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THE STEAMER *ADVENTURE* and the KELLEYS ISLAND, OHIO LIMESTONE INDUSTRY

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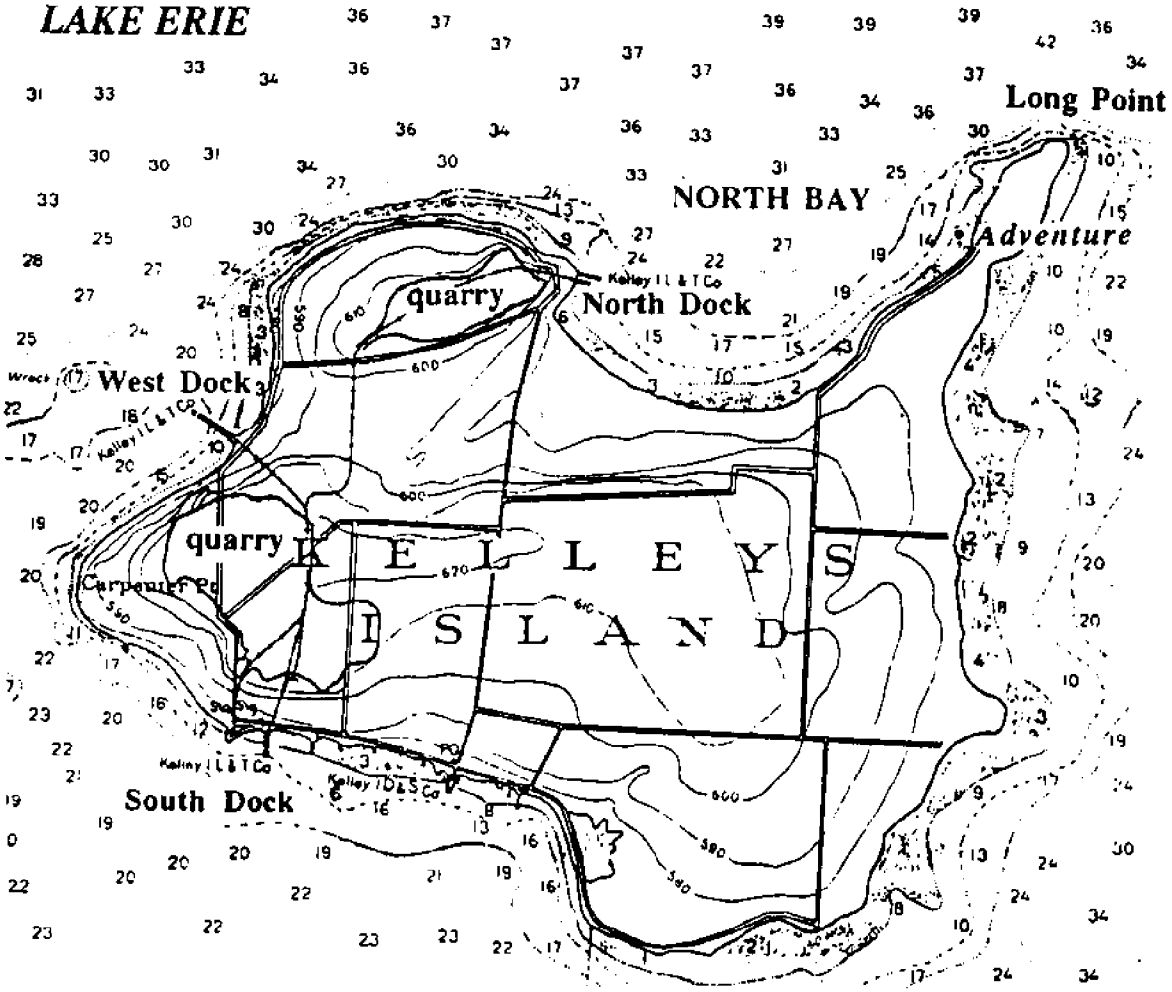
FRONTISPIECE



Frontispiece. US Lake Survey Chart of Kelleys Island, Lake Erie (1940) showing locations of Kelley Island Lime & Transport Company docks and the *ADVENTURE* wreck.

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TABLE OF CONTENTS **PAGE**

INTRODUCTION

Stone quarries on Kelleys Island date back to around 1830. For over a century they yielded high-quality limestone. The stone left the island in several forms: building stone for coastal construction projects, flux stone for steel mills, and burned stone for agricultural lime and other lime products. Eventually Kelleys Island became the largest producer of lime in the world (Myers et al. 1992, p. 21). Virtually all of these stone products were transported from the island by merchant steamers and sailing vessels. One of these vessels, the steamer *ADVENTURE*, met a disastrous end in 1903 while engaged in this trade (Figure 1). The remains of this shipwreck in the North Bay of Kelleys Island provide insight into the maritime aspects of the lime industry during its heyday.

Archaeological investigations of this shipwreck were undertaken as part of a nautical archaeology workshop offered at Firelands College of Bowling Green State University in September and October 1997. The workshop, *Shipwreck Archaeology for Recreational Divers*, was organized by the Ohio Submerged Lands Advisory Council, an advisory body to the Ohio Department of Natural Resources and the Ohio Historical Society, charged with considering the cultural resources in Lake Erie.

The objectives of the following paper are to describe the shipwreck site of the *ADVENTURE* and to document the history of this vessel, particularly in the context of the flourishing limestone industry of her era. The *ADVENTURE* is representative of the critical maritime transportation link between the Kelleys Island source and mainland users of limestone commodities. The importance of this maritime link will be explored through the example of this vessel.

HISTORICAL DOCUMENTATION

SCHOONER *ADVENTURE*

Construction Details and Vessel Class. The *ADVENTURE* was built in 1875 at Detroit, Michigan by well-known shipbuilder John Oades. She was a conventional two-masted schooner with straight stem and a square transom stern. Like hundreds of her contemporaries, she was fitted with topmasts, a long bowsprit, and a centerboard, and she undoubtedly carried foresail and main, two gaff topsails, a forestaysail, and two or three foresails or "jibs" (Kihlberg 1963, p. 74-75). She may also have used the triangular "raffee" on her foremast which was the characteristic of many Lakes sailing craft of her era (Figure 2). Her crew would have consisted of three or four men and a cook.

The *ADVENTURE* measured 104.0 feet in length, 24.0 feet beam (width), and 8.0 feet depth of hold. According to the laws of the U.S. Customs Department, official length was measured on deck from the inside of the stem to the after side of the sternpost; beam was taken to the outside of the planking at the widest part of the ship, and depth was measured from the upper side of the deckbeams amidships to the upper surface of the ceiling (inner) planking in the hold. Her register tonnage was 148.97 gross tons and 141.53 net (a "register" ton is equal to 100 cubic feet of enclosed space, and does not represent a measure of weight). The enclosed space below decks measured 139.86 register tons and she had a "trunk cabin" on her deck aft which measured 9.11 register tons (911 cubic feet). The ship's capacity would have been approximately 250 tons of cargo (175,000 board feet of lumber).

ADVENTURE was among the smaller Great Lakes schooners. Larger and more numerous ones were "canallers" or still larger craft. Canallers measured approximately 145 feet in length, 25 feet in breadth, and 10 feet depth of hold, and they were several hundred in number. These vessels were tailored to the dimensions of the old (second) Welland Canal (1845 to 1883), connecting Lakes Erie and Ontario. The Great Lakes merchant fleet of the mid-1870s included some 2,000 schooners in all, nearly half of which were canallers (Barry 1996, p. 123-124; Labadie 1989, p. 19-22; Labadie and Murphy 1987, p. 46-50; Mills 1910, p. 183-186).

Schooners larger than canal-size were used principally in the lucrative grain and iron ore businesses or in the Chicago lumber trade, while canallers were employed largely in the Lake Ontario and Upper Lakes traffic, and the smaller sailing craft were more often engaged in the "itinerant" trades, taking advantage of whatever small cargoes became available at the Lakes' smaller (and often shallower) ports. The largest sailing vessels in 1875 were 200 feet long, although a few schooner-barges exceeded that length; these latter craft were principally used as towbarges (Barkhausen 1947, p. 10).

The *ADVENTURE*'s construction appears to have been typical of wooden ships of her day in most respects (Figure 3). She was entirely built of white oak. She had closely-spaced transverse frames, all connected by a longitudinal backbone of heavy oak keelsons. Inner and outer planking was 2-inch thick white oak. The whole structure was strengthened by bands of heavier planking, called the "thick strakes", running the entire length of the hull under the deckbeams and along the bilges on both sides. The hull of such vessels was commonly stiffened further by the use of large tamarack brackets or "knees" under each deck beam where it meets the vessel's sides (although it has not been possible to confirm the use of knees in *ADVENTURE* because so much of the upper

hull structure was destroyed in her fire). The ship was iron-fastened, with 3/4- and 1-inch iron "treenails" in her frames and smaller 5/8 round and 3/8-inch square nails in the planking.

Ownership and Service History. The initial enrollment was issued to the schooner *ADVENTURE* October 1, 1875 at Detroit, Michigan by special surveyor J. E. Parry. It describes the vessel as having one deck and two masts, plain head and a square stern, with measurements as above (104.0 x 24.0 x 8.0 feet, 148.97 gross tons and 141.53 net tons). The official number assigned her was 105567.

The ship's official documents indicate that she was built for Oades' own interests; for the first two and a half years of her existence, she was owned by John Oades (3/4 interest) and son Walter H. Oades (1/4 interest). Her first master was George H. Collins. In 1876, the Board of Lake Underwriters assessed the value of the *ADVENTURE* at $8,000. It may be speculated that Oades used the craft to transport oak from Ohio ports to his Detroit shipyard property, although no evidence has yet been found to substantiate that premise. John Oades constructed 14 ships on the Detroit waterfront between 1868 and 1890, but he is best known for the 36 vessels he built at Clayton, New York between 1846 and 1865. The earlier vessels included some of the largest and finest passenger steamers on Lake Ontario, along with many barks and schooners. Oades was born at Sacketts Harbor, New York in 1815 and came to Clayton in the early 1840s. He relocated in Detroit in 1865, where he superintended the highly successful Campbell & Owen shipyard before resuming business on his own two years later (Wright 1969, p. 94-95).

Enrollment documents dated April 2, 1878 (Detroit, Michigan) show a change of ownership to Edward Cunningham (1/2) and F. B. Wallace (1/2). Both men were from Detroit, and Edward Cunningham was listed as master. Little is known of the schooner's activities during this time. *Inland Lloyds Vessel Register* for 1884 lists *ADVENTURE* with a valuation of $5,000. Another enrollment was issued at Detroit on April 13, 1886, showing a change of ownership to Edward Cunningham (1/4), F. B. Wallace (1/2) and J. E. Wallace of Chicago, Illinois (1/4); Edward Cunningham continues to be given as master. The 1886, 1888, and 1890 editions of the annual *List of Merchant Sailing Vessels of the United States* list Detroit, Michigan as her home port.

In 1891, enrollment documents issued on February 13 show a change of district to Cleveland, Ohio, and a change in ownership to H. C. Case of Sheffield, Ohio (1/2) and J. F. Padley of the same place (1/2); Case is given as her master. On May 25, 1894, the ownership was shifted to H. C. Case (1/4) and J. H. Padley (3/4), with Case remaining in command. April 11, 1895, documents of show J. H. Padley (3/4) and J. M. Robinson of Lorain, Ohio (1/4) as owners and

Robinson as her master. J. M. Robinson became sole owner of the schooner early in 1896 as reflected in an enrollment at Cleveland, Ohio dated February 4. Erroneously, the 1897 edition of *Inland Lloyds Vessel Register* continues to list Detroit as port of hail and the owners as Cunningham et al. The insurance value listed in this edition of *Lloyds* is only $1,500. At some time during the winter of 1896-1897, Robinson took in a partner. A new enrollment issued at Sandusky, Ohio on April 20, 1897 shows the vessel owned by Robinson (1/2) and Frederick Groch of Sandusky (1/2).

STEAMER *ADVENTURE*

Construction Details and Vessel Class. After serving as a sailing vessel for two decades, *ADVENTURE* was rebuilt as a screw steambarge at Sandusky, Ohio in 1897 by Henry D. Root of nearby Lorain. The conversion seems to have been done on property owned by David Dussault. Dussault operated a sand and gravel business on the Baltimore & Ohio dock at the foot of Warren Street, and on another dock at the foot of Meigs Street in Sandusky. Second-hand machinery was used for the ship's conversion.

Root was very highly regarded in marine circles, having operated a shipyard at Lorain from the early 1850s until 1907 or 1908; he is credited with building some 49 vessels and rebuilding several others. He built all manner of Lakes craft, but principally schooners in the early years and fish tugs after 1890.

Rebuilding of the *ADVENTURE* from a schooner to a steambarge was effected by reconstructing the ship's square stern and installing a boiler, engine, tailshaft, propeller, and rudder. Simpler tasks included removal of the ship's bowsprit and her after (main) mast, relocating the foremast, and erecting a small forecastle at the bow. A cabin was also constructed on a raised poop deck at her stern (Figure 1).

Essential machinery consisted of a small, single-cylinder high-pressure vertical steam engine salvaged from the steambarge *HANDY BOY* and a boiler from the tug *MYRTLE*. The engine, with a 16-inch cylinder and an 18-inch stroke, had been fabricated in 1881 by Phoenix Iron Works at Port Huron, Michigan, and used in the *HANDY BOY* until the craft was destroyed by fire at Huron, Ohio September 4, 1888. The *HANDY BOY* was very nearly the same size as the *ADVENTURE*, measuring 104.6 x 25.9 x 7.5 feet, and 136 gross tons. The Kelley Island Lime & Transportation Company last owned her. The boiler used in the *ADVENTURE* came out of the 50-foot tug *MYRTLE*, which was built in 1875 at Black River (Lorain, Ohio) and owned by Fred Groch, the same man who purchased the *ADVENTURE* shortly before her 1897 rebuilding

(Wendt 1984, p. 129). Although the tug was abandoned at Sandusky around 1892, she may have been out of service for some time previous to that date: the Marquette (Michigan) *Daily Mining Journal* advertised on December 17, 1887:

> "The tug *MYRTIE* (sic) of Sandusky - for sale cheap; in first-class condition. Write to Fred Groch, Sandusky, for particulars"

According to the 1902 edition of *Beeson's Marine Directory*, the boiler was the firebox type and measured 5 feet 6 inches in diameter and 12 feet in length; its' manufacturer is unknown.

Steambarges were developed on the Great Lakes following the Panic of 1857, when low freight rates and an overdeveloped merchant fleet drove most vessel owners out of business. Around 1862 a Buffalo ship-owner took idled passenger steamers and made huge barges out of them, and he used large tugs to tow them from port to port (Mills 1910, p. 186-188). He reasoned that a freight steamer could be designed which would serve the same purpose, but could also carry its own cargo on deck, and the steambarge was the result (Mills 1910, p. 188-190); Labadie 1989, p. 25-28; Labadie and Murphy 1987, p. 55-57). The *TRADER*, built at Marine City, Michigan in 1865, is believed to have been the first steambarge.

Steambarges (or "lumber hookers") were single-decked steamships whose basic hull construction differed little from contemporary schooners, except that they were self-propelled, with boilers and engines, and had cabin accommodations necessary for larger crews. The earliest steambarges had their cabins aft as did *ADVENTURE*, although the larger steambarges which evolved after 1880 often had pilothouse and some of their cabins on a raised forecastle at the bow; this feature was advantageous in larger craft since it improved visibility for the master and wheelsman. Most vessels of this type ranged between 90 and 175 feet in length with capacities from 150,000 to about 1,000,000 board feet (800 tons) of lumber. Between 1865 and 1910 there were 800 steambarges built on the Great Lakes (Labadie 1982), and the type was adopted in the Pacific Northwest when the lumber industry moved there at the turn of the century. On the West Coast, the vessels were referred to as "steam schooners".

These sturdy vessels carried their cargoes on deck as well as below, but because their below-decks capacity was limited, they were particularly suited for products which could be exposed to the weather and piled high on deck. These products included lumber, coal, sand, stone, or barreled salt. Steambarges were also good money-makers because they had the horsepower to tow two, three, or more loaded barges behind, multiplying their payloads several fold on any given trip.

Some of the more powerful "hookers" routinely towed six barges back and forth between Saginaw, Michigan and Toledo, Ohio or Buffalo, New York during the 1870s and '80s. The relatively small engine and boiler inherited by the steamer *ADVENTURE* would not have been sufficiently powerful to tow more than one or two barges.

Steambarges proved essential to the development of the lumber industry on the Great Lakes and to the cheap transportation of forest products. Moreover, they were the prototypes for the Great Lakes' unique "bulk freighters" which soon followed them in the grain and iron ore trades and persist to the present day with little change (Labadie and Murphy 1987, p. 57-60). Steambarges disappeared not long after the collapse of the lumber industry in the Great Lakes region around 1920, but their double-decked descendants have served America's economy for more than 130 years by hauling mountains of grain, coal, and iron ore inexpensively. The bulk freighters of the Great Lakes are known the world over for their efficiency and economy, and they are direct descendants of the modest little steambarges like the *ADVENTURE*.

Following her 1897 reconstruction for Robinson and Groch, the *ADVENTURE* measured 108.0 feet in length, 24.0 feet beam, and 8.3 feet depth of hold. Her draft would have been about 8 feet aft and 6 or 7 feet forward. Her register tonnage was changed to 141.72 gross tons and 95.37 net tons. Because of the space taken up by her machinery and coal bunkers, the ship's cargo capacity was somewhat reduced. No revised capacity figure has yet been found, but it may be estimated at 200 tons or approximately 150,000 board feet, based on a comparison with similar vessels. The 1902 edition of *Inland Lloyds Vessel Register* indicates that she was approved for deckloads of lumber up to 7-1/2 feet high. Following her rebuilding, *Inland Lloyds Vessel Register* (1897) listed the vessel's insurance evaluation as $6,000.

Ownership and Service History. Temporary enrollment documents for April 20, 1897 (Sandusky, Ohio) show master carpenter H. D. Root of Lorain, Ohio as the rebuilder of the vessel in Sandusky. She was rebuilt as a screw steamer with one deck and two masts, plain head, and a round stern. The new dimensions were length 108 feet, breadth 24 feet, and depth 8.3 feet. The new tonnage was 141.72 gross tons and 95.37 net tons. Ownership is given as J. M. Robinson of Lorain, Ohio (1/2) and Frederick Groch of Sandusky, Ohio (1/2) with J. M. Robinson remaining as master.

Later that spring, permanent enrollment documents issued in Cleveland (May 26, 1897) list the owners as Frederick Groch of Sandusky (51/104), J. M. Robinson of Lorain, (51/104), and A. C. Moss of Sandusky (2/104). The home port is given as Lorain, and the master is listed as S. J.

Putnam (or S. J. Batman). During 1897, William H. McNalley, George Besh, and John M. Robinson also served as masters of the *ADVENTURE*.

The Groch Coal Company likely ran the *ADVENTURE* from Sandusky to Lorain and Cleveland, Ohio in the stone, lime, and cement trade from 1897 until 1901 when she was sold to parties from Port Huron, Michigan. The 1897 edition of *Inland Lloyds Vessel Register* for side-wheel steamers and propellers lists the value of *ADVENTURE* at $6,000 with the port of hail as Sandusky, Ohio and the owner as Robinson et al. The 1898 edition of *Lloyds* shows a decrease in value to $5,000 and the 1900 edition shows a marked, further decline to $1,500. Enrollments documents for June 8, 1898 show Frederick Groch as the sole owner and master.

Frederick Groch surrendered enrollment for the *ADVENTURE* in the Sandusky District on May 31, 1901. The surrender document lists him as both owner and master. Also on May 31, 1901, the new owners Charles Beyschlag (1/3), Joseph Lowes (1/3), and Jno. Beyschlag, Jr., all of St. Clair, Michigan, enrolled the *ADVENTURE* at Port Huron, Michigan. Charles Beyschlag is given as master. The 1903 edition of *Beeson's List of American Steam Vessels on the Lakes* gives owner or manager as Charles Beyschlag of St. Clair, Michigan. In 1901 a new deck was installed and she was refitted. Correspondingly, *Lloyds* upgraded the value of the vessel to $5,000 (Figure 4).

From 1901 until 1903 the *ADVENTURE* was engaged in the transport of lime and limestone from Kelleys Island and the delivery of salt to Sandusky, as well as handling cargoes of gypsum from in the vicinity of Tawas Bay, Lake Huron (Dorr and Eschman 1970, p. 125-126). The 1902 edition of *Merchant Sailing Vessels of the United States* listed the crew size of four and the home port as Port Huron. The October 8, 1903 edition of the *Sandusky Daily Register* reported that the *ADVENTURE* had been in port at Sandusky "a day or two ago and discharged a cargo of salt at the Big Four docks." On the same date the *Sandusky Evening Star* stated that the *ADVENTURE* was owned by "Charles Beyschlag of St. Clair, Michigan" while the *Port Huron Daily Times* and *Cleveland Plain Dealer* gave the owners as "Beyschlag, Schlinkert and Lowes of St. Clair."

LOSS OF *ADVENTURE*

On October 6, 1903, the *ADVENTURE* sailed from Sandusky to Kelleys Island, Ohio. During this voyage *ADVENTURE* was commanded by Captain John Lowes who had his wife and young daughter on board. By 4:00 in the afternoon of October 7, she had taken on a cargo of burned lime at the Kelley Island Lime and Transport Company's North Bay dock (Figure 5) when disaster struck. While lying at the dock she caught on fire (Figure 6). Flames were first discovered just

forward of the boiler in the hold and soon the ship was ablaze. The *Sandusky Daily Register* reported that the fire "spread so rapidly that the sailors were glad to escape with their lives." The *Sandusky Evening Star* stated "It is reported that the lime became wet and was set afire, but this report is not confirmed." When it was seen that the ship could not be saved, prompt action by Captain Regan of the steam tug *L. P. SMITH* in getting a line onto the burning steamer and towing her out into North Bay saved the schooner *ALEX ANDERSON*, which was lying dangerously near the burning craft. The *ADVENTURE* was towed to shoal water near the base of the island's northeast point (Long Point) and allowed to burn itself out (Figure 7).

The *Sandusky Evening Star* reported that the captain and his family, as well as the crew were rescued but narrowly escaped death, and most of their belongings were destroyed (October 8, 1903). The steamer and its cargo were a total loss as the vessel burned to the water line and sank in about 15 feet of water some 200 feet off Long Point in North Bay. The estimated value of the loss in 1903 was $2,500 for the vessel and $1,500 for the lime cargo. The *Sandusky Daily Register* reported that the vessel and its cargo were uninsured (October 8, 1903).

