 1917:285,295–297; Brewington 1947:172).

Durham boats remained the dominant means to move bulk cargoes on the Delaware and Mohawk rivers, as well as elsewhere, until the advent of canals brought a more efficient mode of transportation (Anderson 1917:309; Brewington 1947:172). The completion of the Erie Canal in 1825 and the Delaware and Raritan Canal in 1834 significantly reduced the demand for Durham boats, and the introduction of the railroads in the 1840s and 1850s completed their obsolescence. While old Durham boats continued to be used to collect sand or paver stones and occasionally to haul produce, Durham boats were largely absent from New York waters by 1830, and the last recorded Durham-boat voyage on the Delaware ended at Philadelphia in 1865 (Anderson 1917:296; Lord 1990).

Despite their relatively short period of dominance, Durham boats were important to the development of New York, the Mid-Atlantic, and Ontario. These vessels were New York's first canal boats, moving many goods along the short canals of the Western Inland Lock Navigation Company, unimproved rivers and lakes, and rivers marginally improved with wing dams (Lord 1990, 2003; Weiskotten 1991). As such, Durham boats were one of the primary vectors for the spread of commerce and settlement in central New York and throughout the Mid-Atlantic region.

Hull Description and Associated Artifacts

The Oneida Lake Durham-boat site was discovered by Timothy Caza in 2011, and the site was preliminarily mapped by the authors during 2013. The site was further investigated in 2015 through a combination of excavation and detailed recording. Divers under the direction of Ben Ford excavated test trenches at the bow, stern, and mast partner to expose the hull, which allowed shipconstruction details and the shape of the hull to be recorded in measured drawings and video footage (Ford et al. 2016).

Hull Description

The wreck is oriented perpendicular to the long dimension of Oneida Lake, with the bow pointing approximately south and the stern oriented to the north. The hull is 62.5 ft. (19.1 m) from the forward face of the stem to the aft face of the sternpost. The maximum beam is 10 ft. (3 m) to the outer faces of the frames, but there are hull planks lying outside the hull, so that the total site width is approximately 15 ft. (4.6 m) (Fig. 3). The hull lies nearly flat on the bottom, but with a slight slope (1:25) toward the stern, so that the stem extends approximately 2 ft. (0.6 m) above the mudline, while the sternpost is buried. The portions of the vessel exposed above the mudline are eroded and covered with a thick layer of zebra mussels (*Dreissena polymorpha*), but the portions beneath the mudline are very well preserved.

The white oak (*Quercus alba*) stem measures 6–8 in. (15.2–20.3 cm) molded and 9 in. (22.9 cm) sided, and is defined by a graceful curve (Fig. 4). Molded dimension is the measurement from the inside surface to the outside surface of a timber, while the sided dimension is the dimension visible in a plan view and perpendicular to the molded dimension. The top of the stem is 33 in. (83.8 cm) above the interior bottom of the hull (approximately 37 in. [94 cm] above the bottom of the keel plank). The lower portion of the stem is flat and in plane with the bottom of the vessel by 36 in. (91.4 cm) aft of its forward face. A 3 in. (7.6 cm) molded and 1 in. (2.5 cm) sided rabbet begins 5 in. (12.7 cm) below the top of the stem and runs the length of the timber extending beneath the hull, where it becomes inaccessible. The rabbet, a groove cut into the side of the stem and sternpost, would have received the ends and sides of hull planks, and three iron-fastener holes are still visible within the rabbet. The 1 in. (2.5 cm) dimension of the rabbet matches the thickness of the hull planking and would have allowed the planking to be flush with the surface of the stem. The 3 in. (7.6 cm) dimension provided an adequate surface for the plank ends to be nailed. The rabbet presumably narrows as the stem curves towards the keel and the angle of the planking changes. In addition to curving along its length, the exterior surface of the stem is beveled in section, so that

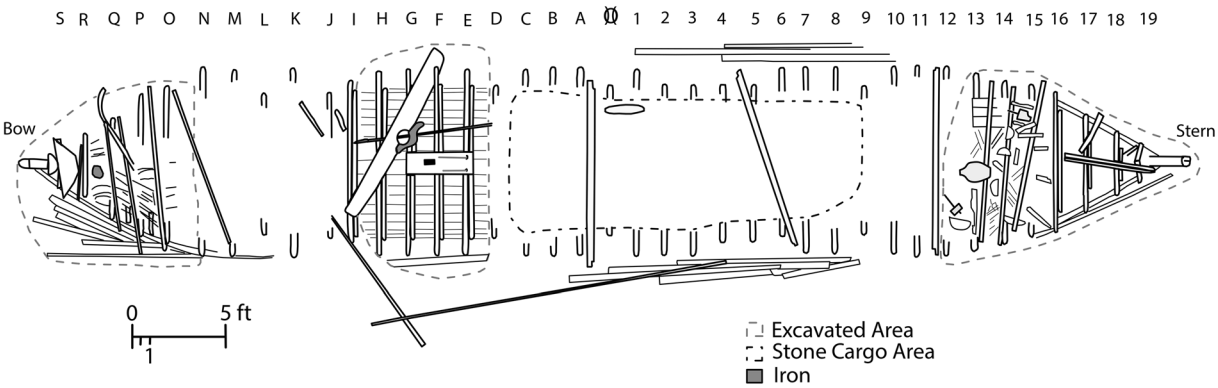

Fig. 3 Site plan, Oneida Lake Durham boat. (Drawing by Ben Ford, 2016.)

