

From Quarry to Quay: Shipwrecks of McCracken's Cove

The 2001-2002 Sturgeon Bay Wreck and Wharf Investigation
at the Birmingham Site



Bradley A. Rodgers, James D. Moore III, Annalies Corbin,
Jacqueline D. Piero, and Andrew Pietruszka

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Cover: Andy Weir at the datum point setting up the transit and EDM on the old Graef and Nebel Quay.
This section of the loading dock may contain two more buried vessels (Program in Maritime Studies).

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Abstract

In September 2001 and 2002, ECU's Program in Maritime Studies supported by the Wisconsin Historical Society conducted two field semester projects on the north shore of Sturgeon Bay, Wisconsin, a place locally known as McCracken's Cove. The site included the area between Birmingham's Cottages and the old Graef and Nebel quarry jetty, perhaps 500 feet (152.5m) of shoreline. In this area the ECU team located the remains of four wooden vessels – two scow schooners, one canal schooner, and one steam barge. One vessel was determined to be the wreck of the stone barge *Dan Hayes* while two of the three abandoned vessels incorporated into the jetty were determined to be *J.S. Williams* and *Cleveland*. Each of these vessels, including one unidentified vessel located near the tip of the quay, were documented in place and examined archaeologically.

Research indicates that the dolomitic limestone mining industry that flourished in Sturgeon Bay toward the close of the nineteenth century and the early part of the twentieth century gathered wooden ships from around the lakes for conversion to stone transportation barges. When the barges became un-seaworthy and no longer functional for cargo hauling it appears they were used to extend quarry quays. In this process, someone simply positioned, scuttled, and filled the vessel with stone riprap. Two additional vessels may lay buried beneath the shore side of the old wharf. Placement of vessels within the wharf indicates its morphology and how people designed, constructed, and modified the quay through time.

The sunken vessels themselves represent an extremely valuable resource concerning the maritime history of the Great Lakes. Of the three wrecks identified by name, *Dan Hayes* is a scow schooner, *J.S. Williams* is a canal schooner, and *Cleveland* is a steam barge. These vessel types are underrepresented among documented vessels, while *Cleveland*, through this study, becomes the oldest extant example of Steam Barge yet documented.

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Field assistance to ECU and WHS crew members was provided by the Wisconsin Underwater Archaeology Association (WUAA), and special thanks goes to Russell Leitz, Bruce Burrows, Danny Aerts, Kristy Lingo, and Jim Ankney for their help in documenting the wreck site. Visiting Scholar Patrick Labadie was of great assistance concerning Great Lakes History. We would also like to thank Jon Van Harpen for offering his insight and sharing his personal historic documents.

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It would have been impossible to complete this project without the dedication of the following ECU graduate students who conducted the fieldwork and research: 2001, Alena Derby, Keith Meverden, Jason Paling, John Hart Asher, Kate Goodall, and 2002, Brian Jaeschke, Samuel Blake, Christopher Valvano, Jackie Piero, Andrew Pietruszka, Jimmy Moore, and Andrew Weir. Last, thanks to Nadine Kopp and Seth Walton for their assistance in the compilation of this report. The Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA05NOS4191067, funded this project. Additional support was provided by the University of Wisconsin Sea Grant Institute.

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Introduction

The city of Sturgeon Bay, straddles the Sturgeon Bay Ship Canal forming the southern border of Door County, Wisconsin, it has historically taken a significant role in promoting and accommodating trade throughout the Great Lakes (Figure 1). The ship canal, finished in 1879 formed a short cut through the peninsula allowing ships to bypass the contrary wind, currents, and reefs of Death's Door. Commodities passed through the canal going to different destinations but at one time Sturgeon Bay's economy depended almost entirely on the maritime-based trade in dolomitic limestone.

The stone trade played an essential role in supporting the community from 1880 to the Great Depression. Dolomite quarried from Sturgeon Bay was transported around Lake Michigan mainly for the construction of piers and breakwaters. Since the quarries were located directly on the bay, the only practical way to transport this limestone was by water, utilizing barges that could carry the hefty cargo. These barges were not purpose built vessels but ships that were adaptively reused for the purpose. When these barges became too old and un-seaworthy, they were intentionally scuttled and incorporated into the quays or jetties owned by the various quarry companies in order to extend their deep-water loading face. This practice was more economical than simply disposing of or breaking the unwanted vessels, since wooden support cribs were expensive, and the lumber had to be cured for nearly three months before it could be used (Moore 2003: 1, 132).

The practice of extending piers with abandoned ships makes Sturgeon Bay an ideal site for archaeological study. Seemingly every ship type used on the lakes eventually made its way into the archaeological record in this manner. Archaeologists can, in this case, use Sturgeon Bay to study the construction of many different ship classes all in one area, rather than suffer through a hit and miss searching process to discover scattered examples left on the lake bed from foundering and collision events. During September 2001 and 2002, an archaeological survey was conducted in McCracken's Cove located along the northern shore of Sturgeon Bay, where the former Graef and Nebel quarrying company constructed a loading wharf near the turn of the twentieth century (Figure 1). The survey built on information gathered in 2001 in the documentation of the wreck of the scow schooner *Dan Hayes*. The jointly sponsored project included contributions by East Carolina University's Program in Maritime Studies (ECU) and the Wisconsin Historical Society (WHS), and was partially supported by Wisconsin Sea Grant. The archaeology team's primary goal was to complete a Phase II pre-disturbance survey of the wreck of *Dan Hayes* and three other vessels that had been purposely integrated into the Graef and Nebel wharf's structure. The wreck and three abandoned vessel's were studied and mapped, and their positions and conditions were

analyzed (Figure 2). Though the identity of one jetty watercraft remains a mystery, the other two have been tentatively identified as the barge conversions of the schooner *J.S. Williams* and passenger/package freight propeller *Cleveland*.

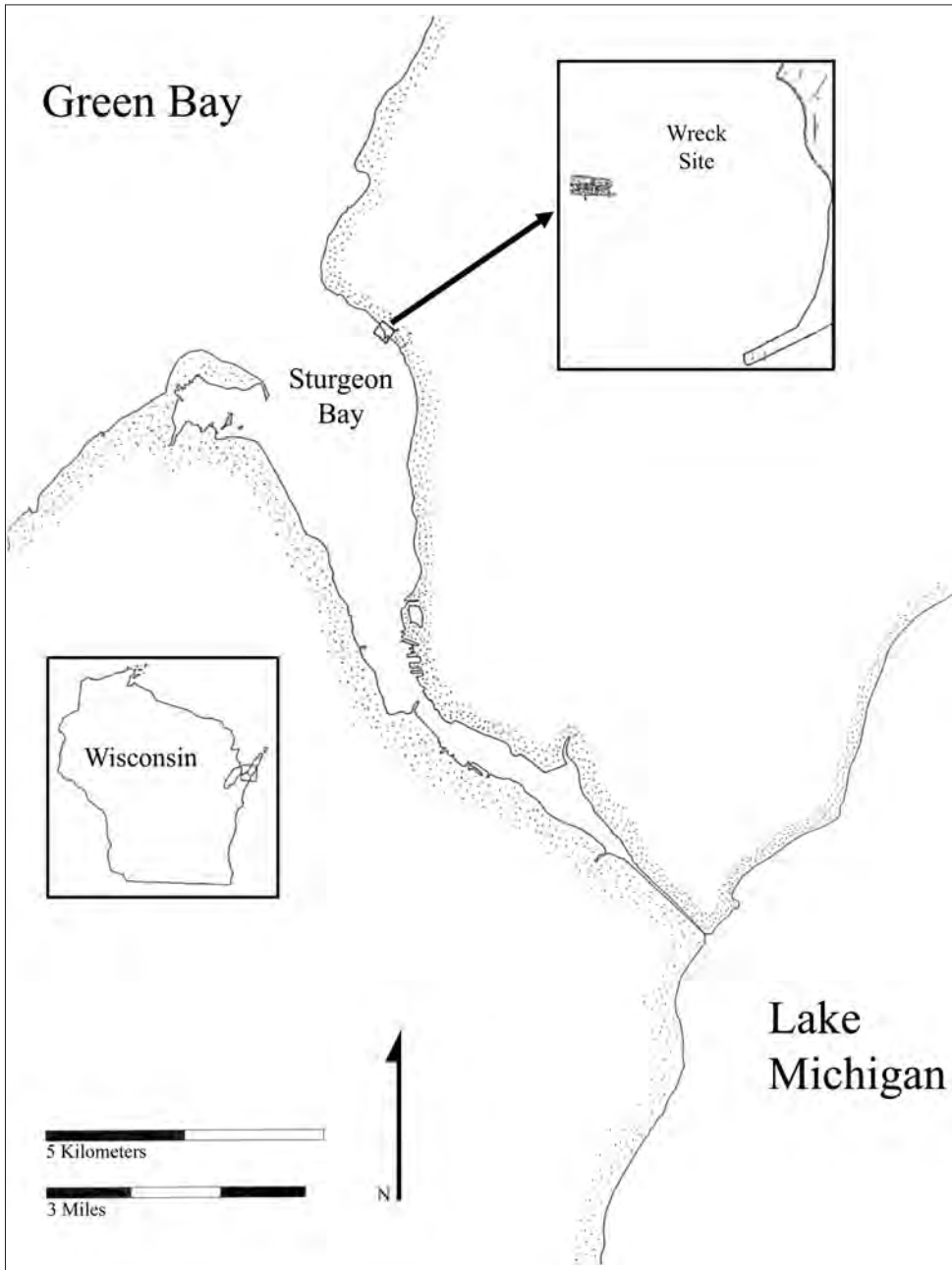


Figure 1. Sturgeon Bay, Wisconsin, showing location of McCracken's Cove and the old Graef and Nebel quarry quay (©Program in Maritime Studies, 2006).

FOLD OUT TO REVEAL FIGURE 2

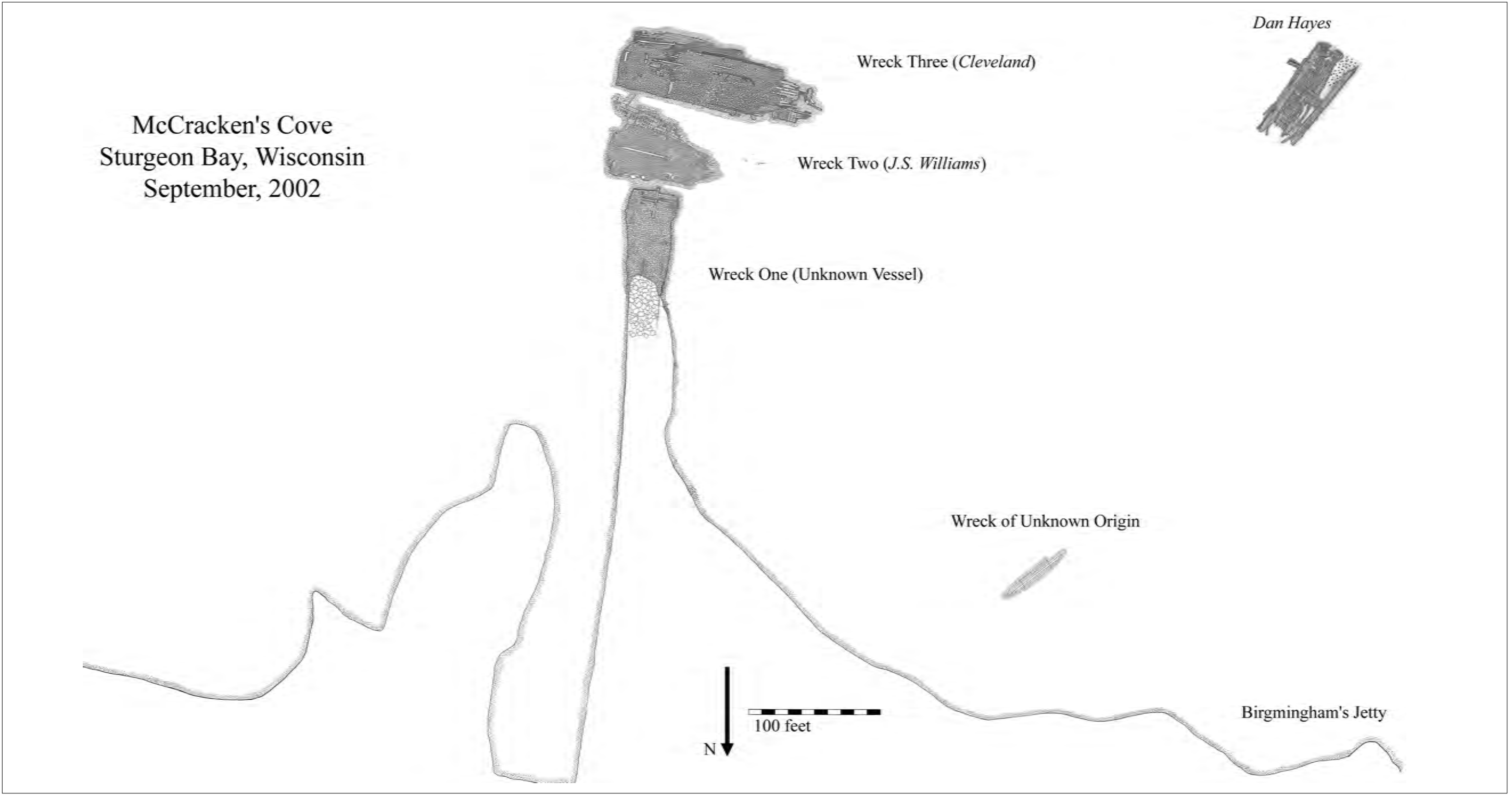


Figure 2. McCracken's Cove showing the locations of three identified sunken vessels and one unidentified vessel interred within the end of the quay (©Program in Maritime Studies, 2006).

This report not only discusses these vessel types but illustrates Sturgeon Bay's stone quarrying heritage to demonstrate how barges played a vital role in this industry incorporated into wharves or quays after they could not be used afloat. Historical information regarding Sturgeon Bay's quarry operations and the purposeful integration and adaptive reuse of barges into docks is quite limited; archaeology in this case can be used to offer insight into these historical practices. The data gathered at McCracken's Cove, both historical and archaeological, has led to a deeper understanding of Sturgeon Bay's cultural and economic history, in this case bringing to the fore the great utility of combining professions to further study the past. It also has brought to light four examples of historically rare vessel types including a seldom studied scow schooner and the oldest example of a steam barge yet to be archaeologically documented.

Environmental Overview

The Door Peninsula protrudes from northeastern Wisconsin, extending about 84 miles (135.185 km) into Lake Michigan. The peninsula, encompassing the whole of Door County, forms the eastern border of Green Bay. Sturgeon Bay and the Sturgeon Bay Ship Canal make a complete cut through the peninsula, bisecting it diagonally (Figure 1). Though this strip of land is only 3-10 miles (4.83-16.093 km) wide, its rugged coastline is approximately 200 miles (321.869 km) long (Cooper 1989: 7; Mason 1966: 1; Rodgers et al. 2003: 3).

