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An Archaeological Study of Glamis: The Role of a 19th-Century Iron Barque

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THE FLORIDA STATE UNIVERSITY
COLLEGE OF ARTS and SCIENCES

AN ARCHAEOLOGICAL STUDY OF *GLAMIS*:
THE ROLE OF A 19th-CENTURY IRON BARQUE

By
BERT HO

A Thesis submitted to the
Department of Anthropology
in partial fulfillment of the
requirements for the degree of
Master of Science

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ABSTRACT

The late 19th and early 20th -century shipping industry experienced a transition in ship technology from sail to steam propulsion. This thesis examines the continued use of iron-hulled barques during this transitional period, with a discussion of previously studied examples of the remains of iron-hulled, sailing barques from the 19th century. Archaeological and archival research gathered on *Glamis* strongly supports the hypothesis that the shipwreck site GC013 is the iron-hulled barque, *Glamis*, wrecked in 1913 off the coast of Grand Cayman, Cayman Islands, B.W.I. Despite the advances of steamship technology, some countries not only continued but also expanded their use of sailing ships. I describe and explain this practice using Norway as a paradigm.

CHAPTER 1

INTRODUCTION

Technological changes in late 19th-century iron ships had a direct effect on the longevity of the sailing barque in the shipping industry. With the introduction of the steam-powered vessel as a more economical and efficient transporter, sailing ships, like the iron-hulled barques, were delegated to a specific role in the industry. During the last years of the Age of Sail, iron barques remained a cost-efficient means of delivery. Shipping companies could use smaller crews to work the square-rigs, and the maintenance was relatively inexpensive (Jackson and Williams 1996:1-30). Countries that did not readily adopt steamship technology acquired older iron barques, because of the demand for bulk carriers at low costs (Burns 1999; Gardiner 1993; Souza 1998). Iron barque construction enabled these sailing ships to withstand the wear of decades of travel, and maintain a steady employment despite the rapid incorporation of steamships in shipping company fleets. The archaeological and historical study of the British-built, Norwegian-owned barque *Glamis* is presented in this thesis as a detailed example of an aging, iron barque acting in this role.

19th-Century Iron Ships

Iron barques of the late 19th century remained profitable cargo carriers through the early 20th century because of their rigid hull construction. Chapter 2 discusses the iron barque in terms of its construction and historical development from wooden ship designs. Using Underhill's (1988), Gardiner's (1993), and Souza's (1998) publications about iron ship technology, the transition between sail and steam technology during the 1800's is presented based on changes in ideology and economic benefits. These changes led to a division in the shipping industry reflected in the cargoes carried by steam and those carried by sailing ships. Iron barques working

away from their home ports were often employed in tramp services, or carrying bulk cargoes between foreign ports. This chapter includes the *Glamis* and two other archaeologically studied examples of 19th-century iron barques, all of which participated in tramp shipping, and sailed under a Norwegian flag at the time of their wrecking. Though the three ships did not wreck at the same time or in the same place, a relationship is established in the similarity of ship type, nationality, and role in the late 19th-century shipping industry.

Shipwreck Archaeology and *Glamis*

Like many iron barques of its time, *Glamis* often sailed in unfamiliar seas between ports far from its owners. According to archival research done by Margaret Leshikar-Denton of the Cayman Islands National Museum, *Glamis* was reported to have wrecked during heavy squalls off the East End of Grand Cayman in 1913. In November of 2003, the Cayman Islands National Museum sponsored a mapping project of the probable *Glamis* shipwreck site, supported by the Cayman Islands Department of Environment, various dive charter companies, and students from The Florida State University. Chapter 3 will discuss the *Glamis* Mapping Project, including methodologies used, site descriptions, and an interpretation of the site using historic documents describing the wrecking event.

Based on the archaeological evidence, the site is likely to be that of *Glamis*. Chapter 4 will expand upon the life of *Glamis*, beginning with a brief background of Norwegian shipping activity during the late 19th century. The history of *Glamis* includes a discussion of the Alexander Stephens and Sons' Shipyard in Dundee, as well as a description of the *Glamis*' construction there. Using archival and archaeological evidence presented in Chapters 3 and 4, evidence supporting the shipwreck GC013 as the remains of *Glamis* will be presented.

In conclusion, *Glamis* will be related to the process of clarifying the continual use of sailing iron barques during the Age of Steam. Secondary questions relating to why Norway expanded its sailing iron ship fleet during the rapid expansion of steamship technology will be discussed with possible causes. From this study, new questions have arisen related to Norwegian shipping practices in other areas of the world, and to larger problems with understanding imperialism through world trade. These topics will be offered as future questions that can build upon the issues studied in this thesis.

Appendix A includes a background of the Cayman Islands. Because *Glamis* has become a valuable exponent of Cayman maritime heritage, a presentation of the unique Cayman history must be incorporated. The majority of information in Appendix A is derived from Roger C. Smith's (2000) *Maritime Heritage of the Cayman Islands*, Margaret Leshikar-Denton's (1993) dissertation study of Wreck of the Ten Sail, and Michael Craton's (2003) *Founded Upon the Seas*. Previous archaeological work is discussed to highlight the Cayman Islands' long and diverse maritime culture, which continues to resonate in the course of Caymanians' everyday lives and throughout the landscape of the Islands.

Conclusion

This chapter has presented the focus of this thesis and briefly described the remaining chapters. Chapter 2 focuses on the technological transition to iron shipbuilding, and the services that most sailing iron ships provided during the Age of Steam. Three examples of sailing iron ships, including *Glamis*, are discussed because of their similarity in construction, nationality, and function. Before *Glamis*' role as a sailing ship in the shipping industry can be discussed, an examination of the iron barque's development during the late 19th century must be included.

CHAPTER 2

IRON SHIPS

Development and Technology of Iron Sailing Ships

Development of iron ships after the 1850s resulted from technological advances and a demand for larger, stronger ships (Arnold 2000; Gould 2001; Souza 1998). During the era of imperialism, countries seeking new lands competed for markets of raw materials and foreign goods. Delivery speed and amount of cargo transported became measurable factors of business success, and led to demands for increases in hull size and sail area, and, eventually, for the mechanical propulsion of ships (Souza 1998). In *Shipping, Technology, and Imperialism*, Jackson and Williams (1996:8) discuss the industry of shipbuilding and necessary advances in technology:

The growth of long-distance trade and imperial expansion between the seventeenth and mid-nineteenth centuries occurred within the context of wooden sailing vessels, growing bigger and more complicated after the Napoleonic War. But initiatives . . . increasingly relied on . . . shipping technology to initiate new vessels for new needs, encouraged in later stages by . . . metallurgical and mechanical inventions . . . Countries possessing a tradition of wooden shipbuilding could be left behind as the industrialized shipbuilding industry produced vessels more suitable for extensive maritime aggrandizement.

Industrialized countries, such as England and the United States, began to use iron more frequently in ship construction by the early 1800's (Arnold 2000). In the United States, iron ships were primarily reserved for river travel, using steam power to traverse numerous rivers throughout the northeast, southeast and mid-west (Gould 2001:198). Shipbuilders in Europe tended to transition more slowly to steam technology, while utilizing iron more frequently to build large sailing vessels. By 1855, worldwide wrought-iron production totaled nearly 6,000,000 tons with more than half being produced by Britain (Gould 2001:196). The effects of

large-scale iron production on shipbuilding in Europe are seen in the latter half of the 19th century, as iron ship construction increased dramatically. The first section of this chapter will discuss benefits of iron-hulled ships and how sailing ships remained useful despite the introduction of steam power.

Transition from Wooden to Iron Hulls

Construction of large, wooden sailing ships remained relatively uniform over several centuries. Gould (2001:197) states, “it has been claimed that a sailor from the . . . Spanish Armada of 1588 . . . transported suddenly to the first half of the [19th] century, would [be] instantly familiar with the ship and could take up his duties with a minimum of delay.” Wooden ship building was considered more of an art form than iron ship building, with years of apprenticeship needed to learn the necessary skills of working and shaping large timbers (MacGregor 1993:32). With the introduction of iron into ship construction, the business of shipbuilding “industrialized,” and ship orders increased throughout northern Europe, especially at yards on the Clyde, Thames, and Mersey rivers (Arnold 2000; Gardiner 1993; Walker 1996). Iron’s strengths in comparison to wood emerged early in the 19th century, increasing its popularity as a ship building material (Gardiner 1993).

The most prominent weakness in wooden hulls is the lack of longitudinal rigidity (MacGregor 1993:32). Wooden hulls throughout history were constructed by numerous, relatively small individual planks, often overlapping or staggered to increase longitudinal strength (Steffy 1994). While these shipbuilding techniques were effective for centuries of large, wooden ship construction, ships intended for the 19th-century shipping industry required maximum hull volumes and increased rigidity. According to MacGregor (1993:34), ships that began incorporating iron bracing still faced problems of optimizing cargo volume because wooden support structures still occupied internal volume. This led many shipbuilders to incorporate iron framing fully, and completely eliminate wooden supports (Figure 2.1).

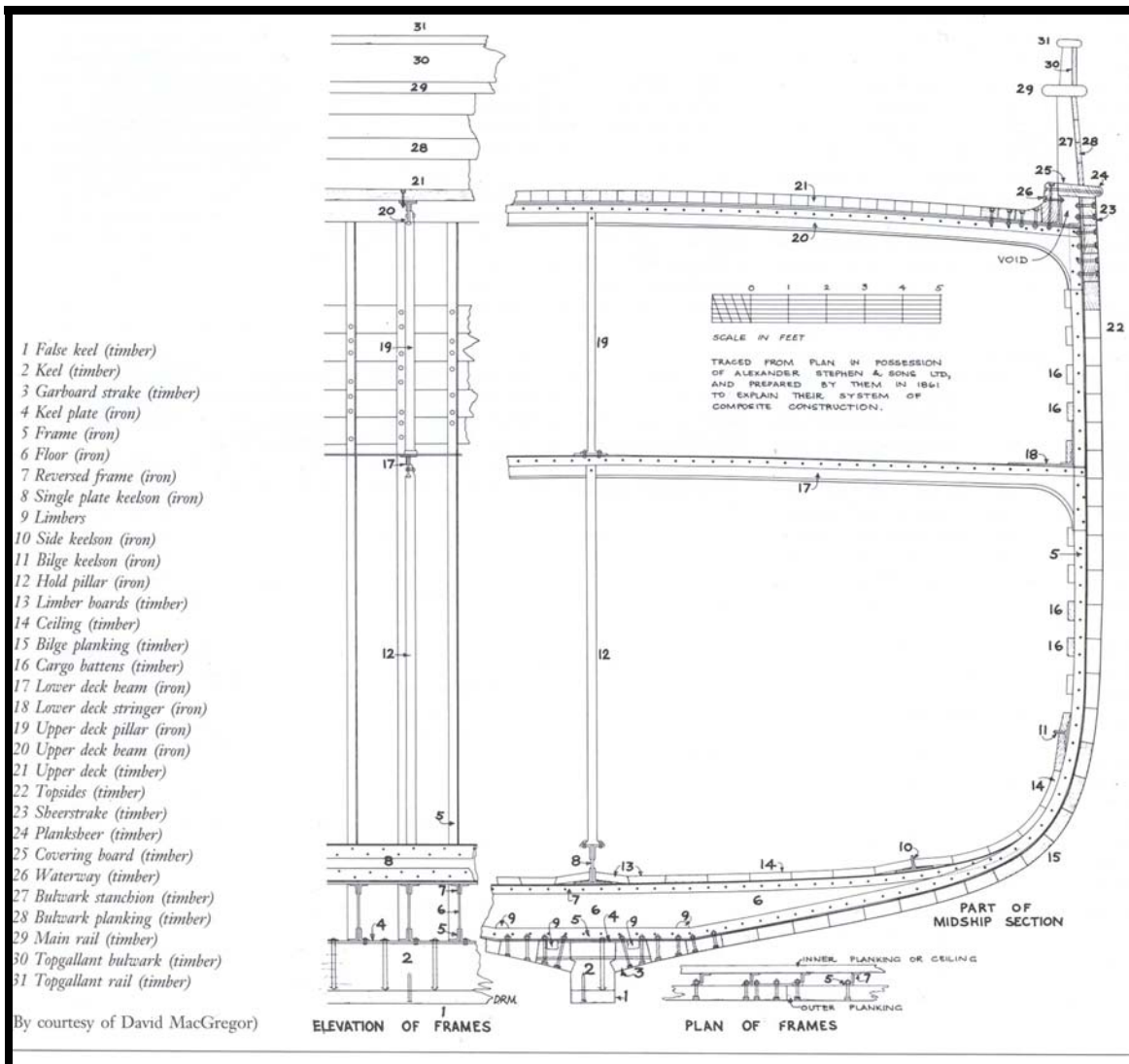


Figure 2.1: Cross section of a composite built ship

(MacGregor 1993:36)

Iron shipbuilding benefits included a reduced amount of time needed for construction, added strength, and an increase in internal volume by eliminating unnecessary support structures. Even with these benefits, iron ships did not replace wooden ships immediately (Gardiner 1993; Gould 2000; MacGregor 1984a). Iron shipbuilders on the River Clyde, River Mersey, and the Thames offered iron hulls, steam propulsion and screw propellers as early as the 1840's, but few orders were placed because of the ship owners' reluctance to change from traditional wooden ship usage (Arnold 2000; Walker 1996).