ARCHAEOLOGICAL DOCUMENTATION

OBJECTIVES AND METHODS

Although the wreck of the steamer *ADVENTURE* is relatively well known to sport divers of the western Lake Erie area, serious efforts had never before been undertaken to document the features of this archaeological site. Certain artifacts have been removed through the years, most probably including the boiler by commercial salvagers soon after the sinking, and the propeller in the 1960s by a diving club. The objectives of the present project were to train a cadre of avocational divers in the techniques of shipwreck documentation and then put these newly acquired skills to the test by conducting an archaeological study of the *ADVENTURE*.

Nautical Archaeology Workshop. During fall semester of 1997, an experimental workshop course titled *Shipwreck Archaeology for Recreational Divers* was taught by the authors and several colleagues at Firelands College of Bowling Green State University in Huron, Ohio. The course was designed to offer SCUBA divers an appreciation of the underwater cultural resources of Lake Erie, information on the construction of historic vessels and their historical and archaeological significance, and underwater techniques for documenting shipwrecks. The experience was a blend of lecture, dry- and swimming pool-simulation laboratories, plotting exercises, and actual shipwreck site mapping. The workshop was sponsored by a grant from the Lake Erie Protection Fund and by in-kind services from the Great Lakes Historical Society and the Ohio Sea Grant College Program at The Ohio State University. The workshop provided a group of 38 underwater

archaeology students with an opportunity to document the wreck of the *ADVENTURE*, which facilitated the preparation of detailed maps and drawings of the site, as well as to participate in the restoration of the vessel's propeller.

Field Methods. The location of the *ADVENTURE* shipwreck in North Bay of Kelleys Island is relatively well known, but as with all shipwrecks in Ohio waters, no record of any previous archaeological documentation is available. After locating the site based on sports diver tradition, a general reconnaissance dive was performed to determine the basic orientation of the shipwreck and identify the major features to be mapped. The primary documentation technique selected for the site was the trilateration method. This method required first establishing a baseline coincident with the keel of the vessel, and fastening a durable tape measure longitudinally along the entire length of the shipwreck and extending it some 10 to 20 feet beyond the bow and stern. Major features of the wreck selected for mapping were marked by attaching 2-inch by 2-inch plastic squares (cut from milk cartons) on which identifying numbers were placed with a water resistant marker. Teams of divers were then sent to specific segments of the wreck to locate these features. Precise location for every significant point on the feature was achieved by recording the distance to that point from two positions on the baseline, thus forming a triangle with the feature at the apex.

Once the positions of the major features were determined, teams of divers were assigned specific details to measure and sketch (Figure 8). A preliminary site map was constructed in the field as the dive teams returned to the shore and reported their findings. Later, individual sketches were then integrated into an overall site map (Plate 1). The site was also recorded by video taping it. A video camera in waterproof housing was used to record the wreck, using a right-angle vertical orientation, a uniform distance of ten feet, and a predetermined grid to ensure thorough pictorial coverage of the entire site. The resultant footage was used to verify the manually-recorded site information and to fill in details which may have escaped the more formal documentation procedure.

Description of Site. The reconnaissance dive on the site revealed that the shipwreck lies between 125 and 275 feet offshore of Long Point on Kelleys Island, in North Bay. The nearest landfall from the site is about 525 feet northeast of the roadway gate to Long Point and 3,200 feet southwest of the tip of the point (Figure 9). The shoreline consists of shelving bedrock and low limestone cliffs. This type of landform is known as an alvar (Cusick 1997, p. 3). Alvars are horizontal limestone or dolomite bedrock laid bare by glacial action which then are maintained as natural openings by constant waves and ice scour. Offshore the bottom consists of silty sand mixed with gravel, limestone cobbles, and large glacial boulders. On this material, the remains of

the *ADVENTURE* lie nearly flat to slightly canted toward the port (left) side (Plate 1). A thin layer of zebra mussels (*Dresissena polymorpha*) colonized most of the exposed surfaces of the wreck, and some small freshwater sponges (*Eunapius fragilis*) were observed in various crevices and cracks. Patches of wild celery (*Vallisneria americana*) and coontail (*Ceratophyllum demersum*)were found all around the site, most of it four to six feet tall, and some thin growth of green algae (*Cladophora glomerata*).

The ship's hull is 102 feet long, extending from the sternpost to a point near the bow, with a maximum width of 24 feet. It lies on a heading of N23°E, with the stern at the northern extremity, in depths ranging from 10 to 15 feet (Plate 1). The 19-foot stem and forefoot structure is detached and separate, lying 155 feet northwest of the forward end of the hull and 160 feet west of the sternpost, in approximately 18 feet of water (Figure 8-A). The position of the shipwreck components was determined using standard land surveying techniques once divers had placed buoys to mark the extremities of the sections. A 200-foot-long baseline was established along the shore with its center near the projected offshore center of the site. Horizontal angles from the baseline to the various buoys were then measured with a theodolite. Next the position of the baseline was located in relation to the Long Point gate (visible on aerial photographs of Kelleys Island), and the position of the shipwreck was transferred to an aerial photograph (Figure 9).

Interestingly, a second shipwreck was observed very near the *ADVENTURE* site. About 50 feet southeast of the stern of the *ADVENTURE* are the remains of an 80-foot-long wooden scow schooner, lying along an east northeast axis, and laden with rough cut limestone blocks of irregular sizes. While this was at first believed to be part of the *ADVENTURE* wreck, its size and characteristics soon established that it was a separate but unidentified vessel. No attempt was made to document this wreck.

RESULTS OF INVESTIGATION

Interpretation of Site. The remains of the steamer *ADVENTURE* are largely intact, although the fire that ended the ship's career reduced her hull to the waterline, and only her framing and bottom features survive to the present time. The hull is entirely white oak, and most of its structural features are well preserved and solid, although there are clear indications of the fire that consumed the remainder of the ship. The iron fastenings are also well preserved, as are numerous machinery parts. The ship's hull is characterized by a heavy oak backbone composed of several longitudinal keelsons, together with transverse ribs (frames), and longitudinal oak planking both inside and outside the frames (Figures 3 and 10).

Framing. The backbone of the vessel is made up of four individual keelsons, each 9 x 9 inches in cross-section, with three fixed to the frames and a fourth "rider" keelson along the centerline on top (Figures 3 and 10). The outermost of the lower keelsons are reinforced by bands of 3/4-inch iron 9 inches wide, running much the length of the hull, i.e. from position 53 on the baseline all the way forward to position 101. These reinforcing elements would have the effect of adding another oak keelson on each side (Inches 1962, p. 32; Slyker 1958, p. 11-12). The keel itself is far less significant than the keelsons. It is fixed to the underside of the frames, and it measures 9 inches in width and 5 inches in depth. The keelsons run from the sternpost all the way forward to the point where the forefoot and stem once connected, a length of 102 feet, although not all of the four individual members have survived intact. The structure is intact from the engine bed near the stem (14 feet forward of the sternpost) to a point some 83 feet forward; only portions of the lower keelsons extend the remainder of the hull's length.

The keel structure is pierced at mid-length by the trunk for a centerboard, which undoubtedly survived from the ship's schooner days, although centerboards were also used in many steambarges. Centerboards were basically a feature required in sailing vessels. They were a form of adjustable keel, used to keep a ship on course when a beam wind tended to drive the bow sideways, especially when the ship was "light" or without cargo (Barkhausen 1990; Cuthbertson 1931, p. 235-237; Wilson n.d., p. 40-42; Inches 1962, p. 31). The centerboard was lowered through a slot in the ship's keel, thus the opening or "trunk". *ADVENTURE*'s centerboard trunk was 33 feet long, extending from the 52-foot mark on the baseline forward to the 85-foot point. The trunk originally would have stood at least eight feet high, reaching right up to deck level (Figure 11). Its opening was 4-1/2 inches wide and 31 feet long. The centerboard itself was pivoted on a pin at the forward end of the trunk and raised by means of a small winch on deck with a chain leading to the after end of the board. No evidence of the pivot-pin was found in the wreck, but a portion of the winch was located in the starboard side of the wreck abreast of baseline point 65 (Plate 1 and Figure 8-B). In the way of the centerboard trunk, the ship's frames were strengthened by a third "futtock" extending outboard some four feet from the centerline, while the remainder of the ship's frames were made up of only two futtocks. The highest points of the centerboard trunk are presently no more than three or four feet from the ship's bottom due to fire damage and decades of erosion by water and ice.

The common method of fabricating ship's frames in 19th century America was to build them up or laminate them, using overlapping sections or futtocks (Estep 1918, p. 35-44; Greenhill 1988, p. 103-109). Each of the *ADVENTURE*'s frames is 8 inches wide, made up of two 4-inch-wide futtocks. The frames extend from rail to rail, right across the ship's bottom, with the keelsons

fixed to their upper surface and the keel underneath. They taper in their depth from 8 inches at the centerline to 6 inches at the bilge; although no frames have survived above the bilge-line, it is estimated that they would have been no more than 4 or 5 inches deep at deck level. The frames are spaced at 22-inch intervals, leaving 14 inches space.between adjacent frames. A frame spacing of 22 inches was typical in ships of the *ADVENTURE*'s era, although with their 8-inch width, her frames are somewhat lighter than average.

One element of the ship's construction that is not entirely typical is the arrangement of the stern framing. Most wooden ships have "cant frames" at the ends, both forward and aft. These are half-frames which do not run continuously all the way across the hull of the ship, as do the frames in the midships portion of the hull, but instead they are fixed to either side of the stempost and the sternpost (Paasch 1890, p. 14, plate #2 in appendix). In the case of the *ADVENTURE*, the stern frames do run all the way across the hull, right through the "deadwood" at the sternpost. Instead of the more common tapering of the "run" into the sternpost, *ADVENTURE*'s hull is very full and round aft, with a flat underside and a projecting "skeg" sternpost. Although this configuration has been observed in other wooden ships, it is not common. Interestingly, in at least one other case where the pattern was observed, it was in the steambarge *SIDNEY O. NEFF*, which had, like the *ADVENTURE*, originally been built as a schooner (Jackson 1983, p. 107-114). It is assumed that this unusual method of framing the stern had to do with its transformation from the original square transom design to the round overhanging stern typical of steam vessels.

The ship's fastenings are unremarkable. Keelsons and frames are fastened together with 1-inch round iron "treenails". Frames have their individual futtocks fixed together with 3/4-inch treenails. Planking is fastened with a combination of 3/8-inch square nails and 5/8-inch round treenails; in the thick strakes, "clench rings" or "rove washers" are used on the treenails to make the fastenings doubly secure (Desmond 1919, p. 58-61). Most of the fastenings in the *ADVENTURE* wreck are solid and little deteriorated. Few loose fastenings were observed, while most wooden vessels that suffered similar fire damage are littered with them; it may be assumed that through the years divers have removed many loose treenails, bolts, and nails.

At the forward end of the wreck, the stem has been separated from the keelsons where it was once attached, and it lies flat on the lake bottom some 155 feet away, with its bottom oriented roughly to the north and its upper end to the west. The stem is built up of several oak timbers. It is 19 feet long and tapers from 24 inches depth at the bottom to 15 inches depth at its top. The stem is "arcuate" or bow-shaped, forming an arc of approximately 75°. The upper portions of the stem are

much deteriorated, and it is supposed that it suffered fire damage. The ends of several planks are still attached to the rabbet (groove) on the underside of the stem.

Planking. Like all of her contemporaries, the *ADVENTURE* was double-planked (Figures 3 and 10). She had 3-inch oak planking both inside and out, securely fixed to each frame with iron "treenails" and spikes (Desmond 1919, p. 56-61; Estep 1918, p. 64-71). The planking was from 8 to 14 inches wide and up to 40 feet in length. On the inside of her hull, the ship also had 4-inch "thick strakes" to reinforce critical areas (Desmond 1919, p. 63). Thick strakes were bands of three or four planks at the turn of the bilge and just under the deck beams at the ship's sides; these bands of heavier planking acted as trusses to contribute longitudinal stiffness to the hull. Much of the exterior planking has survived as well as some of the interior "ceiling". One 60-square-foot area on the port side about 20 feet forward of the engine mount shows extensive fire damage. This is thought to have been the location of the coal-bunker, and it may have been the source of the fire that destroyed the ship.

Machinery. A very visible assembly at the stern of the ship is the engine bed with its adjoining shaft-log and sternpost (Plate 1). These structures are the most tangible remains of the ship's power plant, which at one time consisted of a boiler, a single-cylinder reciprocating steam engine, crankshaft, tailshaft, propeller, and rudder, plus smaller engine-room auxiliaries (Figure 8-C). While the boiler is gone and the cylinder-head has been removed from the engine, numerous artifacts still remain in the wreckage, including broken castings, bent rods and eccentrics, piping, and the ship's 5-foot-long condenser (Figure 8-D). The rectangular engine bed is built up of thick 12-inch oak timbers tied securely into the ship's keelsons and frames at a point some 15 feet forward of the sternpost, measuring 41 inches in length and 51 inches in width. The cast iron engine frame is detached but lying on the port side of the vessel about 15 feet forward of the engine bed. Eight 1-1/2-inch studs used to bolt down the engine are still standing in the engine bed, but the nuts are all gone, perhaps indicating an effort to salvage the engine.

The distinctive cast-iron flywheel measures 3-1/2 inches in thickness and 26 inches in diameter; it stands at the forward end of the engine bed, still fixed to the crankshaft (Figure 8-C). The crankshaft itself, with its associated journals, piston rods, and eccentrics lies intact in its bearings (Figure 8-E), although all of the connecting rods are twisted and broken off. The crankshaft measures 6 inches in diameter. The tailshaft is still coupled to the crankshaft; it too, measures 6 inches in diameter and 12 feet 6 inches in length from the coupling to the point where it has been cut off flush with the stern bearing at the after end of the sternpost. The tailshaft runs through a 9-foot 6-inch oak shaftlog of 15 x 15-inch cross-section. The ship's 5-foot diameter, four-bladed,

cast-iron propeller wheel was removed by divers in the 1960s, and while it was not at the site during the 1997 investigations, it has since been restored to its original position. The propeller has fixed "buckets" or blades (Figure 12). It is not clear whether or not it was also salvaged from the steambarge *HANDY BOY* when the engine was removed. The *ADVENTURE*'s rudder was not found, but the 1-1/2 inch thick iron rudder shoe is still fixed to the sternpost, with its trailing edge projecting 4 feet 6 inches into the sand (Plate 1).

An interesting feature found in the ship's wreckage is a large iron casting believed to have been one of the support frames for a deck winch. This artifact was found on the starboard side of the wreck near the turn of the bilge, at baseline position 66. It is of heavy construction, roughly triangular in shape, and measuring 31 x 34 x 42 inches. The casting has numerous holes for bolts and shafts. The winch may have been used for mooring lines and for the ship's centerboard. A second large artifact associated with the wreck is the cylindrical condenser, which was observed lying near various engine parts on the port side at point 30 on the baseline. This apparatus captured the steam exhaust from the engine and turned it back into water by cooling it. The water was then recycled back into the ship's boiler. The condenser consists of a riveted-steel drum with steam piping coiled inside it. It measures 18 inches in diameter and 60 inches in length. The third large artifact is the lower portion of the ship's main engine, which consists of a four-legged cast-iron pedestal. This feature lies on the port side opposite position 40 on the baseline, just forward of the condenser. It measures 42 inches in height and has an upper surface 2 inches thick and 32 inches square. The cylinder would have been fixed to this surface.

Replacement of Propeller. The 1,600 lb. propeller of the *ADVENTURE* was salvaged by the Poseidon Diving Club of Newark, Ohio in 1964. Divers from the club spent several weekends cutting the shaft by hand with hacksaws. The massive cast-iron propeller had four blades and measured five feet in diameter. For many years the propeller was displayed at the Newark YMCA as a trophy welded to a flagpole. In 1992, the flagpole was dismantled and the propeller was relegated to a scrap pile behind the city maintenance garage in nearby Heath, Ohio. Detective work by students Greg and Lynda Myers of Centerburg, Ohio led to the recovery and eventual return of the propeller to the *ADVENTURE* shipwreck site in North Bay.

With the cooperation of Poseidon Diving Club and the City of Heath Street Department, the propeller was released to the workshop project, loaded on a trailer, and transported to Lakeside, Ohio on October 17, 1997. The following day the propeller was suspended from an A-frame mounted on the 45- foot long salvage vessel *CHARLOTTE MARIE* (operated by Neil Shrock Towing and Salvage, Inc.) and escorted to North Bay of Kelleys Island by rescue boat *DIVE 1* of

the Lakeside Fire Department. Arrangements for this phase of the replacement effort, including the donation of vessel and personnel time, was coordinated by workshop student Fred Rhoda of Lakeside, Ohio.

At the shipwreck site, divers from the fire department and the workshop, lead by instructor Joyce Hayward, positioned the stern of the *CHARLOTTE MARIE* over the stern of the *ADVENTURE* and the propeller was slowly lowered to its approximate original position (one of the propeller's four blades had been lost during its period in the Newark area, but students learned of the its possible location and plan to replace it on the shipwreck in 1998). This marks the first time a major artifact has been replaced on a shipwreck in the Ohio waters of Lake Erie and hopefully it is an action that will encourage divers to preserve Ohio's underwater heritage and perhaps return other artifacts to their original location on wreck sites (Figure 12).

Interpretation of Cargo. The cargo capacity of the *ADVENTURE* following her 1897 reconfiguration has not been determined, but it is guessed that it might not have exceeded 200 tons. The ship's final cargo was reported as lime, most probably stored in wooden barrels (see section on Lime Production). Small accumulations of a grayish-white slurry were found in the ship's hull adjacent to the keelsons and approximately 20 feet forward of the engine bed. Samples were obtained from the site, and after drying, this material effervesced freely when drops of dilute hydrochloric acid were applied, suggesting that the samples represented the remnants of a lime cargo, perhaps the residue of numerous cargoes carried by the steamer. The hydrated lime deposits were found adjacent to the keelsons on the starboard side of the ship, but no evidence of barrels was noted, such as staves, iron hoops, or flat ends.

The precise size and capacity of the barrels produced at the Kelley Island Lime & Transport Company cooperage has not yet been determined because of the lack of physical evidence, however, some approximations can be given based on published material and period illustrations (Figure 13). Heisler (1987, p. 533) gives the weight of a barrel of dry cement (mixture of calcined limestone and clay) as 376 lbs. Using the density of bulk of quicklime (55 lbs. per cubic foot), such a barrel would have a volume of 6.8 cubic feet or approximately 51 gallons (Eshbach 1952, p. 1-146). Considering the cargo capacity of *ADVENTURE*, which equates to about 400,000 lbs., she could carry about 1,064 barrels. Volumetrically, considering about a 20% loss of space for packing a cylindrical barrel (Leeming 1942, p. 431), this cargo would equate to 8,680 cubic feet or about 62% of the available 14,000 cubic feet of cargo space.

KELLEYS ISLAND LIMESTONE INDUSTRY

GEOLOGIC SETTING

Kelleys Island lies in western Lake Erie, five miles off the Ohio mainland at Marblehead Peninsula and 12 miles north of Sandusky. The island's limestone quarries have long been known to science because of the remarkable glacial grooves (Figures 14) carved in the surface of the Columbus Limestone and the well-preserved fossil fauna (Bowe and Herdendorf 1990, p. 1-8). For decades high-quality building stone, lime, and crushed rock were produced from these quarries (Stauffer 1909, p. 136).

Columbus Limestone (Middle Devonian age) bedrock underlies the major portion of Kelleys Island (Figure 15). 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, p. 7). An uplift in the bedrock west of the Bass Islands, known as the Cincinnati Arch, gives the rock formations of western Lake Erie a regional dip toward the southeast. As a result, most of the islands of western Lake Erie, including Kelleys Island, have a cuesta or hogback shape (Figure 15) with steep cliffs on the side toward the arch and gentle, shoaling coasts away from the arch (Carman 1946, p. 282). The Columbus Limestone is underlain by the Lucas Dolomite, which is exposed in the bottom of the deepest quarries on Kelleys Island (Stauffer 1909, p. 136-142).

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, p. 9). The basal beds 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 (Figure 16). The cherty layer is about 4 feet thick in the quarry walls and contains numerous gray and white chert nodules. The upper 25-foot thick beds are bluish-gray and the purest part of the formation. The top 10 feet of this upper sequence splits into thin slabs (1 to 3 inches thick) on weathering (Figure 17) and contains extensive layers of brachiopod fossils, especially *Spirifer acuminatus*; the next 7 feet down is also very fossiliferous but somewhat more massive in character, while the bottom 8 feet of the upper unit 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 (Stauffer 1909, p. 136-142; Fisher 1922, p. 9, 21-23).

Flux stone requires a fairly high content of calcium carbonate and a correspondingly low amount of silica and alumina while a higher content of magnesium carbonate can be tolerated for stone burnt

for lime (Fisher 1922, p. 21). The following analyses were performed by the Ohio Geological Survey (Lord 1884, p. 534; Orton 1888, p. 753) in the 1880s on Kelleys Island stone destined for these two purposes:

Component	Flux stone for iron smelting	Stone to be burnt for lime
silica	1.81%	1.65%
alumina and iron	0.75%	0.14%
calcium carbonate	87.50%	77.22%
magnesium carbonate	9.75%	20.19%
residue	0.19%	0.80%

The upper part of the Columbus Limestone is a very pure limestone and therefore was valuable for use as lime and flux. Analyses indicate increasing proportions of magnesium carbonate ($MgCO_3$) and decreasing portions of calcium carbonate ($CaCO_3$) from the top to the bottom. In the upper beds the amount of $CaCO_3$ was as high as 97% and the amount of $MgCO_3$ was as low as 27%, whereas the lower massive beds ran as low as 78% $CaCO_3$ and as high as 20% $MgCO_3$. Alumina, iron oxide, and silica made up the remainder (Ver Steeg and Yunck 1935, p. 431). The lower, more massive beds best served dimension and building stone needs.

HISTORY OF QUARRY OPERATIONS

For seven decades, from 1873 to 1939, quarrying was the leading industry on Kelleys Island. Even earlier, around 1830, the first quarry was opened by John Clemons (Martin 1990, p. 18). He and his brother exploited rock from the north shore of the island where limestone ledges rise 25 feet above the lake (Myers et al. 1992, p. 22). The first shipments of limestone were made from a dock on North Bay (approximate extension of Division Street) that was constructed by Clemons (Ver Steeg and Yunck 1935, p. 432). The operation exploited the limestone ledges that rise 25 feet above the lakeshore. Although temporarily abandoned about 1835, the general vicinity of the first quarry was utilized at various times by various firms until its final abandonment in the early 1940s.

The potential for developing a limestone quarry industry on Kelleys Island was one of the factors which prompted Datus and Irad Kelley to purchase the island in the 1830s and members of the Kelley family remained involved in the industry until the turn-of-the-century. When the Kelley brothers purchased most of the island in 1833, several families were resident on the island and employed in quarrying. The Kelleys continued to use the north dock to ship stone, making their first shipments to Cleveland and other markets in 1834. The Kelleys shifted their quarrying activities to the southern side of the island in 1835 and use of the north quarry and dock were discontinued (Myers et al. 1992, p. 22). Other early quarries were soon opened on various parcels of land near the west and south shores by settlers who had purchased land from the Kelley brothers, including William S. Webb, George W. Kelley, A. S. Kelley, George C. Huntington, Charles Carpenter, and John Titus, who owned and operated their own quarries (Martin 1990, p.