the forward face of the stem is 4 in. (10.2 cm) wide. An approximately 1.5 in. (3.8 cm) diameter bolt runs through the stem 2 ft. (0.6 m) below the top of the stem. The bolt is fastened with a nut on the interior and terminates in an irregular and corroded iron mass on the exterior. It is likely that the exterior portion of the bolt is broken, but it may have once held a towing ring or served to attach a rigging component, such as a bobstay. If it is a bobstay fitting, the Oneida Lake Durham boat had a more complicated sailing rig than is often attributed to Durham boats, but, nonetheless, a rig suggested by the bowsprit mentioned in the 1814 contract for the Durham boats built at Montreal (Allen 1814).

The white-oak sternpost has similar dimensions to the stem (6 × 9 in. [15.2 × 22.9 cm]), but rises at a significantly steeper angle (Fig. 5). The top of the sternpost is approximately 30 in. (76.2 cm) above the interior of the bottom of the hull and runs nearly straight and at an approximately 78° angle for its first 2 ft. (0.6 m) before curving sharply to intersect the bottom of the hull. The lower sternpost timber is flat and in plane with the bottom of the hull by 18 in. (45.7 cm) forward of its aft face. The sternpost is similar in section to the stem, with a 1 × 3 in. (2.5 × 7.6 cm) rabbet, and a convex exterior surface that constricts to approximately 2 in. (5.1 cm) on the aftermost face. The rabbet extends to 8 in. below the top of the sternpost. A 10 × 4 × 0.5 in. (25.4 × 10.2 × 1.3 cm) iron plate protrudes from the top of the sternpost. A 0.5 in. (1.3 cm) diameter hole is located at the upper end of the plate. The plate was likely the attachment point for a steering oar, and a rope through

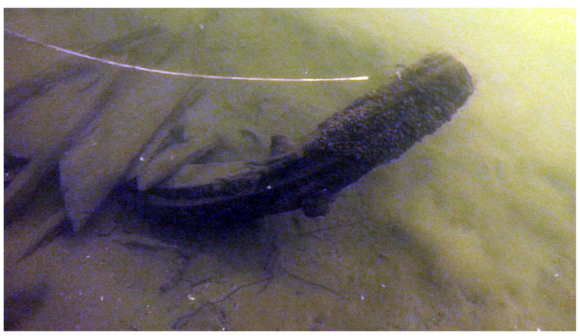

Fig. 4 Stem, view from starboard. Note dislodged bulkheads immediately aft of stem. (Photo by Timothy Caza, 2015.)

Fig. 5 Composite photograph of sternpost. (Photo by Timothy Caza, 2015.)

the hole may have held the oar to the plate, which acted as the fulcrum for the oar.

Both the stem and sternpost rabbets leave 3 in. (7.6 cm) of the post outside the hull planking. In the bow, where it was possible to feel the underside of the vessel, 3 in. (7.6 cm) of timber continues to protrude beneath the hull for as far as was accessible. Where the interior of the hull planking was accessible, the interior bottom of the vessel is flush. These dimensions suggest that the vessel has a 4 in. (10.2 cm) molded keel plank. This timber is not substantial enough to be called a keel, but it would have provided the hull with additional longitudinal strength. It is unknown whether the keel plank was rabbeted to receive the adjacent planks, or the keel plank was simply nailed to the frames like the other hull planks. The hull planking is 1 in. (2.5 cm) thick and ranges from 3 to 6 in. (7.6 to 15.2 cm) wide, with most planks being approximately 6 in. (15.2 cm) wide. The bottom planking is white oak, while the side planking is eastern white pine (*Pinus strobus*). The bottom planking of the vessel is intact, but much of the side planking fell away as the hull deteriorated. Side planks were noted outside the vessel along the length of the hull. There is intact side planking at the bow and stern, including in situ planks and planks that sprang as their iron fasteners gave way.