Among other problems, iron shipbuilders experienced a need for new tools in iron hull construction and difficulty recruiting and educating specialized laborers (Walker 1996:33). Fortunately for the iron shipbuilding industry, numerous universities offered instruction in engineering and industrial design. The University of Glasgow offered one of the widest ranges of classes available in Britain, and the University of Strathclyde was one of the first schools to offer evening classes as part of the Working Man's Institute movement of the 19th century (Walker 1996:35). While most shipyard workers during this period probably did not attend higher education at universities, it is likely that the continual preparation of well-educated engineers and designers supplied shipbuilding firms with innovators during the period of transition between wooden and iron-hulled ships. Because of their knowledge of physics, dynamics, and mechanics, shipbuilding engineers knew the potential benefits of iron ships over wooden ships. With the university systems in Britain educating future iron shipbuilders, the ideas and innovative designs that first emerged were continually supported through a period of sailor skepticism.

Iron ships also possessed physical characteristics that slowed their acceptance initially. Three characteristics of iron ships led many naval engineers to oppose ships made entirely of iron (Ville 1993:53-54). Magnetic deviation caused by the innate magnetic property of iron affected accuracy in compasses (Ville 1993:53). Navigation on ships relied heavily on a compass that could accurately detect magnetic north. The construction process, which included repetitive hammering of iron, caused early iron ships to magnetize and disrupt the surrounding magnetic field. Another innate characteristic of iron ships is the susceptibility to corrosion from the marine environment. Iron oxidation, or rust, quickly damaged iron hulls, often weakening them beyond repair. Iron ships also attracted lightening during storms (Ville 1993:53). The extension of iron plated masts only increased the chances of being struck by lightening at sea. Most problems with iron ships were rectified with the production of higher quality iron and proper electrical grounding.

Sail and Steam

During this transitional period between wood and iron hulls, another technological advancement, steam, also emerged from the Industrial Revolution. Though steam power was not new to European engineers, it was still a relatively new technology in shipbuilding during the

early to mid 1800's. Steamship companies appeared in Europe as early as the 1820's, but without a proven structural or economic superiority to sail at sea, the increase in orders for steamships was gradual (Dirkzwager 1996:189; Souza 1998:106). While many ship-owning companies were reluctant to invest in steamships at first, it was acknowledged by many engineers, including those from the British Navy, that steam-driven propellers had an "operational value" over sailing ships by "operating independently of wind and current to carry out amphibious operations" (Dirkzwager 1996:191).

Though steamships had developed in the early 1800's in the United States, most steam-driven vessels around the world were similarly limited to rivers, harbors, and enclosed waters (Gould 2001:198). Gould (2001) cites the large amounts of coal needed for early steam engines as the cause for their inefficiency. Because steam ships had to carry large volumes of coal, the capacity for cargo and payload decreased. Most early paddle-steamers reserved their limited steam capabilities for harbors and wind-less seas, while they continued to rely on sail as their main propulsion (Gould 2001:199). Sailing merchant ships were able to remain successful during this period, because the inefficiency of steam vessels caused shipping rates to exceed that of sailing ships.

The transitional era between sail and steam included advances in technology and a change in ideology (Souza 1998). According to Souza's (1998:112-121) study of late 19th-century shipping in America, ship owners and sailors endured higher risks than those from the early to mid 19th century. Risks included the operation of uninsured merchant vessels that could not be re-classed because of their poor condition (Souza 1998:115-116). According to the data she gathered, reported casualties were higher in steam vessels than sailing ships, but as sailing ships aged and fell into un-insurable condition, risks compounded and increased (Souza 1998:120). She also notes that older insured ships may have wrecked on purpose in areas where shipwrecks were common occurrences, which would lower the risks to life (Souza 1998:120-121). Perhaps the new risks associated with the operation of early steam engines and boilers led many merchants to continue operating the less expensive sailing ships. A detailed description of steam technology development is not relevant to this thesis, but informative explanations can be found in Dirkzwager's (1996) and Brock and Greenhill's (1973) work.

Historical Development of Sailing, Iron Barques

As stated previously, this thesis seeks to expand upon reasons for the continued use of sailing, iron-hulled barques during the late 19th century, relying on European examples. While Souza (1998) addresses economic and ideological reasons for the persistence of sail, she does not discuss sailing ships built without steam machinery during the Age of Steam. Similarly, Souza (1998) does not include the function of these ships in the late 19th and early 20th-century shipping industry, in terms of cargoes carried and services rendered. Despite advancements in steam engine technology during the 19th century, iron barques continued to be developed and built.

Iron Ship Development

Like many technological advances in engineering, innovation and invention served as catalysts for more efficient and stronger designs. From efforts to improve on rigidity and capacity, shipbuilders used wooden ship types, such as clippers and schooners, to develop iron hull structures (Underhill 1988). Contrary to what is often assumed, iron ships were not invented simply to increase cargo capacity. Large wooden ships of the 1700's and 1800's had capacities in tonnage of up to 1175 tons, which exceeded that of many iron-hulled ships built decades later. It is more accurate to discuss the development of sailing iron ships in terms of increased strength with decreased hull weight, cost efficiency, speed, durability, and economy in upkeep (Ville 1993:53). Along with these beneficial features in the development of sailing, iron-hulled ships, I include the intended function or service of the iron ship as a determinant for the changes in size, materials used, and design.

According to Underhill (1988:10-11), sailing, iron-hulled ship design began with a period of composite-hull construction. This type of ship utilized wooden hulls with iron frames and internal supports, but it was abandoned by the 1870's in favor of hulls completely built of iron (Ville 1993:58; Underhill 1988:11). Iron-hulled barques developed independently from composite ships, based on wooden schooner designs with clipper-like lines in the bow (Gardiner 1993). The term barque distinguishes this sailing ship-type by its sail formation and three masts: the fore-mast, main-mast, and mizzen-mast. Both the fore- and main-mast are square rigged, and the mizzen-mast carries no yards and only a topmast, gaff-sail, and gaff-topsail (Paasch 1977

[1890]:5). Later iron barques incorporated a fourth and sometimes a fifth mast as the length of ships was extended.

Iron Barque Hull Construction

Ships categorized as iron barques varied greatly in length, breadth, depth of hold, and tonnage. When discussing sailing ships of the 19th century, it is difficult to provide a rigid description for any particular ship type because of the multiple combinations of sail configurations and hull dimensions possible. The designation of a ship as an iron barque is based on aspects of its rigging and sail formation, and this ship type can include ships as small as coastal schooners and as large as the steel square-riggers of the 20th century (Underhill 1988:73-113).

The initial design of sailing, iron-hulled barques began with the replacement of wooden hull structures with iron structures. Three iron ships discussed later in this chapter are of similar size, and they represent a progression in iron hull development. A brief discussion of the internal hull structures of iron ships follows, emphasizing the replacement of internal wooden framing with iron (Table 2.1).

Table 2.1: Wooden and iron hull components that are equivalent in function.

WOODEN HULL STRUCTURES	IRON HULL STRUCTURES
Keel	Keel
Keelson	Single Plate Keelson
Stringers	Sister, Side Stringers, and Bilge Keelson
Knees	Angle bars, Turned beam knee
Floors	Floor Plate, Floor Frame
Stanchion	Pillar
Wale	Cargo batten
Beams	Beams, Members

Hull components

Iron hull construction was similar to wooden construction as evident by the structural configuration of iron ships. Keels were laid first, then articulating frames attached transversely. In composite ships, these frames were wooden with iron supports, eventually evolving into complete iron frames. Centerline keelsons were built up from heavy timbers with iron plating on all sides. Iron shipbuilders removed the wooden component and replaced it with a large, T-shaped iron beam with a flat iron plate on top. Sister keelsons, bilge keelsons, and side keelsons in both composite and iron ships replaced stringers in wooden ships. They were located parallel to the centerline keelson and spaced evenly across the lower hull. By relying on strength of iron, more support structures found in wooden ships could be eliminated. Chocks, futtocks, and wales were not found in composite ships and were replaced by a combination of iron floors, stringers, and iron plating in iron ships. Likewise, stanchions, referred to as pillars, were reduced in number (Kihlberg 1972:30).

Iron hanging and lodging knees, or angle bars, were incorporated in composite-built ships, and they are a feature in all iron hulls (Greenhill 1993b:78). These angle bars had the same function and form as wooden knees, but they were smaller, lighter, and stronger. Even with these qualities, they were often only spaced four feet or less apart. The numerous angle bars were necessary to support heavier cargoes and to increase transverse strength.

Iron ships continued to build upon composite ship designs by replacing the remaining wooden components with iron (Figure 2.2). Wood outer hull planking was replaced with riveted iron plates bolted to frames. Side and bilge stringers connected frames on the inboard side. Butt plates, flat iron plates with multiple rows of rivets, secured the plates to each other and covered plate seams on the inner face (Kihlberg 1972:39). Iron bulwarks and caprails were fixed on bulwark plating supported by bulwark plates. These features developed from and replaced wooden waterways, bulwark stanchions, and bulwark planking in composite-built ships (Kihlberg 1972:30; MacGregor 1993:36).

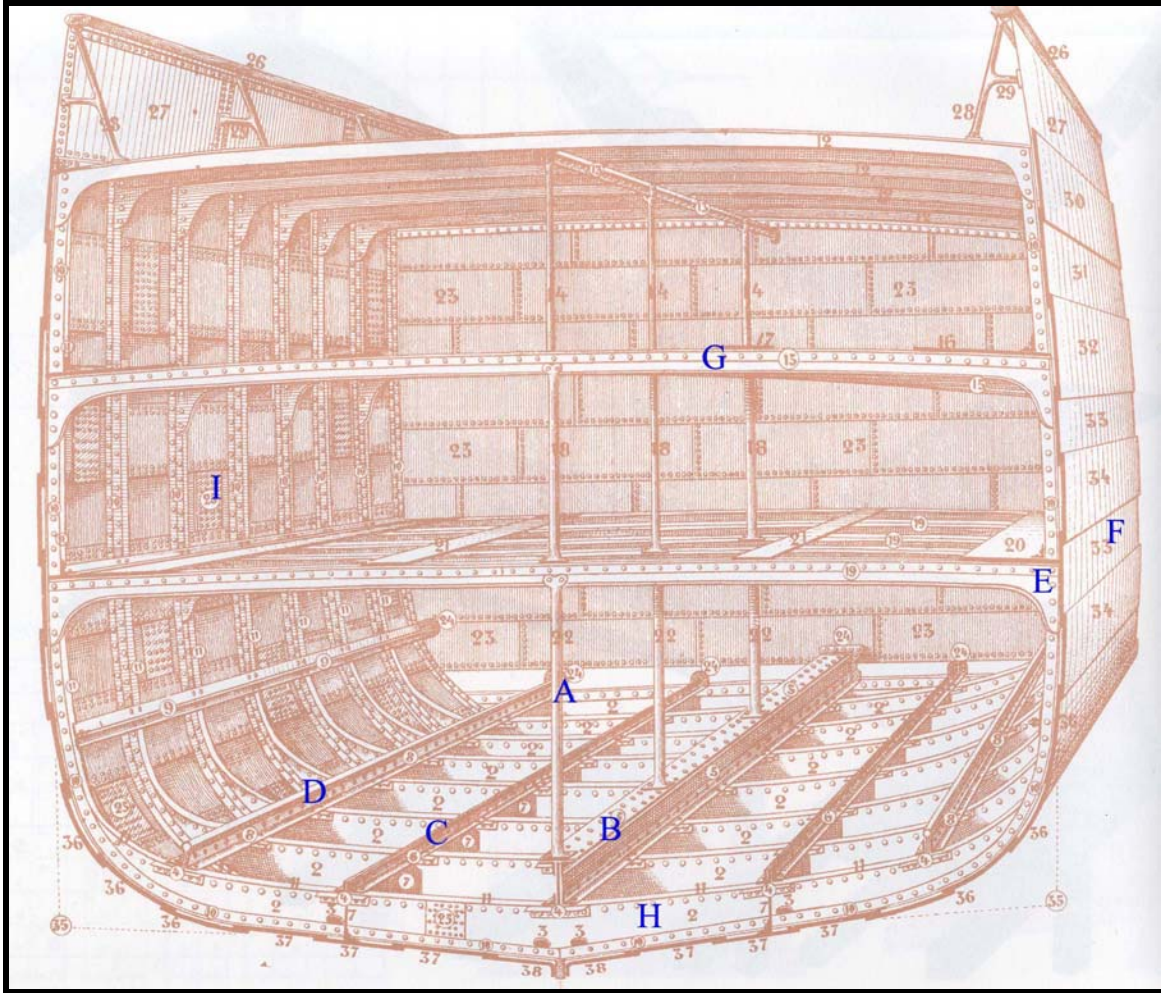


Figure 2.2: Riveted iron ship. A: Pillar, B: Keelson, C: Sister keelson, D: Bilge stringer, E: Angle bar, F: Outer plating, G: Deck beam, H: Floor, I: Butt plate (Modified from Kihlberg 1972:30).

