

FINAL REPORT  
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**ARCHAEOLOGICAL INVESTIGATION of SCOW SCHOONER *W. R. HANNA* at  
KELLEYS ISLAND, LAKE ERIE, OHIO, OCTOBER 1998 - JUNE 1999**

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## I INTRODUCTION

During the second week of September 1997, a four-day workshop in underwater archaeology was conducted at Huron and Kelleys Island (Ohio) in Western Lake Erie by the authors in conjunction with Firelands College of Bowling Green State University and sponsored by Lake Erie Protection Fund Grant No. 63-97. Field exercises focused on the wreck of the small wooden steamship *ADVENTURE* (Ohio State Archaeological Site #33ER481), which had sunk on the North side of the Island in October 1903 following a disastrous fire. Site documentation included examination and recordation of disarticulated debris surrounding the 105-foot steamer. This debris consisted of the ship's stem, which had somehow been displaced by about 150 feet in a northerly direction from its normal position, and what was presumed to be one of the ship's sides lying about 50 feet away in the opposite direction. Careful examination of the latter wreckage revealed that it was not a part of the steamer *ADVENTURE* at all, but rather the remains of an entirely different vessel. It was believed to be the wreckage of a distinctive Great Lakes sailing craft known as a scow schooner. The second vessel was subsequently assigned Ohio State Archaeological Site No. 33ER488.

Time and resources did not allow for a survey of the new wreck during the 1997 season, and so nothing more than a cursory examination was done that year. Plans for a more thorough documentation were deferred until the following year. In October 1998 the second in a series of shipwreck archaeology workshops was again sponsored by the Lake Erie Protection Fund (Grant No. 89-98) which was attended by 40 recreational divers. The second shipwreck, *W. R. HANNA*, was mapped as a class exercise and its documentation is the focus of this final grant report. Additional field work on the site was completed in the summer of 1999.

Preliminary analysis of the new site indicated that it represented the entire lower hull of a wooden scow schooner, a simple square-ended vessel used on the Great Lakes from the 1820s until the turn of the Century. The centerline keel assembly was found almost complete, measuring 82 feet in length and including a centerboard trunk. The outlines of both sides could be traced for much of the vessel's length, and their position indicated a beam (width) of approximately 20 feet. In addition, several longitudinal keelsons were found in the ship's bottom on either side of the keel. On the other hand, many of the central features of the little ship were obscured by a mound of limestone presumed to be the ship's cargo, and both ends of the hull were missing.

Interestingly, the vessel proved to be "cross-planked", unlike most wooden ships, which are longitudinally or "fore-and-aft" planked. As far as is known this is the first vessel of that variety yet discovered on the Great Lakes, and it will provide a rare opportunity for study. The longitudinally-planked scow schooner *ROCKAWAY* was documented off South Haven Michigan in 1984 by an archaeological team from the Lake Michigan Maritime Museum, providing many valuable observations on that variety of scows. Cross-planked ships are a very old vessel type, but little is known of their construction. Wooden ships of the Western World are almost universally built with longitudinal planking fixed to transverse frames, and cross-planked vessels must of necessity, have had longitudinal frames. It has long been acknowledged that some cross-planked scows were built on the Lakes, but scholars have long puzzled about the details of their construction, and in particular, how they must have been framed. The documentation of this vessel will be a highly significant contribution to the history of regional watercraft as a result. Unfortunately, this report is not likely to answer all of the structural questions since both ends of the vessel have been destroyed.

## II GREAT LAKES SCOW SCHOONERS

A scow is a vessel with flat bottom, vertical sides, and a "hard chine" or square bilge. More conventional sailing ships the world over had rounded bottoms and sides with a relatively gentle curve at the bilge where bottom and side came together. In general, the rounder the bilge, the stronger the vessel's hull. The simple scow hull-type appears to have been in use before the medieval period in the shallow rivers and estuaries of Western Europe. Their sturdy shallow-draft hulls made scows particularly suitable for ferries. Although the earliest of these vessels seem to have been rowed, sculled, pole-driven, or pulled by ropes, some seventeenth-century Dutch engravings show sail-driven scow ferries as well, fitted with a single spritsail (DeGroot-Vorstman, 1980:181, 200). Interestingly, in these craft the mast was stood at the vessel's side so that wagons and carriages could be loaded on deck without the obstruction posed by a mast on the centerline. The literature seems to apply to these vessels the name "pont" or "ponter", undoubtedly the root for the modern term "punt", which refers to a small, square-built duck-boat. British historian John Leather attributes the origin of the general scow pattern to the old Dutch "schouw", "a swim-ended craft with bow and stern transoms, really a large form of pram." (Leather 1984:221). The British used many different scow-type vessels in the 17<sup>th</sup> and 18<sup>th</sup> centuries, all of which were classified as barge types (Carr 1936:5ff, 15-16.)

It is not known how or when scows were introduced to the New World, but it would not be surprising if the tradition was brought by Dutch or English colonists very early in the history of this country. Scows were tailor-made for large estuaries like the Chesapeake, the Hudson, the Delaware or the innumerable smaller tributaries reaching inland from the Atlantic. Historian Howard I. Chapelle describes many varieties of flat-bottomed watercraft in use in American waters in the eighteenth and nineteenth centuries, including several different sailing scows (Chapelle 1951:32-33, 45ff). Georgia archaeologist Mark Newell studied numerous "flatboat" designs used in the Southeast, and concluded that the general type was probably brought to America by the English, who used it to colonize the seaboard. He refers to "flat-bottomed pull boats" employed in the (American) colonies as early as 1638 (Newell, 1996:9). Newell also describes a primitive variety of small cross-planked scows which he calls "chine-girder boats". He attributes their development to the very old split log tradition, where the sides of a boat were fashioned from two halves of a split log, and transverse bottom planks were attached between them to gain sufficient width for carrying cargo. He does not venture to guess when the first sailing scows were developed.

Commercial navigation came to the Great Lakes ostensibly following the War of 1812 when the British relinquished their tight control over the region and American entrepreneurs began building ships for competitive trade. The vessel of choice for the next decades was the two-masted schooner. By 1820, there were dozens of them operating on lakes Ontario and Erie, and ten years later their numbers had multiplied several fold. At the height of the sailing ship era in 1870, there were nearly 2,000 schooners on the Great Lakes, including several varieties of sailing scows.

The late Dr. Richard Wright of Bowling Green State University (Ohio), using official U.S. government enrollments, found references to scow schooners operating on Lake Ontario and the Finger Lakes of New York as early as the mid-1820s (Wright, personal interview, c.1985). Twenty years later they were in use all over the Great Lakes and in Lake Champlain. Several hundred scow schooners were eventually built on the Great Lakes, and others were constructed on the Gulf Coast, in California, and eventually in Australia and New Zealand. It was said that there were 400 scow schooners on San Francisco Bay at the turn of the century (Olmsted 1988:24). At least six hundred have been documented on the Lakes using official U.S. Customs Department enrollments; other sources are not nearly as reliable, but suggest that their numbers may have been still greater. Some records describe schooners with "scow bottom" or "scow stern", for instance, and it is impossible to ascertain whether or not such craft were really scows by our definition. It does not help that nineteenth-century journalists were particularly casual about their use of sailing craft terminology. The heyday of scow schooners must have been around 1885, although some of these quaint vessels survived well into the Twentieth century.