The peninsula and the lake into which it intrudes are relatively young geologically, having formed at the time of the last glaciation. Before the glaciers dramatically changed the topography of the area, a substantial river flowed south through what is now the Lake Michigan Basin to the Gulf of Mexico (Martin 1965: 236, 294; Rodgers et al. 2003: 3). Contemporary Lake Michigan, however, has the sharply rising walls of a basin formed by ice rather than the sloping sides of a river valley. The walls drop 500-900 feet (152.40-274.32m) to a wide rocky bottom. This is typical of glacially formed lakes and valleys. The lake was actually formed not by one movement of a glacier, but rather by repeated advances and recessions over thousands of years (Martin 1965: 238-239; Rodgers et al. 2003: 3).

Between 15,500 and 11,000 years ago, glaciers covering the Wisconsin/Lake Michigan area experienced an intense vacillation period. Three glacial advance phases (Cary, Port Huron, and Two River advances) were separated by two recessional phases (Cary, Port Huron, and Two Creeks recessional). During recessional phases, the glacier left behind the borders of a lake. Three lakes temporarily occupied the Lake Michigan Basin: Lake Chicago, Lake Algonquin, and the Nipissing Great Lakes. The last recession left behind the shore of Lake Michigan including the Door Peninsula approximately 10,000 years ago. Wave action in the temporary lakes created cliffs and beaches on the shoreline. Though these formations and the new lake were virtually destroyed by each new advance, they left behind traces that today contribute to the geological composition of the Great Lakes region (Hansel et al. 1985: 40; Martin 1965: 294-295; Rodgers et al. 2003: 3).

The Door Peninsula was left by two ice fields splitting away from one another and gouging out trenches on either side. The results were Green Bay and Lake Michigan, as well as sheer rock walls that became the focus of intense mining activity during the nineteenth century. The peninsula is part of the Niagara Escarpment, the limestone remains of an Ordovician Sea bottom, stretching in an arch from Illinois, through Michigan and into Canada, then south through Niagara Falls and into New York State. The escarpment is composed mainly of dolomitic limestone, a harder, metamorphosed form of limestone (Rodgers and Green 2003: 11-12).

As a result of glacial movement, the water levels of the glacial lakes varied tremendously. The ice sheets tended to dam the northern edges of the lakes, and before the appearance of the St. Lawrence River, melt water necessarily flowed out of the catch basin lakes through many different outlets. Sometimes ice raised the lake levels by blocking these outlets. As the Late Pleistocene ice receded, the rivers opened and the lake surface dropped. The flow of rivers out of the lakes was also affected by the compression of land (Isostatic Rebound) as glacial ice moved back and forth through the region during the different periods of glaciation (Hansel et al. 1985: 40; Martin 1965: 295; Rodgers and Green 2003: 11-12).

Sedimentary characteristics of Lake Michigan vary with location. Edges of the lake are bordered by gravel beaches and bluffs. The bottom of the basin is covered in silt and clay. The sand that is found in both areas also serves as a transition between the two. The size of sand proceeds from large coarse grains at the shore (and to a depth of 60-100 feet (18.288-30.48m)) becoming smaller until mixing with silt at about 300 feet (91.44m) deep. Sands of all sizes in this area are somewhat angular, as they are geologically young (Hough 1958: 65-70; Rodgers et al. 2003: 3).

Within Sturgeon Bay, just north of the main downtown area along the north shore of the bay is McCracken's Cove and Birmingham's Lodge. There is jetty extending from east of the Birmingham property into the cove. It is composed of riprap on the surface, but reinforced and extended by scuttled vessels beneath the water. Three such vessels were investigated during the East Carolina University 2002 fall field school and are combined here in this report with the wreck of scow schooner *Dan Hayes*, recorded the previous year.

The three wrecks examined in 2002 are positioned at the end of the jetty with *Dan Hayes* only a stone's throw distant (Figure 2). Wreck one and part of wreck two are in shallow water, subject to significant wave action on rough days and ice action in the winter. The turbulent water in this area made assessment difficult. The surge combined with a late algae bloom created visibility varying from three to twenty feet. Algae also covered the wrecks and rocks the divers examined. Some freshwater fish lived in and around the wrecks, but the most plentiful denizens of the site were zebra mussels. These freshwater mussels are exotic to the Great Lakes, having traveled to North America in the bilge water of ships from the Baltic Sea. Lacking natural predators in the Great Lakes, Zebra mussels have flourished. No successful methods of eradication of this species have yet arisen, and they continue to spread through the river systems of the Midwest (Rodgers and Green 2003: 13).

In Sturgeon Bay, the mussels form layers several inches thick on any available surface. Shipwrecks have fallen victim in their own way to these intruders (Figure 3). The weight of a mussel colony alone can put enough stress on a wreck to facilitate its collapse. Additionally, sulfur-reducing bacteria thrive in zebra mussel colonies. These bacteria may contribute to the deterioration of metal shipwreck components, accelerating the disintegration of wreck sites (Rodgers and Green 2003: 13).

Divers working the Birmingham site encountered a much smaller zebra mussel population than those in recent years (Figure 4). The water temperature in Sturgeon Bay in 2002 was 72 degrees Fahrenheit (22.2 degrees Celsius) during this investigation, about 15 degrees Fahrenheit (13.8 degrees Celsius) higher than the

year before. This extraordinarily high temperature increased algae growth while decreasing both fish and mussel populations. Divers noticed an approximately 40 percent drop in the zebra mussel population on the wrecks from the previous year. Despite the decrease, technicians still had to clear inches of mussels obscuring construction details on large portions of the wrecks.



Figure 3. Zebra Mussels encrusting one of the wreck sites (©Program in Maritime Studies, 2002).



Figure 4. Sam Blake documenting Vessel Two, *J.S. Williams* (©Program in Maritime Studies, 2002).

Historical Background

The study of socio-economic patterns in a specific location are imperative to understanding history, and historical archaeology depends on the interpretation of artifacts within the context of their economic and historical settings. The following historical background focuses primarily on Sturgeon Bay's maritime history, particularly the stone trade, which played a role in supporting the area's economy in the late nineteenth century and directly relates to the vessels discussed in this report. General regional histories of Sturgeon Bay usually focus, with historic bias, only on important events while industrial activities are downplayed. This situation may cause some individuals to wonder why Sturgeon Bay existed and how the area thrived economically. In addition, sources for the working histories of specific merchant vessels may be difficult to find, vessels were often only noted if they were exceptionally successful ships, or if they were involved in a significant event, such as an accident (Rodgers and Green 2003: 14-15). The archaeological side of the area's history will allow a closer, more pragmatic view of the economic machinations that gave rise to Sturgeon Bay and its interwoven maritime history.

Sturgeon Bay and Little Sturgeon Bay

The largest community in Door County today is Sturgeon Bay. It was originally established as a fur trading post in 1825, because the settlement was situated around a naturally sheltered and protected bay it attracted heavy development throughout the nineteenth century. Sturgeon Bay's stone and lumber industries would eventually aid in producing the needed building materials for blossoming Great Lakes port cities such as Green Bay, Milwaukee, and Chicago (Hirthe and Hirthe 1986: 15; Rodgers and Green 2003: 16; Rowe 1979: 2).

Other economic and industrial communities soon built up around Sturgeon Bay's local saw mills and shingle factories during the 1830s and 1840s. One of these communities was Little Sturgeon Bay, which was situated about ten miles southwest of Sturgeon Bay. By the late 1850s, Little Sturgeon Bay rivaled Sturgeon Bay as the economic center of Door County, as both localities successfully competed in the exportation of lumber, shingles, ice, and for a relatively short time, well-built sailing vessels (Hirthe and Hirthe 1986: 15). In reference to Little Sturgeon Bay's once-thriving ship building industry, an 1862 article in the *Door County Advocate* states,

We call attention of shipbuilders to our Green Bay districts, as also to vessel proprietors, as a cheap and commodious locality. From the city of Green Bay northward to its connection with Lake Michigan, on both sides of the Bay, oak and other fine timber abounds, and can be

obtained and furnished for ship building for one-third the cost than at more distant easterly localities, and of a far superior quality . . . No other locality has a fair timber or as easily and cheaply obtained. We invite attention to the fact of those whose business it is to build ships or to have them built (Hirthe and Hirthe 1986:15).

The rivalry between Sturgeon Bay and Little Sturgeon Bay came to an end in 1879 with completion of the Sturgeon Bay Ship Canal. The Ship Canal allowed the waters of Green Bay in the west to fully connect with the waters of Lake Michigan on the eastern side of the Door Peninsula. It allowed vessels to pass through Door County, which cut 100 miles off the complete journey around the peninsula. The ship canal also allowed vessels to bypass the hazardous waters at the peninsula's northern tip, also known as Death's Door. Sturgeon Bay became a navigational reference point on shipping lanes from various points around Michigan, Illinois, and Wisconsin. The town continued to thrive becoming the true economic center of Door County while Little Sturgeon Bay with its shallower, less inviting harbor, could no longer compete (Hirthe and Hirthe 1986: 31; Rodgers and Green 2003: 15-16).

Overview of Sturgeon Bay's Stone Industry

United States Indian Agent Samuel Stambaugh first analyzed Sturgeon Bay's ample stone resources in 1831. Stambaugh then wrote a report entitled *The Quality and Condition of the Wisconsin Territory*, which stated that Sturgeon Bay had a capacious harbor with the best stone available that could be used for building purposes. Government geologists also studied Sturgeon Bay's natural dolomitic limestone formations in 1843. At that time, Army Lt. Douglas Houghton confirmed Stambaugh's findings and also mentioned that Sturgeon Bay was surrounded by a gratuitous amount of hardwood timber, which increased the region's industrial prospects. Sturgeon Bay's geography also allowed easy access to its abundant stone resources. Locals agreed that Sturgeon Bay had the finest waterfronts to be found along the Great Lakes, and the dolomitic limestone bluffs were close to shore along the sides of the harbor so that the mined stone could be easily transported to the shoreline via narrow gauge rail and shipped. The stone also naturally lay close to the surface, so little stripping would have to be done to get to it (DCA 1900; Rodgers and Green 2003: 16; Rowe 1979: 6).

Specific stone types are chosen for industrial uses based on their strength, and Sturgeon Bay's dolomitic limestone was no exception. During the nineteenth and early twentieth centuries, the industrial uses of standard limestone included the manufacturing of slacked lime, mortars, and whitewashes, and limestone continues to be a modern necessity used in highway construction, steelmaking, beet sugar processing, and concrete mixing. The dolomitic limestone found around Sturgeon Bay, however, was found to be inadequate for dressed building blocks or finished stone due to its immense strength. The crushing strength of Sturgeon Bay's dolomite was several thousand pounds higher than any other limestone or marble deposit found outside of Wisconsin. The dolomite also lay in horizontal beds that

were too fractured and thin for uniform dressing, which is a necessity for building stone. The stone, however, was found to be an excellent commodity in the construction of breakwaters, harbors, and piers due to its density, traverse strength, and lack of absorbency. This extremely durable stone was mined in blocks to be used as building material, or crushed, fired, and made into quicklime (a mortar used until gravel from nearby areas became more useful for manufacturing cheap cement) (Rodgers 1995: 3). Less regular pieces were used in stone crib piers and jetties. Local industry was initially based on the fact that the entire peninsula was made of dolomite. Quarries with docks built especially for the transfer of limestone to waiting vessels dotted the shorelines of the Door Peninsula for decades during the nineteenth century (Beck 1991: 24, 26; Buckley 1898: 343; Currier 1960: 6; Rodgers 1995: 3; Rodgers and Green 2003: 11, 17; Rowe 1979: 13).

For clarification, the construction stone industry is primarily composed of two branches – dimension stone and crushed stone. Dimension stone consists of rock that may be cut into large, uniform blocks or slabs, the slabs are then sold at a set price. Crushed stone is generally the waste product of processed dimension stone, but it also refers to riprap – quarried stone of an irregular shape and size. By the end of the nineteenth century, businesses were generally quarrying Sturgeon Bay's dolomitic limestone as riprap and selling it by gross weight (Currier 1960: 1, 5-6; Rodgers and Green 2003: 17).

The U.S. federal government bought land near Sturgeon Bay in 1834, and the location became known as Government Bluff (this site is now known as Potawatomi State Park). It needed stone to develop its own docks and harbors, and Government Bluff became the site of a major stone quarrying operation. Dolomitic limestone, therefore, became a major exported commodity after furs, fish, lumber and ice. Development was slow, however, and the stone industry would not significantly affect the economy and growth of Sturgeon Bay until the Laurie Stone Quarry opened in 1880. By 1898 there were four quarries within Sturgeon Bay including Leathem and Smith, the Green Quarry, the Laurie Stone Company, and the Termensen and Jensen Company. Most of these companies were established in the late 1890s after a depression affected some of the lesser known quarries, such as the Brewster Quarry, most likely forcing them to close. Sturgeon Bay's quarry industry prospered into the twentieth century as companies, such as Leathem and Smith and the newly established Sturgeon Bay Stone Company, expanded and continued to sustain business (Buckley 1898: 340; Moore 2003: 54, 65; Rodgers and Green 2003: 18).

Sturgeon Bay's quarrying industries began primarily with dimension stone contracts, within ten years these businesses began to rely on crushed stone. Dolomitic limestone of the sort produced in Sturgeon Bay is much easier to quarry as crushed stone, and by 1900 there was a larger market to accommodate this type of stone. Government contracts on the Great Lakes lead to a significant demand for crushed stone and riprap for the assemblage of piers and breakwaters in various locations such as Milwaukee, Manitowoc, Michigan City, Racine, Kenosha, Traverse City, Grand Haven, Menominee, Frankfort, and others. By 1917 almost every harbor around Lake Michigan was constructed in part with dolomitic limestone from Door County. At the turn of the twentieth century, the amount of this limestone utilized as crushed stone doubled the amount used for dimension stone; by 1930, the

production of crushed stone grew to thirty times that of dimension stone (Bowles 1934: 4; Buckley 1898: 344; Rodgers and Green 2003: 22-23).

Quarry Operations

During the nineteenth century, Sturgeon Bay's dolomite was quarried in shallow depressions, also known as open pits. Overburden and plant growth lying over the rock shelf was removed by the use of picks, shovels, and hydraulic scrapers. Once the shelf was undercut, a three-man crew drilled holes into the rock face for blasting; an individual miner would sit on a stool while holding a star bit drill while the other two struck the drill with eight pound hammers. The holes drilled into the rock were about twelve to eighteen inches deep and half an inch in diameter. A black powder charge was placed into each hole and then lighted by a match-lit fuse. The resulting blasts sheared off the rock face that was then cut into predetermined sized blocks with hand tools. These stone blocks were then lifted out of the blast rubble with specially forged crowbars that were sixteen feet long and weighed over 300 pounds. It took the combined strength of four men to use these crowbars. Developments during the twentieth century added greater accuracy and efficiency to the stone removal process, such as the use of dynamite and steam drills (Rodgers and Green 2003: 23-24; Rowe 1979: 11).