Deck Structures and Rigging

Deck structures on iron ships, for the most part, remained relatively unchanged from wooden and composite ships. Iron ships were often built with wooden decks, and wooden superstructure, such as deck houses located on the main level. Similar deck machinery, including capstans and windlasses, was used on wooden and iron sailing vessels (Souza 1998:49-53). Likewise, the same types of anchors, chains, and other ground tackle could be found on wooden, composite, and iron ships.

Rigging on iron ships differed greatly from wooden ship rigging (Greenhill 1993b:79; Underhill 1988). Iron wire rigging began in the early 19th century when chain and linked iron rods were used for standing rigging (Greenhill 1993b:79). Reduction in weight, durability, and strength were benefits of iron rigging, and with the support of standing rigging, “less bulky” masts were used (Greenhill 1993b:80). This technological development gave iron ships a distinct advantage over wooden ships by decreasing maintenance over time and reducing the top-weight of vessels.

By studying the structure of iron hulls, it can be seen that their construction was similar to large wooden hulls in order and configuration. Both were built frame first, with longitudinal and transverse supports. Iron hulls were built more quickly than wooden ships by industrializing the build process and reducing the amount of specialized skills required (Gardiner 1993; MacGregor 1988b; Underhill 1988). Along with benefits of relatively quick construction, practical benefits also served as a major factor in the increase in iron barque tonnage. Iron increased the overall strength of the hull, while decreasing the weight of the ship. The greatest benefit of this characteristic was increased cargo weight and cargo capacity. Cargo types divided between ship types, and sailing and steam ships’ roles became defined by cargoes carried.

Sailing Iron Ships during the Late 19th Century

The introduction and development of steam technology in ships had a significant effect, both positive and negative, on the sailing shipping industry (Gould 2000:238-264; Underhill 1988:11). As steam vessels began to prove their superiority in speed and reliability, many shipping companies chose to direct services requiring quick deliveries to newly built iron steam vessels (Henning and Henning 1990). Cargoes of raw materials that could be transported slowly were designated for sailing ships, and passengers and perishable cargoes were reserved for steam vessels. The division in the shipping industry mirrored the separation between sail and steam technology.

Types of Cargoes

Iron barques of the late 19th century were useful in the shipping industry as reliable, bulk carriers, especially for dry cargoes between foreign ports. These cargoes included traditional bulk cargoes of timber, grain, wool, cotton, guano, and coal (Derry 1973:119). Sailing ships continued to be profitable for ship owners, because the relative low cost of maintenance was far below the earnings from a single voyage (Drake 1995:240-241).

In conjunction with the types of cargoes that iron barques carried, certain routes were often designated for sailing iron ships of the late 1800's. Williams and Hutchings (1992) state that iron barques were used for long voyages from Europe to India, the West Indies, South America, and Australia. Though wooden ships of the same period were faster and did not corrode, iron ships were preferred because less time and money were needed to turnover ships between voyages (Williams and Hutchings 1992:130). Iron ships were also competitive with early sea-going steam vessels because of their cargo capacity (Henning and Henning 1990:136-137)

During the late 19th century, when sail and steam co-existed in the shipping industry, sail remained as profitable as steam by carrying larger cargoes on each voyage. Sailing ships' cost per ton-mile of cargo was independent of the distance traveled, while steam vessels' costs increased with distance. Longer voyages carried greater volumes of deadweight in the form of coal, which also occupied valuable cargo space (Henning and Henning 1990:136). Reduced coal consumption through more efficient steam engines was the technological advancement in steam vessels that enabled them to overtake sailing ships in the shipping industry (Henning and Henning 1990:137). Though steam vessels' greatest benefit was their speed of delivery, cargo capacity proved to be a more important factor for choosing a ship type than speed (Ojala 1997). If ship owners could make the same profit margins using sailing ships carrying bulk cargoes, then there was no economic benefit to adopting an expensive and potentially risky new technology, such as steam power (Ojala 1997:122).

Though sailing iron barques remained profitable into the early 20th century, it was inevitable that steam-powered vessels would dominate transporting of all cargo types. Shipping by sailing ship continued in some countries, with ship owners focusing on cargo types that enabled them to profit because of their ships' large cargo capacity. These ships were often old and in need of major refittings rather than the constant minor repairs that kept them sailing.

Examples of Late 19th-Century Sailing Ships

In North America and the Caribbean, many of these old iron ships continued to be successful as tramps carrying cargoes of lumber and other heavy bulk goods. Tramp shipping refers to merchant shipping on vessels not engaged in regular trade, but rather taking on freight wherever available (Paasch 1977:296). The age, condition, and smaller crew size of these vessels made many ships prone to disaster at sea, especially in areas of strong hurricanes and dangerous reefs. This section of the thesis will discuss three sailing iron ships that operated under the Norwegian flag and participated in similar shipping activities in the late 19th century. *Catharine*, *Lofthus*, and *Glamis* have been studied historically and archaeologically. They represent the problems of aging, sailing ships that served the bulk cargo shipping industry, and may possibly provide insight into ideological views of sailing ships during the Age of Steam.

Catharine

Catharine was a late 19th-century wooden merchant ship later converted into a composite ship. Originally named *Eliza*, *Catharine* was built as a wooden, full-rigged ship for the Canadian lumber industry between 1868 and 1870 (Burns 1999:10). The University of West Florida's Archaeology Institute under contract from the National Park Service's Gulf Islands National Seashore acquired archaeological and historical information about *Catharine*. Located just off Pensacola, Florida, in the Gulf of Mexico, the remains of *Catharine* are detailed in Jason Burns' (1999) thesis. My interest is in *Catharine*'s role as an aging composite ship attempting to serve Norwegian owners as a tramp shipper.

After serving the Canadian lumber industry, the ship was "sold to foreigners" on February 15, 1871, less than four months after its maiden voyage (Burns 1999:14). The new British owners quickly made structural changes that most likely included the composite iron components recorded by the archaeological investigation (Burns 1999:14-15). Composite ships made of wooden hulls with iron reinforcements were not built in large numbers; because of their blended features, they possessed both benefits and problems of later iron ships (MacGregor 1993:34).

Catharine's hull was wood with yellow metal sheathing (Burns 1999:85). According to Ville (1993:56-58), metal-sheathed wooden ships were better protected than iron hulls because

the copper sheathing resisted marine corrosion. Early iron ships corroded quite quickly, but the galvanic reaction between iron and copper made copper sheathing impractical (Ville 1993:56). Wood vessels like *Catharine* needed metal sheathing to protect them from degradation caused by marine organisms.

Composite ships' internal framing was nearly as strong as iron ships. They were less expensive to construct, and also lighter than entirely wooden ships, while needing fewer repairs (Ville 1993:58). Because composite ships were built on wooden ship designs, many terms for wooden structures carried over to composite and iron ships (see Table 2.1). Composite ships had the internal strength of iron, and with wooden planking, copper sheathing could be added to protect the hulls. Metal framing also increased cargo capacity by reducing the size of internal components (MacGregor 1993:35). *Catharine's* long life as a merchant sailing ship is probably due to the composite hull's strength.

According to Burns (1999), *Catharine* was intended to serve the Pensacola timber industry. Pensacola already had developed a strong Norwegian community in what is now known as "Little Norway," and during the late 1800's, the city continued to attract Norwegians for employment in its booming timber industry (Burns 1999:34-36). The Norwegian owners of *Catharine* sent the ship to Pensacola after purchasing it in 1894 to profit from shipping timber (Burns 1999:36). Upon arrival near Pensacola, the ship met a violent storm that caused it to run aground on a sand bar. Unfamiliar waters coupled with dangerous seas ended *Catharine's* service to the Norwegians, while permanently making the ship part of Pensacola's maritime culture (Burns 1999).

The significance of composite ships, like *Catharine*, is that their role as bulk carriers parallels that of iron barques. *Catharine* was an old sailing ship that had undergone several refittings. After being reclassified as a bulk carrier under Norwegian ownership, the ship continued to sail despite constant repairs (Burns 1999:25). Like iron barques, these composite bulk carriers continued to be profitable for Norwegian owners, often at the expense of the ship itself. American timber drew Norwegian business, even as European ships wrecked in great numbers in American waters. These ships were readily available for cheap purchase, and they often were profitable on their first successful voyage (Drake 1995:240). Perhaps the abundance of wrecked sailing ships of the late 19th century is an indication of their expendability, as evident by the next example, *Lofthus*.

Lofthus

The Norwegian-owned, sailing barque *Lofthus* wrecked off the coast of Florida in the 1890's while participating in the Pensacola timber industry. Historical research gathered by the Marine Archaeological Research and Conservation Reporting (M.A.R.C.) organization shows *Lofthus* was an iron barque built in 1868 in Sunderland, England, originally named *Cashmere* (M.A.R.C. 2003). The archaeological study of *Lofthus* was conducted by the Maritime Archaeological and Historical Society (MAHS) during the summer of 2002 in efforts to nominate the wreck as a preserve within Florida's shipwreck preserve system.

Until 1897, *Cashmere* operated successfully in the East Indian trade for the Liverpool Shipping Company. It was rigged as a barque, carrying three masts on a riveted iron hull. False gun ports were painted along the sides of the outer hull in an effort to prevent attacks from Indian Ocean pirates (M.A.R.C. 2003:11). *Cashmere* was sold to Norwegian owners in 1897; the same year large increases in insurance costs for sail tonnage were made in London (M.A.R.C. 2003; Gardiner 1993:92). After renaming the ship *Lofthus*, its owners sent it to America to profit in the timber trade. At this point, *Lofthus* was operating in its thirtieth year as a bulk cargo carrier, and continued to make long voyages as evident by its final delivery. On February 8, 1898, *Lofthus* wrecked off the Atlantic coast of Florida in route from Pensacola to Buenos Aires with a cargo of lumber. Despite assistance from a sea-going tug, the ship was stranded and destroyed by the continuous wave action (M.A.R.C. 2003).

Like *Catharine*, *Lofthus* wrecked off the coast of Florida in its first year of service for a Norwegian owner. The 223-foot-long iron ship now rests on a sandy bottom with its bow pointing northeast in a 240 x 45 feet area. According to site reports, the site included several hull fragments with iron deck beams connected to angle bars spaced 1.2 meters (3.93 feet) apart. These transverse deck beams were connected by longitudinal iron deck stringers. Curving iron supports, possibly side stringers, were also present and connected to deck beams that were spaced 1.2 meters (3.93 feet) apart (M.A.R.C. 2003:8). Hull features noted on the eastern side of the site included "L-beams," or angle bars, articulating with "side stringers" (M.A.R.C. 2003:9-10). The only rigging features noted were two portions of an iron mast (M.A.R.C. 2003:9).

Though structural remains of *Lofthus* are scattered and few in number, the features of its iron hull are comparable to *Glamis*. The final section of this chapter introduces *Glamis* as

another Norwegian-owned sailing iron barque, and is followed by a chapter describing the probable *Glamis* wreck site and recorded features.