The 39 frames that define the shape of the hull were made of white oak and were fastened at regular 18 in. (45.7 cm) intervals along the length of the hull, except in the bow where they are slightly closer together (16–17 in. [40.6–43.2 cm]). The frames begin 2 ft. (0.6 m) from the stem and sternpost. Each frame timber measured 2.5 in. (6.4 cm) sided and 3 in. (7.6 cm) molded, with most frames made up of two timbers. In shipbuilding parlance, the room of the frames is 5 in. (12.7 cm) and the space of the frames is 11 in. (27.9 cm) at the bow and 13 in. (33 cm) at midships. The frames are indicated on the site plan aft of the midship frame by numbers (1–19), and forward of the midship frame by letters (A–S), both proceeding from "1" or "A" with increasing distance from the midship frame. From the stem to 10 ft. (3 m) aft, the breadth of the frames expands to a maximum beam of 10 ft. (3 m) (Frames S–N). The middle 40 ft. (12.2 m) of the vessel was straight sided with frames consistently 10 ft. (3 m) wide (Frames N–S and 1–12). The aft 12.5 ft. (3.8 m) contracts from the maximum beam toward the sternpost (Frames 12–19). The first two bow frames are full frames, shaped from a single piece of wood and reinforced with an oak bulkhead. The bulkheads were attached to the forward face of the frame and have a beveled forward edge to accommodate the slight rise of the hull. The fact that these bulkheads were made of oak rather than a softer wood suggests that they were included to strengthen the frame. The three frames aft of the two bulkhead-reinforced frames were constructed of a floor timber (the lower portion of the frame) with one futtock (the upper portion of the frame) iron nailed to each end. The futtocks overlap with the floor for approximately 12 in. (30.5 cm) along the bottom of the vessel, with the floor timber terminating just above the turn of the bilge. The midship frames are constructed of two floor timbers: an 8 ft. (2.4 m) wide timber that extends from bilge to bilge, and a 10 ft. (3 m) wide timber that extends from gunnel to gunnel (Fig. 6). Thus, the vessel has double frames along the bottom and a single frame above the turn of the bilge. These frame timbers are nailed to each other laterally. The frames are flat along the center 6 ft. (1.8 m) of the hull and then turn upwards for the final 2 ft. (0.6 m) on either side, reaching a height of 30 in. (76.2 cm) above the bottom. The stern framing is very similar to the bow framing, except the stern frames rise more steeply from the bottom of the hull, and the aftermost frame is a cant frame. The two halves of the aftermost frame are not perpendicular to the centerline of the vessel, but angle approximately 15° towards the stern. The two aft frames were reinforced with bulkheads on their aft faces. The upper surfaces of the frames were not always visible, but no nails were noted along the top surfaces of the frames. A 1 in. diameter limber hole runs through the center of all visible frame bottoms.

The boat's mast was mounted 21.5 ft. (6.6 m) aft of the stem, approximately one-third of the distance from bow to stern. The mast itself is not present, but the mast step and partner are extant. The step, which received the foot of the mast, consists of a 40 × 11 × 3 in. (101.6 × 27.9 × 7.6 cm) white-oak timber mortised over Frames G, F, and E (Fig. 7). A 3 × 6 in. (7.6 × 15.2 cm) notch was cut in the center of the timber just forward of Frame F. Two 1 in. (2.5 cm) diameter, approximately 20 in. (50.8 cm) long iron rods protruded from the top of the mast step, just forward of Frame E.

The dislodged white-oak mast partner lies across the wreck approximately 20 ft. (6.1 m) aft of the stem and just forward of the mast step. The 10 ft. (3 m) long partner measures 2 in. (5.1 cm) thick and 12 in. (30.5 cm) wide at its center with a taper toward the outboard ends. Originally this timber would have been mounted to the upper portions of the frames and would have held the mast at the level of the gunnels. A semicircular hole

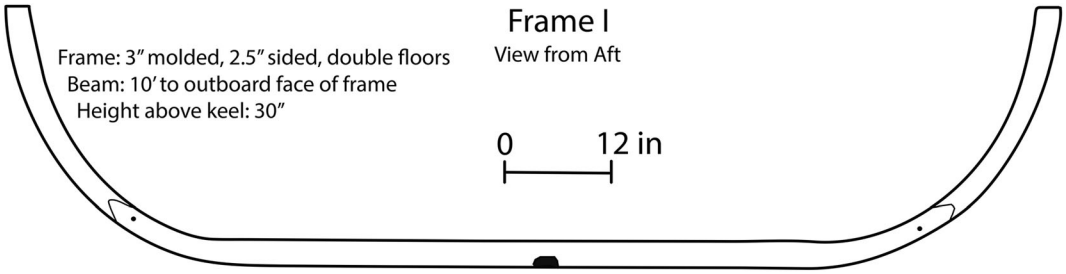

Fig. 6 Aft profile of Frame I. (Drawing by Ben Ford, 2016.)

on the aft edge of the partner is completed by an iron bracket. This hole likely received the mast and the iron bracket, which appears to include a latch on the starboard side, and allowed the crew to lower the mast. The ability to lower the mast while underway was necessary for the vessel to pass under a bridge.