Sturgeon Bay's quarries operated on a seasonal basis, from spring to autumn, and the work involved was quite labor intensive. Each spring, once the snows and ice had melted, new fissures had been created in the rock face, and hearty workmen would toil for long hours to extract as much stone as possible. Hundreds of men were employed by the various quarry companies, and during the working season they often lived in dormitories that were constructed near the quarry sites. The quarry companies also competed with one another as well as other local business for laborers, which led to the adjustment of wages. During the winter months, quarry employees generally took jobs as shipyard workers, lumberjacks, or ice cutters while quarry owners and operators used this time to negotiate contracts, set prices, and calculate wages for the next season (Rodgers and Green 2003: 24-25; Rowe 1979: 6).

The Stone Fleet

While Sturgeon Bay's quarries were in operation, communities around Lake Michigan eagerly awaited shipments of stone products and the easiest and fastest means of transporting the significantly heavy cargoes was by water. The extreme tonnage of dolomite being shipped had to be floated on barges that could withstand rough use and intense point pressure produced in the hold during the loading procedures. A solution was found through the process of converting older, un-seaworthy vessels, into barges that could then be towed to specific destinations and dropped off for unloading, since unloading a ship or barge by hand took much longer than loading it. Salvage companies and shipyards in Sturgeon Bay eventually established locations, such as the Leathem and Smith docks, for old freighters, passenger steamers, and schooners to be converted into stone barges. Converted schooners

generally had their super structure removed, including the main mast, bowsprit, and jib boom. It was quite labor intensive to convert steamers into barges. Upper decks and cabins were deemed unnecessary and removed, and gilded ceilings, deck furniture, ornamental items, and railings were sold to scavengers. Crew cabins and pilothouses were reduced in size, and most of the internal machinery was also removed while pipes and through-hull fittings were secured with wooden plugs. An emphasis was placed on fabricating heavy bulwarks for all converted vessels, so additional iron and wood braces were incorporated into their hulls and tie bolts secured their sides together in lieu of the missing deck beams (Rodgers and Green 2003: 28; Rowe 1979: 11-15).

Though steam tugs were necessary to pull the stone barges, some barges featured a simple sailing rig that helped increase the speed of the tow. Sails were also attached to the barges to aid in maneuverability in case the towline broke or came loose. A skeleton crew of two or three men was also housed in a small cabin at the barge's bow or stern. It was the crew's responsibility to steer and dock the barge, secure towlines, pump the bilge, and secure the vessel if a grounding or collision was eminent. These men would also unload the cargo once the barge reached its destination (Rodgers and Green 2003: 28-29).

There would eventually come a time when some stone barges became so worn and un-seaworthy they could no longer stay afloat. The scrap value of these wooden vessels was not worth the price of demolition since the increasing use of iron and steel hulls made the use of fasteners and fittings from wooden vessels obsolete. These incapacitated barges were often intentionally sunk and filled with stone to create cribs, which would be used to extend wharves and docks so that more barges could be accommodated. The method of using barges for support cribs was efficient and cheap. By implementing stone barges as cribs, the quarry companies could swiftly extend their docks while at the same time disposing of useless vessels (DCA 24 May 1902; Moore 2003: 132; Rodgers and Green 2003: 30; Rowe 1979: 31).

Loading and Unloading Processes

Once workers extracted the stone from the quarry it was transported to the docks so it could be loaded onto stone barges. Borrowing from the method of underground mining practices, the quarried stone was broken up and loaded by hand into mining cars. These cars, riding on a twenty-four-gauge track, were then propelled by gravity to the end of the loading wharf where a waiting barge was loaded to its maximum draft. A winch lifted the end of the mining car so the stone could be dumped directly into the barge or onto a chute that led to the vessel's cargo hold. The barge was moved up and down the wharf and filled carefully since the vessel could become swamped if it was not evenly weighted (Rodgers and Green 2003: 25).

Quarry owners found that it was too expensive for their companies to load stone onto barges via pocket docks and subsequent gravity feed systems developed to load large bulk carriers with iron ore. Innovations were devised, however, to augment the ease with which stone could be loaded. In 1886 Louis Nebel, who was a foreman at the Hagen and English Quarry at the time, fabricated a dump car that

significantly speeded up the loading process. His strategy involved securing a pair of long timbers from the dock to the stone barge. Steel rails, which were spaced thirty inches apart, were then fastened to the timbers. A manned dump car that was controlled by a foot brake could then be moved directly over the barge's cargo hold, and the stone could be dumped once a hook in the back of the car was released. By the early twentieth century, more technologically advanced loading systems were implemented, such as the use of electric conveyer systems, these systems probably made the loading process extremely efficient (Rodgers and Green 2003: 25-26).

As mentioned, the crews employed to work on the stone barges were also responsible for unloading the vessel once it reached its assigned destination. Unloading was primarily performed by hand through the use of a bucket that was suspended from a derrick and lowered into the cargo hold. A mule, or horse when available, was harnessed to the other end of the line and raised the bucket of stone once it reached capacity. Remaining masts and standing rig on the barge served this purpose well. The vessels were also unloaded evenly, and when the hull was almost fully unloaded it was stabilized by arranging the remaining stone in two parallel mounds on each side of the keelson or centerline of the ship (Rodgers and Green 2003: 26).

Though the hand unloading method did not disappear with the development of self-unloading technology, the latter method decreased the amount of backbreaking labor undertaken to deliver some of the stone cargoes. Donkey engines, which first appeared on ocean going vessels in 1855 greatly reduced loading and unloading times. This small engine could be rigged to a vessel's winch while standing rigging acted as a hoist for unloading cargo. The engine's name was derived from the animal operated system used in the hand unloading process. This self-unloading system was relatively expensive, however, and not many stone companies could afford them during the nineteenth century. Furthermore, the availability of docking space and the type of barges used generally dictated the unloading method to be performed and was not always conducive to mechanical systems. The first true self-unloading vessels on the Great Lakes were *Hennepin* (1902) and *Wyandotte* (1907). Sturgeon Bay's Leathem and Smith stone company first used self-unloading technology in 1912 with *Adriatic*, a barge that was equipped with a crane and that could unload itself in less than twelve hours (Rodgers and Green 2003: 26-27).

End of an Era

Though many quarries throughout Sturgeon Bay were operational for over fifty years, the town's quarry industry died out in the Great Depression of 1929. Aluminum, steel, ceramic, and glass industries had begun to compete with stone by the 1920s, but their competition paled in comparison to the economic disaster brought on by the Great Depression. During the Depression, Portland cement and artificial stone products were more easily obtained and became more cost effective than crushed stone. Lack of Federal government contracts brought Sturgeon Bay's quarry industries to a halt. None of Sturgeon Bay's quarries survived the Great Depression; buildings fell into disrepair and unused barges sank at their moorings.

By the time of the Great Depression, however, Sturgeon Bay was economically supported by the shipbuilding industry, which expanded from the acquisition of contracts during each World War. Today, local forest has consumed and hidden the great scars of almost every quarry that operated in Sturgeon Bay. Ruins of piers and foundations are still visible in some locations around the area, and these stand as a tribute to a time when the stone industry played such an immense role in Sturgeon Bay's economy (Bowles 1934: 9; Moore 2003: 151-152; Rodgers and Green 2003: 30; Rowe 1979: 6).

The Graef and Nebel Quarry

Towards the end of 1899, John Graef and Louis Nebel began developing their quarry next to the growing Leathem and Smith company along the northwestern shore of Sturgeon Bay. Immediately after construction of the new quarry commenced operation, Graef and Nebel were awarded government contracts to furnish stone shipments to various harbors around Lake Michigan for pier construction. By the latter half of February 1900, the cribs for Graef and Nebel's loading dock had been sunk, and the company had booked orders for 2,800 cords of stone to be shipped across the lake. One month later, the company had 4,000 cords of stone booked for shipment and the new dock was completed. Graef and Nebel's loading dock extended some 400 feet (122m) to secure sufficient water depth for the barges. A railway system was then constructed so loading cars could be run across the quarry floor, downhill to the shore, and over the quay. Due to the triangular arrangement of the company's property, however, the quarry itself was not directly behind the loading dock. A bluff one-quarter of a mile away had to be dug out so the rail tracks could run diagonally from the quarrying site to the dock (DCA 1899-1900; Rowe 1979: 29, 32).

The Graef and Nebel quarry had fully commenced operations by June 1900. Employees were paid from \$1.50 to \$1.62 for a day's work, and the company's stone fleet consisted of the steam tug *Duncan City* and the scow schooner barges *Dan Hayes*, *Emerald*, *Kate Hinchman*, and *Lizzie Metzner*. The first stone shipments were sent to Racine, Sheboygan, and Muskegon (DCA 1900; Rowe 1979: 30).

Great success met the Graef and Nebel Company's first season of operation. The quarry itself was enlarged during the first week of August 1900 as the property was constantly presenting large quantities of naturally fine stone. At one time, a single blast blew out fifty tons of rock. The only significant loss during the first season occurred at the very end of November when a barge carrying \$400 worth of stone sank in the shipping canal. Business also remained steady during the 1901 and 1902 seasons for Graef and Nebel's quarry as the amount of stone shipped around Lake Michigan increased slightly (DCA 1900-1902).

Competition of the Graef and Nebel Quarry included two other facilities, operated by Lars Jensen and Soren Termansen, located on the southwest or opposite shore of Sturgeon Bay. One of the first duties given to Jensen and Termansen was to provide stone for the Northwestern Railway Company at Escanaba, Michigan. The men also worked in conjunction with the Laurie Stone Company to ship stone throughout Lake Michigan. This system allowed each party to accommo-

date more business throughout the shipping season, as more contracts could be accepted, and unperformed tasks were swiftly completed. Termansen and Jensen operated two of the busiest quarries at Sturgeon Bay by the early 1900s (Moore 2003: 66-68).

Sturgeon Bay's quarry operators felt that the 1903 working season would be the busiest ever in the history of the stone industry. In anticipation of this season and in order to expand business prospects, Graef and Nebel actually consolidated with Termansen and Jensen to create the Sturgeon Bay Stone Company. The merger took place in January 1903, and the new company now operated three quarries around Sturgeon Bay, including the original Graef and Nebel site. As officers of the company, the four men held the following positions: Louis Nebel, president; John Graef, vice president and treasurer; Soren Termansen, secretary; and Lars Jensen, general manager (DCA 1902-1903; Moore 2003: 68).

Though the Sturgeon Bay Stone Company's 1903 season was extraordinarily busy, including the receiving of a stone contract for the A and W railroad company, there were a couple of serious losses later in the year. One of the company's large stone barges got caught in a storm towards the end of July and sank with its entire stone cargo. The resulting loss of \$8,000 was a serious blow to the company. Misfortune struck again when the tugboat *Bliss* was lost in a November storm. The tug had just been purchased for \$2,500, and was carrying \$500 worth of stone (DCA 1903).

Conditions, however, greatly improved for the Sturgeon Bay Stone Company in the following years, and it eventually became one of the best-known stone companies in Door County with one of the most successful stone fleets. The firm unified with the Sturgeon Bay Transportation Company in January 1912, but it was still known as the Sturgeon Bay Stone Company. The business continued to receive government contracts until the time of the Great Depression, when all of Door County's quarries closed (DCA 1908, 1912, 1922; Rodgers and Green 2003: 24, 30).

The following ship histories have been gleaned from various sources and reflect the name identifications placed on three of the four vessels located within the Birmingham site area. Identifications are made through historical sources backed by verifiable archaeological evidence such as size, ship type, location, and historical land deeds that recorded quarry company ownership.

Phoenix/J.S. Williams – Vessel No. 2

One of the submerged vessels located off the old Graef and Nebel quarry wharf may be canal schooner *Phoenix*. *Phoenix* (U.S. Registry #20224) was constructed in 1884 at Henderson, New York. This vessel, originally a three-masted schooner, was built by L. Reed at 121 feet long, 26 feet in beam, and an 8-foot depth of hold (Figure 5). These dimensions by definition make it a classic Great Lakes "canaler." Canalers were vessels intended to fit the exact dimensions of the Welland Canal between lakes Erie and Ontario. *Phoenix* was constructed as a lumber schooner and was commissioned by Reed, Miner, and Company (DCA 1887; Great Lakes Vessels Index 2002).

Phoenix first made headlines November 25, 1887 when it sank after colliding with the barge *Melbourne* just outside of Chicago. The barge struck *Phoenix* at

one in the morning, and the latter vessel's crewmembers were eventually forced to abandon their posts at daylight after a valiant effort to keep the ship afloat. The vessel was fortunately able to be raised the following day and was taken to Chicago. The extent of the damage, however, was a sizeable \$5,000 (*Marquette Daily Mining Journal* 1887; *Milwaukee Sentinel* 1887).

After a successful career of transporting lumber across Lake Michigan, *Phoenix* was docked at Manitowoc in April 1895 and converted into a barge. Once the conversion was complete, the vessel was rechristened as *J.S. Williams*. The name was given in honor of a local Manitowoc resident. *J.S. Williams* was then bought by the Pankratz Lumber Company, but was often loaned to Sturgeon Bay's Laurie Stone Company (DCA 1893, 1895, 1898; Moore 2003: 141).