Glamis

Like *Glamis*, many large sailing ships, including wooden, composite, and iron ships, were sold for fractions of their cost of construction (Drake 1995:240). Small ship-owning companies opted for bulk cargo markets, often in between ports separated by great distance. *Glamis* operated as one of these bulk cargo carriers in the Western Caribbean. Though little has been found to document its voyages under Norwegian ownership, it is known that the ship operated under Norwegian flag from 1905 to 1913 prior to wrecking off Grand Cayman (Leshikar-Denton and Ho 2004) (Figure 2.3).

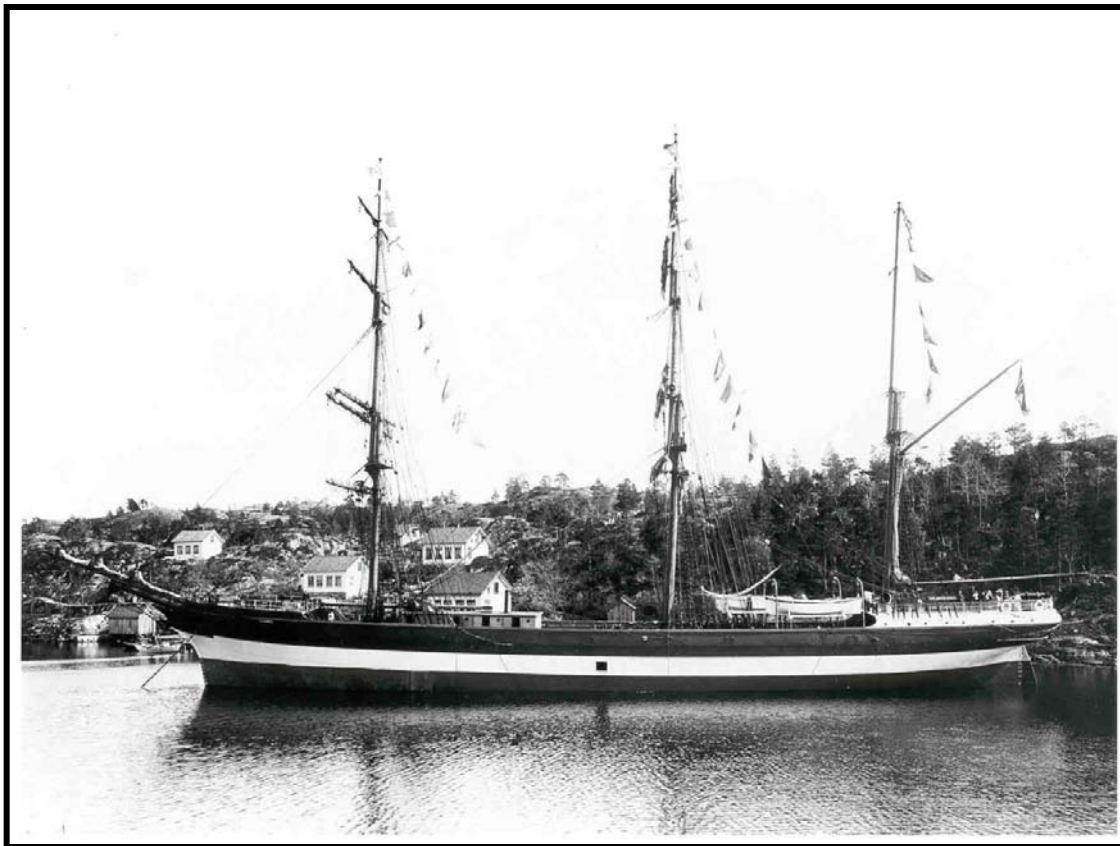


Figure 2.3: 1878 photo of *Glamis* in Gravesend. (Photo courtesy of Norwegian Maritime Museum).

For nearly eight years, *Glamis*' Norwegian owners profited from their successful cargo carrier. During its last voyage from Savanna-la-mar, Jamaica, to Russia, *Glamis* carried a cargo of logwood. Like *Catharine* and *Lofthus*, *Glamis* had remained in service for 37 years, but it maintained a profitable role in the sailing shipping industry. *Glamis* was noted for its speed early in its career, but endured great damage prior to being sold to Norwegian owners in 1905 (Anonymous 1951). *Glamis* serves as an example of a Norwegian-owned vessel that remained operable for a longer period of time than most sailing iron barques (Figure 2.4).



Figure 1.4: Margaret Leshikar-Denton on probable *Glamis* wreck site. (CINM photograph by A. Mustard).

Conclusion

Iron shipbuilding technology experienced a transition in the late 19th century. By the 1860's, iron ship building increased substantially, while steam technology steadily improved efficiency (Ville 1993:61). Dry bulk cargoes allowed larger sailing vessels to continue to be profitable for those owners who chose to continue operating sailing ships. The three examples presented in this chapter represent numerous old sailing ships operating late in their careers as long distance shippers.

Souza's (1998:112-121) application of risk calculations and probability is appropriate in analyzing how profits and losses were made from the use of aging sailing ships during the Age of Steam. I suggest that if profits from a single voyage exceeded the purchase price of several old sailing ships, then the loss of some ships was a relatively low economic risk. I propose that the reason some Norwegian ship owners purchased and lost several sailing ships during the late 19th and early 20th centuries is because they viewed sailing ships as expendable and abundant resources. Losing some ships in their fleet would not cause their shipping business to fail. Although there are other archaeologically studied iron shipwrecks, such as *Killeen* in the Dry Tortugas (see Gould 2000:238-249), the examples I selected share a similarity in nationality at the time of wrecking, and represent certain Norwegian ship owner's use of these types of ships as an economically expendable resource. This argument will be discussed further in Chapter 4, after the archaeological and archival study of *Glamis* is presented in Chapter 3.

CHAPTER 3

SHIPWRECK SITE DESCRIPTION

Glamis wrecked on the East End of Grand Cayman in 1913 according to historical documents. In 1980, as part of the Institute of Nautical Archaeology (INA) survey of the Cayman Islands under the direction of Roger C. Smith, a shipwreck site was recorded as GC013 roughly where *Glamis* was reported to have wrecked. According to the original report submitted to the Cayman Islands Government, the site included several large iron hull fragments, three anchors, and a wide scatter of debris (Leshikar-Denton and Ho 2004). The site became known for lobsters by local fishermen, and it has been visited by various recreational dive operations on the East End of Grand Cayman. During the Cayman Islands Maritime Heritage Trail project research for underwater archaeological preserves, GC013 was identified as a candidate for the first shipwreck to be incorporated on the underwater maritime trail.

The Cayman Islands Maritime Heritage Trail is based on existing models, including Florida's underwater archaeological preserves. Della Scott-Ireton of Florida's Bureau of Archaeological Research's Underwater Archaeology office and Margaret Leshikar-Denton of the Cayman Islands National Museum (CINM) conceived and coordinated a Maritime Heritage Trail that involved the partnership of multiple Cayman Island government departments. The Trail seeks to identify and explain important historical sites around all three islands of the Cayman Islands. Phase 2 of the Trail includes underwater preserves that incorporate significant submerged sites. *Glamis*, the first shipwreck site proposed for the Trail, was selected due to its potential effectiveness as an interpretive dive site and because of its historical significance. Leshikar-Denton invited me to participate and collaborate on the *Glamis* Mapping Project.¹

¹ The *Glamis* Mapping Project is discussed in detail in Volume 1 of CINM's Shipwreck Report Series *The Probable Glamis Site: Archaeological Mapping and Potential for a Shipwreck Preserve*, by Leshikar-Denton and Ho. Material in this thesis, including feature descriptions, site descriptions, previous INA research and archival documents appear in the CINM report, and all information in this thesis regarding the probable Glamis site is included in that report.

Archaeological Investigations of the Wreck site

Mapping Project

In cooperation with the Cayman Islands Maritime Heritage Trail Partners, the CINM directed the *Glamis* Mapping Project with support from Florida State University (FSU), the Department of Environment (DOE), the Reef Resort, Ocean Frontiers, and other dive charters on the East End. The project's goal was to create a site plan that would include all of the major features of the site and effectively delineate the shipwreck site. Support for the November 2003 field operations included Cayman Airways, DOE's 45 foot RV *Sea Keeper*, Ocean Frontiers' 38 foot *Nauticat* and 38 foot *Ocean Hawk*, lodging at the Royal Reef Resort, and divers from DOE, Ocean Frontiers, Cayman Dive Lodge, and Morritt's Tortuga Club. FSU's students included the author as assistant field director, one graduate student, and one undergraduate student to aid in the direction of scientific field operations. FSU's Academic Diving Program (ADP) provided SCUBA gear for FSU students (Figure 3.1 and 3.2).



Figure 3.1: Gear aboard the DOE's RV *Sea Keeper* (CINM photograph by Bert Ho).



Figure 3.2: Ocean Frontier's *Ocean Hawk*. (CINM photograph by Bert Ho).

With less than two weeks to complete the project, each diver on each dive had multiple tasks. Equipment used included multiple slates with mylar drawing film, various measuring tapes in units of tenths of feet, and compasses for orientation on site. Two, two-hour dives were completed by each diver daily during the first five days, with post-processing work done during the evenings and on bad weather days. Pencil drawings made during dives were redrawn to scale, and measured and triangulated features were added to the site plan each evening (Figure 3.3).