In spite of their general longevity and profitability, scows were never ranked by the shipping industry with their more conventional sisters. A key measure of their acceptance was their insurance rating as determined by underwriters. Vessels constructed according to a strict code of standards (the "underwriters' rules") were rated A1, A2, B1, B2, C1 and C2 or, worst of all, "not insurable". The higher the rating, the lower the insurance premiums for a given vessel. The Board of Lakes Underwriters adopted a rule in 1866 saying that:

"Frame-built scows, well-constructed and of good material, with fore and aft bottom plank, may be entitled to class B1 [for] five years, but in no case will scows be entitled to the B1 grade if built with gunwale sides or athwartships [cross-planked] bottom."  
(Board of Lake Underwriters 1866:14)

Scow schooners seem to have been most numerous in the Bay of Quinte and Eastern Lake Ontario, in Western Lake Erie, and around Lake St. Clair and the Detroit and St. Clair Rivers, although they were found from the St. Lawrence River all the way to Duluth. Insights into the operation of a typical Lake Michigan scow may be found in the *Diary of Soren Kristiansen*, published in 1981 by the Delta County Historical Society Foundation of Escanaba, Michigan. The principal criterion for their construction and practical use was undoubtedly shallow water, but they were also very economical. Scows could be built with little money and limited skills, and they could be managed safely by crews smaller than conventional sailing craft (Inches and Partlow, 1964:291). There were many variants of scow hulls, with square ("butt-end"), pointed ("flat-iron"), round ("spoonbill" or "swim-headed"), or barrel-shaped ends (Barkhausen 1947:13-14; Wilson n.d.:32-34). Most scows were built with conventional transverse frames and longitudinal planking, although some had either diagonal or cross-planking, both of which would have required a specialized and non-traditional framing scheme (Greenhill & Manning 1988:126-157). "Gunwale-built" scows had thick sides that provided the requisite longitudinal strength to their hulls, and they could forego the conventional longitudinal planking in their bottoms and utilize simple cross-planking instead (Inches and Partlow 1964:290; Leather 1984:222). Some scows had internal bulkheads running longitudinally, which served the same purpose as the thick gunwales (Hawkins 1987:24-28). Scow rigs were as varied as were their hulls. There were sloops, two- and three-masted schooners (with and without topmasts), scow brigs, brigantines, and barkantines. Most scows used one, two, or three headsails (jibs), and all seem to have been provided with conventional bowsprits for that purpose. Many carried one or two gaff-topsails, although some were "bald-headed" with no topsails at all. Some scows used triangular "raffees" on their foremasts, and a handful, especially in the 1840s, '50s, and '60s, used old-fashioned square topsails. Almost all were fitted up with centerboards.

In spite of their unsophisticated hull forms, scow schooners were generally regarded as good sailers (Chapelle 1951:50; Olmsted, 1988:19). In March, 1860, the scow GRANGER made two trips from Detroit to Kelley's Island for stone within six days in spite of an accidental sinking in the meantime, having been raised the next day (*Detroit Free Press*, March 31, 1860). The SENATOR made 24 round trips from Port Huron, Michigan to Ohio ports during 1870, handling 36 cargoes in a 225-day season (*Port Huron Daily Times*, December 23, 1870). In the 1870s an unnamed scow reportedly outran a fleet of sailing yachts during a much-publicized race from Detroit to Put-in-Bay, when westerly wind conditions were optimal. Scows were also sturdy vessels, capable of sailing in heavy weather and surviving frequent groundings. An 1874 article refers to the 98-foot scow C.C. BUTTS:

"For the twelfth time, the scow BUTTS has been rescued from the beach, and after some tinkering, will if possible, eke out a few years more in the coasting trade...she is 29 years old...and has been wrecked on each of the four [sic] Lakes." (*Detroit Free Press*, June 20, 1874)

### III COMMERCIAL SHIPS IN KELLEYS ISLAND HISTORY

Kelleys Island, Ohio is located in Lake Erie very near the port of Sandusky. It is an important source for high-quality limestone, its' stone quarries dating back to about 1830. At one time it was the largest producer of lime in the world. The Island's quarries furnished building stone for coastal

construction projects, flux stone for steel mills, burned stone for agricultural use, and many other lime products. All of these stone products were transported from the Island on shipboard.

Until around 1880, most of Kelleys Island's stone was carried on board Great Lakes schooners varying from little two-masters 50 feet in length to deep-draft three-masters 200 feet long. Schooners dominated all of the Great Lakes carrying trades from just after the war of 1812 until nearly 1890. During this time the average schooner grew in dimension and tonnage on account of improvements in shipbuilding technology and the general deepening of harbors and channels, but also in response to the burgeoning requirement for the transport of commodities. At the peak of the schooner era in 1871, nearly 2,000 schooners were registered at Great Lakes ports. The number of sailing craft dwindled after that time because of the growing popularity of steam freighters. With a few rare few exceptions, the last schooners disappeared during the 1920s. In general, the ships trading at Kelleys Island reflected the broad patterns of ships employed on the rest of the Lakes, although they were often of the smaller classes because of the necessity to navigate in and out of small unimproved harbors. As early as 1850, many of the craft regularly engaged in the trade were small scow schooners. These rugged little sailing craft were ideally suited for the shallow-draft ports on Lake Erie and Lake Huron; most could be sailed handily by two or three men.

Another class of vessels frequenting Kelleys Island loading docks after the middle 1860s was the "steambarge". This was a single-decked wooden steamer of a little more than 100 feet in length, built to carry lumber cargoes or bulk products such as salt, stone, coal, or iron ore. The earliest steambarges had their pilothouses and all of their cabins perched on the stern along with boiler and engine spaces. After 1880 larger steambarges appeared, some as much as 200 feet in length, and with raised forecastles and pilothouses at the bow. Most of the steambarges in the Kelleys Island stone trade were the smaller variety, seldom exceeding 120 feet in length. They were often paired with consort-barges of similar dimension. A typical schooner could be sailed by four to six men, while a steambarge required 12 to 15; a consort-barge on the other hand, required only two or three. The combination of steamer and barge (or barges) could haul several hundred tons of stone products inexpensively, and unlike sailing craft, they were not dependent on favorable winds. The Kelley's Island Limestone & Transportation Company operated its own fleet of these efficient little steamers from 1872 until they were superseded by more modern craft in the 1940s. Dozens of other owners ran steambarges to the Island's three big docks as well when steam vessels superseded the earlier classes of sail craft. The steambarge *ADVENTURE* was typical of them; her remains were documented at Kelleys Island during 1998, just 50 feet from the site of the smaller scow schooner that is the subject of the present study.

Statements of vessel traffic at Kelleys Island indicate that most of the tonnage in stone was hauled in a few relatively large vessels, but that the most numerous ships were small ones carrying very limited cargoes. Most of the cargoes were destined for Cleveland, but small loads were taken to ports all over the region. Some newspaper reports for a few days in 1881 are typical:

- "KELLEYS ISLAND, O., April 25 – Arrivals since Saturday evening – Steambarge *MONITOR*, [from] Toledo, light; schooner *N. C. WEST*, Toledo, light; scow *PILOT*, Detroit, light; schooner *A. J. ROGERS*, light; scow *SELKIRK*, in tow of tug *AMADEUS* from Cleveland, light. Cleared April 25<sup>th</sup> – steambarge *MONITOR* [for] Detroit [with] stone; scow *PILOT*, Detroit, stone. The *ROGERS* and *SELKIRK* will load with stone for Cleveland and get away Tuesday..." (*Cleveland Herald*, April 26, 1881)
- "KELLEYS ISLAND, O., April 26 – Arrivals this day – schooner *S. B. CONKLIN*, from Cleveland, light; scow *JOHN J. HILL* from Cleveland, light. Cleared – schooner *SELKIRK* in tow of the tug *AMADEUS*, limestone for Calkins & Co., Cleveland; schooner *A. J. ROGERS*, flux stone, Cleveland. The scows *CONKLIN* and *HILL* are loading stone for Cleveland, but will not get away before tomorrow..." (*Cleveland Herald*, April 27, 1881)

• “KELLEYS ISLAND, O., April 27 – Arrivals since noon yesterday – scow *J. M. SPAULDING* [from] Detroit, light; schooner *FERRET*, Detroit, light; scow *J. M. PORTER*, light; steambarge *GEORGE A. MARSH*, Cleveland, light. The schooners *CARD* and *KIMBALL*, Cleveland, light, arrived at noon today. Cleared April 27<sup>th</sup> – schooners *JOHN H. HILL*, Cleveland, flux stone; scow *J. M. SPAULDING*, Detroit, building stone; scow *S. B. CONKLIN*, Cleveland, flux stone; schooner *FERRET*, Detroit, limestone; the *CARD* and *KIMBALL* will load stone for Cleveland, but will not leave before Thursday evening.” (*Cleveland Herald*, April 28, 1881)

A larger sampling would, of course, be more accurate, but its results would not be much different. For that period in the Island’s history, it would illustrate that about half the vessels trading there were scow schooners, although far more than half of the stone was carried in large schooners like the 350-ton *J. F. CARD* and 420-ton *S. H. KIMBALL*. In later years, the proportions would shift further in favor of large vessels, since the average size of schooners had by then grown to 600 tons and more.