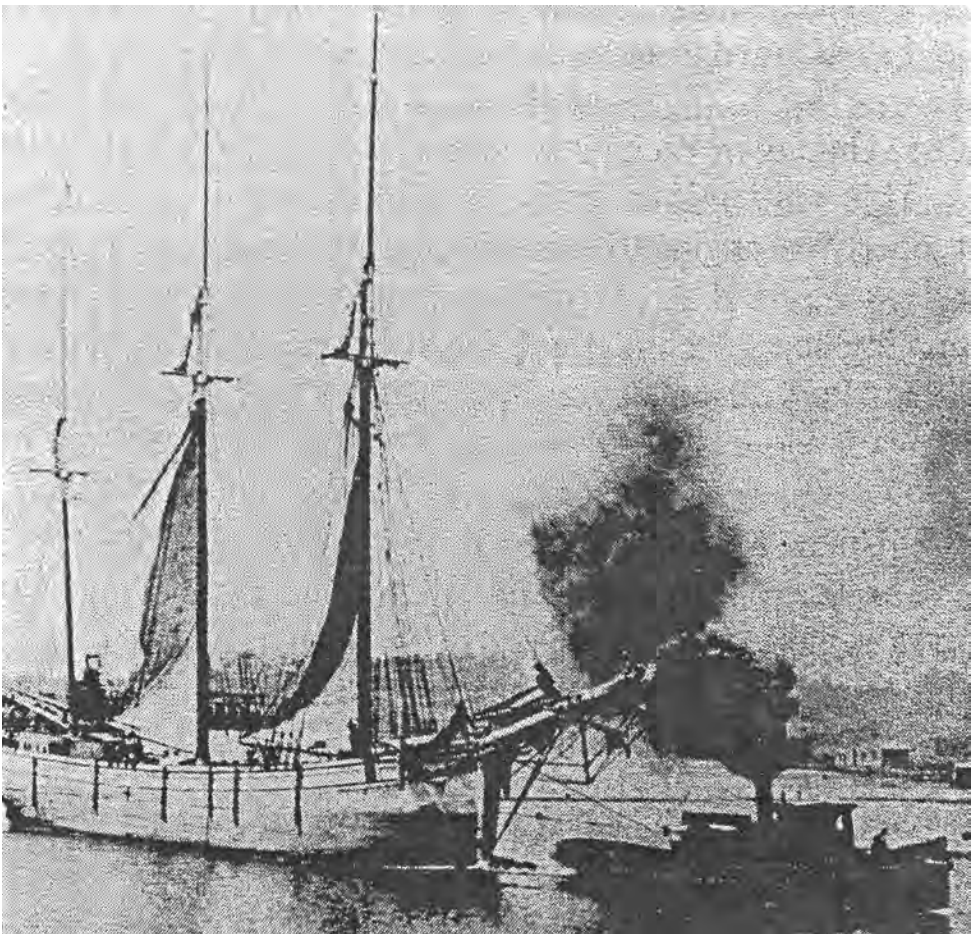


Figure 5. Canal Schooner of the *J.S. Williams* type (probably *Penokee*) under tow. Note the boxy shape and vertically hung log fenders (Courtesy Milwaukee Public Library).

A tragic event occurred in July 1898 when Robert Willman, a twenty-one year old employee of the Laurie Stone Company, was killed on the deck of *J.S.*

Williams. As the vessel was being pulled by the tug *Pankratz*, the barge's anchor became afoul of the towline. Workers attempted to use a large iron hook to free the anchor, but the hook slipped and was flung against Willman, who was crushed against the barge's railing. This incident demonstrates that it was not necessarily safer to work on the stone barges than within the quarry itself (DCA 1898).

The Leathem and Smith stone company purchased *J.S. Williams* in September 1899. By this time, however, the vessel had fallen into a state of disrepair and it was simply left at the northern end of the company's wharf for almost two years. The barge was eventually repaired, but the work performed on it was inadequate and it almost immediately sank off the nearby Leathem and Smith dock. The Graef and Nebel stone company eventually purchased the wreck so it could be used as a crib for the firm's own loading dock. In late May 1902, *J.S. Williams'* remains were raised and towed to the Graef and Nebel dock, where it was intentionally scuttled and incorporated into the structure (DCA 1899, 1901, 1902).

Cleveland

The steamer *Cleveland* (U.S. Registry #4376) was constructed in Cleveland, Ohio and was launched June 3, 1860. The vessel was constructed by the firm Quayle and Martin for the Northern Transportation Company and was used primarily for the lumber trade. *Cleveland* featured a propeller and was 150 feet long, 25.5 feet in beam, and had an 11.6-foot depth of hold (Figure 6). The ship carried cargo throughout Lakes Huron, Michigan, and Superior and additionally served as a packet vessel transporting passengers after modification. In this unusual conversion, *Cleveland* became a passenger / package freight propeller (Figure 7). The steamer remained in the Northern Transportation Company's service for fifteen years (Herman G. Runge Collection, Milwaukee Public Library; Great Lakes Vessels Index 2002; Heyl 1964: 49).

Despite *Cleveland's* reputation as a solidly built cargo vessel, it was sold numerous times to various companies, including the Central of Vermont Railroad Company. The steamer's history was also plagued with a series of mishaps. On June 22, 1866 the vessel was steaming off Bar Point, Lake Erie when it collided with the bark *Maria Morton*. *Cleveland* promptly sank, as *Maria Morton* cut a hole in its side from the deck to below the waterline. *Cleveland* was raised on July 6 and was transported to Malden, Ontario, where the gash in its hull was patched. The vessel was then towed to Cleveland, Ohio for extensive repairs. It was most likely during this time that the steamer was shortened to the length of 134.9 feet. Once *Cleveland* was back in service it was again rammed on August 25, 1868 by the schooner *Phalarope* while steaming in the Menominee River near Milwaukee. Unlike the previous collision, *Cleveland* did not suffer extensive damage (Heyl 1964: 49).

At the turn of the twentieth century, the well-worn *Cleveland* experienced more calamities. The vessel suffered significant damage by fire in June 1900 while dry-docked in Milwaukee. The blaze originated in the engine room, and even though the engine itself was minimally damaged, the crew quarters were almost totally destroyed. Repairs were made, but one month later *Cleveland* sprang a leak while carrying a cargo of cedar along the Chicago River and sank. *Cleveland* was



Figure 6. Steam Barge *Cleveland* in early configuration. Note the pilothouse aft, this is an early deck arrangement, later vessels were built with the pilothouse foreword in classic fore and aft deckhouse configuration, popular after 1869 (Fredrickson and Frederickson 1961).

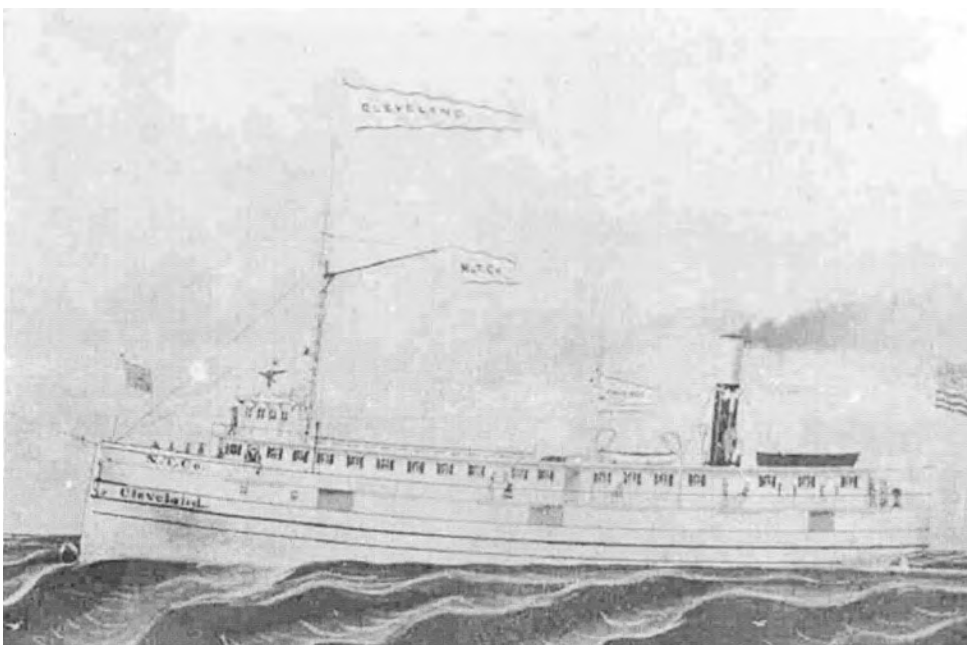


Figure 7. *Cleveland* setup as a Passenger/Package Freight Propeller. Hull modifications include deck cabins, pilothouse foreword, and three bulwarks loading ports (Courtesy of the Dossin Great Lakes Museum).

kept afloat long enough however, for the cargo to be removed, and the vessel itself was successfully raised and towed to Chicago. While being repaired in Chicago, the ship was subjected to an intense examination by local inspectors. *Cleveland* was condemned as being unfit for service, and extensive reconstruction was ordered. Towards the end of 1900, *Cleveland* was taken to Manitowoc and converted into a lumber barge. The vessel's superstructure was dismantled, and its engine and boilers were transferred to the schooner barge *S. M. Stevenson* (DCA 1900; Herman G. Runge Collection, Milwaukee Public Library).

Cleveland's owners used the ship as a lumber barge for less than one full season before they deemed it too inefficient and un-seaworthy. It was towed to Sturgeon Bay in June 1901, and left moored for safekeeping. John Graef and Louis Nebel purchased the deteriorating *Cleveland*, which had sunk at its moorings, in November of that year and decided to use the vessel as a crib for their quarry's loading dock. *Cleveland's* remains were stripped throughout January 1902. The bulwarks, upper planking, and all portable items were removed in the stripping process. The hulk was finally towed to its final resting location near the Graef and Nebel quarry site in early June 1902. *Cleveland* was then filled with rubble stone and sunk next to *J.S. Williams*, thus terminating the vessel's active existence (DCA 1901-1902; Herman G. Runge Collection, Milwaukee Public Library).

Dan Hayes

Historical sources pertaining to *Dan Hayes* paint the picture of an average Great Lakes wooden scow schooner employed in the bulk commodities trade (Fig. 8). According to the vessel's Enrollment, the ship was built at Fairport, Ohio, in 1868, by R. Hayes of the firm Hayes and Fountain, with the official number 3504. As was the custom of many shipbuilders, the ship was no doubt named after a family member. *Dan Hayes* is listed as a scow schooner of three masts and cost \$14,000 (Figure 7). The vessel had a length of 34.17 m (112.1 feet) by 7.38 m (24.2 feet) in beam, with a 2.13 m (7 feet) draft. The vessel's listed gross tonnage was 145 with a net tonnage of 138 (Herman G. Runge Collection, Dan Hayes).

Scow schooners were notoriously bad sailors because of their flat bottoms and squarish ends. Even when new, these vessels could carry no better than a B rating with insurance underwriters (Karamanski 2000: 183). With only a sloping vertical tuck in the stern for water to pass over the rudder, and various ungainly bow shapes, they could not have maneuvered or tacked with much efficiency when fully loaded. Historically Great Lakes schooner scows had three distinct bow shapes. They could have a ramp bow, with or without a cutwater, a nearly conventional schooner stem, or a "bent bow" with the planking forming a V shape, such as the bow on *Dan Hayes* (Inches 1964: 290). It appears that being inexpensive to build, with shorter, less expensive scantlings that did not need lofting or the expertise of a marine carpenter, was more important than sailing qualities.

Yet when sailors "grew sentimental over a schooner scow – and they did – it was because of her character for what she could do in spite of her build" (Inches 1964: 290). In fact, when sailing light and not beating to windward, such ships were reported to be quite fast, as fast as most conventional sailing schooners



Figure 8. *Dan Hayes* with a full spread of canvas. Since it is still at the quay the canvas is likely set out to dry. The triangular foremast topsail is known as a rafee, and is peculiar to the Great Lakes (Courtesy of the Manistee County Museum).

(Chapelle 1935: 349; Inches 1964: 292). Their box shape also allowed them to carry more cargo than a conventional ship of the same dimensions (Inches 1964: 290). Obviously the centerboard was the one indispensable piece of equipment, as without it the ship could not have been sailed at all. Steering the ship with one unbalanced rudder undoubtedly took a great deal of skill as response time to navigational changes would have been sluggish at best. But all in all, the large capacity and small crews needed to operate the schooner rig made the vessels cost effective. Over 700 of these ships eventually plied the Lakes, their heyday being the mid to late nineteenth century.

During *Dan Hayes'* early years, Theodore Consaul of Milwaukee was the vessel's only owner. *Dan Hayes* apparently hauled lumber for Mr. Consaul and reportedly could carry 170,000 board feet (Runge Collection n.d.b.). In 1882 the ship was reportedly rebuilt as a scow. Conversion to a barge in later life seems to have been a forgone conclusion for most of these ships. Barge conversion obviated the scow's poor sailing qualities by adding the reliability of a steam escort while maintaining the usefulness and economy of the scow as a consort. Typically the conversion involved removing the main mast to facilitate loading and unloading. It is unclear whether the vessel's owners removed the deck amidships for the same reason. Archaeological evidence from other stone barge sites has shown no signs of mid-ship decking or hatch combings. Moreover, evidence suggests that usually owners installed tie bolts and turnbuckles between the port and starboard sides in

the mid-ships area to keep the ship's sides from splaying outward; a duty usually performed by deck-beams (Rodgers 1995: 22-33).

Dan Hayes' sailing history illustrates its relatively poor sailing qualities. On 3 August 1898, the vessel capsized in a stiff north wind off North Point, near Milwaukee, with a load of lumber from Manistee. Apparently, the ship sprang a leak off Fox Point and became waterlogged, floating only because of the lumber it carried. Nevertheless, the crew battled to save the ship for five hours. Finally, Captain Ole Oleson and his three man crew were forced to take to the yawl boat as the vessel became more unmanageable. Eventually *Dan Hayes* rolled and was dismantled of all but its mainmast. The deck load of lumber valued at \$1,000 was lost. Though no casualties were reported, its owner, Captain Oleson, probably sustained the entire financial loss (DDFP August 3, 1898; DCA August 6, 1898; DCA December 31, 1898). It seems likely that *Dan Hayes* was under sail when it capsized; fore and aft or gaff sail rigs were used even on barges under tow in the lakes. Setting sail on a barge under tow lessened the amount of fuel used by the barge's escort, and helped reduce the side to side rolling motion of the barge.

Wrecking events such as that of *Dan Hayes* were frequent occurrences on the lakes. Many ships were reported lost only to have them reappear repaired and operating out of another port. *Dan Hayes* was no exception. The vessel was eventually towed into Milwaukee and repaired. By May 1900, the ship had been purchased by the Graef and Nebel Stone Company in Sturgeon Bay and refit for the stone hauling business (DCA May 26, 1900).

On 6 August 1904, the *Door County Advocate* reported that *Dan Hayes* had begun leaking while carrying a load of stone for delivery in Menominee. Its escort, the tug *Duncan City*, had no recourse but to shove the barge close to shore and let it settle to the bottom (DCA August 6, 1904). This incident was probably the final blow for *Dan Hayes*. The vessel was examined for potential repair for use in the beet trade, but the archaeological record demonstrates that these repairs were never made (DCA September 10, 1904; May 27, 1905).

Archaeological Investigations

The examination of the three vessels extending from the Graef and Nebel Quarry's jetty in McCracken's Cove was part of a continuing archaeological survey in the Sturgeon Bay, Wisconsin area by East Carolina University's Program in Maritime Studies and the State Historical Society of Wisconsin. In 1999 Dr. Bradley Rodgers led ECU students in a Phase II survey of Bullhead Point. This survey identified the probable remains of the converted vessels *Empire State*, *Ida Coming*, and *Oak Leaf*. These three barges were filled with stone and sunk adjacent to one another in an effort to extend Bullhead Point, which was used as a wharf by the Sturgeon Bay Stone Company. This extension was a response to the increasingly shallow bottom next to the wharf resulting from spills of quarried stone during loading. Rather than dredge the area, workers simply extended the wharf into deeper water. The 1999 survey clarified the positions of the wrecks, allowing archaeologists to interpret the purpose and method of deposition (Rodgers and Green 2003).