18). Datus Kelley wrote of William Webb's early efforts, "Our teams are now busy in hauling stone...Esquire Bill is elected Justice of the Peace. He has quarried about 7 or 8 hundred feet of stone at 6¢ per foot. Says he will quarry all we want." (Graff 1941, p. 81).

The original quarry on the north shore was variously known as Lake Shore, North Side or Kelleys Quarry. Other early operations were known as Carpenter Quarry near the southwestern corner of the island, the Huntington or South Side Quarry on the south shore, and the Titus or West Side Quarry on the west shore. These early quarries were small in areal extent in response to limited markets.

George Kelley, son of Irad Kelley, arrived on the island in 1847 to occupy 140 acres of land in Lot 6 that he had purchased four years earlier from his cousin, Addison Kelley. He operated a general store, but in 1854 traded his business to William S. Webb in exchange for Webb's quarry. George Kelley opened several small quarries in various places on the island and built a dock on the south shore for shipping his stone. Here the keel for the steamer *ISLAND QUEEN* was laid in July 1854 (Martin 1975, p. 66). In May 1865 Franklin and Norman Kelley purchased all of the remaining quarries and docks owned by William S. Webb and A. S. Kelley. This was the beginning of the consolidation of the Kelleys Islands quarries (Martin 1975, p. 25).

Quarrying on the southern and western sides of island developed rapidly in the 1850s and 1860s (Hatcher 1940, p. 382) and more workers were attracted to the island. However, the production of limestone remained eclipsed by the commercially successful viticulture industry until late in the 19th century when market factors depressed the grape and wine economy. Only then did land values, once inflated by vineyard profits, decline to a level where large-scale land acquisitions for quarry ventures were practicable (Pape 1988, sec. 8, p. 10). Finally in 1873, the value of stone exceeded that of the grape crop for the first time. Thereafter, stone increased in importance while the vineyards gradually declined (Gilfillan 1959, p. 20). William D. Kelley, manager of the South Side Quarry and 31-year veteran of the island's limestone business, observed that production in his quarry increased from 500 cords/year in the 1850s to 20,000 cords in the 1880s (Nichols 1888, p. 22).

Quarrying activities resumed again on the north side of the island in 1872 when G. W. Calkins & Co. of Cleveland purchased 162 acres of quarry land from William. D. Kelley and others to compliment their smaller holding on the west side of the island (Figure 18). Until the purchase of the north quarry land, Calkins & Co. shipped stone extracted from their west quarry to Cleveland to be burned for lime (Myers et al. 1992, p. 22). Soon after the new land acquisition the company

initiated an expansion program which included a new dock, enhanced facilities for extracting and processing stone, and housing for quarry workers. In 1875 the company brought several lime kilns to the island from their Cleveland operation and erected them near the new north dock. The same year an extensive cooper shop was built and an elevated wharf was added to the north dock (Myers et al. 1992, p. 23). At this time the company was owned by G. W. Calkins, M. C. Younglove, and Charles Hickox.

In December 1886, Calkins & Co. was incorporated as the Kelley Island Lime & Transport Company (KIL&T Co.) with M. C. Younglove, Cable E. Gowen, and E. B. Merriam as partners. KIL&T Co. consolidated the holdings of the island's smaller operations into three "theaters" of operation: North Bay, West Bay, and South Bay (Figure 19). KIL&T Co. became the largest employer and landowner on the island between 1886 and 1942, and eventually became the largest producer of lime in the world (Pape 1988, sec. 8, p. 11). In describing the island at the turn-of-the century, Thorndale (1898) noted that "after a glance at the vast area of quarries and cored stone, and the outcropping ledges remaining, the island as a whole suggests itself as a single big lime rock, with a layer of earth spread over it." In 1918 KIL&T Co. reached peak production on Kelleys Island as 3,989,339 tons of stone were shipped on 316 boats (Myers et al, 1992, p. 24).

The population of Kelleys Island from the mid-1800s to the mid-1900s fluctuated largely in response to quarrying operations on the island. Figure 20 traces the growth and decline in the number of year-around island inhabitants from 1820 to 1996. The peak period of island population corresponds to the peak period of limestone production, from about 1870 to 1920. At the turn-of-the century over half of the occupations on Kelleys Island were directly related to the limestone industry (Myers et al, 1992, p. 35).

QUARRYING PRACTICES

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. 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. The first American lock at Saulte Ste. Marie, Michigan (1874-1876) was also built with Kelleys Island stone (Martin 1975, p. 25). Ross (1949, p. 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, p. 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, p. 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, p. 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, p. 21). The Lake Shore quarry furnished both the magnesium-rich portion of the Columbus Limestone and underlying beds of Lucas Dolomite, also rich in magnesium, for the lime kilns.

The first lime kilns on Kelleys Island were built on the south shore by George Kelley in 1855 (Pape 1988, sec. 8, p. 12; Myers et al. 1992, p. 30). and by Calkins & Co. on the north shore in 1875 (Behnke 1974, p. 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, p. 23, 24) describes the early operations of the KIL&T Co. in vivid detail. Within two years, KIL&T Co. laid five miles of railroad track on the island and operated two locomotives and 15 cars to haul the stone to the kilns and to the docks for shipment to commercial centers. At the quarries the Company employed a stationary engine and two diamond drills while at North Bay it built 16 state-of-the-art iron kilns to burn the limestone (Figure 21). KIL&T Co. also constructed residences for its employees and established a general merchandise store because center of Kelleys Island village was 1.5 miles distant. In all, KIL&T Co. invested about $300,000 during its first two years of operation.

Twenty years later, KIL&T Co. holdings covered over 1000 acres and over $800,000 had been invested in its operations. The Company advertised itself as "the largest of its kind in the world" (Hatcher 1949, p. 304). To work the quarries and kilns, KIL&T Co. imported foreign workers from central and eastern Europe — Italians, Slavs, Greeks, Hungarians, Portuguese, Poles, Macedonians, Bulgarians, and Germans. A large group of them lived on Kelleys Island, others in the vicinity of Marblehead. In the late 1930s, the workings on the island began to dwindle, along with the population, and the industry was concentrated on Marblehead Peninsula.

The 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 (Figure 21). 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, p. 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.

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 (Figure 22). The barrels were then rolled to an adjacent warehouse (6,000 capacity) or 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 (Figure 23). The annual lime production by KIL&T Co. in the late 1880s was about 650,000 barrels and involved some 275 workers. Nichols (1888, p. 23) observed that "the lime produced by this firm is singularly white, strong and pure, being used almost exclusively for building and plastering purposes." In referring to the thinly

bedded rock overlying the lime beds, Nichols also 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."

When limestone, a carbonate of calcium ($CaCO_3$), is heated sufficiently it undergoes a decomposition which yields calcium oxide and carbon dioxide ($CaCO_3 \rightarrow CaO + CO_2$). The temperature required to maintain this conversion at one atmosphere of pressure is about 1250° F (Nebergall et al. 1963, p. 650). The manufacture of calcium oxide or quicklime on Kelleys Island was carried out in tall chimney-like furnaces known (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 (Figure 24). 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 (Nebergall et al. 1963, p. 650). In the furnace, carbon dioxide began to disassociate at 700° F and was completely freed at 900° F. Operators attempted to maintain a constant temperature of 800° F in the kilns for optimal processing (Myers et al. 1992, p. 30). Wood was typically used to fuel the Kelleys Island kilns.

Pure calcium oxide is a white amorphous substance that emits an intense light, called "limelight" when heated to a high temperature. Lime reacts vigorously with water and exothermally (releasing heat), forming a hydroxide ($CaO + H_2O \rightarrow Ca(OH)_2$ + 15,500 calories) which is known as hydrated lime or slaked lime (Nebergall et al. 1963, p. 651). Because lime is a perishable product, particularly susceptible to the deleterious effects of moisture, the most convenient and safe way to ship the product from Kelleys Island was in water-tight barrels.

During the first decade of the 20th century the 16 North Bay kilns were running at full capacity, producing 1,600 barrels of lime per day. 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, p. 188).

Crushed Stone. To 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 sizable inventory of narrow gauge rolling stock and steam cranes (Figure 25). 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 (Figure 26).

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, p. 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, p. 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, p. 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, p. 23). Thus, quarry operations began to dwindle and KIL&T Co. went out of business on the island in 1942.

DEPENDENCY ON MARITIME TRANSPORTATION

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, but in the later years all the limestone was crushed and shipped to Lorain, Cleveland, Buffalo, and Gary

for flux, or to Duluth to be burned into lime. In the late 1800s the quarry operators burned lime on the island and shipped it throughout the Great Lakes region until it was found to be more economical to burn stone near the markets or near sources of fuel (Ver Steeg and Yunck 1935, p. 433).

During the decade before and following the turn-of-the-century, North Bay lime kilns produced up to 1,780 barrels of lime per day. The peak of the limestone business on Kelleys Island occurred during this period when mechanization stepped up production, creating a boom. KIL&T Co. grew to be the largest limestone producer in the country and its stone was reputed to be the best (Gilfillan 1959, p. 20). With the construction of the West Bay loading dock in 1910, KIL&T Co. was able to increase its production of stone. For the next decade the Company shipped over half a million tons annually in some 600 lake carriers (Linhardt 1995, p. 35). The company continued to expand and eventually the wide distribution of quarries on the mainland led to the abandonment of those on Kelleys Island in the early 1940s.

Port Facilities. In 1875 the Kelley's Island and Sandusky Cable Company successfully laid a submarine cable on the bed of Lake Erie between the island and the mainland. The cable was attached to an instrument in the Atlantic and Pacific Telegraph office in Sandusky and on July 8 the first message was sent from Erastus Huntington on the island to George Daniels, mayor of Sandusky (Peeke 1916, p. 341). This communication link greatly facilitated orders for limestone products and dispatching vessels to distant markets.

When the KIL&T Co. was formed in 1886, one of the company's first requirements in developing the vast deposits of limestone on Kelleys Island was the establishment of terminals for mainland distribution. These were created in Buffalo, Cleveland, Detroit, and Duluth (Nichols 1888, p. 23).

In the South Side quarry in the 1880s, the quarried stone was sorted into 8 to 10 grades and then conveyed to waiting vessels or corded on the docks. The stone was loaded onto vessels by horse-drawn wagons from an elevated platform, through aprons or chutes lying on either side. The docks had sufficient facilities for expeditiously loading a number of vessels at a time. Nichols (1888, p. 22), writing of the scene at the South Side dock, reported that "vast walls [of stone] may be seen from passing steamers" and "no rubbish or loose stone is allowed to accumulate, and everything about the dock has a neat and orderly appearance seldom met with." At that time market for the limestone extended from the lower end of Lake Erie to Duluth, Minnesota.

At the North Side quarry, burned lime was the dominant product in the 1880s. The lime was packed into wooden barrels for storage in an adjacent warehouse or loaded directly on a vessel waiting at the warehouse dock (Figure 5). Maritime facilities also included a concrete pocket dock which consisted of an extended jetty with an elevated track and chutes on the sides for loading boats (Figure 28). 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, p. 186).

By the 1898, KIL&T Co. operated several Shay locomotives (Lima Locomotive Works, Lima, Ohio) and 150 cars in the quarries. Four steam shovels were used in connection with the crushing plant and 8 large derricks were employed in loading the large sections of stone blasted from the limestone beds. Four docks, lying on the north, west, and south shores, were owned by the company and afforded ample facilities for loading vessels with stone. A railway system connected all of the quarries to the docks; light engines, drawing 10 to 12 cars, were used to transport the stone. In describing the scene, Ryall (1913, p. 186) commented that "in noise, and importance, these little engines resemble the small but mighty harbor tug, they draw heavy loads and are very busy."

Flux stone had become the major focus the island's limestone industry by the first decade of the 20th century. The increased production of flux stone necessitated the construction of improved dock and loading facilities. Because crushed stone was sold by weight, in 1907 a scale house was constructed along the rail grade connecting the stone crusher with the north dock. This facility permitted large volumes of flux stone to be weighed in an expeditious manner (Myers et al. 1992, p. 31).

The stone loading docks on the north and south shores were less used after 1910 when a central facility was constructed on the west shore. Built on the same pier site as the first Titus Quarry dock of 1842, West Bay dock was designed to accommodate narrow gauge dumping cars via a 600-foot-long overhead trestle (Myers et al. 1992, p. 24). In the 1920s, stone was loaded by steam shovels into dump cars and hauled to crushers where it was broken and graded according to size. It was then reloaded into dump cars for transport to great storage bins (Figure 29). From the bins the stone was loaded directly by gravity into bulk freight boats. At the South Side dock the stone was loaded directly from the cars into boats (Fisher 1922, p. 22). By the 1930s, the north and south loading docks were abandoned and all stone was dumped into freighters and barges from an elevated pier on the west shore.

Merchant Vessels. One of the earliest steam vessels associated with the limestone industry, *ISLAND QUEEN*, was built on Kelleys Island in 1854. She was a 179-ton wooden side-wheel steamer with an overall length of 121.5 feet, beam of 20.6 feet, and draft of 7 feet (Frohman 1965, p. 77). This vessel was owned by a stock company formed by Addison Kelley to meet the transportation needs of the Ottawa City Cement Company on Catawba Island. Investors on Kelleys Island contributed $7,000 and DeRevera St. Jurjo of Put-in-Bay $2,000 toward the original stock subscription. When completed the total cost was about $18,000, twice the amount estimated and subscribed, and she "did not pay out for five years" (Hills 1925, p. 134 and 135).

The cement works at Ottawa City, located about five miles west of Kelleys Island at the northern extremity of Catawba Island, was then in full operation and shipping cement to various lake ports. The management of the company made liberal offers, in the way of freight guarantees, as an inducement to build the *ISLAND QUEEN*. The keel was laid in July on George Kelley's shore dock and she was launched in late November. After being frozen in for over a month at the island, on January 7, 1855 she was towed to Sandusky by the steamer *ARIEL* where her machinery was installed. She was powered by an upright or "Sawgate" high-pressure engine. She was ready for service in the Spring of 1855 with a registered tonnage of 172. Her route included Fremont, Plaster Bed and other Sandusky Bay ports, besides Sandusky, Ottawa City, and the Islands. She also went once a week to Cleveland and Toledo with cement from Ottawa City and made part of her earning by towing sailing vessels in and out of Sandusky Bay (Hills 1925, p. 134). She was commanded by Captain Orr (Peeke 1916, p. 340).

When the Civil War broke out the economy of the region improved and the *ISLAND QUEEN* made money. She gave up going to Fremont and began daily, instead of tri-weekly, trips to the Islands except when she carried freight to Huron, Black River or some other port after completing her excursions. Only two vessels were owned by Kelleys Islanders in 1863, the *ISLAND QUEEN* valued at $5,000 and a sailboat at $150. Seven men were employed as crew for these vessels out of a total island population 600 for that year. Peeke (1916, p. 340) reported the coastwise exports from Kelleys Island for 1863 as follows:

Red cedar (714 cords)	$ 4,291
Limestone (390 cords)	780
Steamboat wood (3,248 cords)	4,102
Corn, wheat, and pork	2,000
	$11,173

The *ISLAND QUEEN* never met with a serious accident or suffered anything more than a broken crank shaft until she was captured by the Rebels in September 1864, in an ill-fated attempt to free

Confederate officers from the Federal prison on Johnson Island, and sunk on Chickenolee Reef about eight miles north of Kelleys Island (Frohman 1965, p. 77-81). She was raised in a few days, comparatively uninjured and put back in service, but sold two years later because the growing business on the route necessitated a larger boat. She was replaced by the 340-ton steamer *EVENING STAR* (Peeke 1916, p.340; Hills 1925, p. 134).

About 1860 the scow *ELMINA* was lost in a fog while engaged in carrying stone from Kelleys Island to Cleveland for her owner, Charles Carpenter (Hills 1925, p. 135). In 1872 the steam barge *CHARLES HICKOX* (Figure 18) was built for Calkins & Company, then owner of North Quarry, by H. D. Root at Lorain, Ohio to carry lime and limestone from Kelleys Island to Cleveland. Another vessel, the 300-ton schooner *J. E. GILMORE*, carried stone from Kelleys Island, making regular trips up to 1884 or later. This schooner was owned by Erastus Huntington and her master, Captain Ort. Moor of Kelleys Island. Hills (1925, p.135) noted this vessel leaked so badly that the crew had to dump several bushels of horse manure into the water around the boat to be sucked into the seams and thereby caulk the leaks while she was in port.

Soon after the forerunner of the KIL&T Co. was organized in 1872, a fleet of five steam barges was procured at a cost of $140,000, which included the *ALBERT Y. GOWEN* (Figure 27), *GOOD HIT*, *HANDY BOY*, *JIM SHERIFFS*, and *TEMPEST* for an aggregate tonnage of 3,200. The steamer *JIM SHERRIFS* carried stone to Duluth while the steamer *ALBERT Y. GOWAN* transported lime to Cleveland and Detroit. Later, the steamers *DESMOND* and *ISABELLA J. BOYCE* were purchased for the Cleveland stone trade and the steamer *NORMA* for carrying freight between Sandusky and Kelleys Island. The *NORMA* was later succeeded by the steamer *EDWARD P. RECOVE.* In addition to these vessels, KIL&T Co. operated two steel barges and a tug to tow them to Cleveland loaded with limestone (Hills 1925, p. 137).

In 1878 Norman Kelley bought the screw steamer *MONITOR* and the schooner *ONEIDA* for the limestone trade. The master of the *MONITOR* was A. Doville of Kelleys Island. This vessel served the N. Kelley & Company until the firm sold out to the KIL&T Co. in 1891 (Hills 1925, p. 137). In 1913, KIL&T Co. operated a fleet of 10 vessels, consisting of wooden and steel barges, tugs, steamers, and sail-rigged craft were owned by the Company and used to transport the limestone (Ryall 1913, p. 187).

CONCLUSIONS

The *ADVENTURE* was one of dozens of steam and sailing vessels that serviced the limestone industry of Kelleys Island in the late 1800s and early 1900s. Although *ADVENTURE* was among

one the smaller calling at the island, she was capable of carrying a cargo in excess of 1,000 barrels of burned lime. However, only known record of the *ADVENTURE* taking on a cargo at Kelleys Island is the day she caught fire at the lime kiln dock and sank in North Bay. The sinking took place in the midst of peak lime production on the island, a period when Kelley Island Lime and Transport Company was one of the leading crushed limestone and lime producers in the world. Perhaps the high demand for lime products in 1903 was the reason the *ADVENTURE* was pressed into service to augment the vessels operated by KIL&T Co.

Archaeological investigations of the shipwreck site have provided a likely answer to the question of the fire's origin. Contemporary newspaper accounts mention both flames from the boiler and wetting of the lime as possible causes of the tragic fire. Because a large area on the port side of the vessel, forward of the engine mount, shows extensive fire damage the first possibility is most likely. The fire-damaged area is thought to have been the location of the coal-bunker, and it may have been the source of the fire that destroyed the *ADVENTURE*.

A number of research questions remain unanswered after the field investigations. One of the most baffling being the faith of the more than 1,000 barrels of lime that were thought to be on board at the time of the sinking. Contemporary newspaper articles report that the vessel was fully loaded with a lime cargo and that the entire cargo was lost in the fire and subsequent sinking. Yet no evidence of any barrels, particularly their metal hoops, was found on the site.

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APPENDIX – CHRONOLOGY OF MERCHANT VESSEL *ADVENTURE*

1875

Enrollment

October 1, 1875: Detroit, Michigan. Vessel enrolled as a schooner with one deck and two masts, plain head and a square stern. Built in 1875 at Detroit by John Oades, master builder.

Dimensions: 104.0 x 24.0 x 8.0 feet, 148.97 gross tons (139.86 below decks and 9.11 trunk cabin)

Owned by John Oades of Detroit (3/4) and Walter H. Oades of Detroit (1/4); Geo. H. Collins, master

Official number (US) 105567

1876

Board of Lake Underwriters

New Tonnage	149
Where Built	Detroit
By Whom	J. Oades
When	Sept. 1875
Owners	J. Oades
Port of Hail	Detroit
Value	$ 8,000
Class	A 2

1877

List of Merchant Vessels of the United States

Y/E June 30, 1877, Merchant Sailing Vessels of the United States, &c.

Official No.	105567
Rig.	Sc.
Tonnage	148.97
Home port	Detroit, Michigan

1878

Enrollment

April 2, 1878; Detroit, Michigan. Change owners to Edward Cunningham of Detroit (1/2) and F. B. Wallace of Detroit (1/2); Edward Cunningham, master

1879
1880
1881
1882
1883

1884

Inland Lloyds Vessel Register — SCHOONERS (Date 1884- not listed)

New Tonnage	149
Where Built	Detroit
By Whom	J. Oades
When	1875
Owners	Cunningham et al.
Port of Hail	Detroit
Value	$ 5,000
Class	A2

1885

1886

Enrollment

April 13, 1886; Detroit, Michigan. Change owners to Edward Cunningham of Detroit (1/4), F. B. Wallace of Detroit (1/2), and J. E. Wallace of Chicago, Illinois (1/4); Edward Cunningham, master

List of Merchant Vessels of the United States

Y/E June 30, 1886, Merchant Sailing Vessels of the United States

Official No.	105567
Rig.	Sch.
Dimensions	104.0 length, 24.0 breadth, 8.0 depth
Tonnage	148.97 gross, 141.53 Net
When built	1875
Where built	Detroit, Michigan
Home port	Detroit, Michigan

1887

1888

Twentieth Annual List of Merchant Vessels of the United States

Y/E June 30, 1898, Merchant Sailing Vessels of the United States

Official No.	105567
Rig.	Sch.
Gross tonnage	148.97
Net Tonnage	141.53
Length	104.0
Breadth	24.0
Depth	8.0
When built	1875
Where built	Detroit, Mich.
Home port	Detroit, Mich.

1889

1890

Twenty-Second Annual List of Merchant Vessels of the United States

Y/E June 30, 1890, Merchant Sailing Vessels of the United States

Official No.	105567
Rig.	Sch. (Schooner)
Gross tonnage	148.97
Net Tonnage	141.53
Length	104.0
Breadth	24.0
Depth	8.0
When built	1875
Where built	Detroit, Mich.
Home port	Detroit, Mich.