#### IV 1998 FIELD INVESTIGATIONS

Following the 1997 survey of the steamer *ADVENTURE*, plans were made to return to Kelleys Island the next year and to survey the small scow schooner found nearby. Buoyed by their success with the 105-foot steamer, however, it was the general consensus that the much smaller wreck would not be the primary objective during 1998, but only a secondary or alternate site. One of the three or four larger wrecks lying near the Island would be given priority. It was a risky choice, since a larger vessel would be much more of a challenge, and the two weekends allotted for the task might not prove adequate. The question of whether or not to go to another site was rendered moot when the team gathered for the workshop early in October and found sustained northerly winds pounding the Island’s North shore. Worse still, the choppy seas had churned up the Lake causing visibility underwater to drop to zero. Even where there was some shelter from the wind and waves, it was impossible to work productively underwater. On Saturday, October 10, an effort was made to set up base lines and to begin a survey of the 140-foot schooner *EXCHANGE*, lying 300 feet off the island’s South shore near the Marblehead ferry landing. After several teams had attempted their individual tasks, the survey was aborted due to the extremely poor visibility. Virtually no useful information was gathered from the site.

On Sunday morning, October 11, the wind diminished and the water clarity began to improve on the North side of the Island, and the decision was made to attempt a survey of the unknown scow schooner. This was the last day of the workshop, and only a small site could have been undertaken at that stage. After several days of frustration and indecision, all of the participants were enthusiastic and optimistic, and they quickly organized into teams.

Project leaders fixed a measuring tape to the centerline keel structure of the wreck, with the zero point at its western (bow) end; this would form the survey baseline. All subsequent observations and measurements would be made relative to that line. Four teams were assigned to different sectors of the wreck site and given the responsibility to document whatever features of hull, cargo, artifacts, or debris might be found there. Each team had a lead person, at least one artist or draftsman, and at least two persons capable of making and recording measurements of wreck features relative to the baseline. One person also photographed significant features of the wreck.

The scow wreck was not believed to be of singular historical value, and it had clearly suffered from decades of exposure to shallow water and sports diving activities. Virtually no retrievable artifacts were seen at the site, and no excavation was planned. As a result, no attempt was made at precise recording of the site with traditional XY-coordinate grids and the stratigraphic measurements normally employed on terrestrial sites. Rather a simple, reliable method was chosen to map the site as efficiently and accurately as possible with the resources available. Wherever possible, simple right-angle measurements were used to establish the location of wreck features, taking advantage of the structure of the ship itself. Since the bottom planking was known to lie at right (90 degree) angles to longitudinal structures like the keel or keelsons, the bottom planks could be used like draftsmen’s T-squares to ascertain right-angle measurements outboard on either side of the baseline. A feature might

lie one foot four inches to port of the 56-foot mark on the baseline. When it was not possible to fix the location of some feature using the right-angle method, more laborious "trilateration" was employed. Using this technique, two measurements are required from different positions on the baseline, and the feature can be shown to lie at the intersection of two arcs defined by the separate measurements. When the measurements are transferred to a scaled site plan, the position can be accurately established. Photographs and measured sketches were also encouraged to illustrate any features of special interest.

A project leader gathered information from the teams during a debriefing that followed each dive, and data was immediately entered onto a site plan. This step proved very difficult, but it was essential to motivating the participants and to tracking the progress of the survey. The resultant, constantly-evolving plan made it clear where any voids existed in the accumulated data, and it ensured that the on-going survey was targeted at those (weaknesses). The site plan was a rough drawing which would be corrected and improved long afterward using field notes, sketches, and photographs generated during the progress of the survey. Video documentation would also have been enormously helpful during this latter stage of the project, although the necessary equipment was not available during the October field work.

## V RESULTS OF 1998 SURVEY

In spite of the serious time constraints imposed by the Fall weather, the archaeology team was able to gather much valuable data on the Kelleys Island wreck during its' one-day field investigation. It was confirmed that the craft was indeed a cross-planked scow schooner as suspected. It measured approximately 83.5 feet in length and 20 feet in width. The wreck lay in 10-12 feet of water on a sand bottom, approximately 50 feet southeast of the *ADVENTURE* site and 300 feet from shore. The keel was oriented on a compass heading of approximately 220 degrees. At least one-half of the site was buried under the quarry stone which had been the ship's cargo.

Besides the sizeable mound of stone cargo, measuring approximately 30 by 60 feet, the principal features of the wreck consisted of the centerline keel assembly, several keelsons on each side, most of the ship's bottom planking, and some lower portions of the sides. There were also remnants of the inner planking or "ceiling" and a scattering of artifacts. There were no clues found regarding the circumstances of the vessel's loss.

The ship's backbone assembly consisted of a keel, two assistant keelsons, and two rider keelsons; all white oak, fastened with  $\frac{3}{4}$ -inch iron treenails. The keel and riders were pierced just forward of amidships by a centerboard trunk approximately 24 feet long. The keel measured 14 x 14 inches in cross-section for most of its length, but it was moulded 14 inches and sided 10 inches at the after end. Outboard or "floor" keelsons, five on either side of the keel, were moulded 8 inches and sided 6 inches; these appear to have been fir rather than oak. In most large commercial ships oak was used for framing members, while white pine was used for deck beams, cabins, and masts (Hall 1880:138). The spacing between keelsons averaged 16 inches, but it varied because the keelsons were lap-jointed rather than scarphed, causing doubling up at some locations. The configuration and dimension of chine-logs proved difficult to establish, since these features were not intact at any location, and where they did survive, they were largely buried in the ship's cargo. The arrangement of the chine-logs is of great interest, since they are essential to an understanding of the framing scheme employed in this vessel type. A careful examination of this feature indicated that they were sided 6 inches and moulded 9 inches, fixed to side and bottom planking with treenails of  $\frac{3}{4}$ -inch diameter. Since so little of the ship's sides were preserved, it was not possible to determine how the vertical framing in the sides was fixed to the chine-logs, although it was clear that the ship was fitted with light frames between inner and outer planking, and not the thick edge-bolted sides characteristic of "gunwale-built" scows. No rabbets or mortises were seen in the chine-logs to indicate the dimension or spacing of the vertical frames, but a uniform spacing between inner and outer planking indicated a moulded dimension of 6 inches.

Planking was approximately 2 inches thick inside and out, averaging 10 inches in width. Fastenings were  $\frac{3}{8}$ -inch square nails. Bottom planking near the bow averaged only 6 inches in width while the remainder of the bottom planking averaged 10 inches. It seems likely that the wider planking

is a part of the original fabric of the ship, while the narrower pieces at the forward end probably represent repairs. Hull damage resulting from groundings would logically occur at the ship's bow, thus it is logical to assume that the discrepancy in planking characteristics was a result of routine repairs during the ship's twenty-nine years of service. The outer planks appeared to be white oak throughout, whereas the ceiling seemed to be 2-inch fir, except for the occasional 2½- to 3-inch oak ceiling plank, evidently introduced for strength at key locations. Not enough of the ceiling was exposed to determine the arrangement of these thicker planks in the hold, but one such plank was seen near the 56-foot mark on the baseline, perhaps marking the location of some feature such as a hatch opening or the ship's main mast. No elements of the ship's decks, beams, or upper works have survived, perhaps because they were fabricated of fir, but undoubtedly because they were also exposed to sunlight, wave action, and ice movement nearer the Lake's surface.