The mast partner also served as a thwart, adding additional support to the upper portions of the frames and helping to resist the inward pressure of the water on the hull. Three additional white-oak thwarts were noted aft of the mast partner at 30.5, approximately 40, and 49 ft. (9.3, 12.2, and 14.9 m) aft of the bow (by Frames A, 5, and 12). These timbers measure between 2 × 4 in. and 2 × 5 in. (5.1 × 10.2 cm and 5.1 × 12.7 cm), and are 10 ft. (3 m) long, with a notch in both ends, likely to fit over the side of the vessel. The lengths of these thwarts and the mast partner affirm the 10 ft. (3 m) beam of the hull. There may have been a missing or unexcavated thwart forward of the mast step, at approximately 10 ft. (3 m) aft of the stem, to continue the pattern of a thwart approximately every 10 ft. (3 m) along the hull.

The aftermost thwart and possible forwardmost thwart likely supported small decks at either end of the vessel. There is clear evidence of these decks in the form of deck beams and concentrations of dislodged and deteriorated deck planking at both ends of the hull. In the bow, five approximately 2 × 2 in. (5.1 × 5.1 cm) deck beams lay across the hull. These beams fell into the vessel as the upper portions of the hull deteriorated, but increase in length moving away from the bow, suggesting that they fell near their original positions and were not subsequently disturbed. The aftermost beam was likely attached to Frame N. Mixed with the deck beams and lying on top of the frames is a jumble of approximately 6 in. (15.2 cm) wide planks. The majority of the planks are broken and deteriorated, suggesting that they are a softwood. These planks are likely the remains of the forward deck and possible interior ceiling planking that originally lined a forward compartment beneath the forward deck. The stern deck was similarly constructed. Three deck beams are associated with Frames 13, 14, and 15 (Fig. 8). Aft of these beams there are three possible deck beams lying within the hull, including a double timber that extends to the sternpost. It is unclear whether these are disarticulated deck beams or the aft portion of the rear deck was partially supported

Fig. 7 Mast step and partner. The mast step is situated in the *center* of the frame. Note that the step is notched over the double frames. The iron bracket of the mast partner is situated in the *bottom right* of the frame. View toward port. (Photo by Timothy Caza, 2015.)

Fig. 8 Stern deck beams and port-side frames. (Photo by Timothy Caza, 2015.)

by the double timber running along the axis of the vessel in the form of a carling. This area is also dominated by disarticulated softwood planks that are likely the collapsed remains of the deck. An area of intact ceiling planking was noted on the starboard side of the vessel, terminating at Frame 13. These planks were identified as eastern white pine and confirm that the interior of the aft compartment was at least partially lined with ceiling planking to protect anything stored there from water in the bottom of the boat.

A possible walking board was observed among the hull planks lying outside the port midship section of the hull. The forward end of this large, approximately 18 in. (45.7 cm) wide plank was noted among the smaller hull planks, but the aft end was buried, so the total length is unknown. Two approximately 2 × 4 in. (5.1 × 10.2 cm) holes, oriented along the long axis of the plank, had been cut into the face of the board. The holes were at the approximate midpoint of the plank, but on the edge closer to the hull. These holes may have been handholds for moving the plank, but their definite purpose is unknown.

Artifacts

In addition the hull remains, several artifacts were noted within the hull. Two setting poles were recorded near the middle of the vessel. Both poles were approximately 2 in. (5.1 cm) in diameter and terminated in an iron tip. One setting pole was located outside the hull on the port side from approximately Frame H to Frame 4. This pole was fully uncovered and measured 19.5 ft. (5.9 m) long. The second pole was uncovered beneath the mast partner. The iron tip of this pole is situated near Frame I, but the distal end of the pole was not excavated. A wood sample from the setting poles was identified as likely to be white ash (*Fraxinus americana*), but possibly black ash (*F. nigra*).

A cast-iron tea kettle was noted in the bow, approximately 4 ft. (1.2 m) aft of the stem. A 12 × 1 3/8 × 0.5 in. hardwood bar was recovered from immediately forward of the sternpost. The stern compartment area also contained a wooden mallet, a wooden scoop, a stoneware jug, and the remains of several barrels (Fig. 9). The wood scoop was located at the turn of the bilge, on the starboard side of the hull between Frames 14 and 15. The wooden mallet was recovered on the port side of the hull, lying on the flat bottom of the vessel between Frames 12 and 13. The area around the

Fig. 9 Artifacts recovered from the stern area (*top to bottom*): wooden scoop, wooden mallet, and stoneware jug. (Photos courtesy Lake Champlain Maritime Museum, 2015.)

mallet and scoop is littered with barrel staves and partial heads, suggesting that a number of barrels were stored within the stern compartment. The association between the scoop and several of the staves suggests that the scoop may have been inside a barrel at the time of sinking. Finally, the stoneware jug was recovered along the centerline of the vessel, between 51 and 52 ft. (15.5 and 15.9 m) aft of the stem. The jug was uncovered beneath a thin layer of sediment and above the other artifacts in the stern area, suggesting that it may have been on the stern deck, rather than in the stern compartment, when the boat sank. The 1.5 ft. (0.5 m) tall, gray jug is covered with a clear salt glaze and has the remains of simple cobalt-blue decoration of five angular lines near the shoulder. The jug has a tooled lip with three tooled lines beneath it. Vessels of similar shape were made throughout the first half of the 19th century (Greer 2005).