1891

Enrollment

February 13, 1891; Cleveland, Ohio. Change owners to H. C. Case of Sheffield, Ohio (1/2)and J. F. Padley of Sheffield (1/2); H. C. Case, master

Tonnage: 148.97 gross tons and 141.53 net tons

1892

1893

1894

Enrollment

May 25, 1894; Cleveland, Ohio. Change owners H. C. Chase of Sheffield, Ohio (1/4) and J. H. Padley of Sheffield (3/4); H. C. Case, master

1895

Enrollment

April 11, 1895; Cleveland, Ohio. Change owners to J. H. Padley of Sheffield, Ohio (3/4), and J. M. Robinson of Lorain, Ohio (1/4);.J. M. Robinson, master

The Milwaukee Wisconsin (May 3, 1987)

"During the past winter the schooner *ADVENTURE* was transformed into a steamer at Sandusky"

Twenty-Seventh Annual List of Merchant Vessels of the United States

Y/E June 30, 1895, Merchant Sailing Vessels of the United States

Official No.	105567
Rig.	Sch. (Schooner)
Gross tonnage	148.97
Net Tonnage	141.53
Length	104.0
Breadth	24.0
Depth	8.0
When built	1875
Where built	Detroit, Mich.
Home port	Cleveland, Ohio

1896

Enrollment

February 4, 1896; Cleveland, Ohio. Change owners to J. M. Robinson of Lorain, Ohio; J. M. Robinson, master

Sandusky Newspaper, Winter 1896 (Personal communication, Gordon Wendt, January 26, 1998)

Newspaper reported that conversion of *ADVENTURE* to a screw steam was planned by the owners for the Spring of 1897 in Sandusky, Ohio. David Dussault, who operated shipyards at the Baltimore & Ohio Railroad dock (Foot of Warren Street) and at the foot of Meigs Street in Sandusky, was mentioned as the probable shipbuilder to do the conversion work. The conversion was to take place after partial ownership of the vessel was transferred to the Groch Coal Company of 505 Water Street, Sandusky, Ohio, Frederick Groch, president. The steam engine was to came from the tug *HANDY BOY* and the boiler from the tug *MYRTLE* of Sandusky .

1897

Enrollment

April 20, 1897; Sandusky, Ohio. Vessel rebuilt at Sandusky in 1897 as a screw steamer with one deck and two masts, plain head and a round stern; H. D. Root, master carpenter.

Dimensions: 108.0 x 24.0 x 8.3 feet, 141.72 gross tons and 95.37 net tons.

Owned by J. M. Robinson of Lorain, Ohio (1/2), and Frederick Groch of Sandusky, Ohio (1/2); J. M. Robinson, master.

Enrollment

May 26, 1897; Cleveland, Ohio. Permanent document, vessel having arrived at her home port: A. C. Moss of Sandusky, Ohio (2/104), J. M. Robinson of Lorain, Ohio (51/104), and Frederick Groch of Sandusky (51/104); S. J. Batman, master

Indorsements of Change of Master

June 5, 1897, Cleveland, Ohio: Wm. H. McNalley present master in lieu of S. J. Putnam
June 8, 1897, Cleveland, Ohio: Geo. Best present master in lieu of Wm. McNalley
June 26, 1897, Port Huron, Michigan: John M. Robinson present master in lieu of Geo. Best

Inland Lloyds Vessel Register — SCHOONERS

Net Tonnage	142
Built of	Wood
Where Built	Detroit
When Built	1875
Owners	Cunningham et al.
Port of Hail	Detroit
Value	$ 1,500
Class	A2 1/2

Inland Lloyds Vessel Register — SIDE WHEEL STEAMERS/PROPELLERS

Supplement No. 2, June 1, 1897

Net Tonnage	95
Built of	Wood
Gross Tons	141
Where Built	Detroit
When	1875
Owner	Robinson et al.
Port of Hail	Sandusky
Value	$ 6,000
Class	A2
Remarks	Nee. Sch.

1898

Enrollment

June 8, 1898; Sandusky, Ohio. Change owners to Frederick Groch of Sandusky; Frederick Groch, master

Inland Lloyds Vessel Register — SIDE WHEEL STEAMERS/PROPELLERS

Net Tonnage	95
Built of	W
Where Built	Detroit
When	1875
Rebuilt	1897
Owners	Robinson et al.
Port of Hail	Sandusky
Value	$ 5,000
Class	A2 1/2
Remarks	Nee. Sch.

1899

1900

Inland Lloyds Vessel Register — SIDEWHEEL STEAMERS/PROPELLERS

Built of	W
Gross Tons	141
Where Built	Detroit
When Built	1875
Re-built	1897
Bot'm Cl'k'd	1897
Owner	(handwritten) Fred Groch
Port of Hail	Sandusky
Value	$ 1,500 (handwritten) $ 5,000
Class	B1 (handwritten) A1
Remarks	Ref, 1897. Rec. To & Re. 1899 (handwritten) & Re. (strike-thru), New Dk.+ Re 1901

Vessel Movement Reports (*Detroit Free Press*)

June 19, 1900: *MAUMEE VALLEY* being towed by *ADVENTURE* – up bound on Detroit River
June 22, 1900: *ADVENTURE* and barge – downbound on Detroit River
July 12, 1900: *ADVENTURER* (sic) – cleared Sandusky with coal
July 13, 1900: *ADVENTURE* – upbound at Detroit

1901

Enrollment

May 31, 1901; Port Huron, Michigan. Change owners to Charles Beyschlag of St. Clair, Michigan (1/3), Joseph Lowes of St. Clair (1/3), and Jno. Beyschlag, Jr. of St. Clair (1/3); Chas. Beyschlag, master

1902

Buffalo Morning Express (June 15, 1902)

"Port Austin [Michigan], June 14. During the heavy fog last night the steamer *ADVENTURE* stranded five miles north of this point. She ran on a rocky bottom, but it is resting easily. The crew is now engaged in jettisoning a part of the cargo of alabaster [gypsum], and tugs have been sent for to release the steamer."

List of Merchant Vessels of the United States

Y/E June 30, 1902, Merchant Steam Vessels of the United States

Official No.	105567
Rig.	St. s. (Steamer, screw)
Gross tonnage	141
Net tonnage	95
Length	108.0
Breadth	24.0
Depth	8.3
Service	I. f.
Crew	4
When built	1875
Where built	Detroit, Michigan
Home port	Port Huron, Michigan

1903

Beeson's List of American Steam Vessels of the Lakes

Rig.	do
Gross Tonnage	141
L'gth	108
Beam	24
Depth	8
Class	B 1
When Built	1875
Where Built	Detroit, Mich.
Owner or Manager	Chas. Beyschlag
Address of Manager	St. Clair, Mich.

Vessel Movement Reports (*Detroit Free Press*)

July 22, 1903: Steamer *ADVENTURE* – upbound at Detroit

July 31, 1903: Steamer *ADVENTURE* – upbound at Detroit District

September 16, 1903: Steamer *ADVENTURE* – upbound at Detroit District

September 20, 1903: Steamer *ADVENTURE* – downbound at Detroit District, towing barge *MONTPELIER*

Cleveland Plain Dealer (October 8, 1903)

"BOAT AND CARGO A TOTAL LOSS.

Steamer *ADVENTURE* Destroyed by Fire at Kelleys Island.

All Members of the Crew Rescued

KELLEY'S ISLAND, O., Oct. 7 — The steamer *ADVENTURE* loaded with lime caught fire at 4 o'clock this afternoon while lying at the north dock. The tug *L. P. SMITH* towed the steamer away from the dock into shoal water. The steamer and cargo are a total loss.

The prompt action of Capt. Regan of the tug *SMITH* in getting a line to the burning steamer and towing her out saved the schooner *ANDERSON* which was lying at the dock from burning also.

The *ADVENTURE* was owned by Beyschlag Schlinkert and Lowes of St. Clair. She was commanded by Capt. John Lowes who had his wife and little daughter on board. All including the members of the crew were rescued. The fire was first discovered just forward of the boiler in the hold."

Port Huron Daily Times (Thurs., October 8, 1903)

"The steamer *ADVENTURE* caught fire while lying at the dock at Kelley's Is. on Wednesday afternoon with her cargo of lime and was totally destroyed. The fire originated near the boiler, when it was seen that the steamer could not be saved, she was taken in tow by the tug *SMITH* and pulled away from the dock in order to save the schooner *ANDERSON* which was lying dangerously near the burning craft. The *ADVENTURE* was owned by Beyschlag, Schlinkert and Lowes of St. Clair."

Sandusky Daily Register (Thursday, October 8, 1903)

"*ADVENTURE* TOTAL LOSS

Steamer Burns at Kelley's Island.

Took Fire While Lying at Docks--Whole Crew Saved.

The steamer *ADVENTURE*, loaded with lime, took fire at Kelley's Island at 4 o'clock Wednesday afternoon while lying at the north dock, and burned to the water's edge. Both cargo and vessel are a total loss, with no insurance.

The tug *SMITH* towed the burning steamer into the lake, thus saving the schooner *ANDERSON* and the dock from burning also.

Captain John Lowes was in command of the *ADVENTURE*. He had his wife and little daughter on board, but they, with the rest of the crew, were saved.

It is not known how the fire originated. It was discovered in the hold just forward of the boiler, and spread so rapidly that the sailors were glad to escape with their lives.

The burned steamer was 108 feet long, 24 feet beam and 8 feet deep. She was built in 1875.

The *ADVENTURE* was in port a day or two ago and discharged a cargo of salt at the Big Four docks. The vessel was formerly owned in Sandusky."

Sandusky Evening Star (Thursday, October 8, 1903)

"STEAMER BURNED

Total Loss of the *ADVENTURE* at Kelley

HAD NARROW ESCAPE

Captain and His Wife and Child Barely Reached Dock—Vessel is Towed to Shoal Water.

The steamer *ADVENTURE*, owned by Charles Beyschlag of St. Clair Mich., and whose master was Capt. John Lowes, was burned to the water's edge at Kelley Island about 4 o'clock Wednesday afternoon. The boat was loaded with lime, and was at the north dock.

It is reported that the lime became wet and was set afire, but this report is not confirmed. The steamer and cargo are a total loss, and Captain Lowes, his wife and little daughter had narrow escapes from death.

The tug *L. P. SMITH*, towed the burning vessel into shoal water and thus saved the schooner *ANDERSON* from being set afire. The crew managed to escape, but most of their belongings were destroyed.

The *ADVENTURE* was formerly owned by Fred Groch, of this city, but he sold her about a year and a half ago. She is 108 feet long, has a 24 feet beam and is 8 feet deep. She was built in 1875."

Enrollment

October 12, 1903; Port Huron, Michigan. Documents surrendered: burned; total loss at Kelleys Isl., Lake Erie, Oct. 7, 1903

1904

Beeson's List of American Steam Vessels of the Lakes — Vessels Lost During Season of 1903

Propeller *ADVENTURE*, 141 tons, burned at Kelley's Island, Lake Erie, October 7th. Value of vessel, $2,500, cargo $1,500.

LIST OF ILLUSTRATIONS

Figure 11. Photograph taken inside the hold of the 105-foot schooner *ALVIN CLARK*, built in 1846 at Truago, Michigan, showing the prominent centerboard trunk extending from the keelsons right up to the deck. This is similar to the trunk in the *ADVENTURE*'s hull (photograph courtesy of C. Patrick Labadie Collection).

Figure 12. Cast-iron propeller being replaced on wreck of steamer *ADVENTURE* after being missing for three decades (photograph by Ricki C. Herdendorf).

Figure 13. Wood-cut illustration of Kelley Island Lime & Transport Company lime kilns at North Bay quarry complex, circa 1888; note stack of wooden barrels on stone floor at base of kilns (from Nichols 1888, p. 23).

Figure 14. Glacial grooves in Columbus Limestone at North Bay quarry, circa 1872 (photograph courtesy of Ohio Geological Survey).

Figure 15. Geological cross-section through the islands of western Lake Erie, showing the bedrock formations (modified from Carman 1946, p.282).

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Figure 18. Glacial grooves in Columbus Limestone at G. W. Calkins & Company's North Bay quarry as viewed from the southwest, circa 1873; note steamer *CHARLES HICKOX* at North Bay dock (photograph courtesy of Ohio Geological Survey).

Figure 19. Map of Kelleys Island showing property owners in 1896; note Kelley Island Lime & Transport Company holdings on North Bay and South Bay, each with conspicuous dock facilities (from *1896 Illustrated Atlas of Erie County, Ohio*).

Figure 20. Kelleys Island, Ohio population trend 1820 to 1996 (data source: U.S. Bureau of the Census).

Figure 21. Kelley Island Lime & Transport Company lime kilns at North Bay quarry complex as viewed from the north, circa 1902; note platform with stone cars from which the kilns were charged with limestone (photograph courtesy of Ohio Historical Society Archives, Columbus, Ohio).

Figure 22. Kelley Island Lime & Transport Company lime kilns at North Bay quarry complex as viewed from the northeast, circa 1900; note bridge to dock in center foreground for transporting cargoes to and from vessels (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 23. Kelley Island Lime & Transport Company cooper shop (right foreground) and lime kilns (center background) at North Bay quarry complex as viewed from the southwest, circa 1900 (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 24. Generalized cross-section of a lime kiln; nce fired, such kilns were operated on Kelleys Island for weeks without shutting down (from Nebergall et al. 1963, p. 651).

Figure 25. Kelley Island Lime & Transport Company steam crane at North Bay quarry as viewed from the northeast, circa 1910; note boarding house on top of unexposed glacial groves (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 26 Kelley Island Lime & Transport Company office building and company store at North Bay quarry as viewed from the southwest, circa 1903; note steam cranes on tracks at quarry's edge and the north end of lime kilns at extreme right side of photograph (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 27 Kelley Island Lime & Transport Company's steamer *ALBERT Y.GOWEN* at South Bay dock, circa 1890; vessel was built by H. D. Root for KIL&T Co. in 1888 at Lorain, Ohio and measured 124 x 26 feet, 359 gross tons. Unlike the *ADVENTURE*, she was a double-decked, bulk freighter (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 28. Kelley Island Lime & Transport Company dock and kilns at North Bay quarry complex as viewed from the south, circa 1900; note masts of a three-masted schooner at elevated pocket dock (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 29. Kelley Island Lime & Transport Company's West Bay dock as viewed from the northeast, circa 1925; note Shay steam locomotives pushing narrow gauge dumping cars, loaded with crushed limestone, via a 600-foot-long overhead trestle to storage bins at the end of the dock. From the bins the stone was loaded directly by gravity into bulk freight boats (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

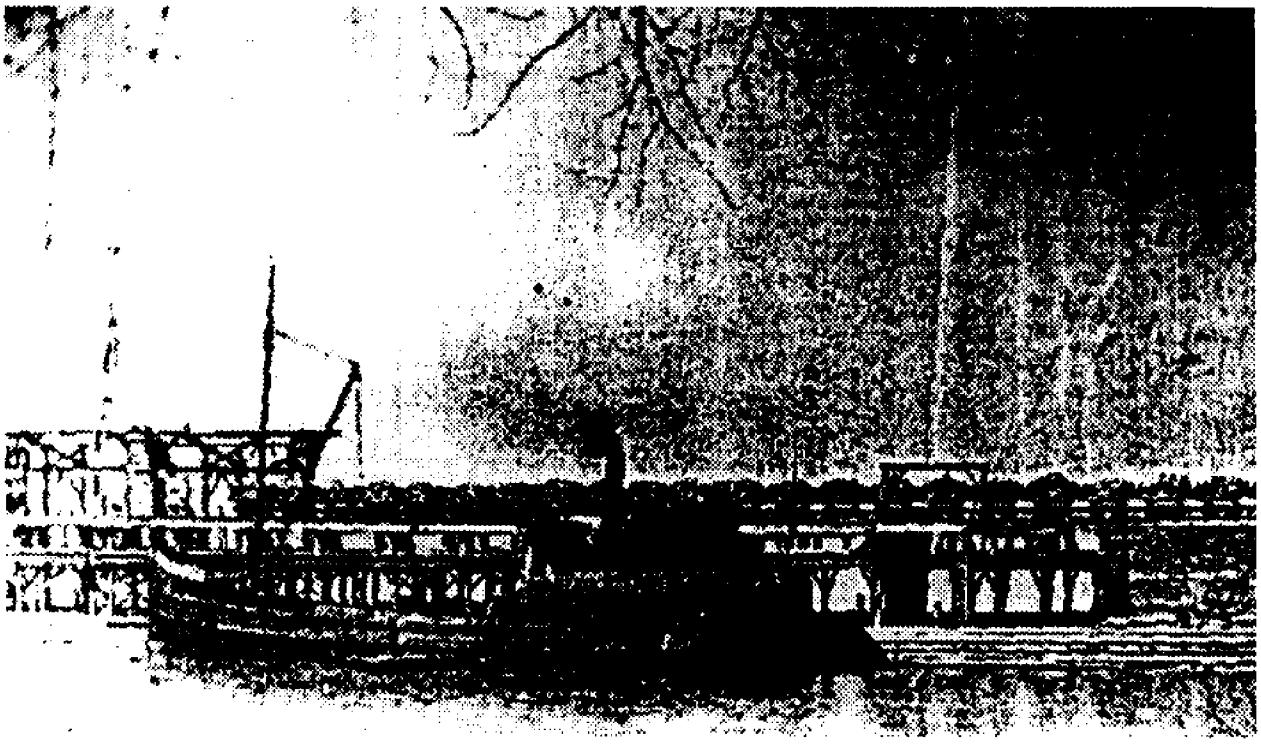


Figure 1. Steam barge *ADVENTURE* at North Lime Kiln Dock, Kelleys Island, circa 1903 (photograph courtesy of Great Lakes Historical Society).

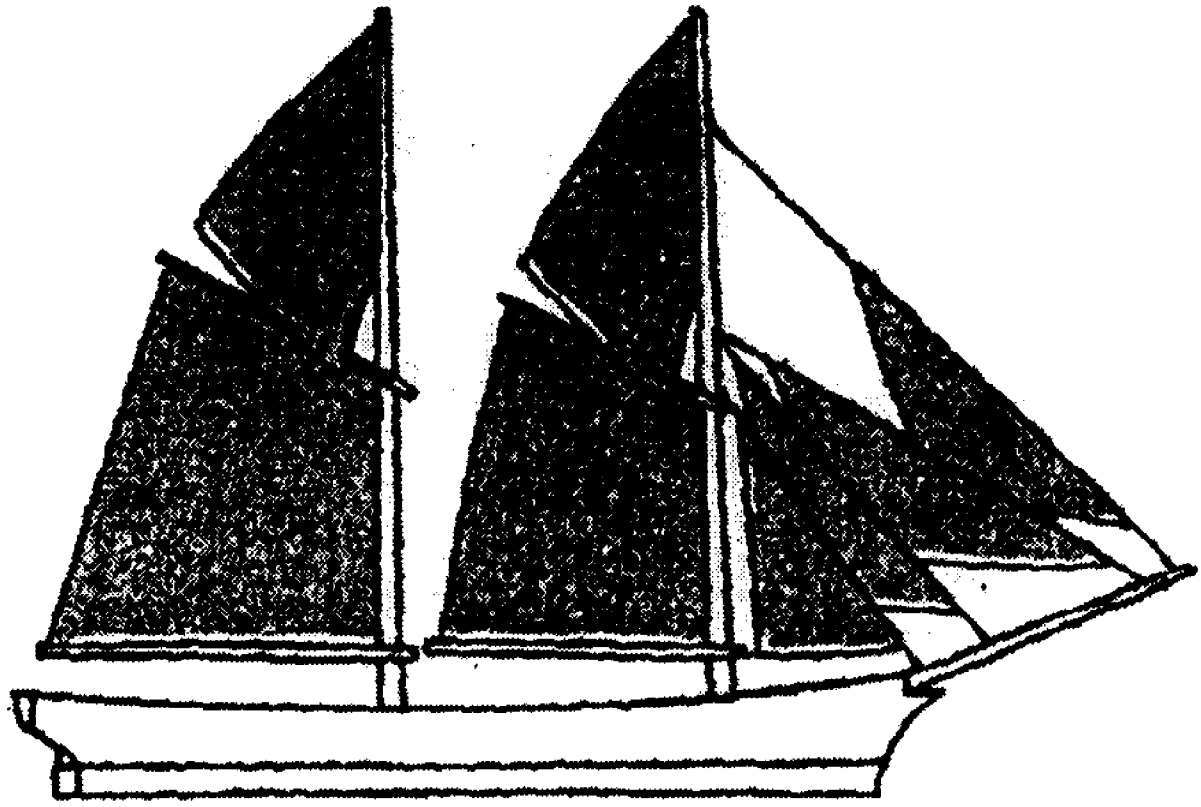


Figure 2. Rigging plan for a typical two-masted schooner approximating the *ADVENTURE*'s size and shape (modified from Kihlberg 1963).

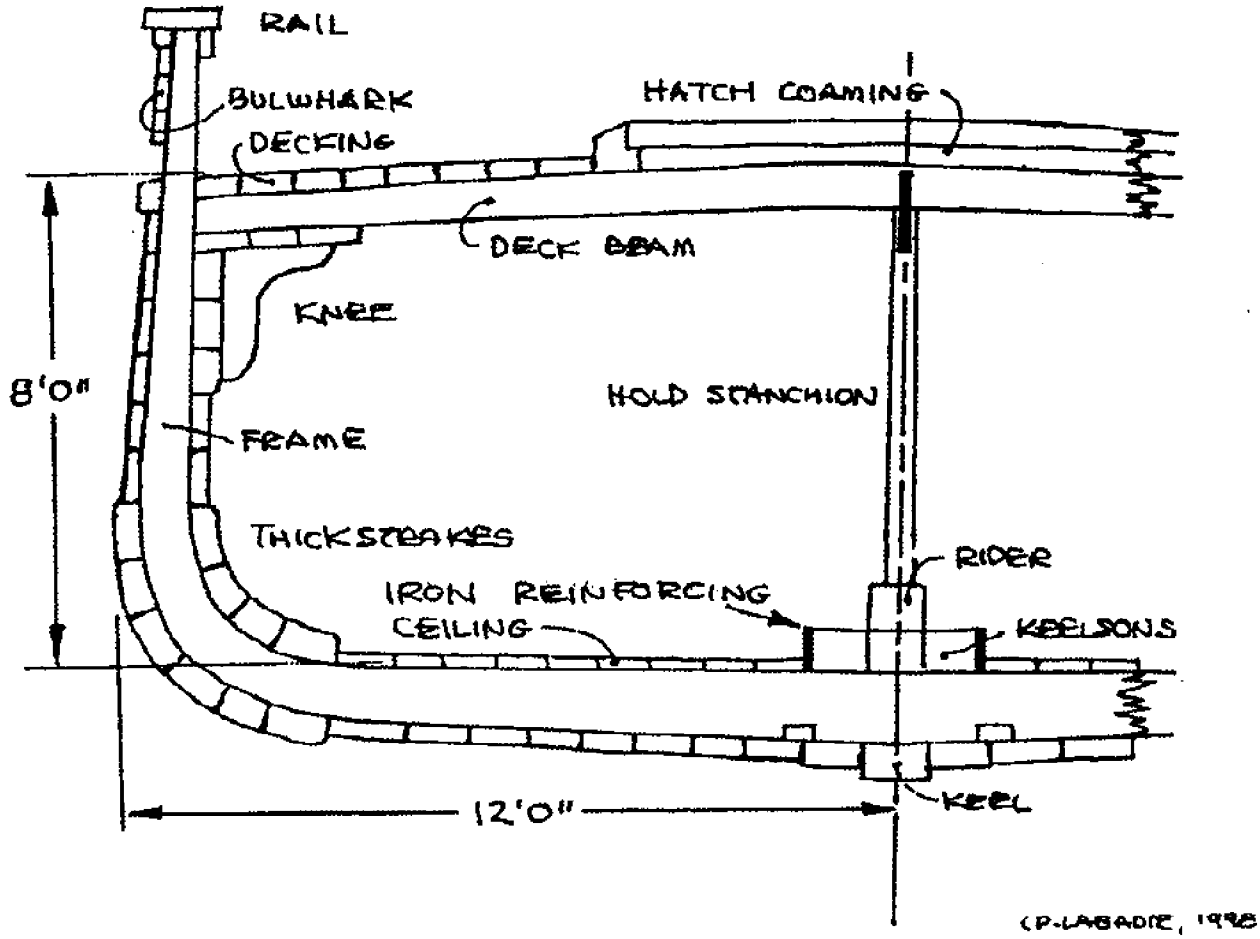


Figure 3. Reconstructed cross-section of the *ADVENTURE* based on observations at the shipwreck site.