No elements of the ship's rigging were found at the site. The size of the vessel suggests that it was a two-masted schooner, although the mast steps were not positively identified in the surviving rider keelsons. Their positions would be of interest. Short oak bolsters were found on either side of the keelsons near the bow (from position 5 to position 8), perhaps indicating the location of the forward mast step, although this could not be corroborated by any other evidence. A single iron "chain plate" or strap was discovered during the 1997 field work, lying along the Kelleys Island shore several hundred feet West of the location of the wreck. This distinctive fastening for the mast shrouds cannot be positively associated with the scow wreck, but its size and crude manufacture strongly suggest that possibility; it appears to be too small for the nearby *ADVENTURE*. The chain plate measures ½ inch in thickness, 2½ inches in width, and 63 inches in length; one end is rolled into a loop for the strop of a wooden "deadeye". The total absence of iron shrouds, fittings, or rigging tools indicates that the scow may have been hemp-rigged. Iron wire for ship rigging was common by the 1870, and its absence may suggest a vessel of pre-Civil War construction, although modest vessels like scow schooners were not always equipped with the costly English-made cable even decades later (Martin 1990:8-9).

Relatively few artifacts were found in association with the ship, although several elements of a cast-iron cook stove were observed about 20 feet off the starboard side and others on the same side near the stern. A few nondescript iron fittings and clay pot-shards were discovered lying in the wreckage, plus the broken remains of a one-gallon clay jug and a perfectly-preserved drawknife. No thorough search was made of the area surrounding the wreck, but the excavation of shallow test holes suggests that a significant body of artifacts may lie buried in the sand. Toledo area sports divers produced a collection of artifacts reportedly removed from the site many years ago, including woodworking tools and personal effects. Among them were a variety of hammers, files, twist drills and ship augers, an adz, a slick, a large jug, and a high-topped leather shoe. All of these artifacts were suggestive of mid-to-late 19<sup>th</sup> Century manufacture. Some of the tools had manufacturer's marks, but none have yet been investigated. It is interesting to note that all of the tools were woodworking tools rather than boatswain's tools or rigging hardware. No tackle blocks, rigging wire, shackles, or splicing tools were discovered. Aside of the fact that all sailing craft carried some boatswain's stores, this is also a strong indication that the scow was rope-rigged rather than the wire-rigging which had become commonplace long before 1886.

## VI IDENTIFICATION

The scow schooner found alongside the steambarge *ADVENTURE* in 1998 was not immediately identified. There were no known local traditions regarding the wreck. Veteran local divers thought that the vessel was part of the larger steamer, although some had been diving on it for years. As a result, no effort had been made to determine the identity of the sunken scow. When it was established that the wreck was indeed distinct from the nearby *ADVENTURE*, many standard historical sources were consulted. None described a wreck near the *ADVENTURE* site, although many small sailing craft were reported lost in the general vicinity of the Lake Erie Islands and the nearby Pelee Passage. Among the vessels lost in the area were several scow schooners.

A preliminary list of vessels lost at or near Kelleys Island, Ohio, was compiled from several popular sources (Hamilton et al. 1966, Mansfield 1899, Runge n.d., and Wright n.d.):

- 1844 • Schr *CLEVELAND* sunk with stone near Kelleys island
- 1847 • Brig *UNCLE SAM* foundered East of Kelleys Island with lumber (Dec)
- 1848 • Schr *ASHTABULA* capsized near Kelleys Island (Jun)
- 1850 • Schr *EMORY FLETCHER* sank at North Bay, Kelleys Island in gale; raised (Apr)
- 1852 • Sidewheeler *ST. LOUIS* wrecked on Kelleys Island Shoal NE of the Island (Nov)
- 1853 • Schr *GOVERNOR PORTER* sunk near the Island with stone
- 1854 • Schr *FLORENCE* foundered off Kelleys Island (Dec)
- 1857 • Bark *EMPIRE* wrecked at Point Marblehead (May)
- 1861 • Scow *WILLIAM MATTHEWS* foundered at Kelleys Island
- 1867 • Scow *EAGLE* aground at Kelleys Island
- 1867 • Scow *FAIRY* reported ashore at Kelleys Island
- 1869 • Schr *IRIS* aground
- 1870 • Schr *MARY ANN* wrecked with stone near Point Marblehead (Jun)
- 1871 • Schr *VERNIE M. BLAKE* sunk at Kelleys Island
- 1872 • Schr *LOUIS McLANE* foundered at anchor North of Marblehead (Aug)
- 1874 • Schr *EXCHANGE* sunk South Side of Kelleys Island with stone (Nov)
- 1875 • Schr *CONSUELO* foundered off Marblehead, raised 1880 (May)
- 1875 • Scow *MAYFLOWER* sank with limestone off Kelleys Island; recovered (Aug)
- 1877 • Scow *GRAND ARMY* capsized near Kelleys Island (Jul)
- 1879 • Scow *JOHN A. SAUNDERS* stranded off Marblehead with stone cargo (Nov)
- 1880 • Scow *UNCLE SAM* stranded 2 mi. from Kelleys Island
- 1883 • Schr *H. P. BALDWIN* sunk at Kelleys Island with stone
- 1884 • Scow *L. B. CROCKER* stranded at Carpenter's Point, Kelleys Island (Apr)
- 1884 • Tug *RELIEF* burned and beached on Carpenter's Point, Kelleys Island (Jul)
- 1886 • Schr *STAR OF HOPE* stranded off the Island, broke up (Oct)
- 1886 • Scow *W. R. HANNA* foundered & pounded to pieces at Kelleys Island with stone (Oct)
- 1888 • Schr *C. H. PLUMMER* burned and sunk South of the Island (Nov)
- 1902 • Steambarge *GEORGE DUNBAR* foundered 4 mi. ENE of Kelleys Island (Jun)
- 1903 • Steambarge *ADVENTURE* burned and sank in North Bay with stone (Oct)
- 1903 • Schr *JOHN MARK* sunk with stone South of the Island; recovered (Oct)
- 1905 • Barge *RACINE* sunk at the Island with stone
- 1906 • Schr *WM. CROSTHWAITE* sunk 1½ mi. North of East Harbor with lumber (Sep)
- 1906 • Barge *CONSTITUTION* sunk near West dock, Kelleys Island with stone (Sep)
- 1911 • Scow *KEEPSAKE* stranded on rocks North of Kelleys Island (Aug)
- 1911 • Steamer *F. H. PRINCE* burned on East side of Kelleys Island (Aug)
- 1922 • Barge *JOHN J. BARLUM* foundered 1½ miles NNE of Marblehead Light (Sep)

A methodical check of the known schooner losses in the area established that only the *W. R. HANNA*'s dimensions were a perfect match to those of the North Bay scow wreck, and it seems a safe assumption that other vessels may consequently be ruled out. Newspaper accounts of the *W. R. HANNA*'s loss have so far not provided sufficient information to confirm the wreck's identity, however, and local historians are seeking corroborating evidence. The late Kelleys Island historian Captain Frank Hamilton noted that the scow schooner *W. R. HANNA* had "foundered (and) pounded to pieces at Kelleys Island" in October 1886 with a cargo of stone, although no specific location was identified for the loss. A chart of Western Lake Erie shipwrecks based on Hamilton's research shows the *W. R. HANNA* off the tip of Long Point, on Kelleys Island Shoal, several miles northeast of the North Bay wreck's location.