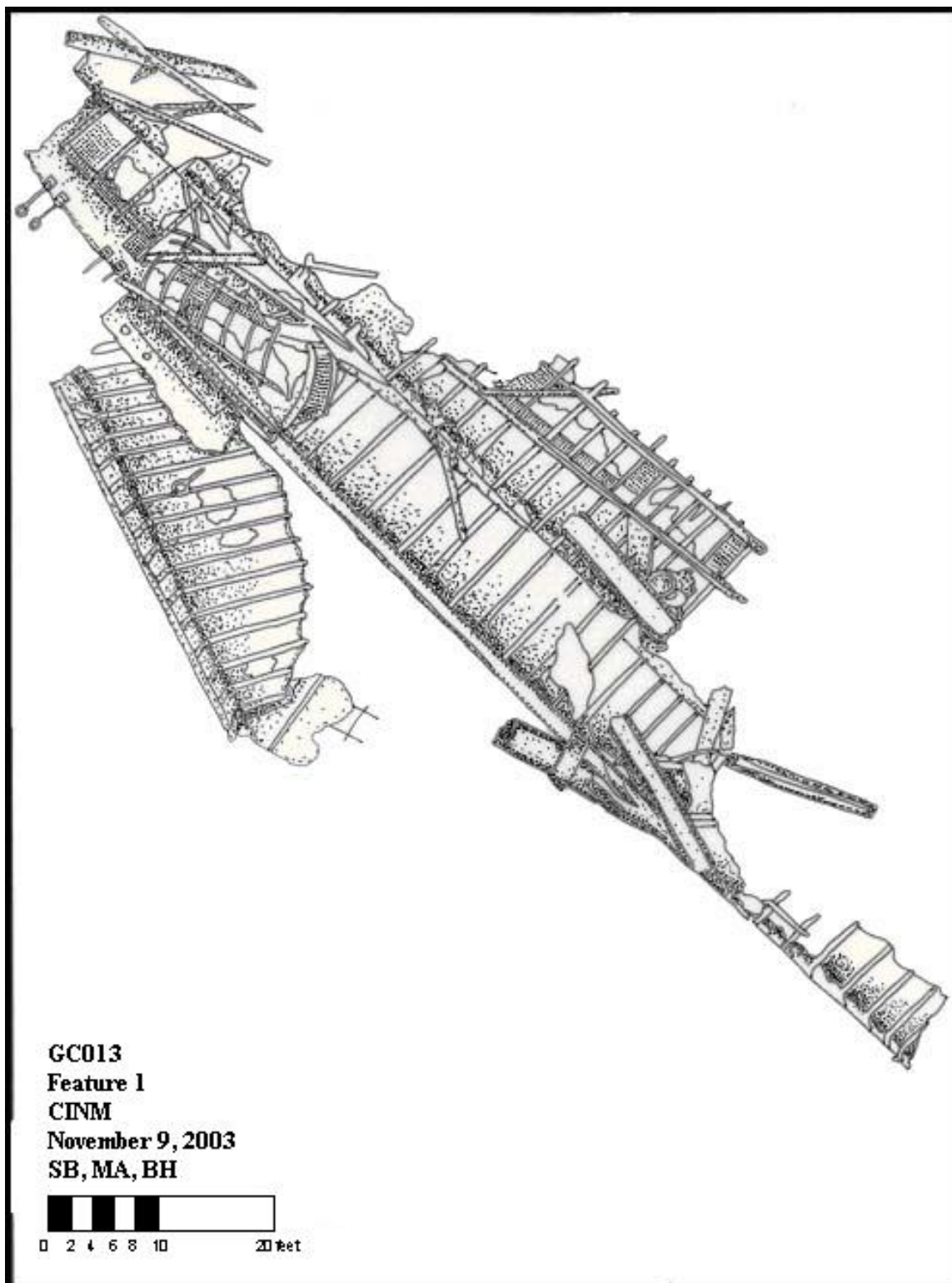


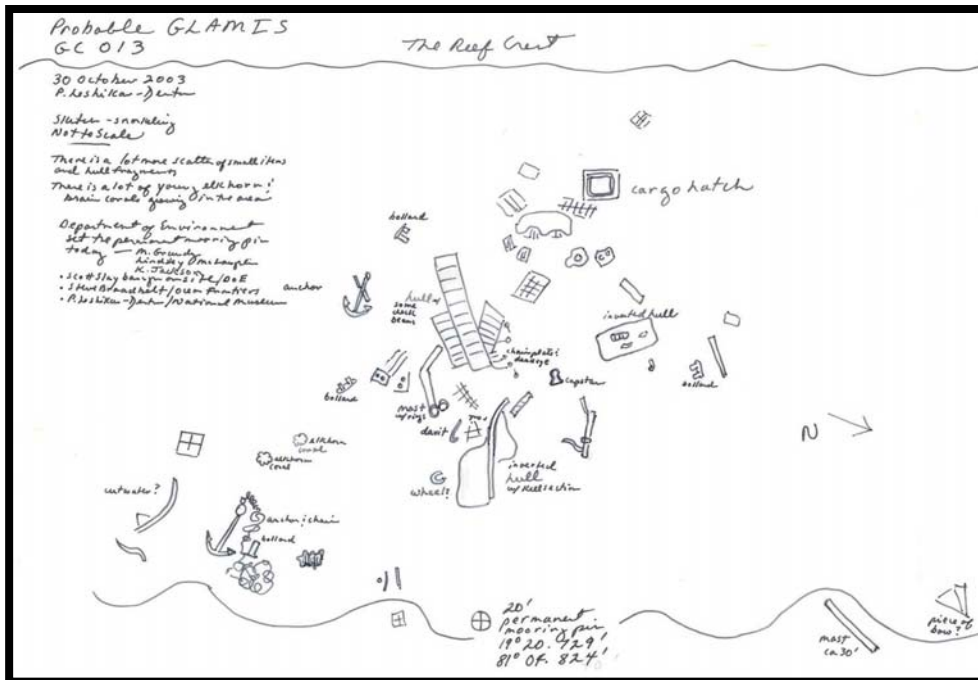
Figure 3.3: Center hull section, redrawn to scale. (Courtesy of CINM)

Photographs taken with Canon Digital Elphs S200 and S230 cameras supplemented measurements used for scale drawings of features.

Methods and Logistics

The most challenging feature of the shipwreck site was the large area of the debris scatter. Wreckage extended nearly 360 feet east to west, and approximately 170 feet north to south. Other features identified as parts of the bow and jibboom were located in deeper crevices approximately 150 feet further east, with possible hull components and superstructure closer to shore inside the reef. In order to effectively map the large area, a baseline was oriented along the East-West axis and made long enough to incorporate the site. Two 150-foot measuring tapes were mated together to form the baseline, and they were secured approximately every 10 feet. The baseline was positioned in the center of the main wreckage, close to the larger features. This enabled more accurate measurements to the large hull fragments, by decreasing the distance between the features and the baseline. Smaller features further from the baseline were triangulated to the larger hull features, and placed into the site plan.

Once the baseline was laid, offset measurements were taken to accurately plot the features on the site plan. Prior to the mapping project, a rough sketch of the site was drawn by Leshikar-Denton. The research team used this sketch to properly plan each day's work (Figure 3.4). Divers were directed to work areas and assigned features to record during pre-dive briefings. Teams of two or three including at least one archaeologist measured and drew features individually, often recording multiple features per dive. Despite strong surges and a stiff current, measurement accuracy was achieved by placing multiple divers along the measuring tape to reduce slack. Perpendicular transects were completed with compass bearings, after determining the iron wreckage had little to no effect on the accuracy of compasses.



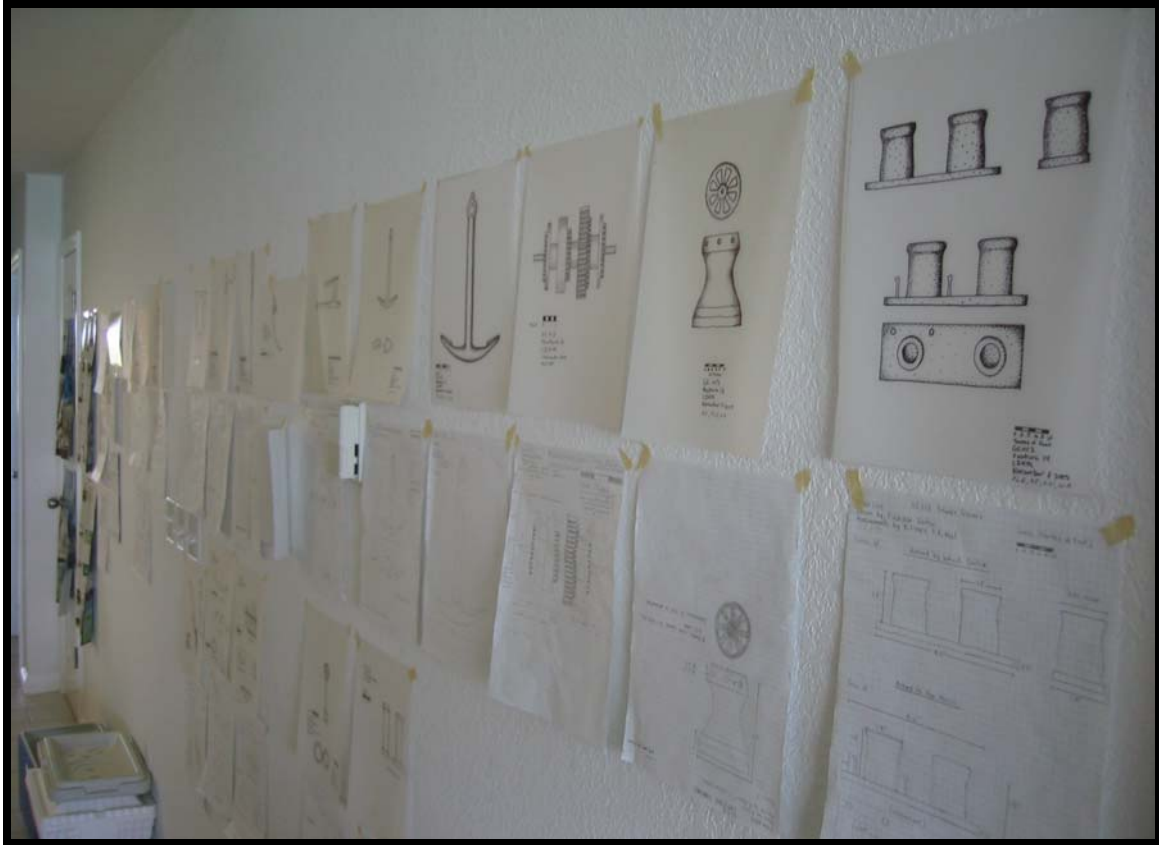


Figure 3.5: Project headquarters, scale drawings of features. (CINM photograph by Bert Ho)

Despite the limited number of days on site, valuable information was gathered for creating an accurate site plan. Measurements and features provide physical evidence for comparison with historical information that strongly supports the identification of this wreck site as that of *Glamis*. Iron construction features and the debris orientation support the site identification as an iron barque of the late 19th century, wrecked with its stern on the reef. The following section will describe the most diagnostic features; all feature descriptions are provided in Appendix B.

Feature Descriptions

Hull Features

Hull features were fragmented and disarticulated. Larger features included numerous frames, angle bars, and outer plating, while some smaller features consisted of frames with no plating. Hull components were the most abundant structures of the ship remaining on site, including areas of the keel, keelson, bilge, and sides of the hull (Table 3.1).

Table 3.1: Hull features

Feature Name	Feature #	Length	Width	General Location
Largest hull section	1	98.2 feet	45 feet	Center of site, on baseline
Inverted keel section	2	80.0 feet	36 feet	NE of center
Inverted hull	3	28.6 feet	15.7 feet	N of center, W of #2
Hull fragment	4	12.3 feet	11.0 feet	SE area of site
Cutwater	8	24.6 feet	0.7 feet	SE area of site
Possible bow section	18	20.6 feet	13.5 feet	Extreme NE area of site
Hull fragment-bilge	26	18.2 feet	11.8 feet	NW of center of site
Keelson fragment	29	16.0 feet	1.3 feet	NW side of site

Feature 1 was the largest coherent section and was located in the center of the site. It consisted of three levels of port side deck supports, lying diagonally across one another (Figure 3.6).



Figure 3.6: Feature 1, large hull section located in center of site. (CINM photograph by Dan Schaar)

Each piece contained multiple frames, angle bars, and outer hull plating. Feature 1 hull components were located on the port side of the vessel, and the angle bars supported the main deck and internal poop deck. Four chainplates and two iron straps were also located on the northeast side of Feature 1 on the gunwale. Frame spacing, from center to center, was consistently 4.4 feet, and each arm of the angle bars extended 4 feet from the bend. Possible pillars were scattered throughout the central area of the feature, ranging from two to ten feet long. A small, curved hull section with seven frames was found lying on the western side of the feature. Its original position may have been at the turn of the bilge. We identified riveted butt plates between frames where outer hull plating remained. Areas of the plating had large holes, and all edges were jagged and rapidly oxidizing.

Feature 2 was identified as an inverted portion of the hull with a segment of the keel and keelson. It was found with the outer face of the external plating facing upwards, with the keelson protruding from the west end (Figure 3.7).



Figure 3.7: Feature 2, inverted hull section with keelson. (CINM photograph by Bert Ho)

The length of the attached keel was 78.3 feet, and another disarticulated keelson segment measured 21.1 feet. Garboard strakes extended to both sides of the centerline, with widths of approximately 4.4 feet. Outer hull plating was fastened clinker-style, as indicated by the overlapping seams. Remains of a possible bilge or sister keelson also extended from underneath the feature.

A bow feature identified as a portion of the cutwater was located in the southeast area of the site. Feature 8's total length measured 24.6 feet with a consistent width of $7/10^{\text{th}}$ of a foot (Figure 3.8).



Figure 3.8: Feature 8 Cutwater. (CINM photograph by A. Mustard)

The shape of the cutwater consisted of a gradual curve, with a slight “S-curve” near the point. Fragments of jagged bow plating connected near the point with two riveted butt straps as reinforcements. Another bow feature, Feature 18, remained in the crevices on the extreme northeast side of the site. Five cant frames decreasing in angle formed a point possibly below which a bowsprit located. This feature measured 20.6 feet in length and 13.5 feet at its widest point. Frames were spaced 2.1 feet from center to center with outer plating present between frames.

Other hull features included portions of the bilge, hull frames with outer plating, and scattered remnants of deck beams and pillars. Many of the smaller hull fragments were not measured and plotted in the site plan, because of limited time on site and their lack of diagnostic features.

Table 3.2: Deck Machinery and Anchor features

Feature Name	Feature #	Length	Width	General Location
Cargo hatch	5	10.6 feet	11.6 feet	W side of site
Anchor with chain	10	10.6 feet	7.5 feet	E side
Anchor with stock	11	9.8 feet	7.9 feet	S of center
Windlass	12	6.2 feet	Varying	E, by Datum A
Capstan	13	2.9 feet	1.8 feet	N of center
Bollards/Bits	14,15,19,33	Varying	Varying	Various locations

Deck Structures, Machinery and Anchor Features

A variety of deck features were found throughout the wreck scatter. These features included a large cargo hatch on the west side of the site, with a base measuring 10.6 feet by 11.6 feet. Its coming extended 1.7 feet above the surrounding lip or base (Figure 3.9).