In another survey led by Rodgers in the fall of 2000, students and staff from East Carolina University and the State Historical Society of Wisconsin surveyed and mapped the remains of *City of Glasgow*, which lies in Lilly Bay near the outlet of the Sturgeon Bay Ship Canal. James Davidson constructed *City of Glasgow* – one of the largest wooden bulk carriers to navigate the Great Lakes. *City of Glasgow's* construction represents that of a generic wooden Great Lakes bulk carrier from the late nineteenth century – a ship type found suitable for eventually transformation into a stone barge for the Leathem and Smith Quarry before it grounded at its present location (Rodgers et al. 2003).

In the fall of 2001, Rodgers and Dr. Annalies Corbin traveled to Sturgeon Bay with a new group of students to execute a Phase II survey of the wreck of the scow-schooner *Dan Hayes*, included in this report. The three vessels surveyed near McCracken's Cove in 2002 have been included in an area that has been designated as the Birmingham's Site, which also includes the wreck of *Dan Hayes* (Figure 2). Other components of the site are the Graef and Nebel Quarry and a rail jetty. The integration of the three vessels into the Graef and Nebel Quarry's wharf is an example of adaptive re-utilization, a situation in which vessels are used for a purpose other than originally intended. *Dan Hayes*, possibly a scow or converted scow-schooner, is the only true wreck of the four associated with the Birmingham's Site. That is, it is the only vessel of the four at Birmingham's Site that sank while underway. Similar water depth and projected draft depth of the vessel indicate that the vessel sank as it was run aground. Reportedly, the scow began leaking while carrying a cargo of stone, forcing its escort tug, the *Duncan City*, to push it as close to shore as possible. *Dan Hayes* sank in approximately six feet of water, only 300 feet (30.5m) from the jetty (Rodgers and Corbin 2002). *Dan Hayes*, as do the other ves-

sels at McCracken's Cove, reflect Door County's economic history demonstrating how archaeological interpretation points to the transport of the main local commodity of the day, dolomite. *Dan Hayes* is also a scow-schooner, another underrepresented vessel-type. Interestingly, the Bullhead Point and *Dan Hayes* investigations contributed to an understanding of the three wrecks investigated in the fall of 2002, demonstrating even before the McCracken's Investigation began that the placement of the vessels at McCracken's Graef and Nebel jetty was no accident.

During the fall of 2002, a team of graduate students from the Maritime Studies Program at East Carolina University, led by Dr. Bradley Rodgers and Dr. Annalies Corbin, conducted a Phase II archaeological investigation of the former Graef and Nebel Quarry loading dock located in Sturgeon Bay Wisconsin. The project was designed as a field school to provide instruction and experience to the students in conducting an archeological investigation in an underwater environment. The crew consisted of Jackie Piero, Andrew Pietruszka, Christopher Valvano, James Moore, Andrew Weir, Samuel Blake, Keith Meverden and Brian Jaeschke. The project was organized in conjunction with and supported by the State Historical Society of Wisconsin and Wisconsin Sea Grant, through Russ and Cathy Green.

The survey team established a base on site at Birmingham's Bar and Cottages, allowing the team immediate access to the site. Work was conducted from 10-20 September 2002 and utilized snorkel and mask for survey with scuba and a hookah surface supplied air systems reserved for deeper recording tasks. Several research goals were established and prioritized due to the limited amount of time the team had on site. These goals consisted of conducting a visual survey of the surrounding area, establishing the number and extent of the vessels that made up the jetty, gathering historical information on the site, producing a plan view map of all the wrecks, producing a site map, and producing a cross section map of all wrecks. All goals were accomplished in the allotted time.

Methodology

Work on site began with a general survey of the area surrounding the Graef and Nebel Quarry jetty. Several line searches were conducted using snorkel and mask. The first area to be surveyed was from Birmingham's jetty heading east to the quarry's jetty. The average water depth was only five feet with a visibility of approximately 15 feet. The divers each carried several buoys to mark any historic cultural remains the team located. When a diver located a suspected target a series of pulls on the survey line would alert the team and the search would halt temporarily. After the target was buoyed the survey would continue. During the survey two large cultural remains (timbers from a ship) were located and marked. One of these was determined to be a previously known site discovered during the 2001 field season. The second was determined to be a new site, believed to have been carried in close to shore by storm activity or ice push in the winter.

Next the team focused on the western side of the Graef and Nebel Quarry jetty including the slip formed by the jetty. Four students conducted a line search in the slip at an interval of ten feet. No historical cultural remains were located. The team continued moving down the shore to the west and east of the slip. Some scat-

tered, non-articulated lumber was located in the area that divers did not record due to its scattering over an expansive area.

Archaeologists conducted the final visual survey off the end of the Graef and Nebel Quarry jetty. This area became the focal point of the archaeological investigation conducted at the Birmingham's site. The first task was to locate the three known ships that made up the jetty and buoy their location. After locating the wrecks, the team conducted two arc searches, using scuba, to the east and west of the ships. Two divers conducted the searches with one diver remaining stationary and the other swimming arcs that would increase by ten feet each time the diver changed position. No significant material culture was located.

After the visual surveys of the area were complete the focus of the project was to map and assess the three vessels that were incorporated into the structure of the Graef and Nebel Quarry jetty. A reconnaissance of the site was performed to establish where a baseline should be laid to best meet the goals of the team. The site contains the remains of three vessels with Vessel One being the closest to the land side of the jetty and Vessel Three being the furthest away. A continuous baseline of steel cable was laid. Three turns were incorporated into the baseline in order to best cover the entire site which produced four line segments defined as AB, BC, CD, and DE. Points A and E were respectively the beginning and terminus of the baseline while points B, C, and D were the turning points. Line segment AB began approximately 20 feet from the bow of Vessel Three and ran along the keelson to the eastern edge of the jetty with a total length of 148.75 feet. Here at point B the baseline turned north forming an angle of 92° at the vertex of AB and BC. The baseline ran for 13 feet forming line segment BC. At point C the baseline turned east forming an angle of 173° at the vertex of BC and CD. Line segment CD was 53.6 feet in length. At point D the final turn was made forming an angle of 52° at the vertex of CD and DE. The final line segment of DE was 125.25 feet long. The baseline covered both Vessel Three and Vessel Two. Vessel One was excluded from the baseline due to its perpendicular orientation to the other two vessels, the shallow depth where it was located and the small amount of the vessel that protruded from the jetty.

Due to the currents generated at the site by wind, a decision was made to anchor the baseline to the keelsons of Vessel Three and Vessel Two using small nails. This provided stability to the baseline and prevented movement. The baseline was anchored at each end by driving a large metal fence post at an angle into the lake bottom reinforced with rebar outriggers. The baseline was attached to the fence post using stainless steel U bolts. The baseline was tagged at 10-foot intervals with 0 being located near the stem of Vessel Three. Cross lines composed of polypropylene were attached to the baseline at 10 foot intervals from 90 to 130 on line segment AB to 210 to 250 on line segment DE with the intentions of moving the lines east as the project progressed.

After the baseline was established the team then recorded its location from the main site datum using an electronic distance measurer and transit. The position was shot using the same datum established during the 2001 field season located at the end of the Graef and Nebel Quarry jetty. All five points on the baseline were shot. A diver was placed in the water on scuba with a support person on the surface using snorkel and mask. The diver placed the base of the stadia rod directly on

the specified point located on the baseline. This process was repeated for all five points on the baseline. Along with the baseline the team recorded a detached piece of wreckage located to the west of the jetty beyond the baseline.

The next goal for the project was to produce a plan view map of all three of the vessels. Three separate maps were made due to the size of each of the vessels. A sketch of the baseline and the position of the vessels coordinated the underwater measured sketches produced by the individual divers, and prevent any section from being left out of the overall map. Mapping units consisted of ten-foot increments on the base line with each technician responsible for mapping from the baseline to the port or starboard side of the vessel. The divers used hookah surface supplied air and scuba to complete the mapping of Vessels Two and Three. Surveyors located the positions of any disarticulated sections of wreckage by triangulation from the baseline.

Students mapped Vessel One using snorkel, mask, and scuba due to its location in shallow water averaging two-feet. The map was created using reference to a temporary baseline established between the jetty and the stem post. Individual features were measured in reference to each other. After this phase of recording, the locations of the major features of Vessel One were recorded using transit and EDM. Most of Vessel One remained buried in the jetty by large stones.

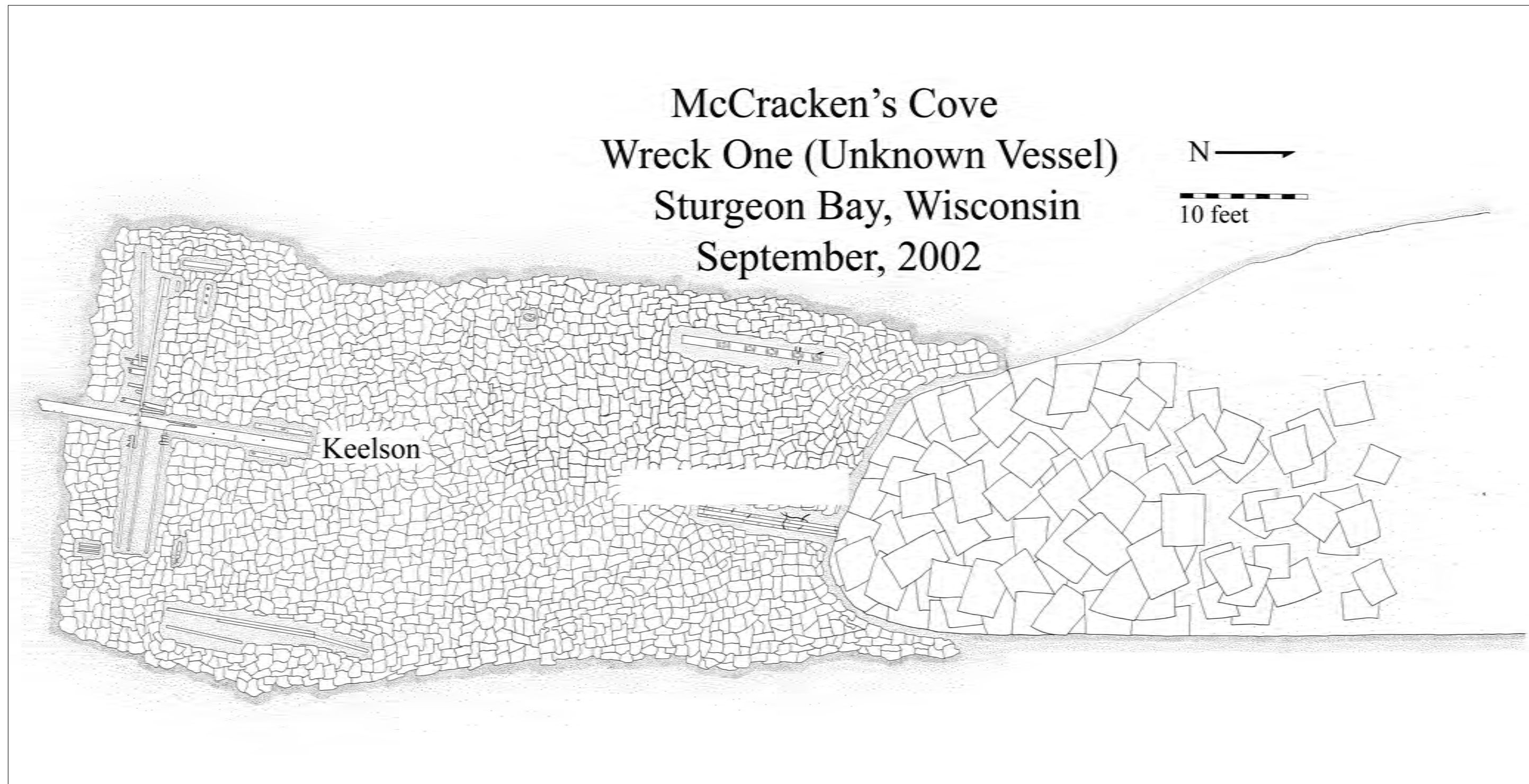
Technicians working individually or in teams of two carried out mapping on site. Each diver was equipped with a dive slate, ruler, measuring tape, pencil, plum bob, and close pins. Individual sections of the site were recorded by producing measured sketches or by producing a scale drawing on location on Mylar. Participants then traced the Mylar drawings onto the main vessel site map. The measured sketches were later used to recreate the vessel using the diver's measurements.

The final phase of mapping consisted of creating a cross section of Vessel Two and Vessel Three. A cross section of Vessel One was not feasible because so much of it was buried under the jetty. When site mapping was complete the baseline was removed. On the final swim in a diver located the remains of the axles of what the authors believe to be a narrow-gage mining car. This discovery was made on the final day of the project allowing little time for proper investigation. The location of the axle was trilaterated to pieces of wreckage discovered during the initial visual survey and photographed. Collection of historical information relating to the site took place at the local library as the project progressed.

Description of Findings

■ VESSEL ONE

Vessel One is an unidentified centerboard schooner partially buried under the jetty almost completely covered with rock (Figure 9). Its length cannot be determined but it has a 26 foot beam determined by measuring from the centerboard trunk to the starboard side. The stem post is sheared at its base but remains underwater just beyond the tip of the jetty. The single-frames that do protrude from the rock overburden have two-foot (0.61m) centers. Single-frames would be an unusual feature of any nineteenth century schooner type vessel on the lakes and may indicate



FOLD OUT TO REVEAL FIGURE 9

Figure 9. Vessel One lies mostly buried beneath the riprap stone making up the outboard end of the old Graef and Nebel quay. Only the tops of the starboard side frames show through the rock overburden, but this is enough to indicate that this is a scow schooner (©Program in Maritime Studies, 2006).

that rather than frame tops, these are actually king post tops, marking this ship as a scow. Adding to the circumstantial evidence that the vessel may be a scow-schooner, is an unidentified piece of wreckage lying just 300 feet distant (91.5m) to the northwest, that appears to be the partial side section of a scow. Since *Dan Hayes* retains both of its sides, the piece is of unknown origin, and there are no other close by wrecked or abandoned vessels.