The *W. R. HANNA* was built in 1857 at Sandusky, Ohio by William R. Hanna for Jonathan Learned (sometimes spelled Larned), also of Sandusky. According to her official U.S. Customs enrollment documents, she was a single-decked scow schooner with two masts and a square bow and stern. She measured 86'2" in length, 22'4" breadth of beam, and 6'0" depth of hold. Her registered tonnage was 102<sup>6</sup>/<sub>95</sub> according to the old style of measure (in accordance with a Treasury Department regulation adopted in 1790) or 86.16 gross tons and 81.16 net tons (according to regulations adopted in 1864 and amended in 1881). She was assigned official number 26669. Her enrollments indicate that she changed hands several times, although it should be observed that the enrollment dates do not necessarily coincide with the dates of actual sale; rather, they reflect the dates when those transactions were registered with the U.S. Customs Department. It may be useful to note here, too, that "tonnage" as reflected in vessel enrollments does not mean weight, but rather a register ton refers to a measure of enclosed space. One register ton represents 100 cubic feet of enclosed space in the ship's hull or superstructure. Inspection of enrollment documents yielded the following history of this vessel:

- July 23, 1857, Sandusky, Ohio. The *W. R. HANNA*, new, was owned by Jonathan Learned, who was also the ship's master or captain.
- September 8, 1857, Sandusky; owned by Jonathan Learned and Rollin B. Hubbard of Sandusky, each one-half. Learned was still master.
- March 28, 1859, Sandusky; owned by Watson Hubbard of Sandusky; Jonathan Learned still master.
- April 10, 1865, Sandusky; *W. R. HANNA* "readmeasured" to conform with newly-adopted federal regulations. Her measurements according to the new system were 84.7 x 21.6 x 5.6 feet, and 86.16 gross tons. The name of her master (and former owner) is listed in this document as "J. Larned".
- June 5, 1868, Port Huron, Michigan; the vessel was sold to Henry and John Howard of Port Huron, each one-half; her master was Thomas A. Ellery.
- February 27, 1871, Port Huron, Michigan; the owners were unchanged, but her master is listed as A. H. Peer.
- April 13, 1875, Port Huron, Michigan; ownership transferred to Lawrence Sinclair of Port Huron, who was also her master.
- April 21, 1877, Port Huron, Michigan; ownership changed to Lawrence Sinclair and M. C. Brown of Port Huron, each one-half; Mr. Sinclair is listed as master.
- March 29, 1878, Port Huron, Michigan; owners changed to Henry Howard and Elizabeth Bedford of Port Huron; George H. Bedford, master
- May 5, 1881, Port Huron, Michigan; new owner is Horatio N. Jex of Port Huron, who is also master.
- May 15, 1882, Detroit, Michigan; a temporary enrollment indicated that the vessel was owned by L. J. Seek of Toledo, Ohio, "ice dealer"; her master was listed as Frank Provonsha. This document was succeeded by a permanent enrollment issued at Toledo, Ohio on January 2, 1885, confirming the same owner and master.

The vessel was removed from U. S. registry at the Toledo on June 30, 1888 with a notation that her official papers were lost when the vessel was wrecked, although no date for her loss was recorded at the time. The failure to terminate her enrollments in the Fall of 1886 may indicate the intention of her

owners to salvage the vessel, although no evidence of salvage attempts has yet been found in local newspapers.

A violent storm swept across lake Erie on October 14 and 15, 1886, taking a heavy toll among the ships. Several substantial schooners were destroyed. The schooner *ST. JOSEPH* grounded at Fish Point, Pelee Island; the *SEA LARK* stranded on Pelee Island; the *O. M. BOND* was driven ashore at Rondeau on the Canadian shore; the *NEVADA* was beached at Ashtabula, Ohio; the *BELLE MITCHELL* foundered southwest of Long Point (with all hands); and the *GEORGE M. CASE* went down off Port Colborne. Several barges in tow of the steamer *PASSAIC* were badly damaged and nearly lost. All were victims of a gale-force wind that rose in the South and shifted to the West on the night of the 14<sup>th</sup> (personal communication, G. Wachter, June 25, 1999).

Northern Ohio newspapers (Sandusky, Cleveland, and Toledo) described the severity and the tragic aftermath of the storm:

- “Toledo, Oct. 14 – The storm today struck Toledo about noon, and from that until three o’clock, the velocity of the wind was about forty-five miles per hour. There was considerable damage done in a small way, blowing down chimneys, breaking in show windows, unroofing buildings, blowing down telegraph and telephone lines and overturning shade trees. No casualties. Reports from north-western Ohio bring tidings of similar damages...” (*Sandusky Daily Register*, October 15, 1886)

- “Buffalo, Oct. 14 – A terrific gale accompanied by rain set in here this afternoon and continues with increasing fury. At midnight the wind is blowing at the rate of 65 miles per hour. “The Island” inhabited by squatters is flooded and water is rushing in huge waves over it. Twenty-nine houses have been totally destroyed and over 100 persons are homeless. The wife and daughter of Charles Lambert were drowned and several others are reported missing. The basements of all houses on Canal Street are flooded and the Western Transportation [ware] house was blown down, causing a blockade of the Lackawanna tracks. Michigan and Main streets are flooded 700 feet from the dock and Ohio Street is completely flooded. All the lumber yards on the island are wrecked. The damage to shipping is very great. Barges are floating over Evans’ dock and a number are reported smashed. At 8 this evening the rear wall of the new music hall went down with a crash. No one was injured.” (*Sandusky Daily Register*, October 15, 1886)

- “LAKE AND HARBOR [Sandusky] – There were no arrivals or departures in marine circles yesterday on account of the storm... The *JAY COOKE* came in from Put-in-Bay but reported a stormy passage, and they would not venture to return, and remained at her dock. The [R. B.] *HAYES* was an hour getting over from Fox’s dock and would not venture out again. The [AMERICAN] *EAGLE* started out in the afternoon, but did not go far before she gave up and returned. The [B. F.] *FERRIS* also gave up and stayed in... The Bay was in a turbulent condition all day, and outside the waves were said to be mountain high. There are a number of vessels at the B & O dock, but none of them ventured out, although some are ready to sail... A pound boat capsized near Kelley’s Island yesterday morning, but as far as could be learned there was no damage except a good wetting to those in the boat”(*Sandusky Daily Register*, October 16, 1886)

- “BLOW YE WINDS - A POWERFUL SOUTHWESTER STIRS UP THE ELEMENTS – About 4 o’clock yesterday morning a gentle breeze sprang up from the southwest which gradually increased until by ten o’clock a semi-tornado accompanied by heavy rain was making things lively in this vicinity. The wind continued with unabated fury all day and into the night, but about two o’clock this morning began to abate and gradually died down to its normal velocity... Inquiry at the Signal Station showed that during the day the wind registered the frightful velocity of 53 miles per

hour, which is considered very near a hurricane...This has probably been one of the heaviest gales that has visited these parts in a number of years." (*Sandusky Daily Register*, October 16, 1886)

- "The scow *HURON* [sic] is reported aground on Kelley's Island...The water was reported to be down three feet below normal Thursday evening." (*Sandusky Daily Register*, October 16, 1886)

- "THE MOST SEVERE GALE FOR YEARS – Port Colborne, Ont., Oct. 15. – The gale yesterday was the hardest blow experienced here for years. Water was raised some eight feet in the harbor and the current into the canal was equal to Niagara's river. The wind was principally from the southwest and continued until midnight, when it shifted to the westward and moderated. This morning it was still blowing strong from the west. About four hundred feet of the west pier was washed away. The schooner *HARTFORD* from Detroit arrived here all safe about 4 o'clock this morning. The captain says the sea was something terrible, washing clear over the vessel and filling the cabin, but the boat sustained no serious damage..." (*Cleveland Plain Dealer*, October 17, 1886)

- "The scow *W. R. HANNA*, owned [sic] by Capt. Frank Provonsha of this city, went ashore during the recent great storm on Kelley's Island, and was pounded to pieces. She is a total loss. She was partly loaded with stone for Detroit at the time. The *HANNA* was valued at \$1,000. No insurance." (*Toledo Blade*, October 30, 1886)

We suspected that the reference to the scow "*HURON*" in the *Sandusky Daily Register* of October 15 was probably an error, and that the vessel in difficulty was in fact, the *W. R. HANNA*. No scow *HURON* is known to have been in service at that date.