Cargo

The central portion of the shipwreck was dominated by a pile of stones approximately 2 in. (5.1 cm) square and 0.5 in. (1.3 cm) thick. The pile extended from approximately 26 ft. (7.9 m) aft of the stem to 45 ft. (13.7 m) aft, and covered the entire bottom of the hull to a height of approximately 1.5 ft. (0.5 m) above the bottom. After consulting with the staff of the New York State Geological Survey and Dr. Carlton Brett (University of Cincinnati), the stone was identified as a silty dolostone of the Salina Group. This type of stone is associated with the Camillus Formation that occurs within a band of Silurian-aged rock extending across west central New York and immediately south of Oneida Lake. The volume of the remaining stone cargo is approximately 100 cu. ft. (2.8 m^3), which weighs approximately 5.25 tons (4.76 metric tons) (Glover 2005:660). This weight, as well as the amount of space that the stone occupied within the hull, suggests that it was cargo rather than ballast. It is unknown whether the vessel was carrying additional cargo that floated or deteriorated.

Discussion—Oneida Lake Shipwreck as a Durham Boat

Description of the Vessel as Built

When originally built, the Oneida Lake Durham boat was 62.5 ft. (19.1 m) long overall, with an internal length of 61.5 ft. (18.8 m) between perpendiculars, and a length along the keel plank, representing the flat-bottom length of the vessel, of approximately 58 ft. (17.7 m) (Fig. 10). The maximum beam of the vessel was 10 ft. (3 m) to the inside of the planking, with an additional 2 in. (5.1 cm) added with the planking. The bow narrowed from 10 ft. (3 m) aft of the stem and the stern narrowed from 12.5 ft. (3.8 m) forward of the sternpost. The sides were 30 in. (76.2 cm) high, with little, if any, sheer, or rise, toward the end. The keel plank may have protruded an additional 3 in. (7.6 cm) beneath the hull. The majority of the hull was constructed of white oak, which would have provided significant strength, but eastern white pine was used for the side planking to reduce weight in the portion of the hull least likely to contact hard surfaces, either intentionally or inadvertently.

The shape of the hull was defined by the sternpost, stem, and frames. The stem is made of a naturally curved (compass) timber with a gentle arc. The natural curve of this timber would have increased its strength and allowed the boat to be easily beached for loading, unloading, and stops. This shape also would have lessened the damage when the boat inevitably ran into rocks and bars in shallow rivers. The stern also appears to be built from a compass timber, though at a steeper angle. It was less necessary to have a gentle arc toward the stern, as the boat was less likely to back into obstacles, although the obtuse angle of the stern likely helped deflect following water and prevent it from swamping the vessel. The steeper angle of the stern also increased the usable space in the stern of the boat. The use of a compass timber for the stem and sternpost indicates the wealth of shipbuilding timber that New York builders had access to at that time. The majority of the frames have a pronounced, but not hard, turn of the bilge, forming a capacious hull with flat floors. The curve of each frame is defined by a 30 in. (76.2 cm) radius circle, so that two 60 in. (152.4 cm) diameter circles touching at the midpoint of the frame match the curve of the frame (Fig. 11). This may indicate how the frames were formed, with this geometry being used to scribe the shape of the frame onto the timber from which it was cut. The frames at the bow and stern vary slightly. The bow frames retain the curve of the midship frames, simply narrowing the flat floor portion as they approach the stem. The forwardmost two frames are also shorter to accommodate the slight rise in the stem. The forward stern frames maintain the curve and only narrow for the first few feet, but by the aftermost three frames the frames are nearly vertical. This construction would have

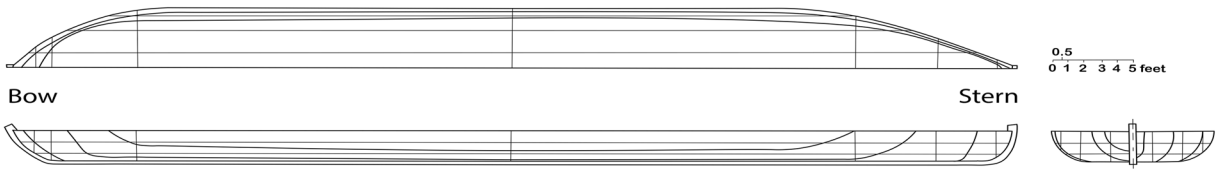

Fig. 10 Oneida Lake Durham boat reconstructed lines. (Drawing by Ben Ford, 2016.)