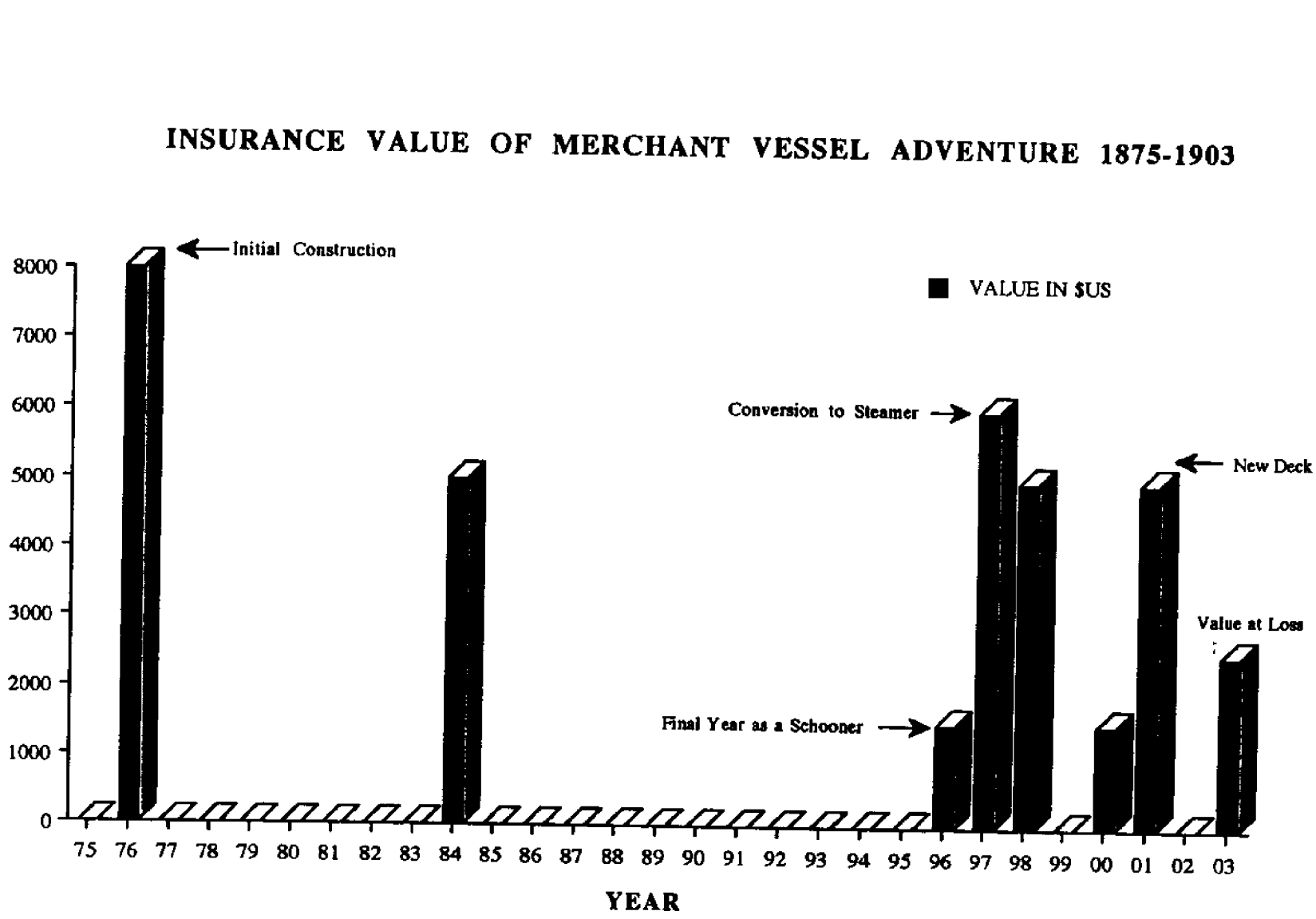


Figure 4. Insurance value of merchant vessel *ADVENTURE* 1875 to 1903.

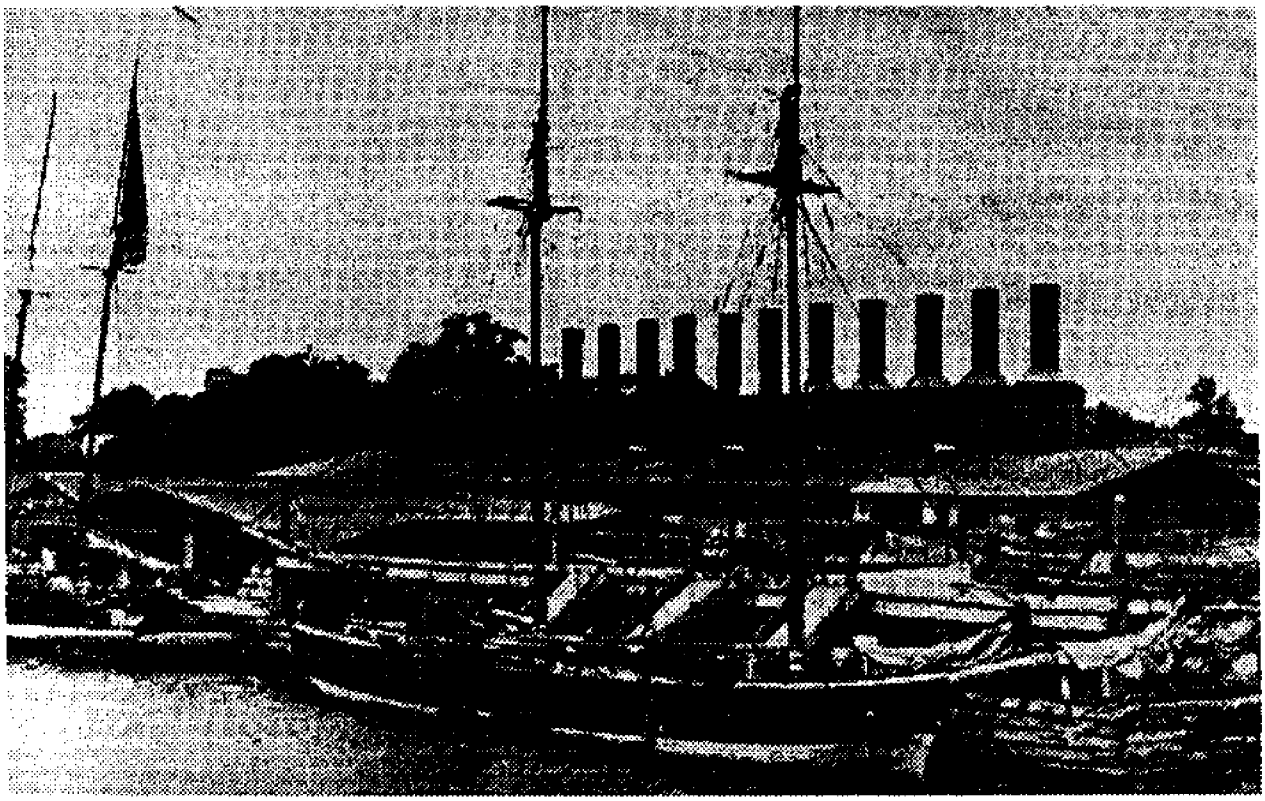


Figure 5. Kelley Island Lime & Transport Company dock and kilns at North Bay quarry complex as viewed from the east, circa 1888; wooden schooner in foreground is of a design similar to the *ADVENTURE* (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Charles E. Frohman Collection).

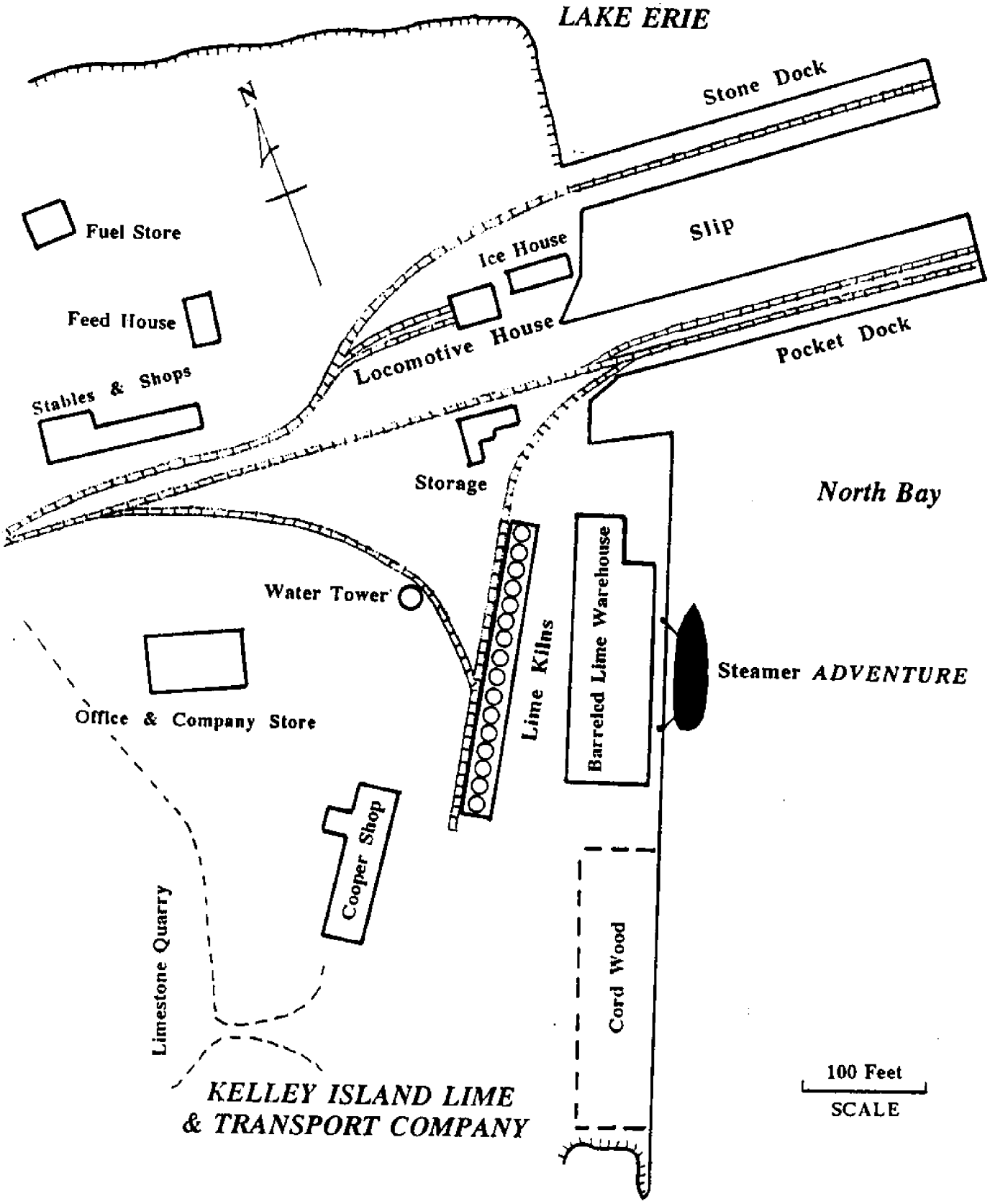


Figure 6. Map of Kelley Island Lime & Transport Company's North Bay quarry complex, circa 1903, showing location of *ADVENTURE* when the fire on board started (based on 1893 and 1905 insurance maps and period photographs).

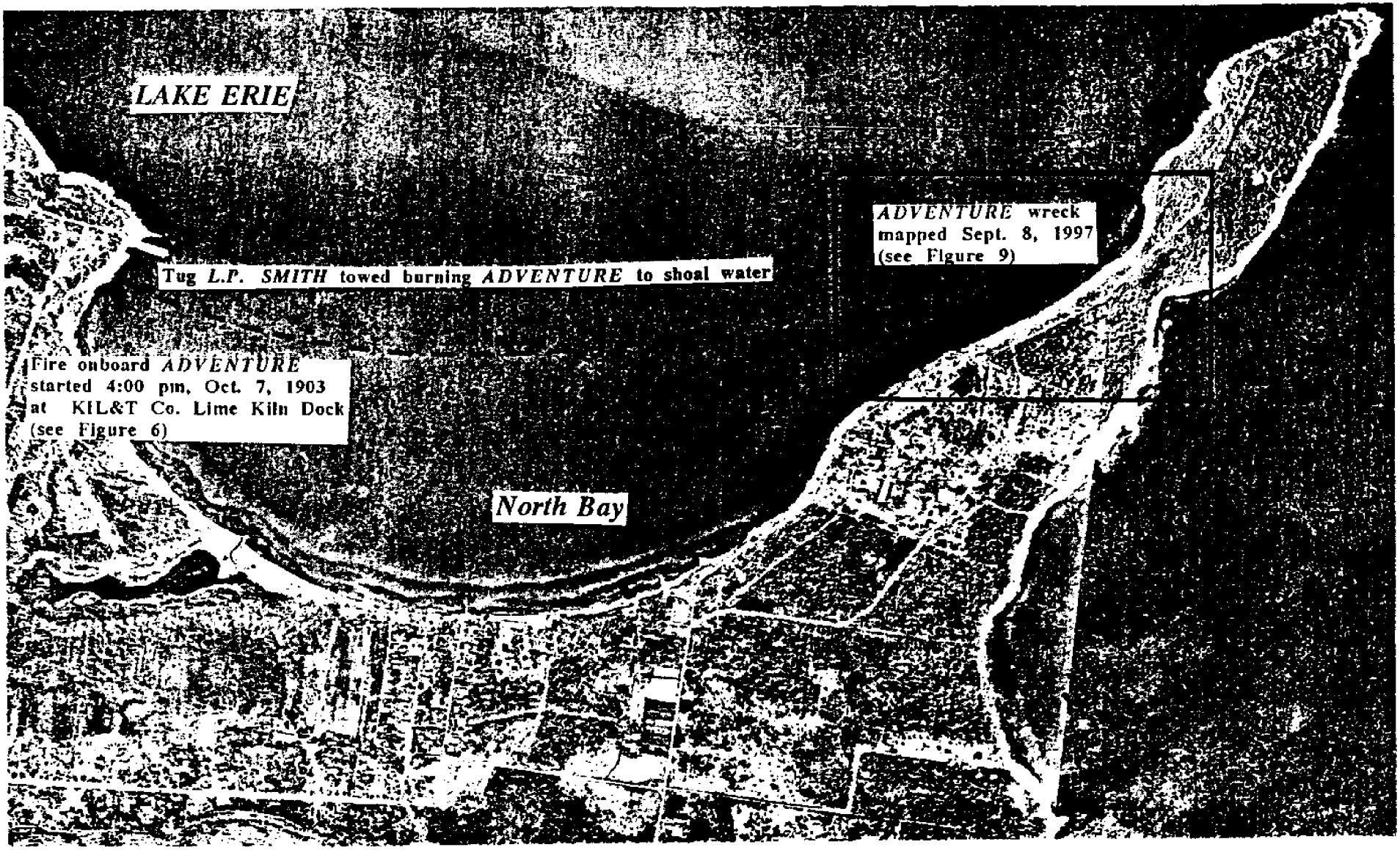


Figure 7. Aerial photograph of North Bay, Kelleys Island showing probable route taken by tug *L. P. SMITH* in towing the burning steamer *ADVENTURE* away from North Lime Kiln Dock on October 7, 1903 (photograph, March 31, 1986, courtesy of Ohio Department of Natural Resources).

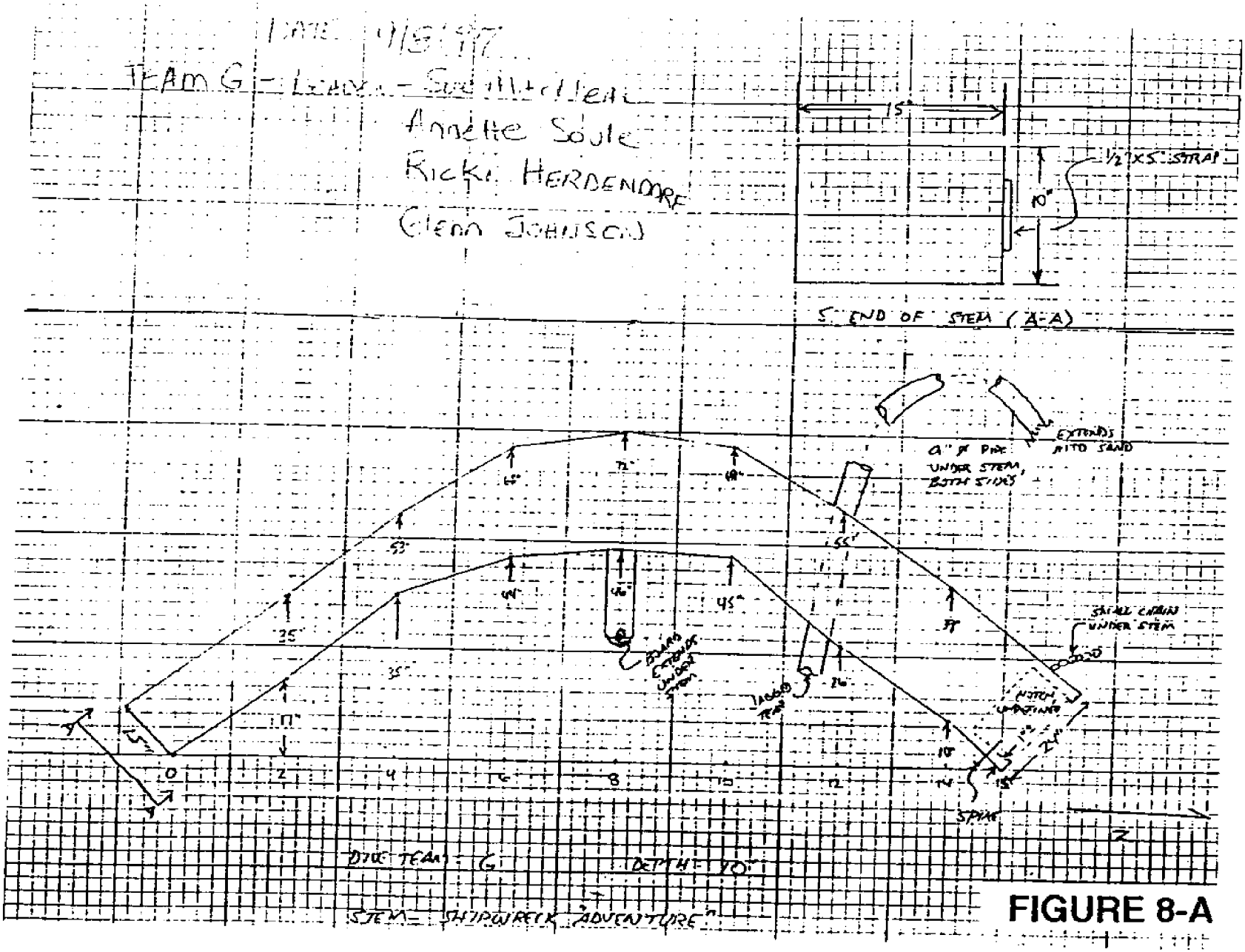
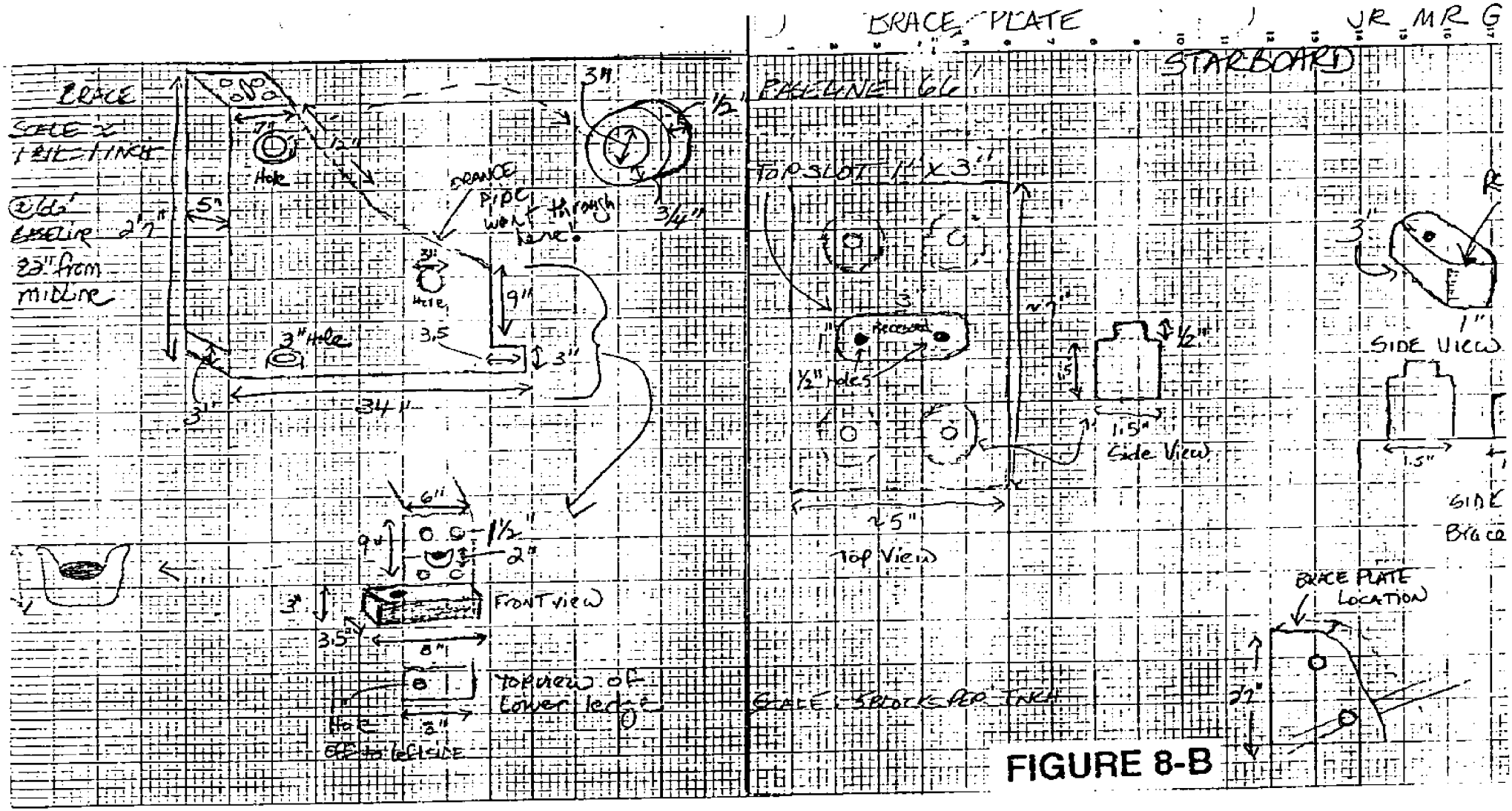


Figure 8. Examples of field sketches made by Nautical Archaeology Workshop students during mapping exercise on steamer *ADVENTURE* site, September 8-9, 1997.