## VII KELLEYS ISLAND LIMESTONE INDUSTRY & MARITIME TRANSPORTATION

### Geology

The limestone deposits on Kelleys Island have long been known to science because of their well-preserved, fossil coral reef fauna, the remarkable glacial grooves carved in the surface of the limestone, and the massive quarries that dominate the islands landscape. For decades high-quality building stone, lime, and crushed rock were produced from these quarries (Stauffer 1909:136-142).

Columbus Limestone (Middle Devonian Period) underlies the major portion of Kelleys Island. This formation is covered by only a thin layer of glacial drift, thus rock outcrops are common, particularly along the shores. Outcrops are of two types: (1) broad shelf areas with gentle dip slopes, common along the south and east shores and (2) vertical to overhanging cliffs up to 25 feet high, especially along the north and west shores (Fisher 1922:7). An uplift in the bedrock west of the Bass Islands, known as the Cincinnati Arch, gives the rock formations in the Island Region a gentle dip toward the southeast. As a result, most of the islands of western Lake Erie, including Kelleys Island, have a cuesta shape — a steep cliffs on the side toward the arch and gentle, shoaling shore away from the arch (Carman 1946:282). Late Paleozoic, Mesozoic and Early Cenozoic erosion of region has left the resistant rock of Kelleys Island as a remnant of ridge that once divided preglacial river valleys (Hobson et al. 1969:219). The Columbus Limestone is underlain by the Lucas Dolomite, which is exposed in the bottom of the deepest quarries on Kelleys Island.

Columbus Limestone consists of three lithologic units on Kelleys Island: (1) a basal, thick-bedded, magnesium limestone, (2) a middle layer of cherty limestone, and (3) an upper sequence of thin-bedded highly calcareous limestone (Fisher 1922:9). The basal beds (unit 1) are well exposed in the North Bay and South Side quarries where they present a massive, vertical face of grayish-brown fossiliferous limestone, 22 feet thick. The cherty layer (unit 2) is about 4 feet thick in the quarry walls and contains numerous gray and white chert nodules. The upper 25-foot thick beds (unit 3) are bluish-gray and the purest part of the formation. The bottom 8 feet of the upper unit (3) is a massive layer of gray to brown limestone known to the quarrymen as "bottom rock" because it formed the floor over

most of the later quarries, the next 7 feet up is more fossiliferous but somewhat less massive in character, while the top 10 feet splits into thin slabs (1 to 3 inches thick) on weathering and contains extensive layers of brachiopod fossils, especially *Spirifer acuminatus*. (Fisher 1922:9, 21-23; Stauffer 1909:136-142).

### History of North Bay Quarries

The first limestone quarry on Kelleys Island was located on the north shore just west of North Bay (33ER343). This quarry was operated by John A. Clemon between 1830 and 1835 (Hill 1925: 122), exploiting limestone ledges that rise about 25 feet above the lakeshore. Clemon constructed a short dock at the base of the cliff. The dock endured for many years (Hill 1925: 122), even though it was not within the shelter of the bay and was exposed to the fury of northerly storms. In 1833 Clemon employed 5 to 6 families to work the quarry (Myers, et al. 1992: 20). That year the Kelley brothers (Datus and Irad) purchased most of the island including the north shore quarry and dock. The following year, the Kelleys began shipments of stone and cedar to Cleveland from this dock, only to abandon the quarry in 1835 as they moved their operations to the south side of the island.

Quarrying operations at North Bay did not resume until 1872, when William D. Kelley sold the property to G. W. Calkins & Company. G. W. Calkins, M. C. Younglove, and Charles Hickox were partners in this firm. A new quarry was soon opened about 1,000 feet southwest of the lakeshore quarry known as the north side quarry (33ER336), and many improvements were undertaken. The company built a new dock in the bay and also had a steam barge built at the Black River (now Lorain, Ohio) shipyards of Henry D. Root. This vessel was christened *CHARLES HICKOX* and was employed in transporting lime and stone from the island to Cleveland (Hill 1925: 137).

In 1875 G. W. Calkins & Company brought several lime kilns to the island from their Cleveland operation and erected them near the new North Bay dock. The same year an extensive cooper shop was built where barrels were made to ship the lime and an elevated wharf was added to the dock (Myers, et al. 1992: 23). The company also constructed tenement houses and a boarding house for the employees.

In 1876 the engineering firm of Baker, Van Bleck & Company contracted with G. W. Calkins & Company for large dimension stone to be used in building the first large American lock at Saulte Ste. Marie. The engineering firm took charge of quarrying the blocks and employed a force of about 150 men for a year (Hill 1925: 124).

The industrial census of 1880 reported that G. W. Calkins & Company had a capital investment of \$35,000 in the quarry complex and that 15,000 cubic yards of stone had been excavated since 1872. Cleveland was listed as the principal market port. The full-time work force (10-hour day) averaged 20 men (peak of 25), and the average salary was \$1.25/day.

On December 28, 1886, a few months after the *W. R. HANNA* was wrecked in North Bay, G. W. Calkins & Company was reincorporated as the Kelley Island Lime & Transport Company (KIL&T Co.) with M. C. Younglove, Cable E. Gowen, and E. B. Merrian as partners. KIL&T Co. soon consolidated the holdings of the smaller quarry operators into three "theaters" of operation — North Bay (33ER336), South Bay (33ER338), and West Bay (33ER337). When KIL&T Co. took over the North Bay complex, 8 kilns were in operation. In the next two years 8 more kilns were built, a narrow-gauge railroad system was constructed that included two Shay locomotives and 15 cars on 5 miles of track, a new 315-foot long dock was erected that had elevated pockets, and steam power was instituted that replaced animal traction and human labor in the handling of stone.

By 1888 KIL&T Co. had also procured a fleet of 5 steam barges at a cost of \$140,000, including the *ALBERT Y. GOWEN*, *GOOD HIT*, *HANDY BOY*, *JIM SHERIFFS*, and *TEMPEST*. These vessels had an aggregate tonnage of 3,200 (Nichols 1888: 23). *JIM SHERIFFS* carried stone to Duluth while *ALBERT Y. GOWEN* carried lime to Cleveland and Detroit. Later the company purchased two more steamers, *DESMOND* and *ISABELLA J. BOYCE*, for the Cleveland stone trade and the steamer *NORMA* (later replaced by the *EDWARD P. RECOVE*) to carry freight between Sandusky and Kelleys Island. In addition to these vessels, KIL&T Co. operated the steam tug *L. P.*

*SMITH* and 2 steel barges to transport limestone to Cleveland (Hill 1927: 137). In the late 1880s KIL&T Co. became the largest landowner and employer on the island and by the turn-of-the-century it was advertised as the largest producer of lime products in the world (Hatcher 1949:304, Page 1988:(8)11).

When completed in the early 1900s, the North Bay complex included an extensive quarry, 16 lime kilns, a cooper shop, warehouses for barrel storage, a stone crusher for production of flux stone, boarding houses and other facilities for the resident labor force, horse barns, carpenter and blacksmith shops, a locomotive shop, a water tower, and several other structures. A constantly changing network of roads and narrow-gauge rail lines linked these facilities to the two docks on the North Bay of Kelleys Island.