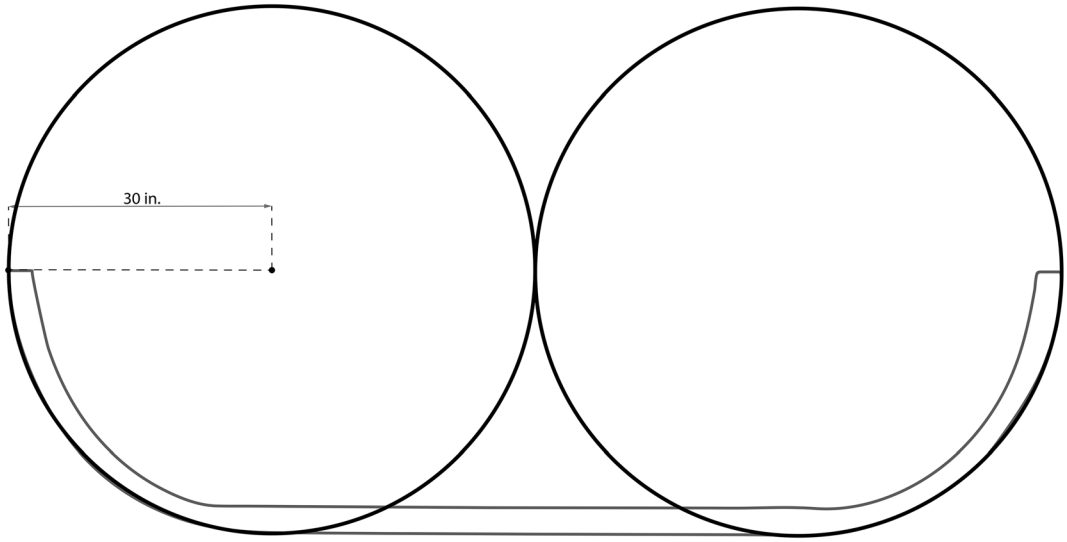

Fig. 11 Two 60 in. (152.4 cm) diameter circles superimposed on a midship frame illustrating the possible design geometry of the Oneida Lake Durham boat. (Drawing by Ben Ford, 2016.)

produced a narrower and less rounded stern, which may have helped with steering. The angle of the aftermost frame, approximately 15° off perpendicular to the centerline, may have been a concession to the narrow stern. If not angled, the last frame would have been dubbed almost out of existence to accommodate the hull planking, but with the angle the frame was able to retain much of its molded dimension and strength. No nails were identified on the interior surfaces of the frames, suggesting that the planking was nailed to the frames from the outside.

Both ends of the vessel were decked with softwood planks (Fig. 12). The stern compartment also had ceiling planks along its bottom. The evidence for a floor within the bow compartment is less clear, but the amount of softwood planking in this area makes it likely. There was no ceiling planking of floor boards in the remainder of the hull, so the cargo would have sat directly on the frames and hull planks.

Two setting poles with iron tips were associated with the shipwreck. It is unknown whether these were the only poles on the vessel when it was in use. Similarly, the wreck has clear evidence of a mast, but the mast itself is missing. It is likely that the mast was pulled free as the vessel sank. Unless it was tightly furled, the sail would have caused substantial drag as the vessel went down, and it is likely that the mast was dislodged at that time and either floated away or sank away from the hull. If not lost in the sinking, the mast would have only been 10–20 ft. (3–6.1 m) below the surface when the vessel

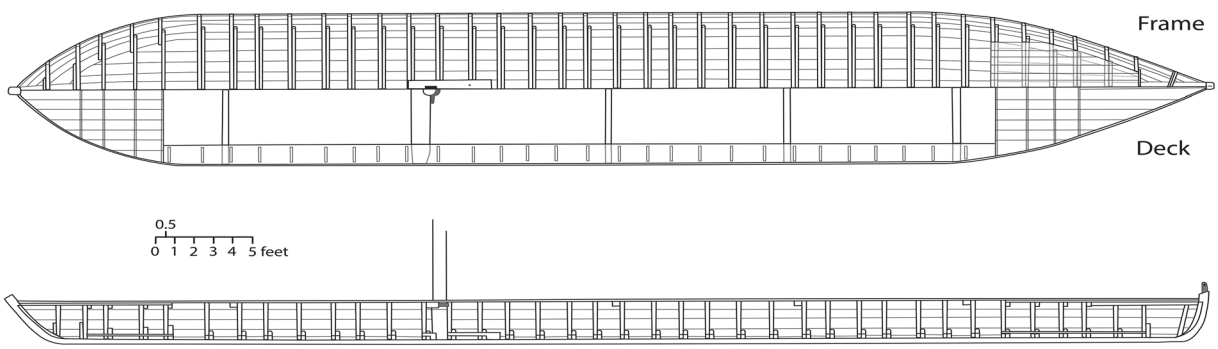

Fig. 12 Reconstruction of the Oneida Lake Durham boat. The *upper half* of the *upper image* shows the boat at the level of the frames, the *lower half* shows the deck level. The *lower image* illustrates the boat as it would appear from the centerline looking toward starboard. Light gray lines indicate hull structure obscured by planks. Dark gray indicates iron. (Drawing by Ben Ford, 2016.)

came to rest on the bottom. In that position it may have also been removed by human or natural forces. The loss of the mast was likely facilitated by its removable design, as evidenced by the bracket on the mast partner. The rest of the equipment associated with a Durham boat: oars, steering oar, and walking boards, are missing. It is possible that these were dislodged as the vessel sank. While the setting poles were likely stowed inside the vessel as it crossed the open lake and their iron tips and hardwood would have caused them to sink with the vessel, other equipment may have been of softwood and not safely stored within the boat. The oars and steering oar were likely in use and simply floated as the vessel sank. The lack of definitive evidence of the walking boards suggests that they were not attached to the thwarts. One of these boards may be lying outboard of the vessel.