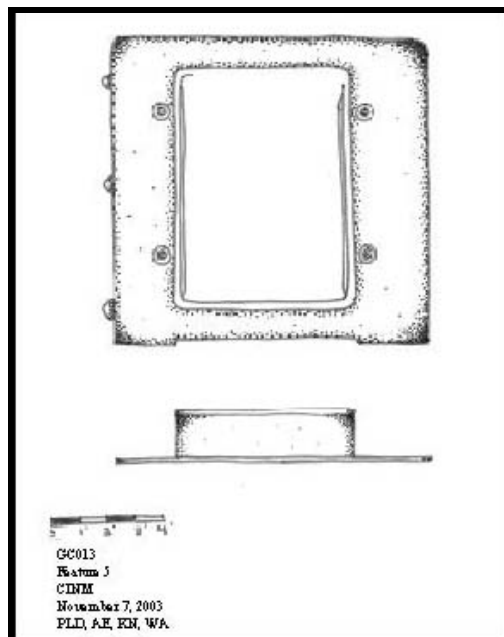


Figure 3.9: Cargo hatch on west side of site.

(Courtesy of CINM)

The base contained four rings, two on opposite sides, which measured 1.3 feet from the hatch walls. An indentation on the north side of the base extended 6.4 feet and was located at the center of the base edge. The actual hatch opening measured 8.4 feet by 6.4 feet and was positioned in the center of the base.

A total of four bollard sets and one single bollard were found around the site. Bollards, or bitts, served as mooring points on large ships, like cleats on small vessels (Figure 3.10).



Figure 3.10: Bollard pair, scale is two feet long. (CINM photograph by A. Mustard)

Mooring lines were wrapped around the cylindrical bollards and secured when ships were docked. The site included three different types of bollards, including paired bollards, staghorn bollards, and a single bollard. Feature 14, 15, and 19 were even-paired bollards, which consisted of two barrels about 1.3 feet in height and 1.2 feet in diameter, standing on a base approximately 4.5 feet in length. A staghorn bollard, Feature 38, also has two barrels, but one barrel is shorter than the other and has a cylindrical extension extending horizontally. The single bollard, Feature

33, consisted of one barrel on a rectangular base measuring 2.7 feet long and 1.2 feet wide. These structures were commonly located near the bow and wherever running lines needed to be secured, such as lines securing life boats (Kihlberg 1975:66).

Two mechanical features were found east of the center of the site. Feature 12 was identified as a mid to late 19th-century windlass, similar to an Emerson and Walker patent windlass design (MacGregor 1984:116) (Figure 3.11).



Figure 3.11: Windlass, scale is two feet long. (CINM photograph by A. Mustard)

It was located on the east end of the site near an anchor with chain. Windlasses were used to mechanically raise heavy objects including anchors and yards, by translating rotational power from a capstan with its large gears. The capstan, Feature 13, was located in association with deck frames near the northern center of the site (Figure 3.12).



Figure 3.12: Capstan, scale is two feet long. (CINM photograph by A. Mustard)

It measured 2.9 feet in height, 2.6 feet in base diameter, and 1.8 feet in drum head diameter. The iron and wood barrel was complete with socket holes spaced evenly around the rim of the drum head.

The anchor, Feature 10, associated with the machinery lay next to a large pile of stud-linked anchor chain. It was located on the east side of the site, amidst a variety of soft and hard corals (Figure 3.13).



Feature 3.13: Anchor with chain pile.(CINM photograph by A. Mustard)

Because no stock was present, the anchor lies relatively flat on the bottom. It measured 10.6 feet in length and 7.5 feet between the bills. The shank's width was 1 foot at the crown and tapered to $\frac{7}{10}$ ths of a foot at the stock ring. Each fluke measured 1.8 feet wide and 2.7 feet long, and the inner diameter of the stock ring was 1.2 feet. A large pile of encrusted anchor chain was just east of the anchor and two sections of chain extended to the west 50 feet and southwest 25 feet. The pile, approximately 20 feet long and 10 feet wide, stood nearly 5 feet off the bottom. Each stud link measured 1 foot long and $\frac{7}{10}$ ths of a foot wide and was oval-shaped with a bar crossing the middle. A second anchor, Feature 11, was found south of the center of the site, with its iron stock in place (Figure 3.14).



Figure 3.14: Author with iron-stocked anchor. (CINM photograph by Dan Schaar)

This anchor leaned on the ball-end of its stock, raising it approximately 10 feet above the bottom. It measured 9.8 feet in length and 7.9 feet wide between bills, with a non-tapering shank 1 foot wide. A stock ring was also attached. Its inner diameter was 1.5 feet. The stock measured 9.4 feet in total length, but portions of the distal end were heavily eroded.

Table 3.3: Rigging and Spar.

Feature Name	Feature #	Length	Width	General Location
Jibboom or Bowsprit	7	25.0 feet	1.4 feet	E, in crevices
Open mast/yard ring	23	3.5 feet	1.3 feet	E end of site
Single spar ring	24	1.2 feet (diameter)		E end of site
Chain plate	31	3.8 feet	0.8 feet	Attached to Feature 1
Double yard, topgallant, or royal mast ring	32	2.8 feet	1feet and 0.85 feet in diameter	E side, near Datum A
Main Mast	34	21.9 feet 19.9 feet	2.2 feet (diameter)	Center of site

Rigging and Spar

Rigging and spar features included portions of the main mast, numerous yard rings, and a possible jibboom or bowsprit. Two segments of the main mast, Feature 34, were found in the center of the site alongside Feature 1. The sections were 21.9 feet and 19.9 feet long, with a 2-foot gap in between the break. Each section was hollow with a diameter of 2.2 feet. A large paired mast ring connected to the larger segment, with several single rings at various locations along both mast sections. A third portion of a mast was also noted, but accurate measurements were unable to be taken because a portion of the mast was underneath Feature 1.

Yard rings (Feature 23 and 24) of various diameters were found on the eastern side of the site. Rings found included clasped-rings and single rings, with some of the clasped-rings open. Their outer diameters were 1.2 to 1.3 feet, with a thickness of 1/10th of a foot. A single, paired ring, Feature 32, was found consisting of two rings of different diameters, connected to form two

hoops. The total length measured 2.8 feet, with interior diameters of 1 foot and .85 feet. No associated yards or masts were found nearby.

Feature 7 was identified as a possible jibboom or bowsprit because of the number of rings found along the shaft. It measured 25 feet in length, with a diameter of 1.4 feet throughout, and was found in the extreme eastern side of the site within crevices. Five rings that served as attachment points for stays were found on the feature. A larger ring with a clamp was located 5.7 feet from the east end of the feature, with a width of $4/10^{\text{th}}$ of a foot. No spar rings were found in this area of the site, but a possible bow section was found nearby.

Table 3.4: Small features

Feature Name	Feature #	Length	Width	General Location
Wheel	16	4 feet (diameter)		E of center of site
Lifeboat davit	17	12.0 feet	5.0 feet	E of center of site
Wheel center-brass	20	1.4 feet		E side of site

Small Features

Some small features were recorded because of their unique form and possible significance. On the east side of the site, just south of Feature 2, a probable ship's wheel was recorded. Its outer diameter was 4 feet, and a segment of its circular form was missing. Inside the wheel feature, four small protrusions were spaced an equal 1.6 feet around the inner curve (Figure 3.15). A possible wheel center was also found on the east side, near Feature 2. It measured 1.4 feet in outer diameter with a thickness of $4/10^{\text{th}}$ of a foot. Three small protrusions spaced equally apart were present around the outer ring. Keith Neale of the DOE first discovered the feature was brass because of its coloration.



Figure 3.15: Possible ship's wheel, scale is two feet. (CINM photograph by A. Mustard)

Feature 17 was identified as a lifeboat davit. It measured 12 feet in height, curving outward on one end to a width of 5 feet. The davit shaft had a diameter of $\frac{3}{10}$ ths of a foot with a possible break on the straight end of the shaft. It resembles a J-shaped davit, also referred to as a radical davit (Kihlberg 1975:66).

Conclusion

Evidence from the mapping project, especially the identified features and their locations, indicated an iron sailing ship wrecked stern first on the reef. Historical reports discuss an iron barque, named *Glamis*, wrecked off the East End of Grand Cayman in roughly the area of the site investigated. Local information gathered as part of INA's 1980 investigations included the name *Glynnis* as the identity of the shipwreck. Further investigations by the CINM produced no known ships by the name *Glynnis*, leading to the belief that the shipwreck was actually the similarly spelled *Glamis* (Leshikar-Denton and Ho 2004). What has been presented in this thesis so far about *Glamis* is necessary to understanding the archaeological site and what remains today

(Figure 3.16). In the following chapter, *Glamis'* past will be discussed in the context of the shipping industry of the late 19th century, and specifically how Norwegians utilized aging sailing ships far into the Age of Steam.

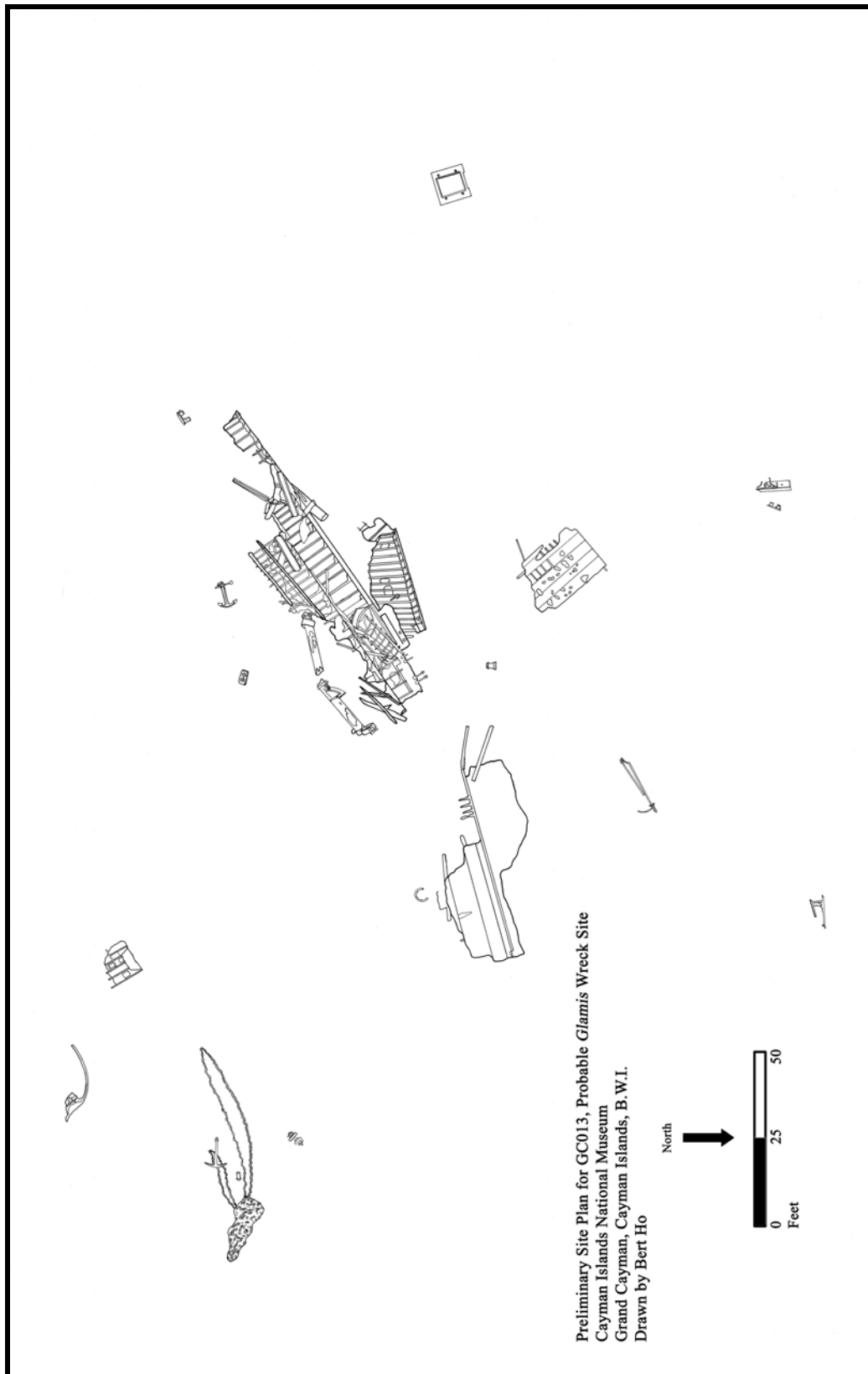


Figure 3.16: Preliminary site plan. (Drawing by Bert Ho)

CHAPTER 4

HISTORY OF THE NORWEGIAN-REGISTERED VESSEL, *GLAMIS*

Norwegian sailors gained respect for their seamanship and capabilities at sea over several centuries. Though they reached ports throughout the world and achieved economic success during the 18th and 19th century, it was often only as employees of foreign shipping companies (Drake 1995). Foreign companies welcomed skilled Norwegian seamen because of their strong reputation at sea and the acceptance of low wages because of a lack of jobs at home (Drake 1995:239-241). Norway's economic and political situations were in need of reform, and this required a strong nationalistic movement. More importantly, the country needed to be able to sustain its own shipping industry by purchasing, building, and maintaining sailing ships during the onset of steam power in the mid-19th century (Larsen 1948). Economic problems for the Norwegian merchant marine during the mid to late 19th century stemmed from decades of poor government leadership and civil unrest throughout northern Europe (Derry 1957:173-193). Events from the prior two centuries had effects on the development of the worldwide shipping industry, and the success of Norwegian shipping depended greatly upon financial, social, and legislative changes both domestic and foreign. The role of sailing iron ships throughout Europe was influenced by several of these changes, and *Glamis*' role as a Norwegian-owned vessel was to profit during this poor economic period in Norway.