Lime products, which had been the main focus of the north side quarry were eclipsed by the flux stone market in the first decade of the 20<sup>th</sup> century. In 1907 a large stone crushing complex was built alongside the North Bay quarry to meet the demand for steel mill flux stone. Lime production was phased out and the kilns were closed and dismantled in 1909. Thereafter, the work pace slowed at the North Bay quarry as KIL&T Co. concentrated its efforts on the South Bay and West Bay operations, and the North Bay quarry fell into disuse and neglect. The outer dock on the north shore burned in 1913, and three years later the elevated dock burned when ashes from a locomotive fell into its loading pockets (Myers et al 1992:24). The North Bay quarry was virtually abandoned in 1924.

### **Quarry Operations and Lime Production**

Quarrying was easy and economical on Kelleys Island because the loose thin soil could be rapidly removed from above the limestone. Because the basal beds of the Columbus Limestone were best suited for dimension stone, deep quarries were the first to be developed. These quarries produced massive stone used for buildings, piers and breakwaters. In addition to building stone, the early quarries were soon organized to produce lime (calcium oxide). Lime replaced dimension stone in the 1870s with the construction of large kilns and dominated operations for three decades. By the early 1900s the focus changed from the production of lime to the that of flux stone, an important ingredient in the manufacture of steel. To produce this type of stone, large stone crushing complexes were built on the island. With the decline in the demand for dimension stone, and the expense of deep quarrying for lime rock, the deeper parts of the quarries were abandoned. By the 1920s, only the thin-bedded upper zone was being utilized and that for crushed stone.

**Dimension Stone.** Kelleys Island dimension stone was sold by the cord, a cord being equivalent to 5.5 tons (128 cubic feet per cord). Several docks were built and used for shipping both stone and cedar wood. Thus, numerous boats were able to dock at the island to purchase stone. A typical early cargo would amount to 50 or 60 cords of stone. The breakwaters at Cleveland and Cedar Point were constructed with Kelleys Island limestone, as well as the piers for the Cleveland High Level Bridge and the first American lock at Saulte Ste. Marie (Martin 1975:25). Ross (1949:39) points out that "the islanders are proud of the fact that many churches in Detroit, some of the finest office buildings in Cleveland, and the Poe lock at the Soo were built of stone taken from the island."

The early methods of quarrying on Kelleys Island were largely performed by hand. Until the 1880s the steps in the stone extraction process included drilling, black power blasting, and hand sledging. Blast-hole drilling was done with a single-jack (one man with a chisel and 4-lb. hammer creating a 3-foot deep hole or double-jack (team of three laborers, one to hold drill and two to alternately strike it with 20-lb. hammers). Hand-chum drills and hand augers that could reach a depth of 8 feet were also used. Dimension stone, stone for lime burning, and flux stone were all quarried with the same tools (Myers et al. 1992:27). The difference in their extraction was related to the size of the rock to be removed and this was controlled by the spacing and depth of the blast holes.

In the late 1880s the mode of quarrying was mechanized with the introduction of steam drill. The holes were filled with powder and single set of blasts would free as much as 400 cords of blue-white stone, remarkably free of spots or impurities (Nichols 1888:22). Steam drills at that time consisted of a piston drill that was an extension of the cylinder of a steam engine. These drills were powered by

steam supplied by piping from a remote boiler (Myers et al. 1992:27). Piston drills were capable of drilling holes up to 15 feet deep.

**Lime Production.** As a secondary product of dimension stone quarrying, the broken blocks of the lower beds were burned for lime. These pieces had a higher magnesium content which required less heat to burn than the more calcareous upper beds (Fisher 1922:21). The north shore quarry (33ER343) furnished both the magnesium-rich portion of the Columbus Limestone and underlying beds of Lucas Dolomite, also rich in magnesium, for an early lime kiln.

In 1855 lime kilns were built on the south shore by George Kelley (Pape 1988:(8)12; Myers et al. 1992:30). and by G. W. Calkins & Co. on the north shore in 1875 (Behnke 1974:7). In 1886 a huge complex of lime kilns was positioned at North Bay by the KIL&T Co. when the demand for building stone declined. Nichols (1888:23, 24) describes the early operations of the KIL&T Co. in vivid detail. To work the quarries and kilns, foreign workers were imported from central and eastern Europe — Italians, Slavs, Greeks, Hungarians, Portuguese, Poles, Macedonians, Bulgarians, and Germans.

The North Bay kilns were so constructed that the stone was conveyed by car or wagon to the mouths of the kilns which were constructed on the same level as the quarry floors. The kilns burned about 80 cords of stone and 48 cords of wood per day. Once the supply of wood on the island was used up other sources were developed. Nichols (1888:24) noted that "an inexhaustible supply [of wood] being obtained from the Canadian shore, just across the lake." Wood for the kilns was also obtained from Oak Harbor on the Portage River in Ottawa County, Ohio.

When limestone, a carbonate of calcium ( $\text{CaCO}_3$ ), is heated sufficiently it undergoes a decomposition which yields calcium oxide and carbon dioxide ( $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ ). The temperature required to maintain this conversion at one atmosphere of pressure is about 1250° F (Nebergall et al. 1963:650). The manufacture of calcium oxide or quicklime on Kelleys Island was carried out in tall chimney-like furnaces or kilns. In a continuous process, the limestone, which was fed in at the top of the kiln, was heated and decomposed by a draft of hot gas, and the lime was drawn off at the bottom of the kiln. The blast of hot gases through the furnace kept the partial pressure of the carbon dioxide at a minimum and permitted the reaction to go to completion at a much lower temperature than would otherwise be required. In a typical kiln furnace of the period, carbon dioxide began to disassociate at 700° F and was completely freed at 900° F. Operators of the Kelleys Island kilns attempted to maintain a constant temperature of 800° F for optimal processing (Myers et al. 1992:30).

Pure lime (calcium oxide or quicklime) is a white amorphous substance that emits an intense light, called "limelight" when heated to a high temperature. Lime is a hazardous substance which reacts vigorously and exothermally (heat-releasing) with water, forming a hydroxide ( $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + 15,500$  calories) which is known as hydrated lime or slaked lime (Nebergall et al. 1963:651). Lump lime, unslaked or unhydrated lime was the type of hard, white material obtained from the kilns on Kelleys Island. It combines with water giving off great heat sufficient to cause ignition when in contact with combustible substances (Leeming. 1942:366) Because lime produced on Kelleys Island was a perishable product, particularly susceptible to the deleterious effects of moisture, the most convenient and safe way to ship the product from was in water-tight, wooden barrels.

After burning to drive off carbon dioxide, the lime (calcium oxide) was drawn out at the base of the kiln onto a substantial stone floor where it was packed into wooden barrels. The barrels were then rolled to an adjacent warehouse (6,000-barrel capacity) or loaded on shipboard as vessels laid along side the warehouse dock. The kiln-dock complex included a large cooper shop where 22 men were employed in making and repairing barrels. The annual lime production by KIL&T Co. in the late 1880s was about 650,000 barrels and involved some 275 workers. Nichols (1888:23) observed that "the lime produced by this firm is singularly white, strong and pure, being used almost exclusively for building and plastering purposes." Maritime facilities at the North Bay complex also included a concrete pocket dock which consisted of an extended jetty with an elevated track and chutes on the sides for loading boats. Barges, steamers, and other vessels of 8,000 to 10,000 tons capacity could be easily loaded from this dock in a matter of two to three hours (Ryall 1913:186).

At the turn-of-the-century, the 16 North Bay kilns were running at full capacity, producing 1,800 barrels of lime per day plus large volumes of crushed stone. KIL&T Co. then employed about 500 men and 50 horses. By the second decade of the century, the company found it cheaper and more convenient to ship the stone, and then burn the lime at its plants in Duluth, thus the focus of its operation changed from the production of lime to the production of flux stone. At this time, the Kelleys Island kilns and cooperage on North Bay were torn down (Ryall 1913:188).