8-A. Displaced stem section by Dive Team G (Sue MacNeal, Annette Soule, Ricki Herdendorf, & Glenn Johnson).



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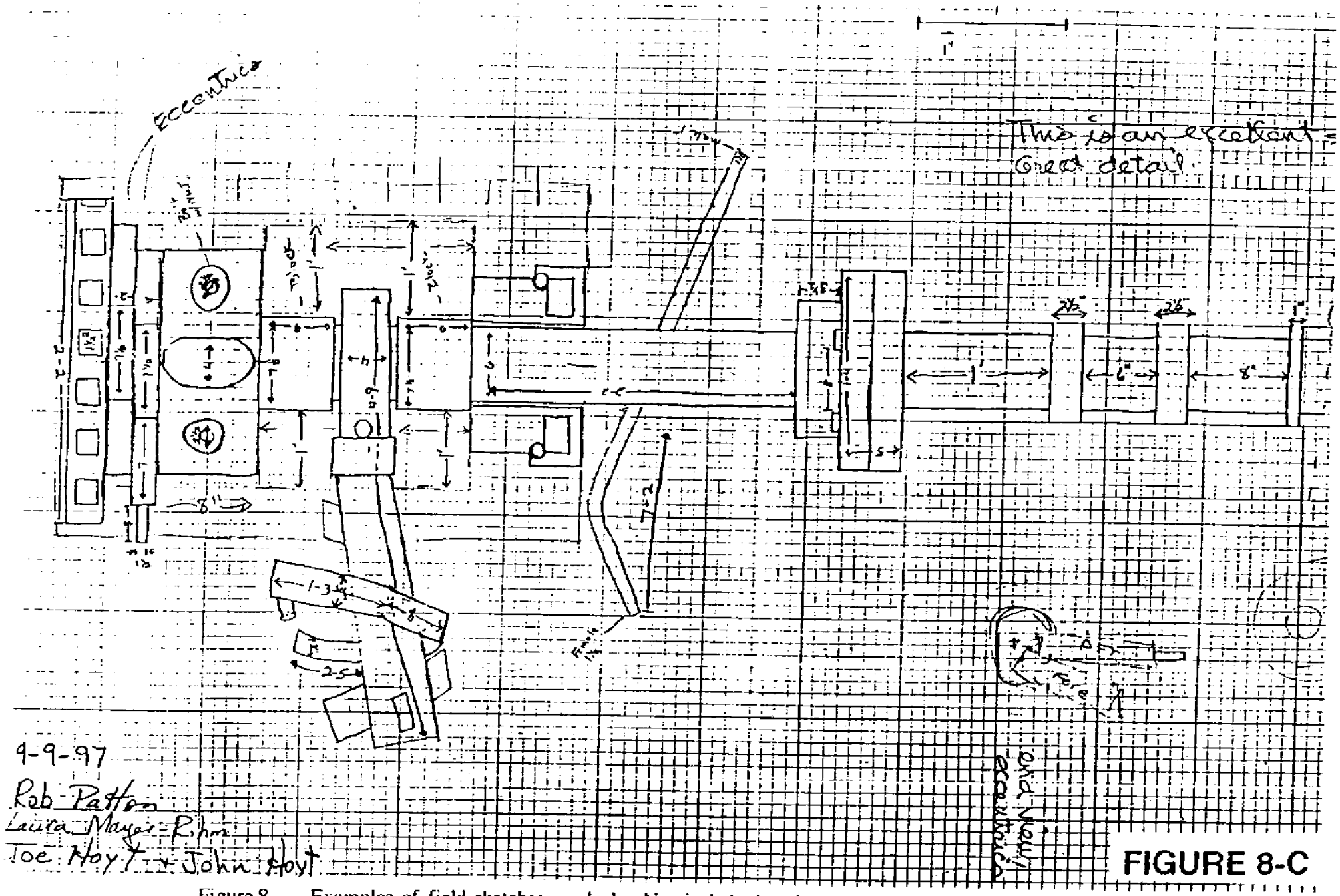
8-B. Deck winch detail by Dive Team E (Joanne Roehrs, Mike Roehrs, Greg Gossman, & Ricardo Bethart).



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8-C. Plan view of crankshaft and tailshaft assembly by Dive Team C (Rob Patton, Laura Mayer-Rihm, Joe Hoyt, & John Hoyt).

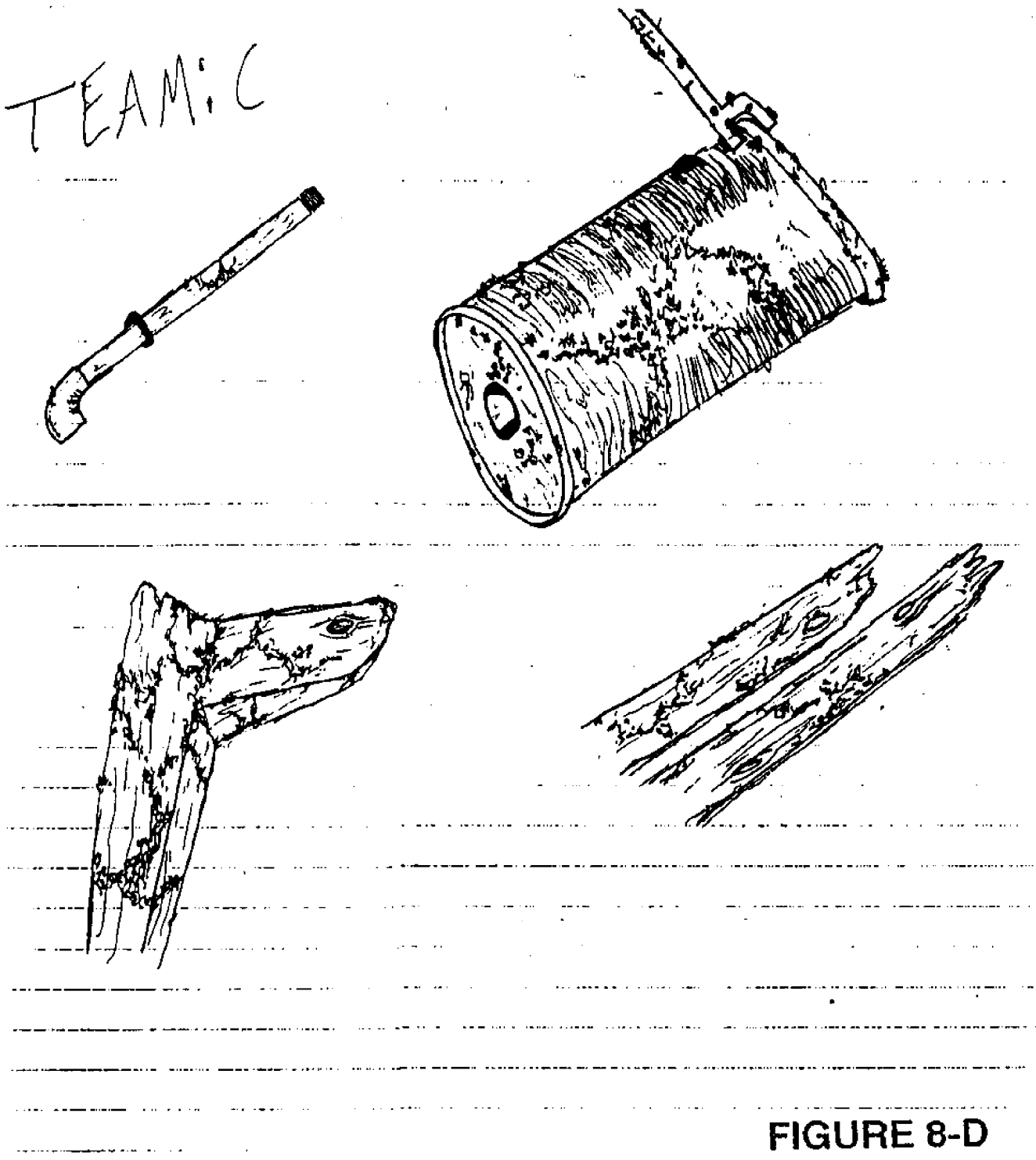


Figure 8. Examples of field sketches made by Nautical Archaeology Workshop students during mapping exercise on steamer *ADVENTURE* site, September 8-9, 1997.
8-D. Sketches of condenser and other stern features by Dive Team C (Rob Patton, Laura Mayer-Rihm, Joe Hoyt, & John Hoyt).

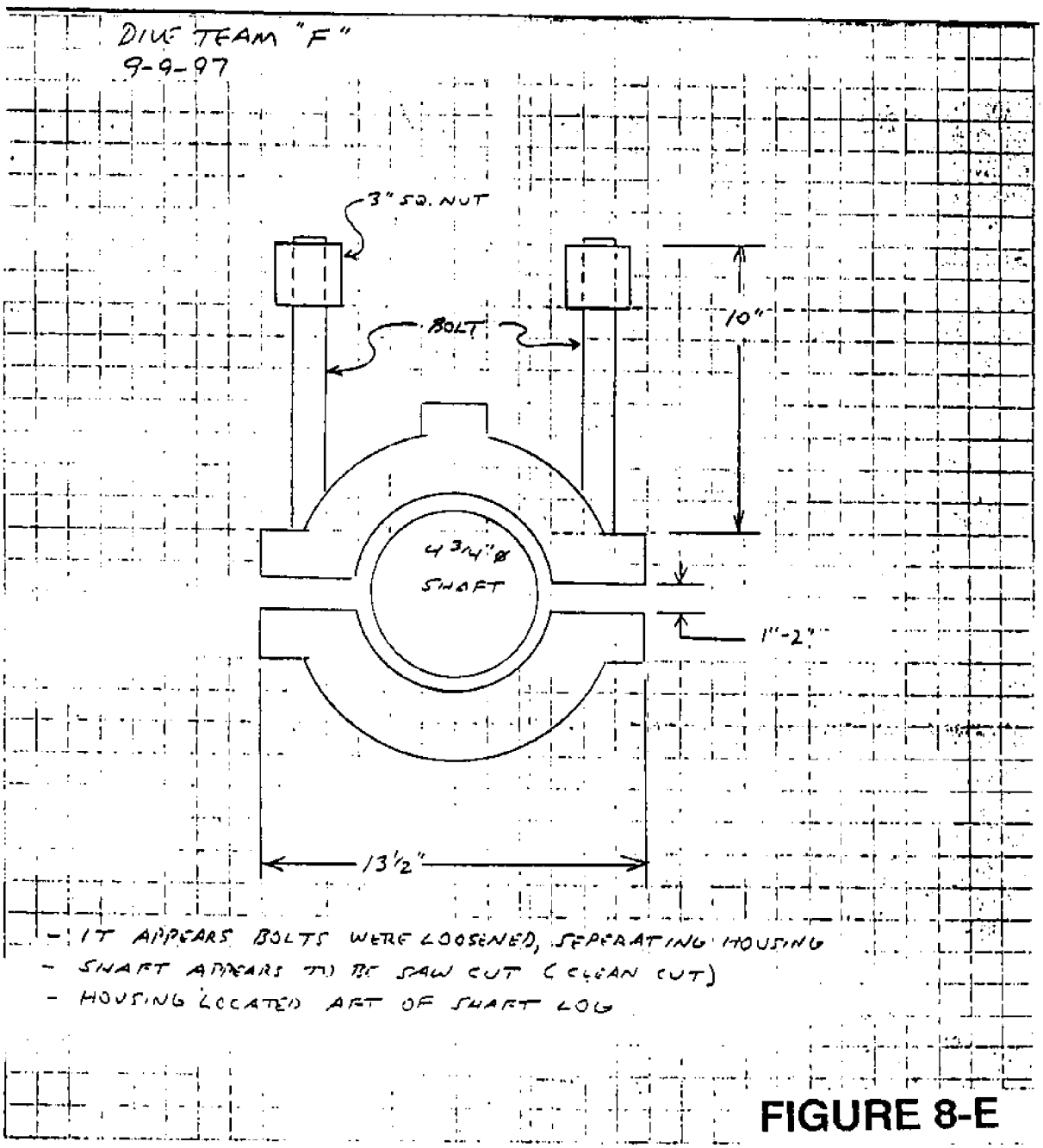


Figure 8. Examples of field sketches made by Nautical Archaeology Workshop students during mapping exercise on steamer *ADVENTURE* site, September 8-9, 1997. 8-E. Stern bearing detail by Dive Team F (Jeff Malcolm, et al.).

Figure 9. Aerial photograph of Long Point, North Bay of Kelleys Island showing location of steamer *ADVENTURE* as determined by field survey (photograph, March 31, 1986, courtesy of Ohio Department of Natural Resources).

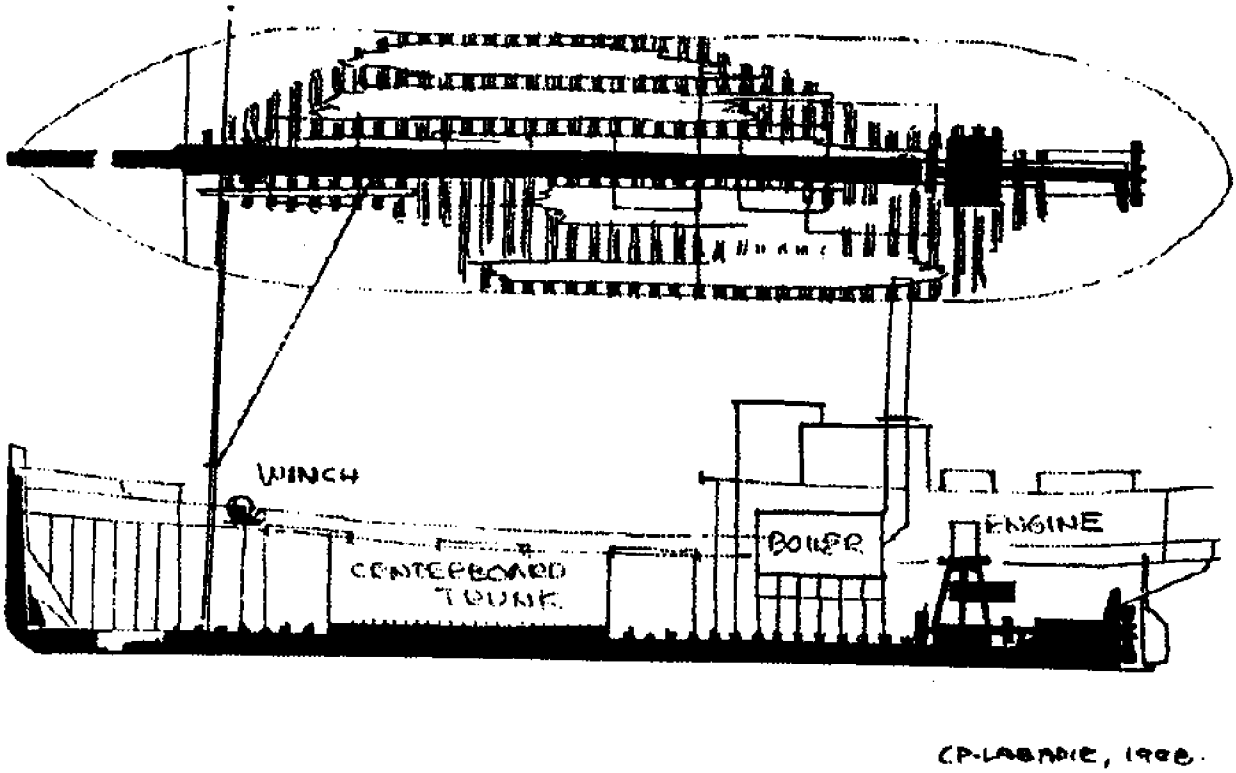
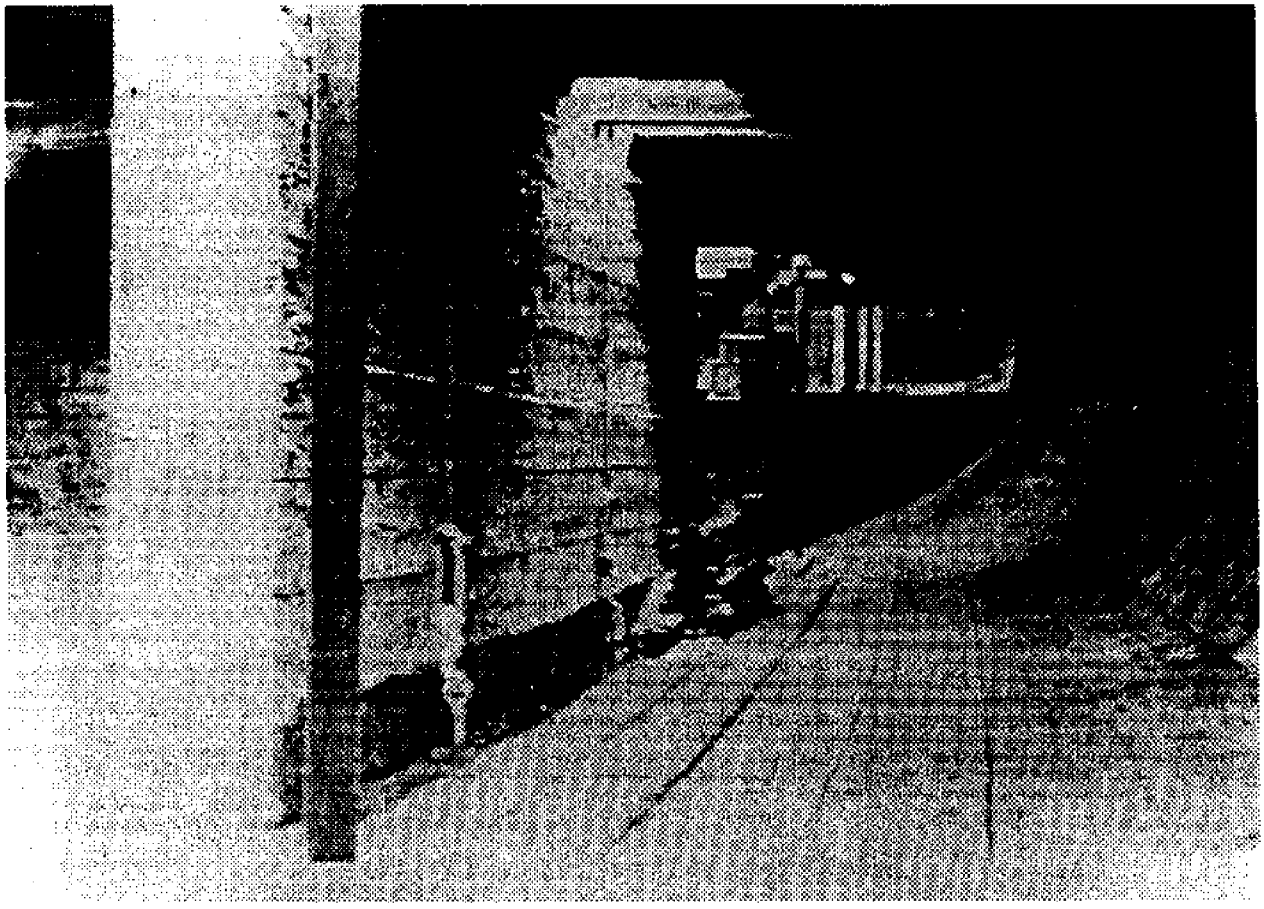


Figure 10. Reconstructed arrangement plan of steamer *ADVENTURE* showing the surviving features (darkened).