Norway before the 19th Century

As early as the 17th century, Norway began to experience a problem that would continue to deplete its abundance of skilled sailors. Emigration of young Norwegian sailors to Denmark, Great Britain, and elsewhere in Europe prevented the growth of shipping companies within the country (Larsen 1948:304). Reputations as skilled seamen created a high demand for Norwegians throughout Europe, and poverty and lack of employment opportunities in their homeland led to Norwegian sailors accepting low wages and moving to countries with jobs (Derry 1957:160; Larsen 1948).

By the 18th century, the scale of emigration prompted the Norwegian government to forbid its citizens to emigrate (Larsen 1948:330-334). Larsen (1948:331) states that government reforms during the 18th century led to a transformation of the Norwegian shipping industry and helped maintain a steady employment rate for the increasing population. The early years of the century marked a period of economic depression, which deflated commerce and the entire shipping industry. Ships lay idle in every port across Norway, and until the 1740's, much of the country's people experienced poverty and destitution (Larsen 1948:331-332). European revolutions, both religious and political, extended liberal views into Norway and reform became both necessary and inevitable.

The growing discontent with the old bureaucracy and decades of Danish rule provided for a national optimism that supported a more democratic rule of governing. Reforms, freedom of trade, tolerance, and liberalism were all aspects of this new freedom from Denmark, and strong Norwegian nationalistic demands for cultural and economic institutions arose from a new sense of identity and nationalism (Larsen 1948: 343).

By the late 18th century, Norwegian-run shipping companies were in demand across Europe (Derry 1973:116-117). Even with the American Revolution developing into nearly a world war, Norwegian shipping experienced a tremendous growth in prosperity. Tonnage increased, exports increased, and the size of the merchant marine increased from 546 to 844 ships. Perhaps even more impressive than the rapid expansion of Norwegian shipping was that much of the growth came from home-built and home-owned fleets (Larsen 1948:348). For the first time, Norwegian shipping was conducted by Norwegian ship owners employing their countrymen for the economic benefit of Norway.

Continued Growth in the 19th Century

The first seven years of 19th-century Norwegian shipping became known as the “golden age” of imports and exports for the country (Larsen 1948:365). China, India, France, England, and Spain were all heavily traveled markets for the Norwegians, and with the merchant marine increasing to 1500 ships, mostly home-built, the expansion seemed endless. Over the next decade, however, world events had a direct effect upon the prosperity, later decline, and eventual resurrection of Norwegian shipping (Larsen 1948:365).

In 1807, the Napoleonic Wars included a series of events that would drastically affect Norwegian shipping and the future of Norway (Barton 2003; Grab 2003). Norway's involvement in an alliance with Napoleon led to a period of economic and social decline, as well as England's declaration of war on Norway. Commercial shipping between England and Norway ceased, until the Norwegian alliance with Napoleon ended lifting the blockade of merchant ships (Barton 2003; Derry 1957; Larsen 1948).

In 1813, a series of events once again involved Norway, affecting their shipping industry directly. Sweden had established a coalition with England and Russia, based on a promise that Sweden would be given Norway for help in defeating Napoleon (Barton 2003). Once again, a blockade of Norway ensued, preventing the importation of grain. With the public storehouses empty and a failed crop in 1812, the suffering of the Norwegian people was intense. Coupled with increased taxes due to inflation, resentment against the government became widespread amongst the people of Norway. Fortunately for the Norwegians, Napoleon was defeated in October of 1813, and a treaty was signed between Denmark and Sweden in January of 1814. The Treaty of Kiel essentially relinquished all of Denmark's claims to Norway, and for the first time since union in 1380, Norway was free of Danish rule (Larsen 1948).

With the political and social turmoil of the early 1800's in the past, Norway once again experienced a period of population and economic growth (Larsen 1948:373). The merchant marine continued to expand with 2900 vessels by 1840, with an average crew size of only six (Derry 1973:116). The number of large ships also increased, and voyages extended beyond northern Europe and the Mediterranean to the Americas (Derry 1973:116). From 1830 to 1850, the number of ships in the Norwegian fleet increased by 75%, and the carrying trade employed more than one-third of Norway's merchant marine (Petersen 1955:31; Derry 1973:117). During the 1850's, the merchant marine continued to grow from 305,552 to 587,527 net registered tons, exceeding the growth of the rest of the world's shipping as a whole (Derry 1973:117).

Norwegian ships frequented numerous ports and also carried a wider variety of goods. Cargoes ranged from spices and meat to raw timber and hides (Derry 1973:118). After the middle of the 19th century, Norwegian shipping increased rapidly by practicing tramp services, or operating on non-regular trade routes. Staying out of Norway's ports for longer periods of time, Norwegian ships carried freight between foreign ports, often taking on cargoes at the captain's discretion (Petersen 1955:31-32). Economically, this role in the maritime culture of the

1800's provided necessary transport for raw goods from un-colonized areas of the world. In the larger world view, this practice also aided imperialistic nations to create a permanent presence that could later help in the development of foreign colonies.

Sailing ships not only stayed away from home longer, but major maintenance and overhauls of ships were replaced by minor refittings and frequent repairs to keep the ships sailing (Derry 1973:116-120). During the mid to late 1800's, developed or industrialized nations of the world entered into a culture of new industries, including building railroads and expanding to underdeveloped lands. Bulk cargoes of raw materials, coupled with the decrease in restrictive measures on trade, allowed for the sailing shipping industry to flourish before, during, and after the Industrial Revolution. Repairing sailing ships and maintaining them as functioning vessels became vital to shipping companies. New materials that strengthened the hull and increased tonnage became the norm for constructing large ships as ship owners sought to increase their shipments and protect their investments (Derry 1973:118-120).

Improvements in Shipbuilding and Changes in Worldwide Shipping Economics

During the mid to late 1800's, building of iron sailing ships increased dramatically (Gardiner 1993). With variability in cargo, efficiency, and the speed of the worldwide shipping industry, iron sailing ships were in demand, increasing in number and in tonnage carried (Greenhill 1993b:80-81). Aspects of maritime culture improved, such as world charting, lighthouse services, and other navigational aids in restricted or hazardous waters. Perhaps the greatest change to the shipping industry was the introduction of the international electric telegraph (MacGregor 1993:42-51). Ships' arrivals and departures could be known almost instantly across the world, and cargo orders were made ahead of time to expedite the whole shipping process (Greenhill 1993b:85).

Along with continual improvements in the shipping industry, demands for innovation in ship design forced the improvement in the efficiency of large bulk carriers (MacGregor 1984b). Innovations on these sailing iron-hulled ships were mostly concentrated on the decks and rigging. Replacing the round, rotating windlass that had been in use for nearly three centuries, the "Patent" windlass was fixed below the main deck, aft of the bow (MacGregor 1984b:129) (Figure 4.1).

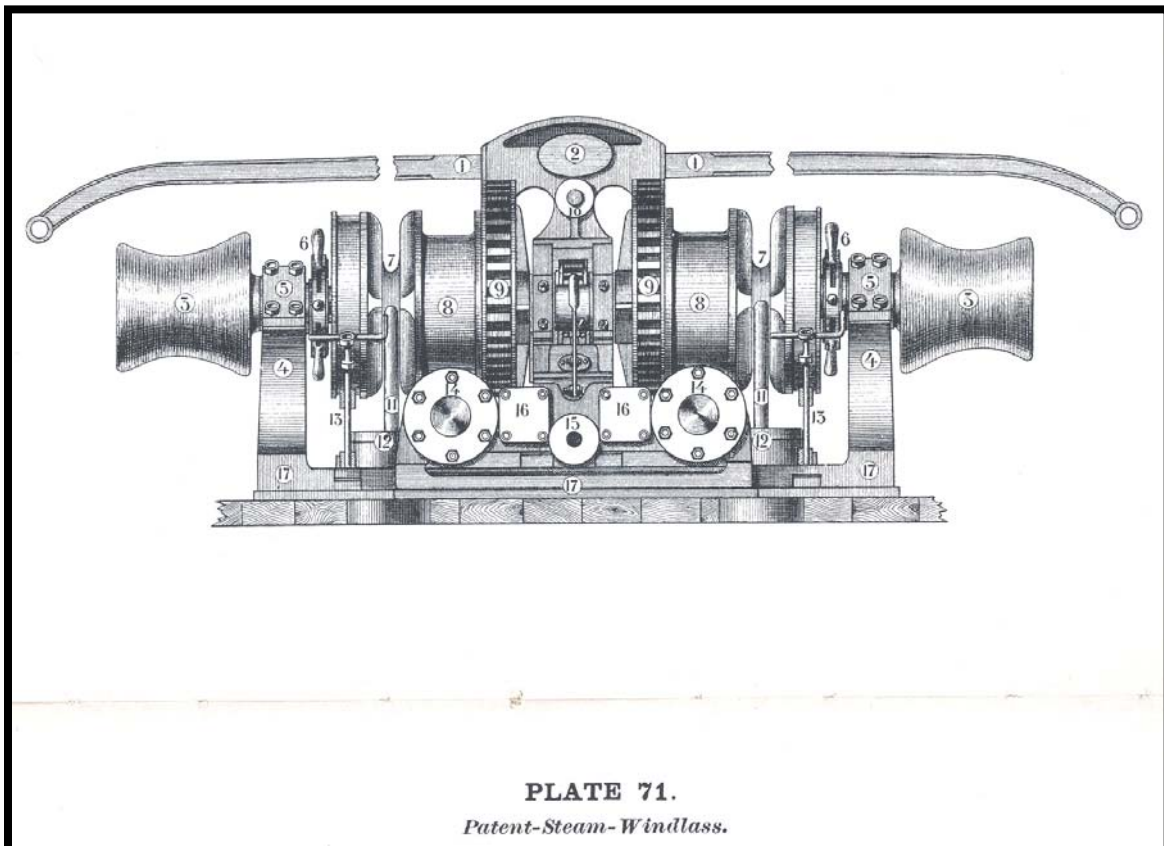


Figure 4.1: Patent windlass.

(Paasch 1977 [1890]: plate 71)

This device used an up-and-down, piston-like motion that powered a rotation of the barrel (Paasch 1977 [1890]). Other changes introduced included anchor cranes, brace and sheet winches, better bilge pumps, iron plated lower masts, and the widespread use of iron wire for both standing and some running rigging. Double topsails appeared in place of hard-to-manage single, large topsails, and double topgallants soon followed. Improvements, like these mentioned above, soon became common amongst the numerous amounts of iron-hulled ships being built in major shipyards throughout Europe (Greenhill 1993b: 85-86).

Increased demand for improved iron barques was evident in the seven-year span from 1852-1859. Thirteen iron barques were constructed at the Alexander Stephen and Sons' Glasgow

shipyard alone, along with at least five more at their Dundee yard (MacGregor 1984b:21). Iron ships were being built throughout Europe during the mid-19th century as they became more popular. Shipbuilders along the Mersey River also began using iron for their larger ships, and in 1854, Getty and Jones shipyard of Liverpool built two of the earliest large iron barques, *Ellen Stuart* and *James Pilkington* (MacGregor 1984b: 36).