The original vessel displaced approximately 36.7 tons (33.3 metric tons). Assuming 1 ft. (0.3 m) of freeboard, the vessel would have displaced approximately 22 tons (20 metric tons) when loaded. Given the weight of the vessel itself, as well as the crew and equipment, this value is very close to the historically recorded 20 ton (18 metric ton) capacity of Durham boats. Loaded with the cargo of stone, the boat had a draft of approximately 5 in. (12.7 cm), plus the possible 3 in. (7.6 cm) keel plank, so that it could have passed through waters having a depth of just over 8 in. (20.3 cm). Conversely, the boat would have had approximately 2 ft. (0.6 m) of freeboard on its last voyage, assuming that the stone was the only cargo.

Use and Loss of the Vessel

Life for the crew aboard the Oneida Lake Durham boat seems to have been spartan. The only artifacts directly associated with the crew are the stoneware jug and the iron tea kettle. It is tempting to associate the jug with the jug of whiskey that Wilson Lugar ascribed to John Anderson (1917:298), but it could just as easily have contained water or apple cider. The location of the kettle near the bow might suggest that the vessel's stove was situated in the bow, although no evidence of the stove was found. The lack of tools and other items in the bow might also support the historical claim that the crew slept in the bow compartment. The stern compartment seems to have been for storage, as it contained barrels, the wooden mallet, and the scoop. The barrels may have contained water, food, or other provisions for the crew. The well-worn scoop may have been used to remove grain or other produce from the barrels and may have, in fact, been in a barrel when the vessel sank.

A search of historical New York newspapers has not yielded any candidates for the Oneida Lake Durham-boat shipwreck, so it is impossible to know exactly how the vessel was lost, but the details of the site do suggest an outline of the boat's final voyage. The members of the crew may have loaded the dolostone on the south shore of Oneida Lake, not far from where it outcropped. They were possibly transporting it across the lake or to a destination farther east or west. Attempting to sail across the short dimension of the lake would explain why the boat sank in the middle of the lake, when staying closer to the shore would have been safer. Wherever the destination, the crew made it to the center of the lake before the vessel sank. With its bow pointing south, the wreck is oriented perpendicular to the predominant direction of wind and waves on Oneida Lake. This may be because the boat was overcome by a storm, turned sideways by the waves, and was swamped, or because the vessel's orientation shifted as it drifted the 40 ft. (12.2 m) to the bottom. If the vessel was sunk in a storm, it is unclear why the captain risked his life for the relatively worthless cargo found on the site. It may have been that the light load and increasing breeze led him to believe that he could beat the storm across the lake. Whatever the circumstances, it would seem that the captain misjudged Oneida Lake, his boat, his skills, or some combination of these factors.

It was considered that the boat was scuttled and that the "cargo" was simply used to carry an old boat to the bottom of the lake. However, the presence of the jug, setting poles, and kettle suggest that the vessel had not been scavenged of salvageable materials. Furthermore, it would have been more convenient to scuttle the boat closer to shore.

Comparison with Historical Descriptions and Archaeological Correlates

The hull remains embedded in the bottom of Oneida Lake closely match the historical descriptions of a Durham boat. The only major construction difference between the Oneida Lake boat and historical descriptions of Durham boats is the absence of knees. Early 19th-century St. Lawrence River Durham boats are described as having knees (Allen 1814; Blackwood 1814), presumably connecting the frames and thwarts, but no

knees were noted on the Oneida Lake wreck. All other evidence, however, points to the identification of this vessel as a Durham boat. The dimensions and carrying capacity fall within the range described by 19th-century commentators, and while this would have been considered a large Durham boat, it was likely not the largest in the region. The long narrow hull shape with a flat bottom and straight sides also conforms to the historical descriptions. The transition from the bottom to sides is somewhat more rounded than some accounts implied, although Wilson Lugar did describe Susquehanna River Durham boats as having rounded bottoms (Anderson 1917:305–306). Similarly, the Oneida Lake boat is double ended, consistent with all historical descriptions, but indicates that the ends are not identical, having an identifiable bow and stern. The use of oak for the lower planking and pine for the upper hull also seems to have been consistent during the 19th century (Allen 1814; Blackwood 1814; Arendt 1894). The Oneida Lake boat also confirms the presence of small decks at both ends of the vessel (Arendt 1894; Anderson 1917:296–297). The likelihood that this shipwreck is the remains of a Durham boat is bolstered by the presence of setting poles and a removable mast, which are closely associated with the propulsion of Durham boats. Furthermore, there are no other boat types known to have operated on Oneida Lake that match the dimensions and characteristics described above. Based on this evidence, the hypothesis that the shipwreck represents the remains of a Durham boat is supported. One confounding factor is the lack of any temporally diagnostic artifacts that link the wreck to the first half of the 19th century, the period when Durham boats were most common on the inland waterways of New York. There are, however, also no artifacts or construction features that suggest a later period. The site can therefore be dated to ca. 1803–1840, the period between the date the Western Inland Lock Navigation Company opened Oneida Lake to Durham boats and when the Erie Canal made Durham boats obsolete in central New York.