Unlike the other vessels that make up the McCracken's Cove Jetty, Vessel One lies under, but is oriented in the same direction as the jetty, bringing up the possibility that the entire 400 foot (121.92m) length of the jetty is composed of scuttled vessels covered in riprap stone. If this is true there are probably two more ships lying beneath the jetty possibly placed there to serve as cribbing when the wharf was first constructed in the 1890s. Vessels Two and Three were obviously brought in after the main construction had been completed and were oriented to increase loading exposure at the end of the wharf by having one flank exposed to the bay, capping the T. Vessel Two's side has split open dumping its overburden probably necessitating the introduction of Vessel Three to the wharf to renew loading activities. Vessels Two and Three, therefore, are likely later introductions to the structure and may be slightly newer vessels than those that are interred within its structure.

■ VESSEL TWO (*Phoenix/J.S. Williams*)

Vessel Two represents a relatively small schooner type sailing vessel that likely carried a centerboard (evidence for the centerboard can be seen toward the bow, the centerboard trunk is no longer intact) (Figure 10). Its dimensions fit roughly with that of a canaler of about 120 feet in length (36.6m) by 26 feet in beam (7.9m). Its exact dimensions cannot be determined now because of the rock overburden and the fact that the hull is much broken and scattered. It is conventionally built with double frames.

The port side appears to have fallen outboard likely due to the vessel's role as cribbing within the wharf and the weight of the rock heaped into its hold. This suggests that usage patterns continue with these vessels even after their incorporation and adaptive reutilization for cribbing within a wharf. The unsupported outward deep face of the ship (turned crib) lies unsupported. The tendency must have been for these unsupported sides to fall outward over time from the weight placed in them. A collapse of this sort would necessitate the mine owners to scuttle yet another hulk outside the first to continually extend the deep face of the wharf. It is highly likely that if the quarry business had continued longer, that more hulks may have been discovered outboard of Vessel Three.

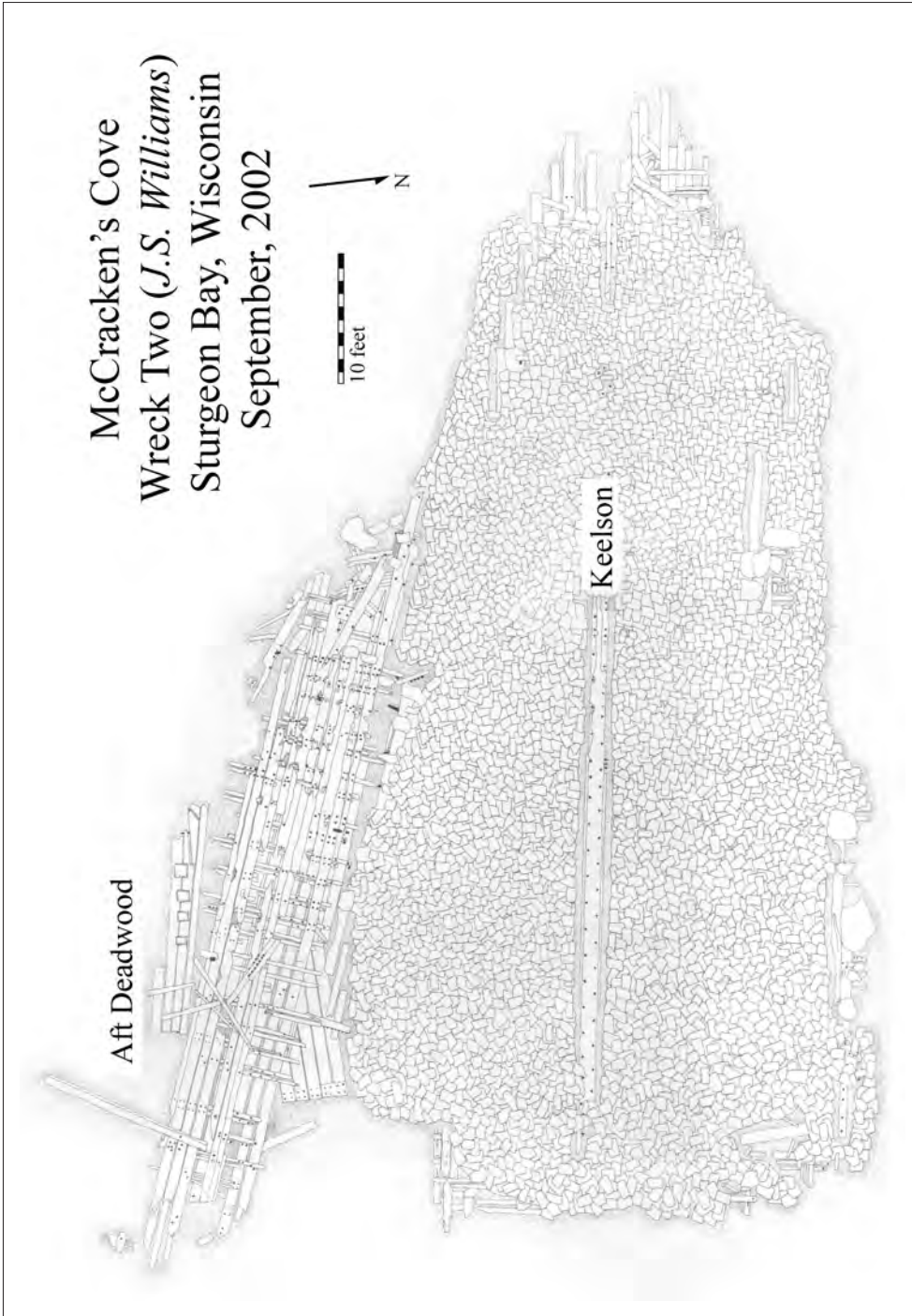


Figure 10. Vessel Two is buried beneath stone at the end of the old Graef and Nebel quarry quay but is oriented to cap the “T” at the end of the jetty. The port or out-board side of the vessel has fallen away under its heavy burden (©Program in Maritime Studies, 2006).

■ VESSEL THREE (*Cleveland*)

Of the vessels at McCracken's Cove, the most unusual is Vessel Three. As with Vessels One and Two, Vessel Three is filled with stone making it difficult to determine exact dimensions (Figure 11 and 12). It likely would have been between 140-150 feet (42.7-45.8m) long and 25-27 feet in beam (7.5-8.1m). These are standard schooner dimensions for the late nineteenth century yet the ship was clearly built as a steam vessel, with added floor reinforcing toward the stern in order to support the boilers and engines. A log crib covers the after part of the ship precluding a full view of the log shaft and outside stern area. The combination of schooner and steamer features makes this a likely Steam Barge.

If this is *Cleveland*, as suggested in the historic record, it saw service originally as a steam barge in the lumber trade, then a passenger/package freight propeller. This is an unusual conversion as steam barges were built to carry lumber and passenger/package freight vessels carried, as their name suggests, passengers and boxed freight. Generally a passenger vessel is required to have increased dead rise and a sharper configuration for speed. The conversion topside, however, would not have been difficult, as the superstructure of a ship is its least permanent structure and can be changed. Cabins could easily be added to the main deck of a steam barge.

Another unusual internal feature of this steamer is that it carries what appears to be an offset centerboard (Figure 13). Steam Barges in the lumber business did sometimes use centerboards, especially if they were converted schooners (Labadie 2004: 32), but purpose built steam barges seem to rarely be built with centerboards. Steam cargo vessels of this small size could use their engine to offset leeway imposed by the wind and current. The centerboards and centerboard trunk watertight casings, took up valuable hull space. Passenger/package freight propellers are a rarity in the archaeological record but the one studied thus far in Little Sturgeon Bay, did not carry a centerboard (Rodgers 1995: 14, 22). This remains an enigma for Vessel Three, which though clearly a steam vessel also has features of a mid century sailing ship.

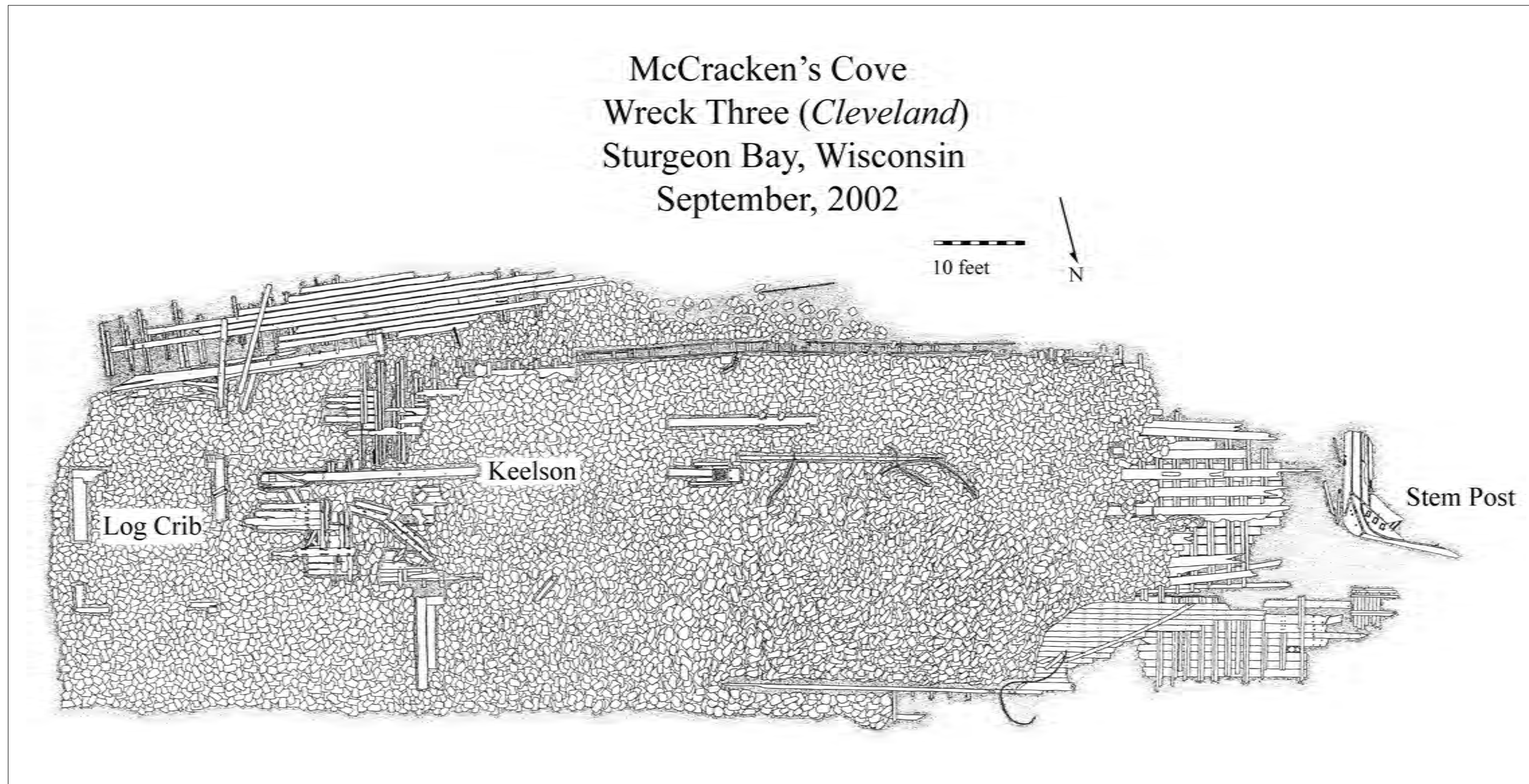


Figure 11. A fortuitous drift of stone from the stern section of Vessel Three demonstrates in its triple floors construction needed to support steam machinery. The bow forefoot lies off to the right side of the drawing. Amidships, bordered aft by the pump box, is the off-set centerboard, indicating that the vessel was constructed before it became popular to put the centerboard through the keel and keelson (© Program in Maritime Studies, 2006).

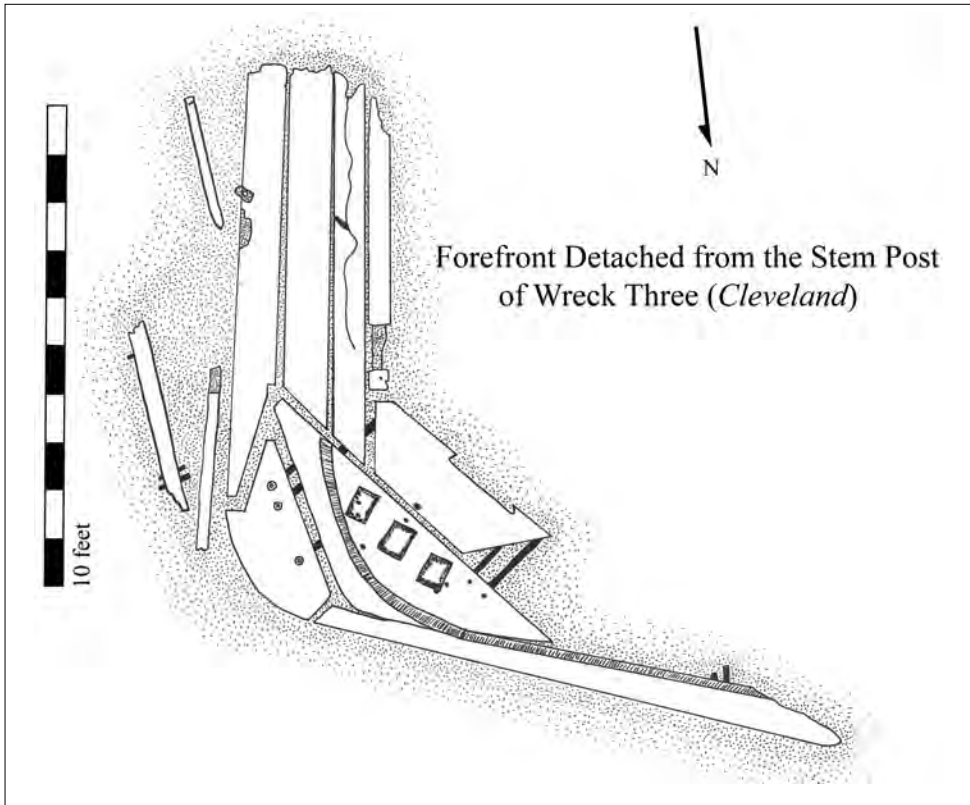


Figure 12. *Cleveland's* forefoot and deadwood. Note the rectangular pockets for the bow cant frames (© Program in Maritime Studies, 2006).