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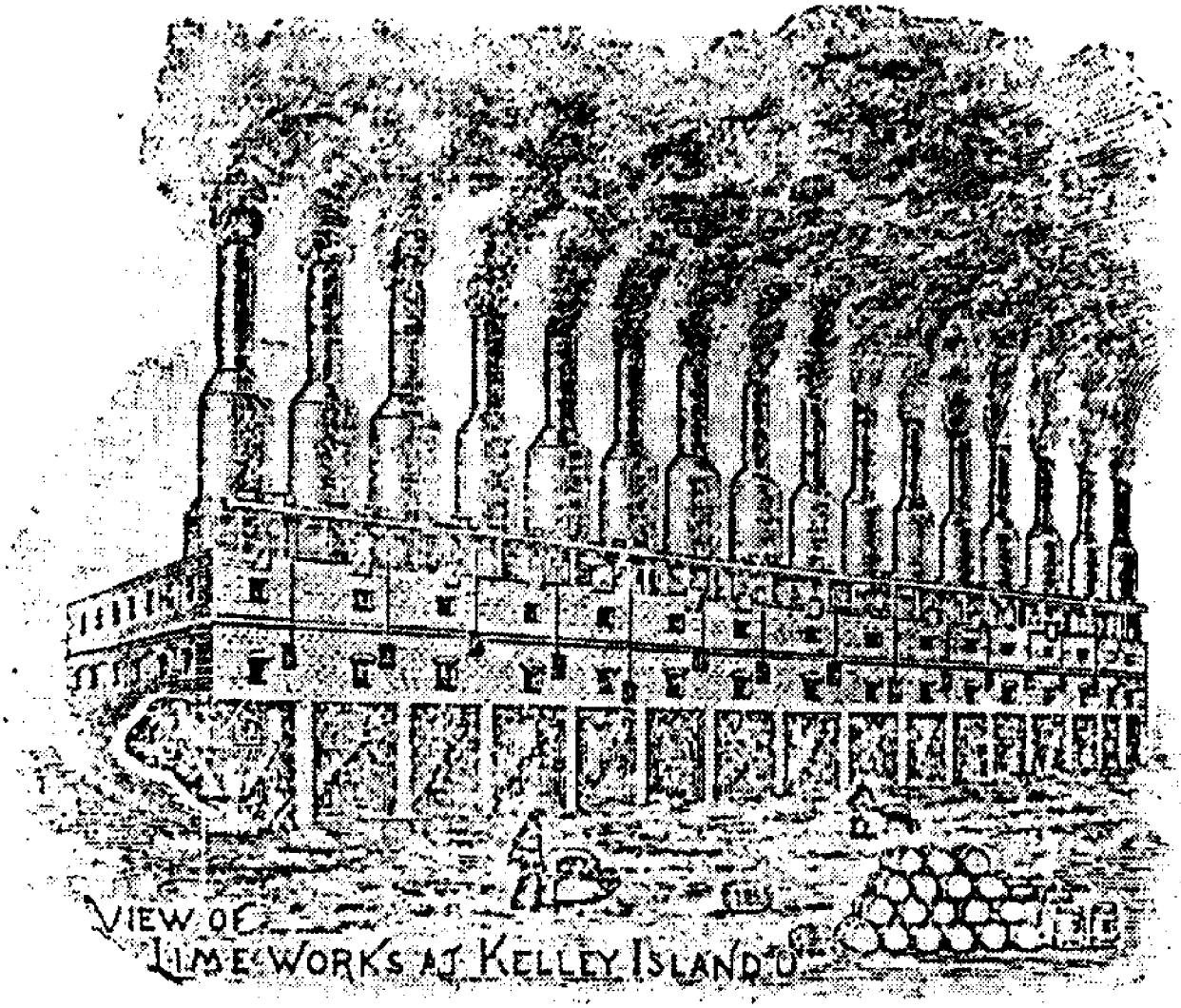

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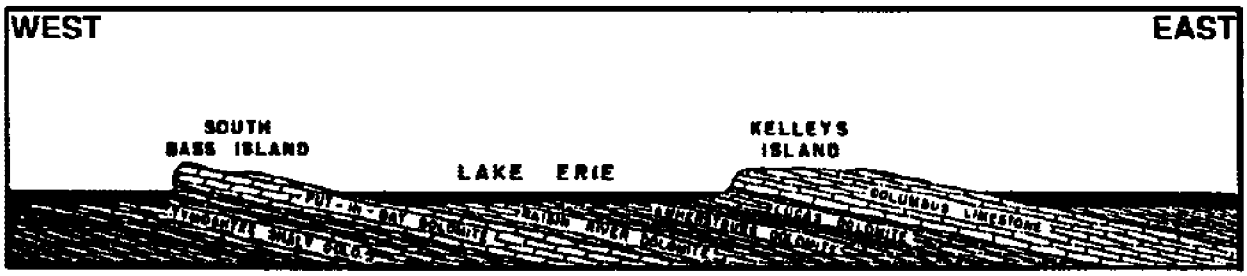

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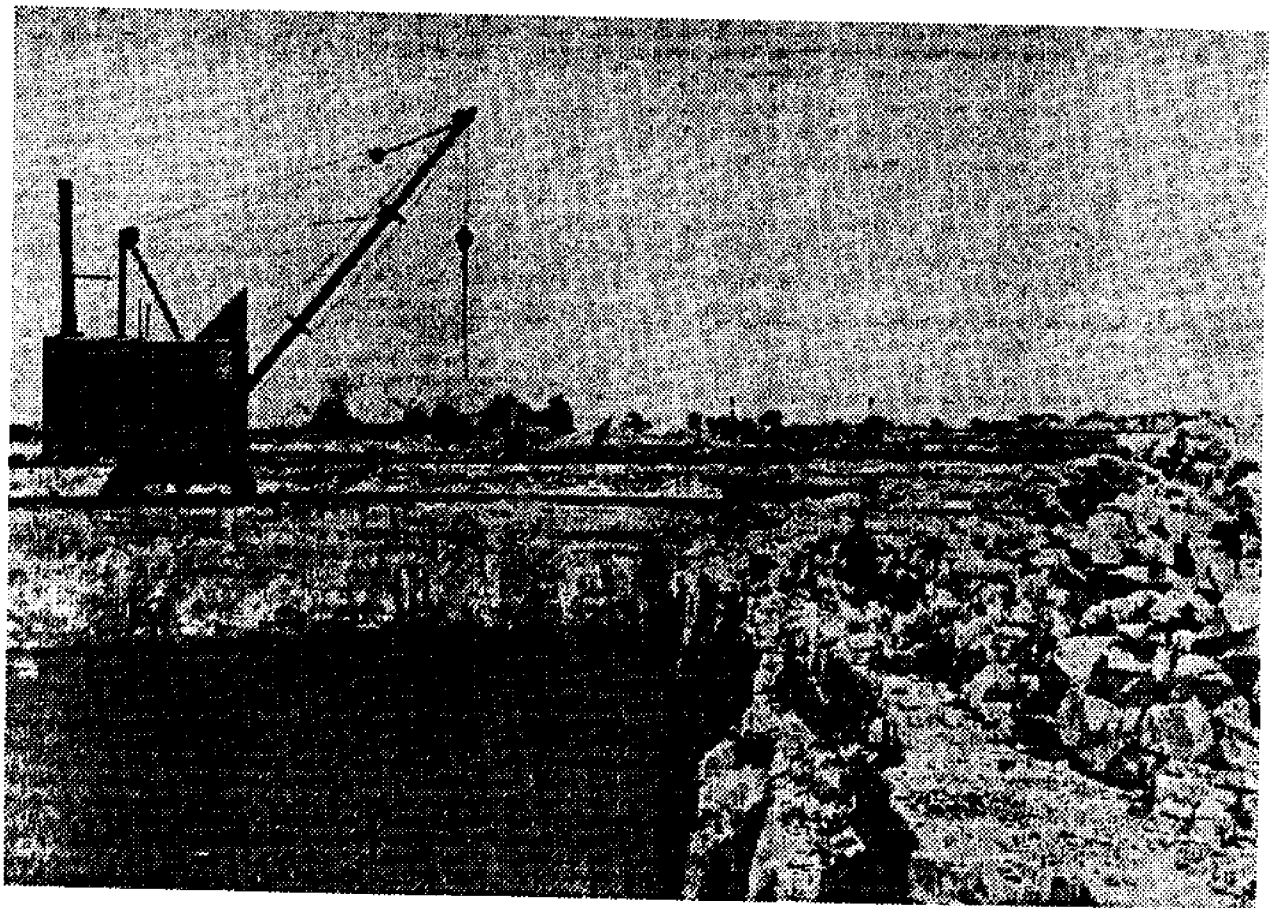

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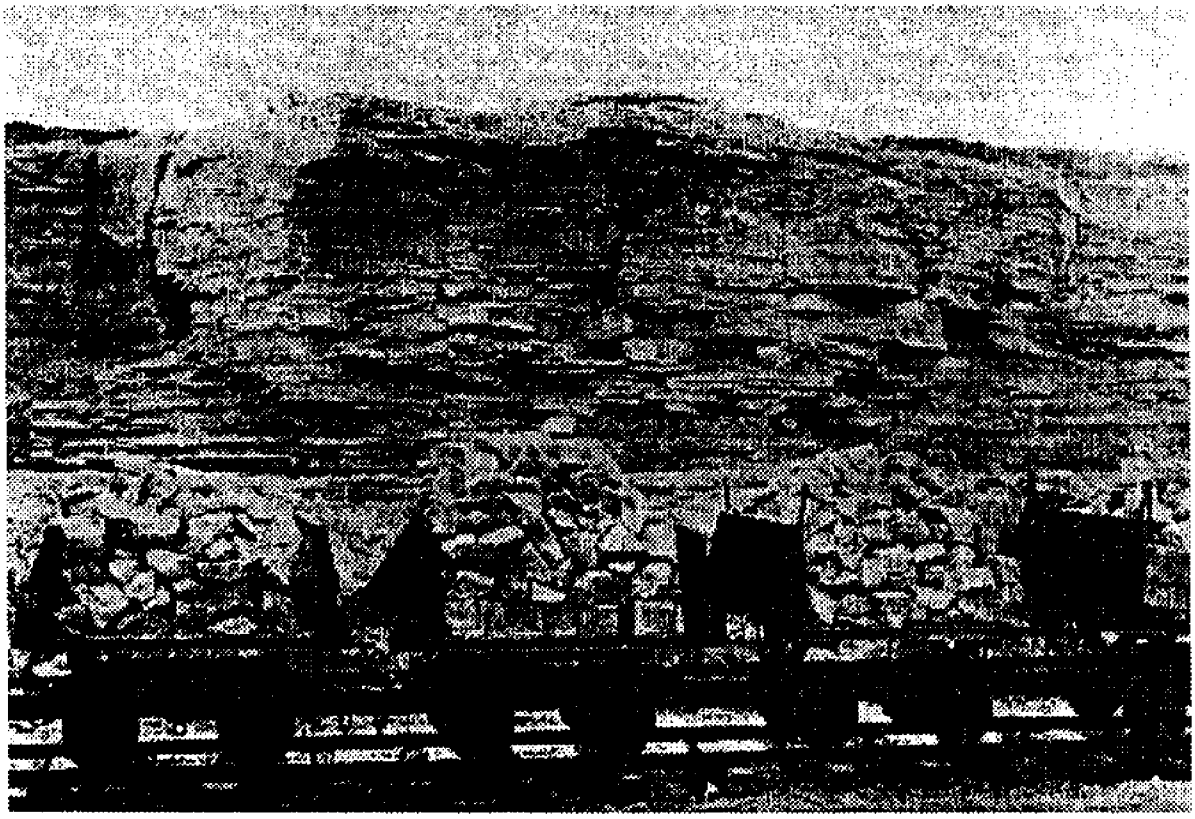

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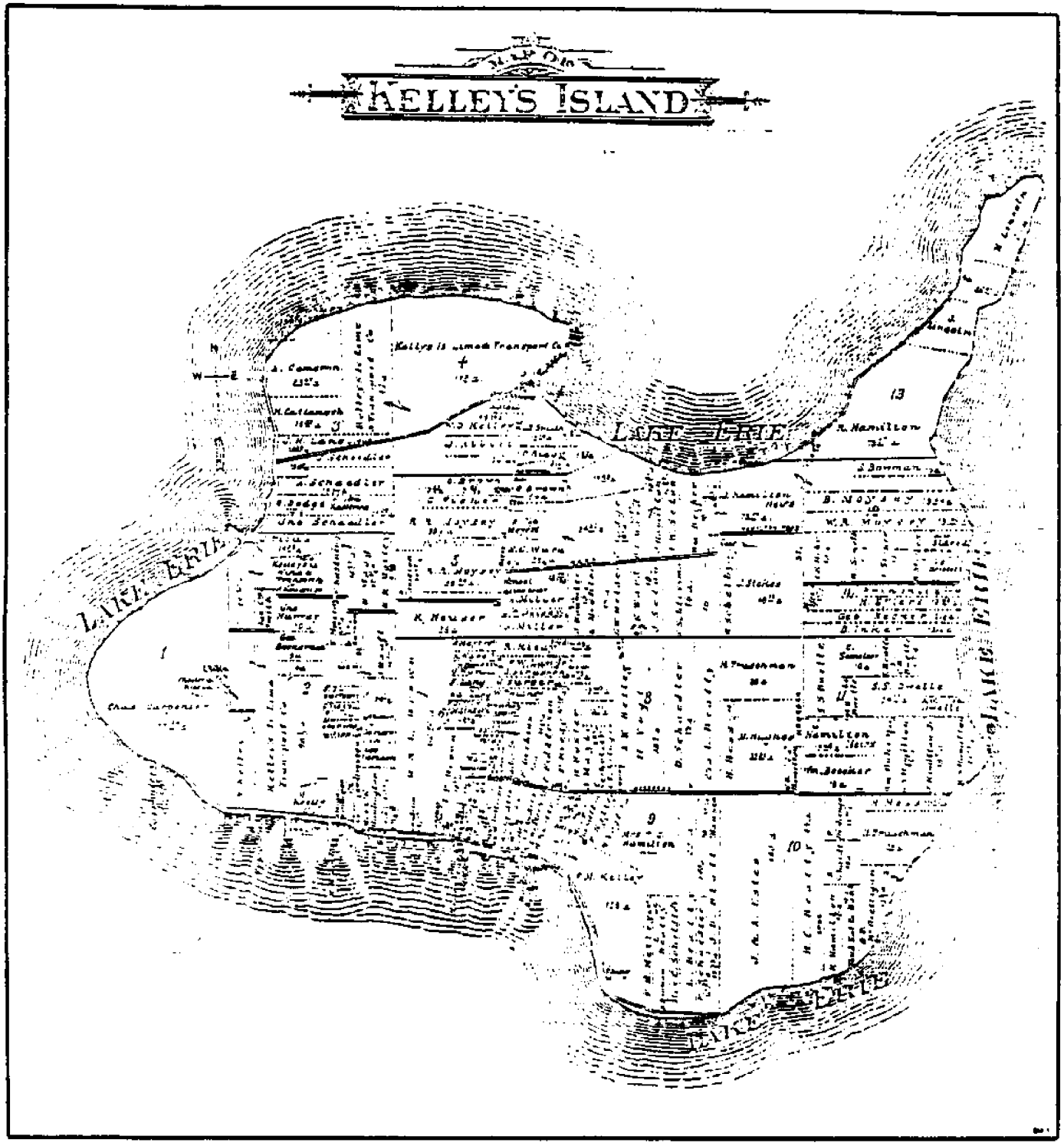

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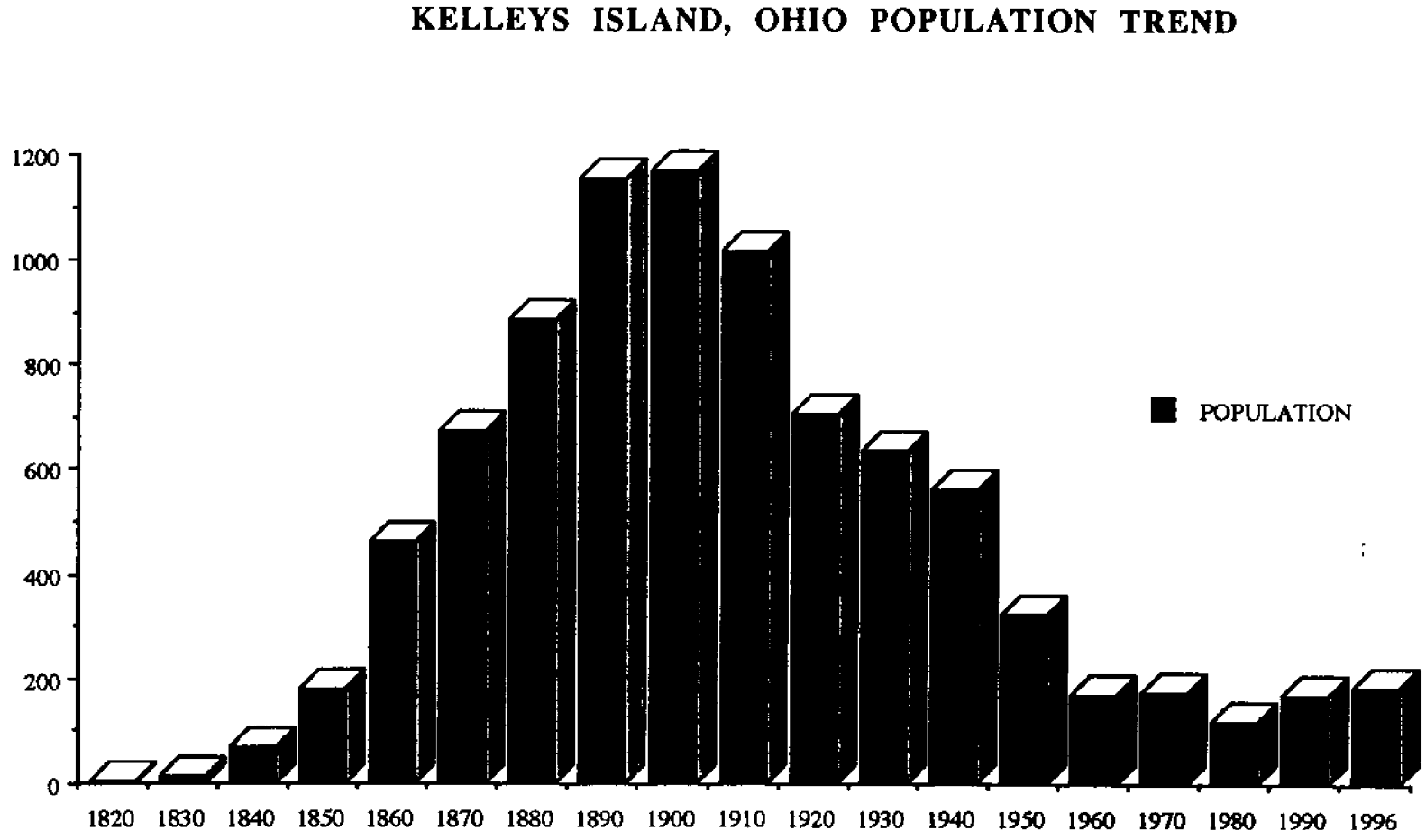


Figure 20. Kelleys Island, Ohio population trend 1820 to 1996 (data source: U.S. Bureau of the Census).

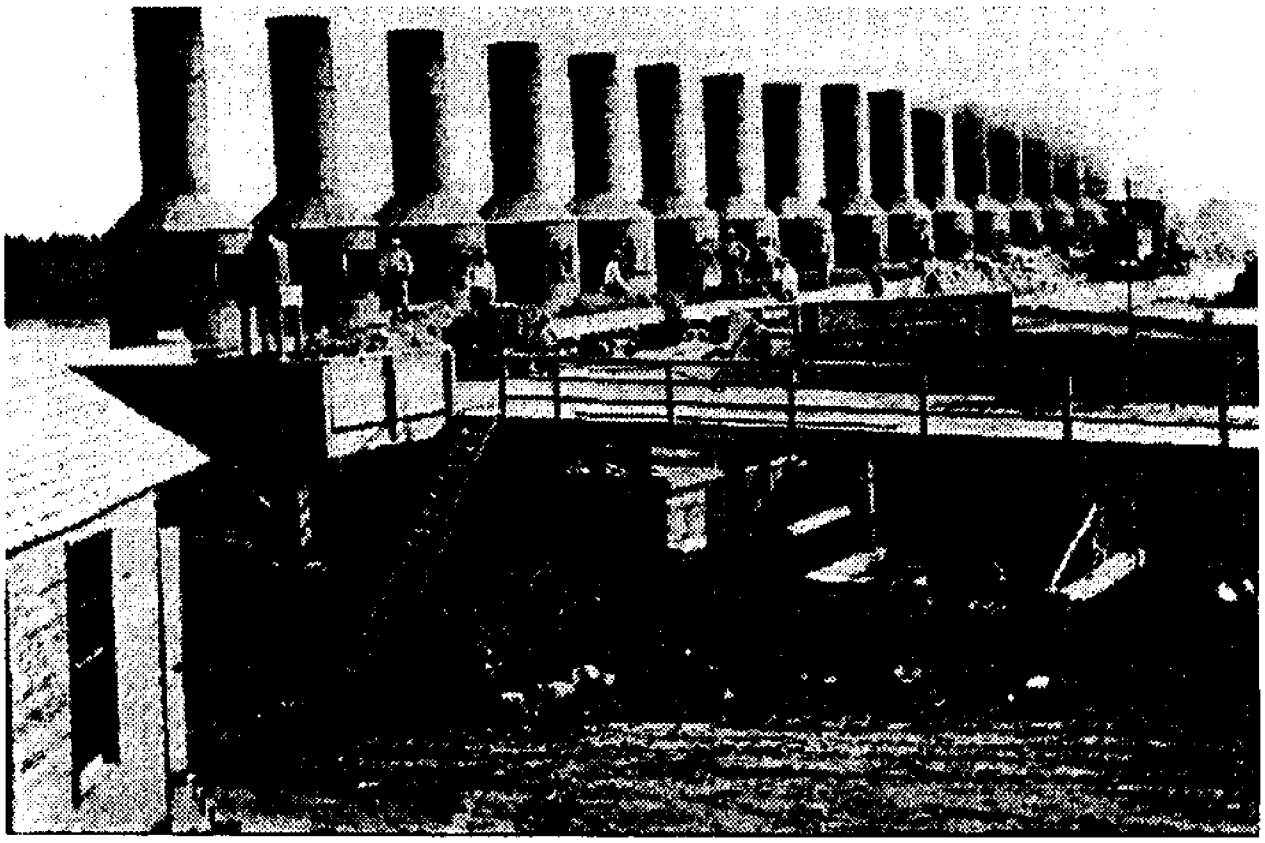


Figure 21. Kelley Island Lime & Transport Company lime kilns at North Bay quarry complex as viewed from the north, circa 1902; note platform with stone cars from which the kilns were charged with limestone (photograph courtesy of Ohio Historical Society Archives, Columbus, Ohio).