**Crushed Stone.** In referring to the thinly bedded rock overlying the lime beds, Nichols (1888:23) pointed out that "above the famous limestone being a valuable and extensive strata of what is termed 'flux stone' used in the process of purifying metals, which commands a ready market all over the continent." To capitalize on these beds and produce flux and other types of crushed stone, two large stone crushing complexes were built, one at North Bay and one at South Bay. Crusher plants, storage bins, and railroad grades are still extant at these two sites. The large scale production of flux stone also required a sizeable inventory of narrow-gauge rolling stock and steam cranes. A machine shop, blacksmith shop, locomotive shed, and ancillary sheds were established at West Bay to accommodate maintenance and repair of these components and an office building/general store were built at the North Bay quarry complex.

In the early 1920s, the upper part of the Columbus Limestone was quarried by drilling a row of holes 25 feet back from the working surface, 25 feet apart, and 15 feet deep. Charges of dynamite were set in these holes and the entire mass was "shot down" (Fisher 1922:22). The stone was loaded by steam shovels into dump cars and hauled to crushers where it was broken and graded according to size. At that time crushed limestone had three primary uses: (1) flux, (2) road ballast and metal, and (3) the main constituent of concrete. As flux, the stone was used in smelting iron and copper, and in the manufacture of bottle and window glass. Flux stone had to pass through a 4-inch ring but be retained on a 2-inch ring; ballast stone had to pass through a 2-inch ring but be retained 0.75-inch ring; concrete stone had to pass through a 1.25-inch ring; and for surfacing roads, all that passed through a 0.75-inch ring, including dust was used (Fisher 1922:21).

The rapid falling off in demand for building stone in the late 1800s and the increase in demand on crushed stone for lime, flux, and road building made it more economical to quarry only the thin bedded upper rock and just some of the "bottom rock" of the Columbus Limestone. Ver Steeg and Yunck (1935:432) noted that "as a result almost the whole top of the island is being removed from west to east; the average depth of the vast quarry is twenty-five feet."

Because the upper thin-bedded limestone was generally less than 20-foot thick, the later quarries tended to expand over great areas without attaining much depth. By the early 1920s KIL&T Co. owned about 40% of the island and most of their holdings had been opened to quarries the thin-bedded upper strata. The islanders began to resist any attempts on the part of KIL&T Co. to obtain more land, fearing that practically the whole island would be devastated by extension of the quarries (Fisher 1922:23). Thus, quarry operations began to dwindle and KIL&T Co. went out of business on the island in 1942.

### **Final Cargo of the W. R. HANNA**

Economical water transportation has been noted as the prime factor that Kelleys Island grew into the largest limestone producing center in Ohio and the lower Great Lakes region at the turn-of-the-century (Orton and Peppel 1906:212). At that time limestone was sold by weight and a ton of dimension stone was marketed between \$1.00 and \$2.00 a ton, whereas lump lime in barrels ranged from \$5.50 to \$6.00 per ton. In 1905 the cost of barrels ready to fill was about \$0.21 each. Barrels of "ordinary size" were used, with 15<sup>1</sup>/<sub>2</sub>" to 16<sup>1</sup>/<sub>2</sub>" heads and 28<sup>1</sup>/<sub>2</sub>" staves. An empty barrel weighed 15 to 16 lbs. and could hold 185 lbs. net of lump lime or nearly 400 lbs. of ground lime (very little ground lime was shipped in barrels). The cost of producing a barrel of lump lime from quarry to loaded aboard a vessel included: quarrying and transport to kiln \$0.05, fuel \$0.07, labor \$0.09 fixed costs \$0.04, barrel \$0.21, for a total of \$0.46. The F.O.B. dockside price was about \$0.56 per barrel (Orton and Peppel 1906:232).

The *W. R. HANNA* was one of dozens of steam and sailing vessels that serviced the limestone industry of Kelleys Island in the late 1800s. The final cargo of medium-sized dimension stone is believed to be destined for Detroit (*Toledo Blade*, October 30, 1886). In June 1999, an attempt was made to estimate the size of the cargo by direct measurement of randomly selected blocks. The limestone blocks, mostly rectangular in shape, occupy most of the central portion of the site, from a position of 9 feet on the baseline to a position of 74 feet, with most of the concentration between 15 and 65 feet. A total of 27 blocks were measured for length, width, and thickness:

Artifact No.	Baseline <sup>1</sup> Position (ft.)	Length (in.)	Width (in.)	Thickness (in.)	Shape of Stone Block	Volume (cu. ft.)	Weight <sup>2</sup> (lb.)
H- 1	9	18	15	8	Rectangular	1.25	210.6
H- 2	10	25	20	7	Rectangular	2.03	342.0
H- 3	11	14	12	4	Rectangular	0.39	65.7
H- 4	12	20	12	7	Rectangular	0.97	163.4
H- 5	14	20	14	6	Rectangular	0.97	163.4
H- 6	20	12	6	6	Triangular	0.25	42.1
H- 7	24	15	10	6	Rectangular	0.52	87.6
H- 8	26	14	11	6	Rectangular	0.53	89.3
H- 9	27	31	14	6	Triangular	0.75	126.4
H-10	30	14	13	6	Rectangular	0.63	106.1
H-11	31	22	14	6	Rectangular	1.07	180.3
H-12	32	12	9	6	Rectangular	0.38	64.0
H-13	34	18	12	7	Rectangular	0.88	148.3
H-14	38	20	14	6	Rectangular	0.97	163.4
H-15	39	19	12	7	Rectangular	0.92	155.0
H-16	40	18	15	6	Rectangular	0.94	158.4
H-17	41	19	12	9	Rectangular	1.19	200.5
H-18	49	9	8	8	Rectangular	0.33	55.6
H-19	50	22	14	9	Rectangular	1.60	269.6
H-20	51	12	12	9	Rectangular	0.75	126.4
H-21	55	15	12	6	Triangular	0.73	123.0
H-22	57	15	12	7	Rectangular	0.91	153.6
H-23	58	15	14	9	Rectangular	1.09	183.6
H-24	59	11	7	5	Rectangular	0.22	37.1
H-25	61	22	21	7	Rectangular	1.87	315.1
H-26	68	16	15	7	Rectangular	0.97	163.4
H-27	74	19	11	3	Rectangular	0.36	60.7
Mean		17.3	12.6	6.6		0.87	146.5

1. Baseline oriented toward the northeast, starting at the bow
2. Weight based on a specific gravity of limestone (CaCO<sub>3</sub>) at 2.7 (1,728 cu. in. = 1 cu. ft. = 168.5 lb. of stone)

The stone cargo covers an area of approximately 1,060 sq. ft. (average stone = 1.5 sq. ft.) and ranges from 1 to 4 stones deep (average 2.5 stones) which gives an average thickness of 1.4 ft. These approximations yield an estimated total of 1,700 limestone blocks, which occupy 1,500 cu. ft., for a total weight of about 253,000 lb. or 126.5 tons. The intended purpose of the stone is unknown, but the size of the blocks is consistent with the material that was being used for harbor and breakwater structures in the late 1800s, particular the size of the stone that was used to fill timber cribs.

The transport of limestone and lime products contributed greatly to the early commercial traffic on the Great Lakes and has traditionally ranked among the top five commodities in shipping tonnage. Initially, much stone, well adapted to building purposes was shipped from Kelleys Island (Ver Steeg and Yunck 1935:433). In the period immediately following the sinking of the *W. R. HANNA*, the island quarry operators concentrated on burned lime and crushed flux stone which was shipped throughout the Great Lakes region on vessels such as the steambarge *ADVENTURE*.

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