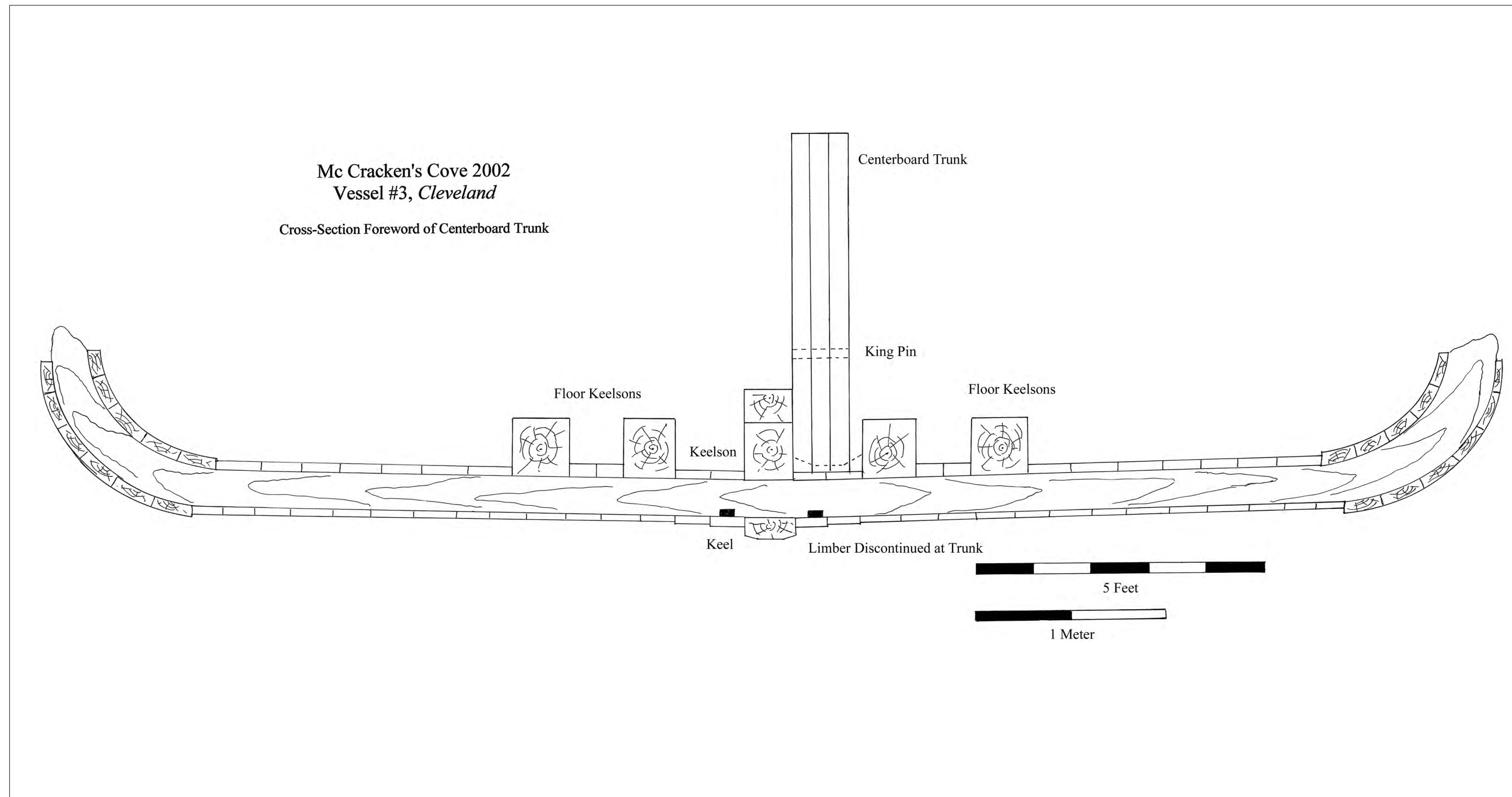


Figure 13. *Cleveland's* cross section complete with two bilge keelsons per side indicate it was a steamer (© Program in Maritime Studies, 2006).

■ VESSEL FOUR (*Dan Hayes*)

Of the four vessels in McCracken's Cove associated with the Graef and Nebel Quarry jetty, only *Dan Hayes* is a shipwreck (Figure 14). The other three vessels are clearly examples of adaptive re-utilization of vessels for a new purpose. The survey conducted on *Dan Hayes*, therefore, provided additional information regarding the wrecking process, artifact disposition, and the marine environment's impact on the site that are not evident with the other watercraft.

The wreck site lies in 6-8 feet (1.8-2.4m) of water, approximately 400 feet (128m) from shore and 300 feet (91.5m) west of the jetty (see Figure 2). Divers established a steel cable base line and cross grid system over the site for mapping. Triangulations of the site were taken at set intervals to create an overall plan view of the wreck. The remains represent the lower section of a wooden ship's hull including the bottom and both the port and starboard sides, now splayed out and lying flat on the bottom. The vessel was constructed in the fashion of a flat or scow, with little or no dead-rise, flat sides with no apparent swell, a ramp for a stern, and what may have been a modified "V" or "bent bow" (Chapelle 1951; Brewington 1966; Inches 1964: 290).

The keel/keelson structure that formed the spine of the scow is internal to the bilge of the ship and does not protrude from the bottom as it would in a conventional vessel (Figure 15). This is an obvious adaptation to shallow-water operation; decreasing the likelihood of damage should the vessel run aground. There are cross keelsons that run the entire beam of the ship and are mortised directly through the keel. These cross keelsons are pinned into the mortise in the keel by iron drift pins driven through them from the bottom of the ship. Since the pins pass through the keel and cross keelsons, and into, but not through the keelson it is difficult to conclude anything other than that the bottom of the ship was built in an inverted position. Though named cross keelsons, in flat or barge terminology, these scantlings are more analogous to floors in standard wooden ship construction. The cross keelsons add stiffness to the bottom of the ship just as conventional floors do, strengthening the vessel in cross section. No limbers are needed for passage of water to the pump, as longitudinal stringers are placed between the cross keelsons and the bottom outer hull planking. This allows free flow of bilge water the length of the ship.

The lack of centerboard trunk and chain plates makes it difficult to conclude that the ship ever sailed. Only a single piece of archaeological evidence suggests this vessel was a sailing scow converted to a barge. Approximately 30 feet (9m) from what would have been the stem of the vessel the keel is no longer pierced for cross keelsons, but rather contains pockets for a set of discontinued cross, or half keelsons. These pockets extend for 27 feet (8.23m) along the keel/keelson and may indicate that the vessel once contained a centerboard that was later removed when it was converted to a stone barge. The pockets do not appear wedge shaped as they would on a conventional centerboard trunk to lock in the half cross keelsons. Normally one of the half frames contains a dovetail which is inserted into the wedge shaped mortise in the pocket. Then a locking half frame is pushed in next to the dovetail so it cannot back out. Since the cross keelsons on this vessel are not paired this locking pocket system may not have been useful.

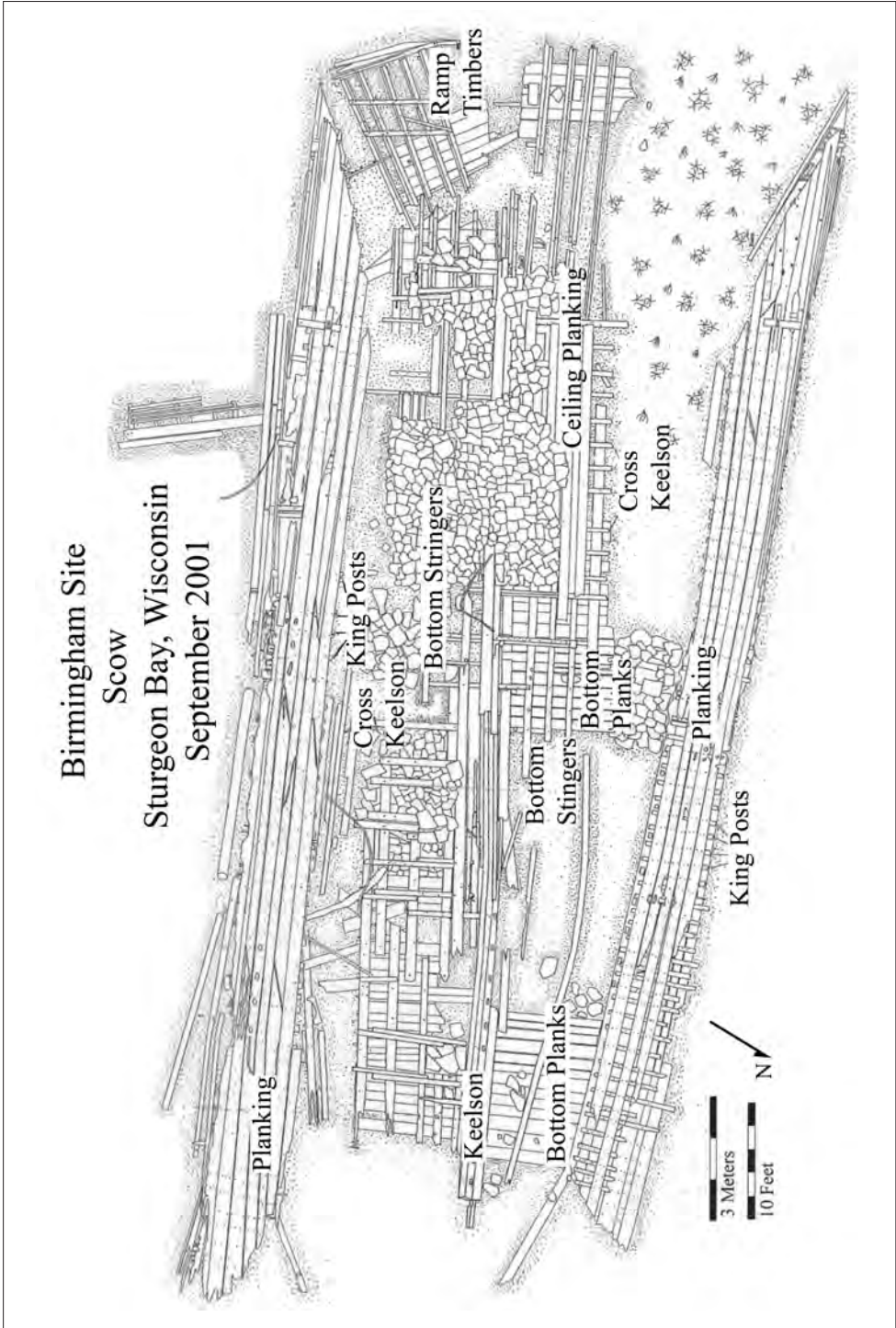


Figure 14. Scow Schooner *Dan Hayes* with sides fallen outward and bow toward the bottom of the drawing. These ships had a flat bottom shallow draft, ideal to service unimproved harbors (© Program in Maritime Studies, 2006).

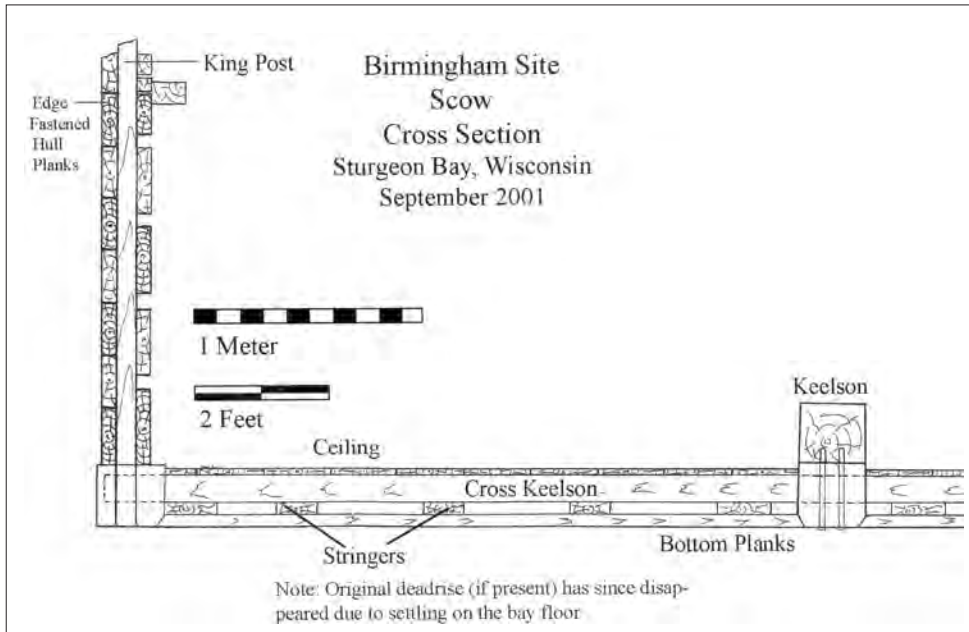


Figure 15. *Dan Hayes* half cross-section showing the internal keel/keelson structure. Fasteners driven from the bottom up through the keel indicate the bottom of the vessel may have been built upside down and inverted before the addition of the sides (©Program in Maritime Studies, 2006).

The keelson remained intact only near the center of the ship where it was apparently protected by the cargo of stone. Any signs of the fore or mizzenmast steps have disappeared along with the keelson and the main mast step lays buried under tons of dolomite. The keelson's separation from the keel in the fore and aft section on the wreck can be attributed to the fact that the fasteners from the keel are merely pins – not through-bolts.

The sides of the ship are fastened much like other ships of the Great Lakes with the larger scantlings drift-pinned while the planks are fastened with nails and roves, also known as compression washers or clenches. Construction of this scow, however, is unlike the construction techniques of a conventional schooner. The bottom planking runs athwartships with the planks fastened to longitudinal stringers located in the bilge. The stringers, in turn, are nailed under the cross keelsons. The cross keelsons are far fewer in number with greater/wider spacing (1.22m/4 foot intervals) than would be expected of floors on a conventional schooner. Longitudinal ceiling planking then covers the cross keelsons to form the cargo bearing bottom of the hold.

The nail and fastener heads for the stringers, cross keelsons, and bottom planking do not show inside the bilge of the ship even with the bilge ceiling removed. This has the obvious advantage of leaving a smooth hold. Any nail heads or projections into the hold would interfere with removal of cargo by a square-nosed shovel. The smooth hold, combined with the fact that the keel/keelson pins are also driven up from the bottom, suggests that the bottom of the vessel must

have been constructed upside down and then inverted to an upright position for the attachment of the sides. This is not an unheard of technique for constructing scows, but would require a substantial effort on the part of the shipyard to flip the hull over once it was complete. Despite the extra step in assembly, rolling the bottom of the hull is no doubt preferable to nailing upward in order to attach the bottom planking, stringers, and cross keelsons. Perhaps the bottoms of these ships were flipped over during a side launch and only afterward the sides and ends attached. One drawback to this construction method is that the pins, bolts, and nails were not clenched, peened (bent over), or flattened to prevent working loose or pulling through. Non-clenched fasteners may be one reason for a B insurance rating.