The identification of the Oneida Lake shipwreck as a Durham boat allows for a reconsideration of other archaeological evidence. It is likely that the Deadman Bay III Wreck (66M15A3) near Kingston, Ontario, is also an example of this type of vessel (Moore 2008). The dimensions, shape, and framing of this vessel are very similar to the Oneida Lake shipwreck, and the possibility that it was a Durham boat was suggested by the original investigator, Ken Mullings (Mullings and Butterworth 1987). The Deadman Bay III Wreck is 65.5 ft. (20 m) long and 11.5 ft. (3.5 m) wide with a flat bottom. The 2 in. (5.1 cm) thick hull planking and 2.75 × 2.33 in. (7 × 6 cm) doubled frames spaced 17.7 in. (45 cm) apart also closely resemble the Oneida Lake boat. However, the presence of three sets of tripled frames, the protruding centerline nails that suggest a missing keelson, and potentially different bow construction indicated by an iron cutwater strap all indicate that the Deadman Bay and Oneida Lake boats are not identical (Mullings and Butterworth 1987). Further investigation of the Deadman Bay III Wreck is likely to provide useful information on regional variation among Durham boats and help to refine the defining features of the type.

The Batsto Boat of Batsto Village, New Jersey, has been described as a Durham boat, but its length, the ratio between length and beam (43 ft. [13.1 m] long, 10 ft. [3 m] beam, and 30 in. [76.2 cm] deep), and its heavy keel and keelson do not conform to most historical descriptions of Durham boats. The Batsto Boat likely carried iron ore for the associated furnace and was dated to the first half of the 19th century, but also had evidence of post-1870s repairs (Starkey 1963; Ewing 1971; Hulan 1986). The dimensions of the Batsto Boat and the reconstructed Durham boats at Washington Crossing Historic Park and Durham Township Historical Society suggest that there is a good deal of variety in what has been previously called a Durham boat (Durham Township 2016; Washington Crossing Historic Park 2016).

Conclusion

This article has demonstrated the close correspondence between the Oneida Lake shipwreck and historical descriptions of Durham boats, but the variety of wrecks and reconstructions that have been previously identified as Durham boats, as well as the differences between the Oneida Lake and Deadman Bay III vessels, make it important to note the diversity of vessels in use on inland waterways during the 18th and 19th centuries, the assortment of terms applied to these vessels, and the flexibility of historical commentators in applying names to vessel types. Historical descriptions often mention other boat types in conjunction with Durham boats, such as Mohawk and Schenectady boats. These boat types were likely similar, possibly varying only in terms of length, construction details, and place of construction

(Schultz 1810; Anderson 1917:305–306; Hulan 1986:68; Burridge 2001:53). The consistent use and description of the term "Durham boat" from Delaware to Ontario to Wisconsin does, however, argue that Durham boats are an emic type that was identifiable by knowledgeable individuals during the 18th and 19th centuries.

Durham boats were also part of an evolving suite of vessels that reflected local variation while retaining several similar characteristics. The Oneida Lake Durham boat has several similarities with the shallop-vessel type. The shallop type predates the Durham-boat type by more than a century and was used along the coasts, rather than rivers, but may have influenced the design of Durham boats. On inland rivers, Dunbar (1937:282) and Ringwalt (1888:10) both associate Durham boats with the keelboats used on the Ohio River and its tributaries. Similarly, Durham boats bear a striking resemblance to the James River bateaux in terms of dimensions and use (Terrell 1992). Durham boats may have also influenced other inland watercraft. Most notably, the builders of *Codorus*, the first iron-hulled vessel built in the United States, may very well have had the success of Durham boats in mind when they designed their 60 ft. (18.3 m) long and 9 ft. (2.7 m) wide hull along the Susquehanna River in 1825 (National Iron and Steel Heritage Museum 2012). How these North American vessels relate to one another and whether they are the product of independent invention, possibly in multiple different places; diffusion of vessel types with European settlers; or the adaptation of European boats to American waters remains to be studied.

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Compliance with Ethical Standards

Conflict of Interest Statement On behalf of all the authors, the corresponding author states that there is no conflict of interest.

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