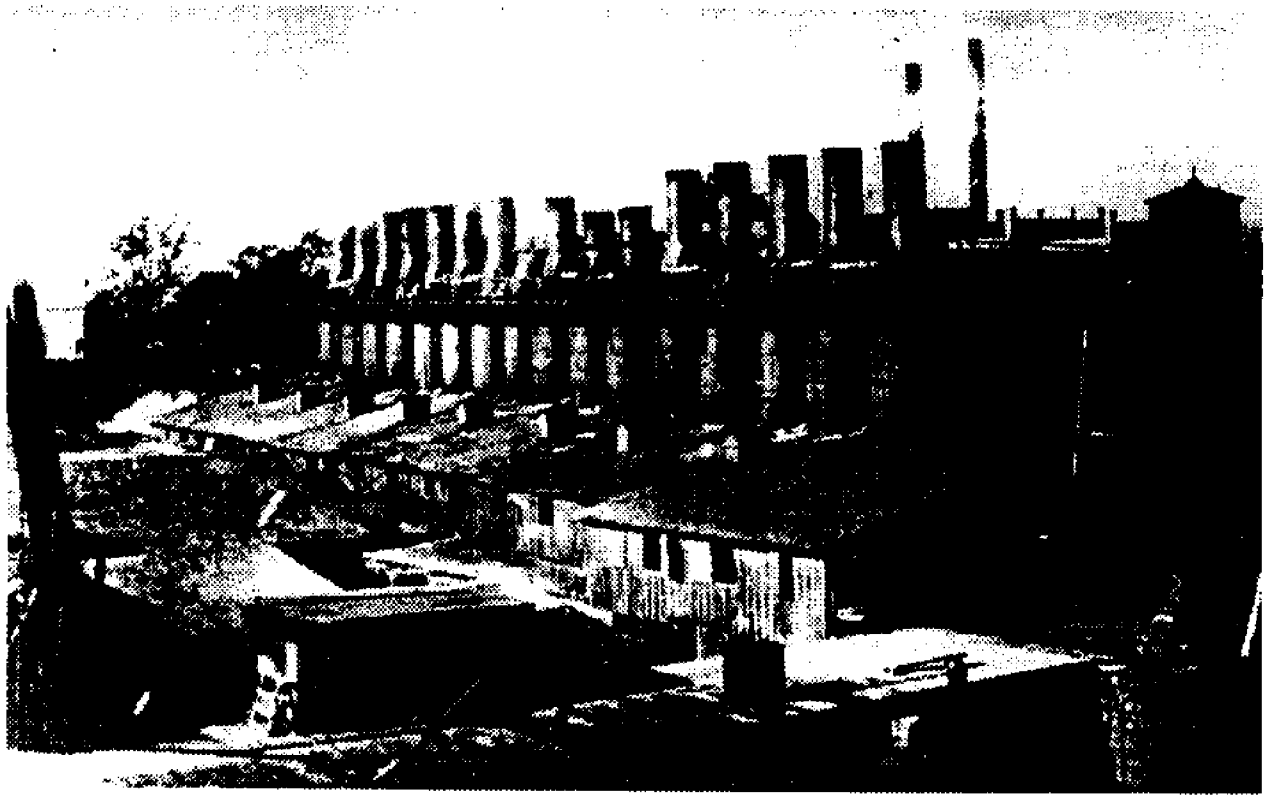


Figure 22. Kelley Island Lime & Transport Company lime kilns at North Bay quarry complex as viewed from the northeast, circa 1900; note bridge to dock in center foreground for transporting cargoes to and from vessels (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 23. Kelley Island Lime & Transport Company cooper shop (right foreground) and lime kilns (center background) at North Bay quarry complex as viewed from the southwest, circa 1900 (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

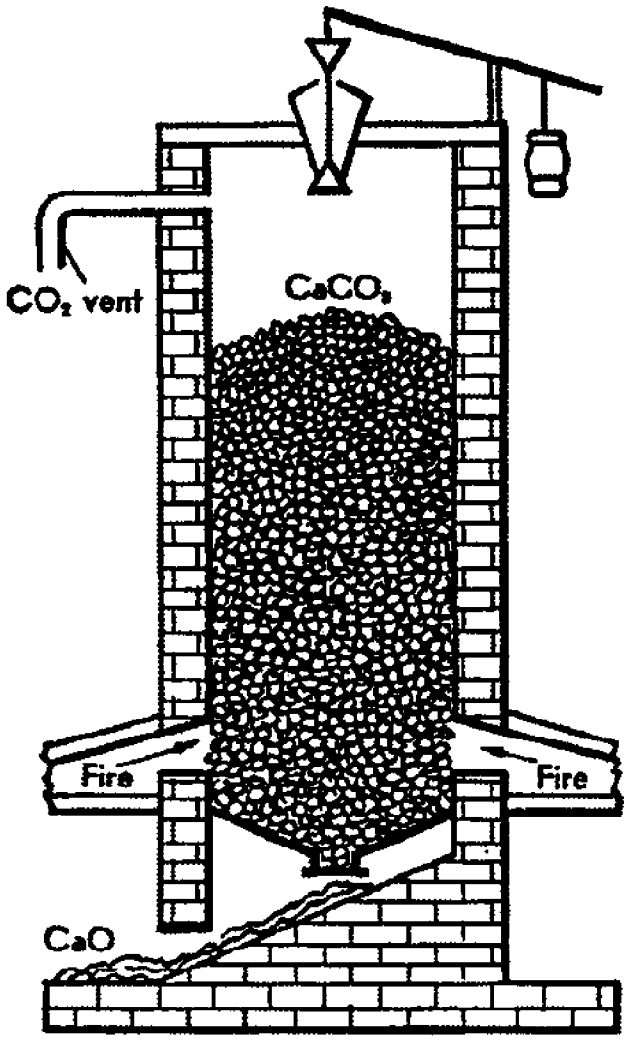


Figure 24. Generalized cross-section of a lime kiln; nce fired, such kilns were operated on Kelleys Island for weeks without shutting down (from Nebergall et al. 1963, p. 651).

Figure 25. Kelley Island Lime & Transport Company steam crane at North Bay quarry as viewed from the northeast, circa 1910; note boarding house on top of unexposed glacial groves (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

Figure 26 Kelley Island Lime & Transport Company office building and company store at North Bay quarry as viewed from the southwest, circa 1903; note steam cranes on tracks at quarry's edge and the north end of lime kilns at extreme right side of photograph (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

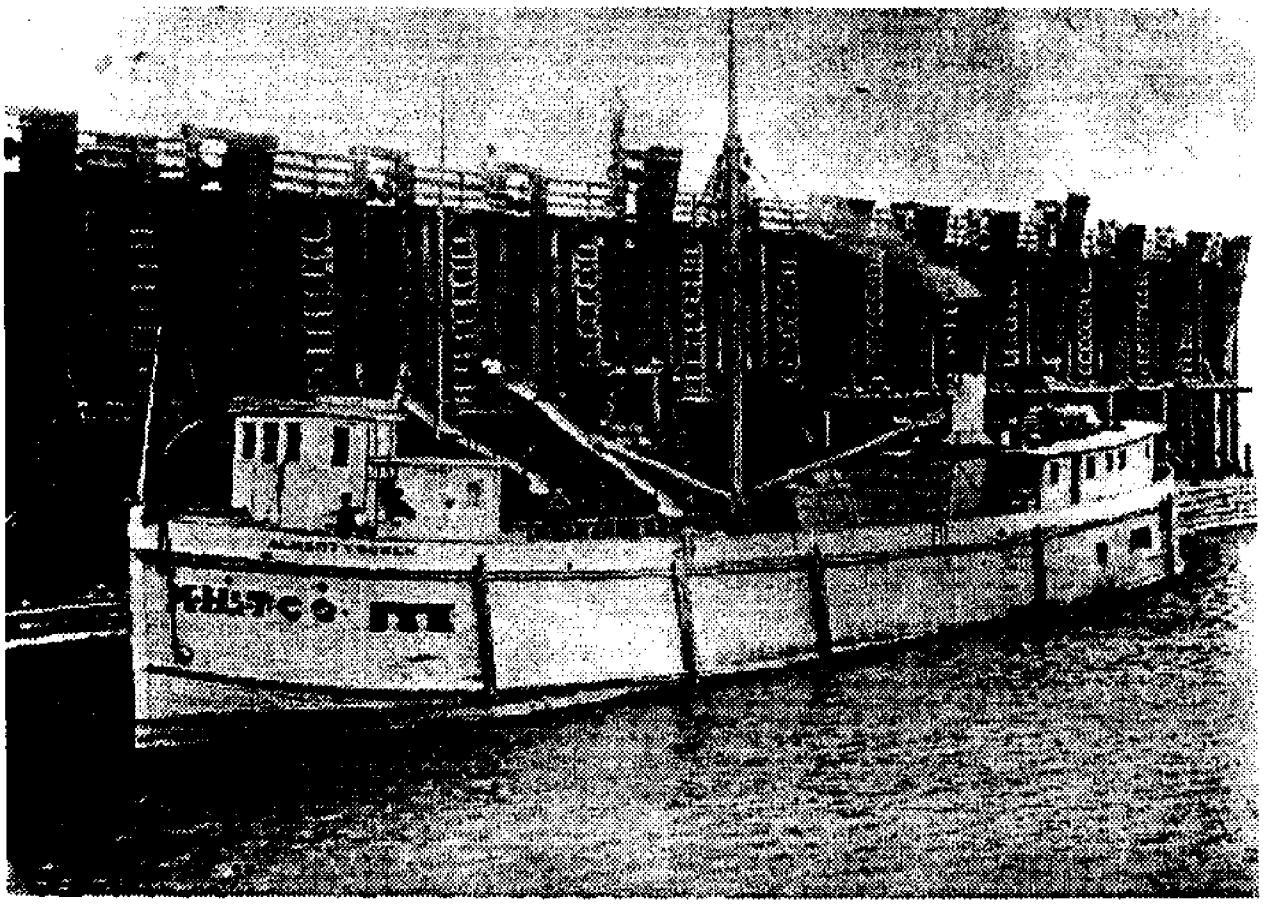


Figure 27 Kelley Island Lime & Transport Company's steamer *ALBERT Y. GOWEN* at South Bay dock, circa 1890; vessel was built by H. D. Root for KIL&T Co. in 1888 at Lorain, Ohio and measured 124 x 26 feet, 359 gross tons. Unlike the *ADVENTURE*, she was a double-decked, bulk freighter (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).

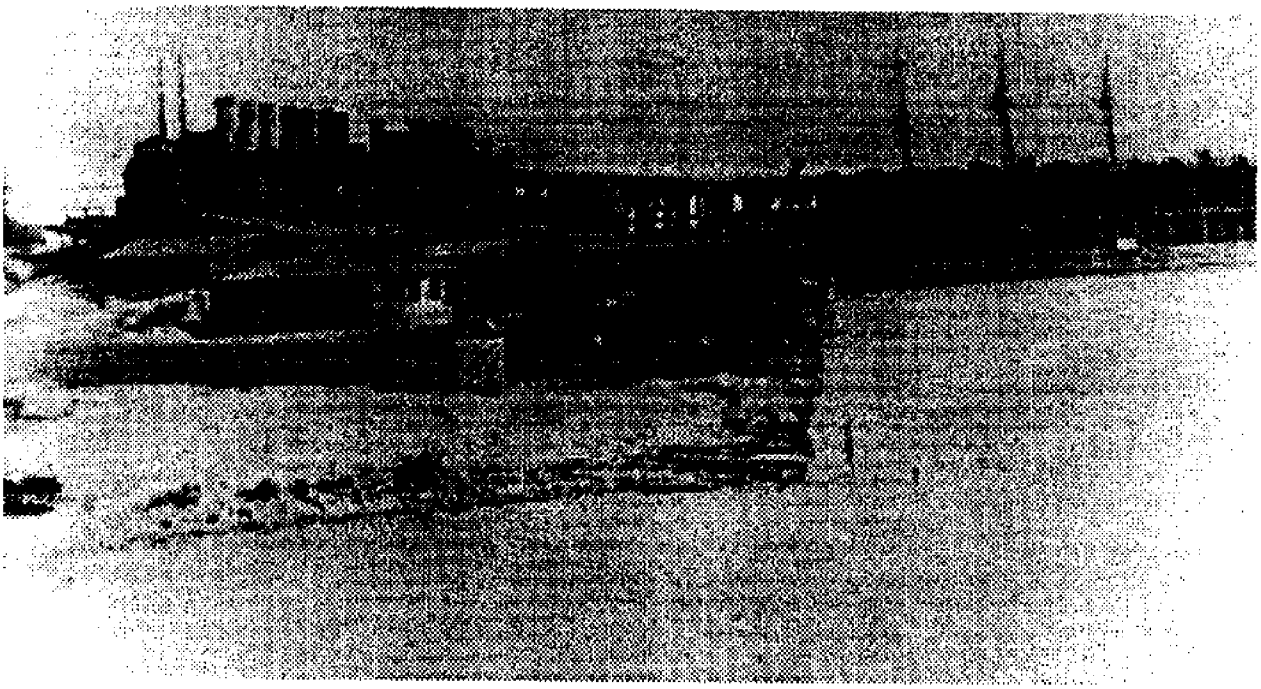


Figure 28. Kelley Island Lime & Transport Company dock and kilns at North Bay quarry complex as viewed from the south, circa 1900; note masts of a three-masted schooner at elevated pocket dock (photograph courtesy of R. B. Hayes Presidential Center,Fremont, Ohio: Capt. Frank E. Hamilton Collection).

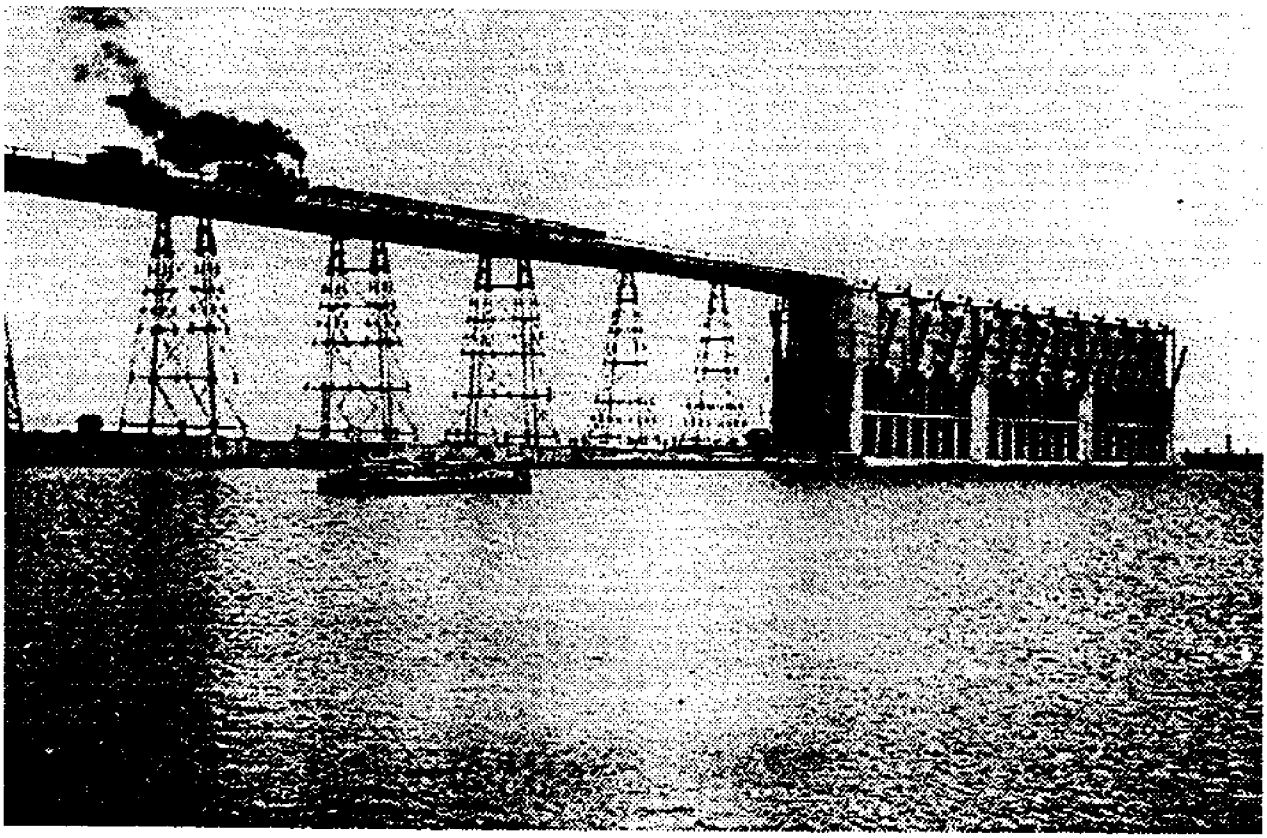
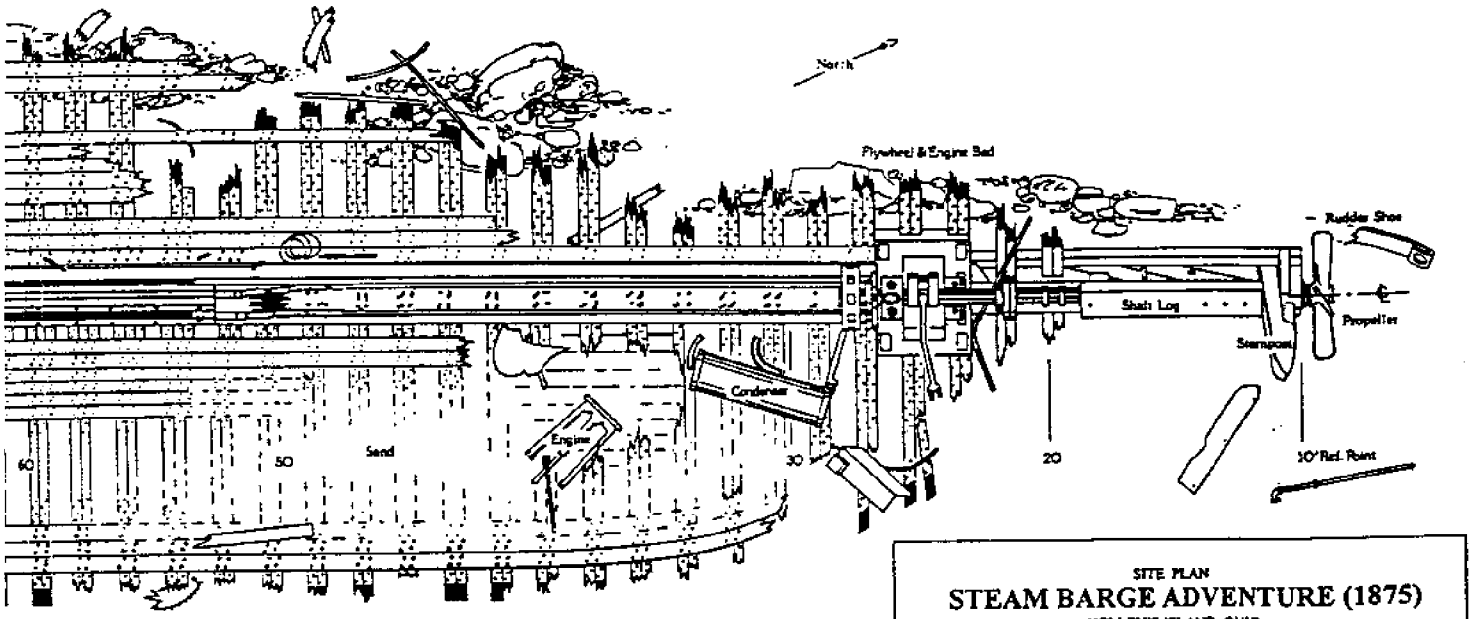


Figure 29. Kelley Island Lime & Transport Company's West Bay dock as viewed from the northeast, circa 1925; note Shay steam locomotives pushing narrow gauge dumping cars, loaded with crushed limestone, via a 600-foot-long overhead trestle to storage bins at the end of the dock. From the bins the stone was loaded directly by gravity into bulk freight boats (photograph courtesy of R. B. Hayes Presidential Center, Fremont, Ohio: Capt. Frank E. Hamilton Collection).



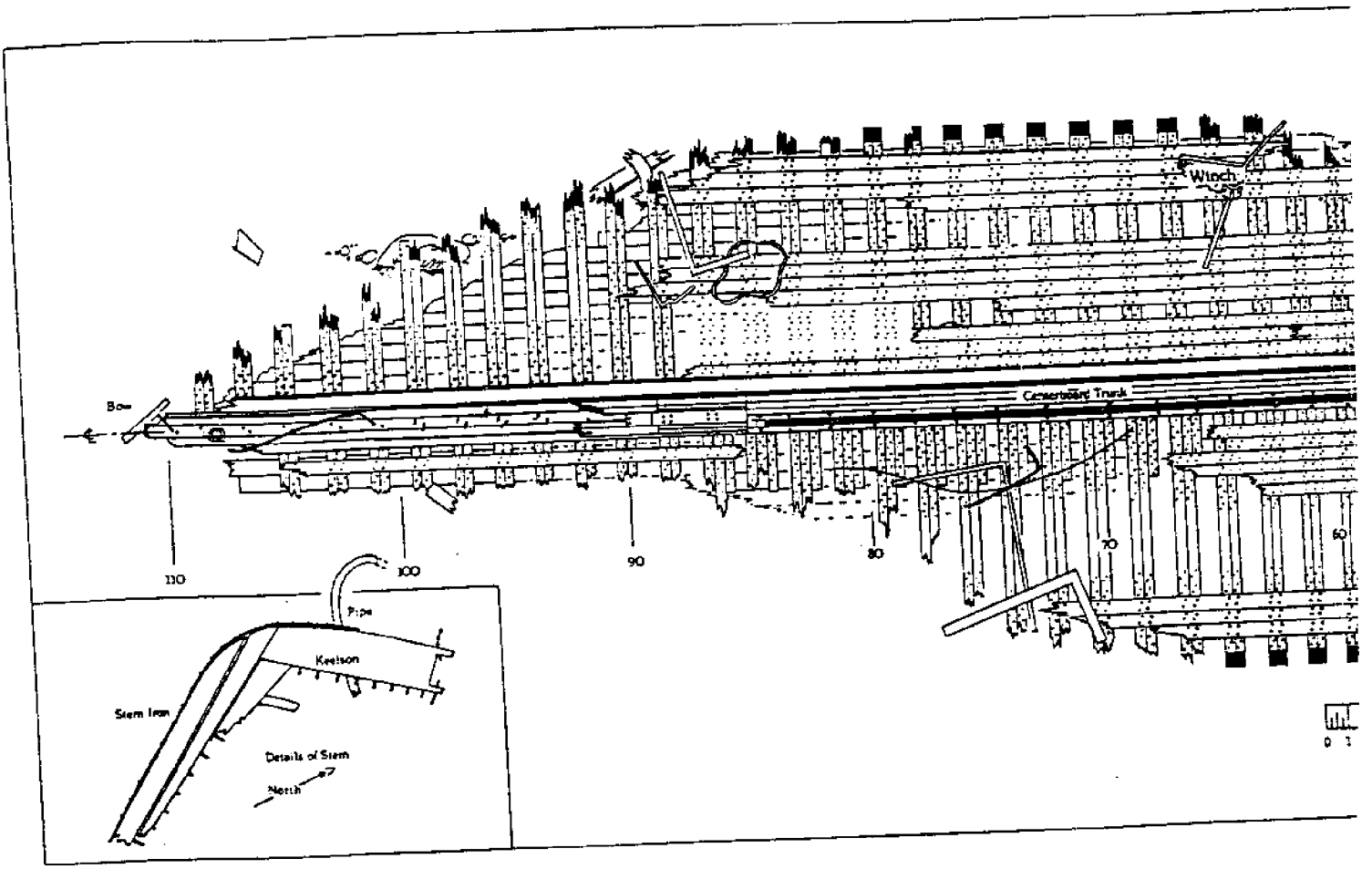
SITE PLAN

STEAM BARGE ADVENTURE (1875)

KELLEY'S ISLAND, OHIO

FIELD SCHOOL IN NAUTICAL ARCHAEOLOGY, SEPTEMBER 3 - 9, 1997
PERKINS CAMPUS, BOWLING GREEN STATE UNIVERSITY

PLATE I


Bow
Winch
Conservation Trunk
110
100
90
80
70
60
Pipe
Keelson
Stem Iron
Details of Stem
North