The sides of the vessel are fastened to the bottom at a 90 degree chine. The chine log accepts both the cross keelsons and the king posts, which act as frames running up the sides at two foot (0.61m) intervals. This manufacturing technique would make it easy to attach the prefabricated sides to the bottom after inversion, simply by raising the sides (barn fashion) and stepping the king posts into the chine log. The exterior and interior of the ship's sides are planked much like outer hull and ceiling planking on a conventionally built ship, the notable exception being that there is little or no curvature, swell, or tumblehome, and the gaps between the ceiling planks are fairly large. Planking and scantlings appear to be oak. The outer hull side planks are 3 inches (76mm) thick; the side ceiling planks are 2.5 inches (63.5mm) thick and are scarfed to the continuing plank with a simple flat scarf. Side planking is edge fastened, though it is impossible to discover whether the 1 inch (25mm) drifts extend from sheer to chine, or merely connect two or three planks. Outer hull bottom planking is 2 inch (5cm) thick while the bottom ceiling is only 1.5 inch (38mm). This is an unusual feature in this ship. Most often Great Lakes craft carry thicker ceiling planks than outer hull planks. The side planking tapers to a point at the stern where it would have followed the incline of the ramp and is rounded at the bow, demonstrating that this vessel once carried a 'bent bow' (Rodgers and Corbin 2003: 216-218).

Conclusion

A study of the dolomite industry is integral to the history of Sturgeon Bay, Wisconsin, but its repercussions extend far beyond this one community. At its heart this survey is but a segment of a far larger project, a 20 year ECU research design that has now documented all of the major vessel types that operated in the Great Lakes in the nineteenth Century. This would not have been possible, but for the tremendous boon Sturgeon Bay offers nautical archaeology. By pure coincidence the stone mining industry, in its habit of converting various ship classes to stone barges, has assembled an archaeological treasure trove of easily accessible, well preserved, abandoned and wrecked watercraft, bringing together in one area many different Great Lakes' ship classes of the nineteenth century. Had archaeologists depended solely on finding these vessels, hunting singular shipwreck sites in deep-water lake bottomlands, the two-decade survey would have taken far longer.

The archaeological implications of this fortuitous turn cannot be understated. Researching and understanding this marine dependent industry has greatly accelerated our knowledge base, not only of mining, but also the maritime history of the Great Lakes, ship construction, and the transfer of technology. Indeed, locating the centers of shipboard industries may become a paradigm or strategy on which future archaeological research can be planned. Until now finding shipwrecks has largely depended on luck, or on searching areas of known shipwreck concentrations such as ship traps (areas of frequent wrecking) or ship graveyards. Yet watercraft abandonment and adaptive re-use near known marine industries has proven, at Sturgeon Bay, a better way to add some predictability to the search for these cultural resources. McCracken's Cove could theoretically be used to build a predictive model for determining the locations of additional submerged resources. Sturgeon Bay, therefore, offers up a valuable case study in archaeological resource concentration and accessibility all contained within its submerged scuttled watercraft, its gigantic wharf/jetty loading facilities and in its open pit mines lying quietly in the forest. The following conclusions, therefore, can be put foreword from this study, dovetailing them with the previous 20 years of Great Lakes research.

Limestone Mining

Archaeological evidence of the dolomite limestone stone trading network litters both the bottom of Lake Michigan and its shores. After the lumber industry slowed in Door County in the late 1870s, the economy of Sturgeon Bay eventually focused on quarrying and exporting dolomitic limestone. Archaeological investigations highlight an industry that dominated the area in the late nineteenth and early twentieth centuries in numbers of workers and capital outlay. Though not well pre-

served in the historical record, the story of this industry lies virtually undisturbed in the archaeological record. During the 2001 and 2002 fall field seasons, East Carolina University archaeologists and graduate students tapped into this record, building upon knowledge gained during previous surveys.

Historical and archaeological research helped to confirm the identity of the large Graef and Nebel jetty at McCracken's Cove plus two of the three vessels at the end of the jetty. It also allowed us to speculate on its artificial nature. It is obvious that all three stone barges were filled with rock and sunk to extend the jetty into deeper water. Without moving any overburden it can be seen that one unidentified wreck lies within the jetty, a small portion extending directly from the end. It seems highly probable that if the entire jetty is constructed in this manner that two more cribbing hulks may lie inside the base. It now also seems likely through their construction features and size that *J.S. Williams* and *Cleveland* lay off the end of the jetty, perpendicular to it. This particular mining practice would be expected over time to manifest itself in the archaeological record through the deposit of a series of parallel hulks used to successively cap the "T" of the jetty, necessitated when the outboard side of the previous hulk finally gives way, spilling its stone, through time and gravity. Had the quarry lasted longer it could be theorized that more vessels would lie parallel and outboard of *J.S. Williams* and *Cleveland*. The vessels deposited in this manner could be dated relative to one another with the older vessels lying closer to shore.

The Phase II survey plan did not include excavation, so only the protruding pieces of the three vessels were mapped. One side of wreck two, *J.S. Williams*, lay broken off and uncovered while sections of the keelson and surrounding scantlings protruded from the rocks that filled this wreck. The fallen side of *J.S. Williams* lay close to and mingled with pieces of *Cleveland* (see Figure 2). While speculation suggests that at some time the port side of Williams collapsed necessitating the sinking of *Cleveland* outboard to repair the deep face of the wharf, there is little doubt that some bridging was needed to run track between the two scuttled vessels. This bridging is evidenced at the south end of *Cleveland's* keelson; a stone crib here successfully fills in the gap between the sunken barges. Four logs, nearly four feet (1.22m) in diameter, formed a box to hold tons of rock. The stone crib seems to be an effective method of extension and would have served as a bridging support between the two hulks on which the mining car track could be laid.

The presence of submerged railcar axles discovered in the last few days at the site and rail iron off the end of the quay contribute more pieces of archaeological evidence. The land and water components of the limestone industry existed in concert, each depending upon the other. The maps and archival information gathered in this and other field seasons clearly illustrate this relationship but it is the archaeology that truly fills in the details of how this industrial connection between land and water worked.

Further study of the Graef and Nebel Quarry jetty would necessitate a Phase III full excavation study. Phase III excavation would uncover the ship cribs revealing detail we cannot see at present. On the other hand excavation would likely not be cost effective at this point. Some of the rocks that make up the point weigh close to a half ton and the work would be difficult, time consuming, and expensive.

Line searches have indicated no other wrecks or abandoned watercraft in the immediate area. As mentioned, it is possible that the entire jetty was constructed in the same manner as the extensions studied and may hide more wrecks beneath its stone mantle. Older vessels may indeed form the base of the jetty, but in order to determine this, major excavations would be required. Without further archaeological investigation, the information already gathered during the Birmingham site investigation adds substantially to the history of Door County. The dolomite industry and the ruined quarries that still dot the shores of Lake Michigan remain an essential part of the historical and archaeological record. No history of the area is complete without these components. The histories of *Dan Hayes*, *J.S. Williams*, and *Cleveland*, contribute to our understanding of the Door County stone industry, and also add a new dimension to the already rich cultural history of this area.

Vessel Two - *Phoenix/J.S. Williams*

Though almost completely covered in quarried limestone there are hints in the archaeological record that add to the information surrounding *J.S. Williams* (*Phoenix*) and *Cleveland*. *Williams* by its historic dimensions would be considered a canaler. This is a logical assumption since the vessel was built on Lake Ontario and had to fit through the Welland Canal to make it to the upper lakes. Welland Canal ships invariably just fit the locks at 142.5 feet (43.4m) in length, 26.25 feet (8m) in beam, with a 10 foot (3m) depth of hold (Mansfield 1895, 229-236). They were extremely boxy in shape with a 5:1 length to beam ratio and often put to use carrying lumber, just as *Phoenix* was originally. A centerboard was an absolute necessity to sail these shallow draft ships.

The scuttled vessel at the Graef and Nebel quarry jetty roughly fits these dimensions and is built with a centerboard. *J.S. Williams* is also double framed and very conventionally built. Nothing in the archaeological record here refutes the historical identification of this vessel as *J.S. Williams*; on the other hand, there is nothing to identify it positively either. The fact that canalers seem ubiquitous to the lakes demonstrate how far a-field ship trading and construction were on the Great Lakes. Builders from any of the five lakes were fairly well known and sold vessels regionally to entrepreneurs regardless of distance.

Vessel Three - *Cleveland*

As mentioned in the Description of Findings, *Cleveland* is a bit of an enigma. Built as an early, but standard steam barge, it was at one time fitted out as a passenger/package freight propeller. Steam Barges in generally hauled lumber and were also known as lumber hookers and rabbits. They are boxy in cross section, beamy, and often carried much of their cargo exposed on the main deck. Internally a steam barge on the Great Lakes took much of their design from sailing schooners. In fact it can be said with some justification that they were no more than a schooner hull fitted with a steam engine and boiler.

Inside a steam barge would have also carried extra longitudinal floor or bilge keelsons to support the extra weight of the machinery and stiffen the hull lon-

gitudinally. Vessel Three at the Graef and Nebel quarry exhibits characteristics of both a steamer and a schooner, as would be expected for a steam barge. It carried two floor keelsons per side and extra floors aft to support the weight of the steam engine and boiler. It also carried an offset centerboard, a characteristic of most schooners that were built before 1860. In this case the centerboard trunk lies to the port side of the keel/keelson structure. Generally, the centerboard and centerboard trunk are built directly through the keel/keelson assemblage just after this time. Since the vessel was built in 1860, it is not surprising that the centerboard is still located in its older traditional position. This trait is the best indicator on site that this ship is indeed an older model steam barge, and if it is *Cleveland* it is the oldest yet documented on the lakes.

Conversion of *Cleveland* to a passenger propeller would have been largely cosmetic with the addition of cabins to the main deck and the movement of the pilothouse over these deck cabins forward. The engines and boilers would have remained as is. The only problem with this conversion is that the boxy, full shape of *Cleveland* would have made it slow compared to purpose built passenger/package freight propellers. Passenger/package freight propellers were characterized by a knife like high length to beam ratio and moderate to extreme dead rise, sacrificing in their shape cargo capacity for speed (Rodgers 1995: 19-20). Speed is generally a necessity in the passenger service and may indicate why *Cleveland* ended its service modified once again into a cargo vessel.

Though not conclusive, archaeological evidence in terms of the vessel's size, internal construction, and offset centerboard trunk hint that Vessel Three is indeed *Cleveland*. As mentioned, *Cleveland*, built in 1860, is the oldest steam barge yet studied and, therefore, an extremely valuable example of this class.

Vessel Four - *Dan Hayes*

The remains of *Dan Hayes* represent a well-preserved vessel approximately 105 to 115 feet (32-35m) in length with beam of between 23 to 25 feet (7-7.62m). Depth of hold would have been about 5 feet (1.5m) to 7 feet (2.1m), giving the ship a Morsom's Rule tonnage of approximately 120 to 144 tons. *Dan Hayes'* recorded dimensions of 112.1 feet (34.17m), by 24.2 feet (7.38m), with a 7 foot (2.13m) depth of hold at 138 to 145 tons is well within this projection. The archaeological investigation also confirmed that this vessel carried stone as its final cargo. In addition, a grounding event is strongly suggested, as the barge was lost in a depth equal to its draft. It seems that these factors combine to corroborate the historical record. This vessel is very probably *Dan Hayes*, which was intentionally grounded by the tug *Duncan City* on its last voyage. Remarkably, the vessel sank only a very short distance from the wharf where it loaded on 6 August 1904, indicating that *Duncan City* very nearly succeeded in returning it to the dock.

Evidence suggests that this ship originally contained a centerboard, a necessity if a scow is to sail, but other sail related evidence is missing or hidden as the wreck now lies. Conversion to a barge probably meant that much of the standing rigging was removed along with the centerboard. In addition it appears that tie bolts were installed athwartship with turn buckles to reinforce or perhaps replace the deck

beams. There is no sign of decking or deck beams in the archaeological remains.

There are few historic references concerning the operation and construction of Great Lake scow schooners. Evidence collected concerning *Dan Hayes* also suggests that shipbuilders manufactured medium or large scow schooner bottoms in an inverted position and turned upright before the addition of sides, bow and stern. In fact, the evidence available suggests these shipbuilders may have produced these vessels in sections with each of the major parts produced independently and brought together for assembly.

Archaeological indications from the wreck of *Dan Hayes* suggest a cheaply constructed, though sturdy, working vessel of moderate tonnage and shallow draft. As built, the ship required neither expensive lofting techniques nor particularly skilled craftsmen. This is just the type of ship needed to serve smaller hinterland communities. Construction costs were reduced by prefabrication and the use of smaller scantlings and planks of shorter length than would have been used for a conventional schooner. The slab-sided construction obviated the need for lofting and bending of planks and steelers. Time in the shipyard was saved by constructing the bottom of the ship upside down and attaching the slab sides after the bottom was completed and inverted. Additional time and money was saved by the use of pins over through-bolts.

It seems doubtful that these cheaply-constructed craft could compete in sailing qualities or durability with grain- or canal-schooners, yet their numbers in the nineteenth century indicate that such compromises in construction made them economically competitive, especially in the market they served. Their shallow draft and flat bottom allowed them to serve unimproved ports. Eventually, however, rail services to these small hinterland agricultural communities relegated the last of these vessels to adaptive reuse, and eventual deposit in the archaeological record by the early twentieth century.

The significance of *Dan Hayes* site is that it represents a converted scow schooner of the later nineteenth century. Neither archaeologists nor historians have studied scows and scow schooners in great depth. Yet their contribution to the local economy and the service they performed for the smaller communities cannot be overlooked.

In addition, their construction, and particularly the idea that vessels of this large size could be constructed upside down and rolled over for finishing is not well documented or understood historically. Nor the idea that cheaply built, but arguably seaworthy, coasting vessels, such as this scow, not only provided valuable transportation service to the hinterland communities, but must have also competed economically with larger better-known schooners, bulk carriers, and consort barges of the nineteenth century (Rodgers and Corbin 2003: 222-223).

Birmingham's Site at McCracken's Cove has been documented using pre-disturbance, non-intrusive techniques. No artifacts were recovered for study, no bottom soil was moved, and all survey markers were recovered, the site has been left as it was found. Hopefully future generations will better appreciate their diving and snorkeling opportunities on this site with the knowledge of what lies there.

Of the four ship hulls exposed at the site, two appear to be scow schooners, *Dan Hayes* and Vessel One in the jetty. Scow schooners are an understudied ship

class built cheaply, and as evidenced by *Dan Hayes*, perhaps built assembly-line fashion. They nonetheless, dutifully carried commerce to the shallow unimproved harbors and ports of the area. Vessel Two, *J.S. Williams*, is likely a type of sailing schooner known as a canaler, yet another understudied vessel type. While Vessel Three, *Cleveland*, is the oldest steam barge ever archaeologically documented and an extremely important case study for this vessel class. In all, this vessel assemblage represents an extremely valuable archaeological/historical resource, and must be respected by the community for what it tells citizens of the past and the hard maritime industrial work of their forbears.

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