Though more iron ships were built, many of the shipbuilders around the world continued to use wood, especially in building American clipper ships, and for building smaller coastal ships, such as schooners (MacGregor 1993:20-41). Timber in the United States and Canada was more plentiful than in Europe, and the California gold rush and the need to ship perishable cargoes quickly created a demand for raw wood and fast, sleek ships (MacGregor 1984b:9-13).

Europe's economy was in decline during the mid 1800's after a series of wars, including the Crimean War. A period of economic growth directly affecting shipping was followed by bankruptcies and disasters worldwide. Expansion ensued with the extension of currency and credit because of the California and Australian gold rushes in the mid 1800's. This coincided with the repeal of the British Navigation Acts, the passing of the Companies Act of 1861, and the general development of banking throughout the world's major countries (Greenhill 1993:84). Ships and their owning parties were venturing further for longer periods of times in pursuit of the business of carrying bulk cargoes on larger iron sailing ships. Shipyards continued to supply owners with large sailing ships, like *Glamis*, to profit on bulk cargoes during the late 19th century.

Alexander Stephen and Sons' Shipyards

Perhaps one of the more complete records of shipbuilding comes from Alexander Stephen and Sons of Dundee and Glasgow, one of the larger producers of wooden sailing ships and later, iron sailing ships (MacGregor 1984b:20-27). Records of the Dundee yard prior to 1868 were destroyed in a fire, and later records, including those of *Glamis*, built at the Dundee yard in 1876, were held at various locations (MacGregor 1984b:20). During the 1850's, most of the orders received by Alexander Stephen originated in the ship-owning centers of Great Britain, mainly London and Liverpool (MacGregor 1984b: 21). Ships were often built to exact specifications of an order, and the records kept by Stephen and Sons permit the exact sequence

of events to be followed, as seen from the summary of events in construction of the iron sailing ship *Charlemagne* (Figure 4.2).

CHRONOLOGICAL SEQUENCE OF EVENTS IN BUILDING THE <i>CHARLEMAGNE</i>	
24 Jan 1856	Offered to build iron sailing ship for R Catto & Son, Aberdeen, 986 tons BM at £17 10s per ton BM.
4 Feb	Letter from Catto & Son agreeing price, but want tonnage and length increased; also want some accommodation as regards periods of payment.
5 Feb	James Stephen went to Aberdeen to arrange terms with Catto & Son.
15 Feb	Sent model of ship to owners at Aberdeen.
26 Feb	Model received back from Aberdeen with a few comments: Catto & Son ask for the hull to be a little finer forward and a little more flair to the bow 'aloft' but 'they think it a very good model'.
27 Feb	Began laying down lines in mould loft.
5 Mar	Began transferring after body lines from mould loft floor to platform preparatory to commencing setting the frames.
28 Mar	After body frames all set out; began on fore body.
1 Apr	Visited Catto & Sons at Aberdeen; some of the fittings discussed.
5 Apr	Contract fixed for supply of iron plates and angles.
11 Apr	Frames all set out.
14 Apr	Began on reverse angles and flooring plates.
16 Apr	Ordered keel from Parkland Forge Co.
30 Apr	Quoted Catto & Son for altering the stern to take a screw. Price £469 including £42 for 10 per cent interest over two years.
2 May	Catto & Son offer £200 for proposed alterations. Any sum less than previous quotation refused; alternative of charging for time and materials offered.
5 May	Catto & Son abandon idea of installing screw.
12 May	Keel laid and stem erected.
20 June	One third of contract price <i>ie</i> £6063 paid, vessel being in frame.
9 July	Deck plan and cabin plan agreed with Catto & Son yesterday. Plating proceeding.
8 Aug	Sent Catto & Son spar plan for approval.
29 Aug	Poop deck laid and caulked.
26 Sept	Work began on cabins.
2 Oct	Iron hull almost finished.
4 Oct	Caulking almost finished. Working on masts. Could be launched in a month's time.
21 Oct	Began putting in masts.
31 Oct	Lower masts in position.
10 Jan 1857	Launched.
[There is a gap in the diaries between 3 December 1856 and 8 November 1857.]	

Figure 4.2: *Charlemagne's* building sequence.

(MacGregor 1984b: 21)

The Stephen family began shipbuilding in 1750 in Burghead (Carvel 1950:17). William Stephen's two sons, William and Alexander continued the family shipbuilding tradition in Scotland during the early 19th century. According to Carvel's (1950:25) study of the Stephen and Sons shipyards, ships built by the Stephen family included steam-driven vessels and larger, more powerful sailing vessels. The younger Alexander Stephen engaged in timber trade between Dundee and the Baltic, Black Sea, and Mediterranean, and later opened his Dundee shipyard in the 1840's (Carvel 1950:28). He continued to expand his Dundee yard by adding new buildings and continually building ships, whether they were ordered or not (Carvel 1950:30).

The Clyde River soon emerged as the center of Scotland shipbuilding, and Stephen soon built a yard there as well. Steam-propelled ships became more popular during the 1850's, which led to increases in steamship production throughout Europe, especially on the Clyde River (Carvel 1950:32-35). Along with prudent business practice, part of the Stephens' success was due to their ability to adapt new technology and attract skillful engineers. Machine-age craftsmen working for Stephen and Sons were encouraged to innovate where possible, and those that produced quality were rewarded with promotions (Carvel 1950:39).

These skilled craftsmen were highly regarded, especially when the Stephen shipyards began building composite ships. During the 1860's, the younger Alexander at the Kelvinhaugh, Scotland shipyard, advocated the principle of simply applying a "coat of planks" to a frame of iron (Carvel 1950:43). His composite ship would have all the benefits of iron ships, including strength, lightness, and large cargo capacity, but would also have copper plating applied to the outer hull. Composite ships were built at all of the Stephen and Sons' yards, including Dundee during the 1860's. In 1867, fire destroyed part of the Dundee yard, prompting the Stephen family to move operations to a new location at Linthouse (Carvel 1950:48).

Despite the destruction of part of the Dundee yard, the Stephen family continued to prosper, building a variety of ships including screw-steamers, clippers, brigs, and barques for various shipping companies (Carvel 1950). The Dundee Clipper Line, owned by David Bruce and Company, ordered its first ship from William Stephen of Dundee in 1874. *Lochee* set the record for a voyage from Calcutta to Dundee, with a tonnage of 1820 tons. The significance of *Lochee*'s launch to the city of Dundee was that for the first time a Dundee-built and Dundee-owned vessel was taking part in the jute trade in East India. Until then, London, Liverpool and Glasgow ships brought the raw materials to the city (Carvel 1950:56). The success of *Lochee*

also prompted the ordering of at least four more vessels, including *Duntune*, *Maulesden*, *Southesk*, and *Glamis*. Each ship would be full- or square-rigged, about 1500 tons registered, classed A1 by Lloyd's, and registered under the Passenger Act (Carvel 1950:56). The estimated costs of these ships would be between £270,000 and £300,000 each.

***Glamis'* History**

Glamis was built in approximately two years from 1874 to 1876 at the Dundee shipyard of Alexander Stephen and Sons. According to Lloyd's Register of Shipping, *Glamis* was 225.3 feet long, 34.8 feet in beam, and 21.9 feet in depth of hold, with a gross tonnage of 1205 tons (Lloyd's Register of Shipping 1878). According to information from the register of shipping for the Port of Dundee, the vessel included two decks, three masts, barque rigging, an elliptic stern, clinker build, a female bust at the bow, and an iron framework. *Glamis* first appeared in Lloyd's register in 1878, and its registry to the Port of Dundee was closed and the certificate cancelled on April 29, 1905.

Perhaps the most significant fact about *Glamis* was that it was one of the last of the Dundee Clippers. *Glamis* and *Southesk* were built in 1876 and 1877 respectively, and both were purchased by Norwegian owners in 1905, with *Southesk* wrecking off Prince Edward Island shortly after in 1906. During *Glamis'* career as a shipper for the Dundee Clipper Line, it completed numerous successful voyages in relatively short amounts of time. Its maiden voyage from Gravesend to Brisbane carried 250 emigrants under Captain John Key, and for a number of years, *Glamis* remained in the Australian trade carrying cargoes of timber between Montrose and Melbourne (Anonymous 1951).

Glamis was presumably a good sailing ship, as it was kept in the fleet long after its sister ships had been sold. On certain voyages, *Glamis* exceeded shipping expectations by arriving in fewer days than most comparable ships. According to records, *Glamis'* traveled from the United Kingdom to the Pacific Coast of North America in 104 days, which was a distance few sailing ships at that time could traverse in less than 100 days. In 1902, *Glamis* was damaged in a hurricane at Port Elizabeth, and in 1904, it became leaky on a voyage from Sydney to Falmouth, forcing a delay in Chile for repairs (Anonymous 1951). Details about *Glamis'* voyages under Norwegian ownership will require further research and future inquiries.

In 1905, *Glamis* was sold to L. Lydersen in Tvedestrand for £2700 after the leaky voyage to Falmouth. According to *Glamis*' record in the Malmstein Register, obtained from the Norwegian Maritime Museum by Margaret Leshikar-Denton, the ship remained in the Lydersen family from 1905 to the time of its wrecking on Grand Cayman in 1913. L. Lydersen is listed as the owner from 1905-1911 and brother N.A. Lydersen is listed from 1911-1913, with Tvedestrand listed as its home port for the duration of its Norwegian ownership (Leshikar-Denton and Ho 2004). During the eight years of service for the Lydersen family, *Glamis* presumably carried bulk cargoes as a tramp shipper. The Lydersen's owned and operated several three-masted barques including *Lady Elizabeth*, *India*, *Western Monarch*, *Heldos (Jessomene)*, and four-masted barques *Sokoto* and *Vandura*. These ships operated as single ship companies, meaning that they were free to carry cargo at the captain's discretion, with no set shipping lane.

At the time of *Glamis*' wrecking, little was known about the condition of the hull. It was noted by Norwegian Vice Consul W.M. Cochran, who lived on Grand Cayman in 1913 that the ship's 33 sails were in poor order. Previous damage may have weakened *Glamis*, but even the strongest hulls could be damaged by striking a reef. *Glamis*' history includes working for a successful shipping line, sailing faster than many of its contemporaries, and operating successfully for nearly 37 years. Its final voyage and the accounts of the wrecking have provided valuable information that can be compared to the investigated wreck site.

Is GC013 *Glamis*?

Based on historical documents and oral histories gathered by INA's 1979-1980 investigations, Leshikar-Denton developed a hypothesis that site GC013 was the remains of *Glamis* (Leshikar-Denton and Ho 2004). Three documents obtained by Leshikar-Denton from the Norwegian National Archive provided detailed accounts and reports of the wrecking by Captain Thomas Thorbjornsen, the First Mate, the Boatswain, W.M. Cochran, and a notarized version of the captain's account by Alfred E. Panton. In all three documents, *Glamis* wrecked off the East End of Grand Cayman on August 19, 1913, during a heavy squall (Appendix C; Appendix D; Appendix E). The area where *Glamis* struck the reef was estimated to be 25 miles from the city of Georgetown.

The wreck site investigated during the November 2003 mapping project was dispersed on a hard coral reef, also approximately 25 miles from Georgetown. Wreck scatter was found to be lying roughly in line along an East-to-West axis. Features representing the bow area identified as the cutwater (Feature 8), anchor with chain (Feature 10), windlass (Feature 12), possible bow section (Feature 18), and jibboom (Feature 7) were all located on the east side of the site. According to descriptions by Captain Thorbjornsen and Norwegian Vice Consul W.M. Cochran, *Glamis*' crew attempted to turn the ship away from the reef when land was sighted. Strong currents and a shift in wind direction drove the ship stern first onto the reef leaving the ship "afloat forward, and on the rocks from midship to aft" (Appendix E). Efforts to sail the ship off the reef were made by the captain and crew, but the ship stuck heavily on the reef before sinking on its port side. Portions of the ship's bow at GC013 were found in deeper water further from the reef. If the ship's stern was caught on the reef, then the forward half of *Glamis* was pointing east, over the area where several bow features were identified at GC013.

At GC013, stern features were found closer to the reef and midship areas of the hull were found centrally on site. The large section of internal framing (Feature 1) was found in the center of the wreck scatter, while the cargo hatch (Feature 5) was found on the west side near the reef. On an iron barque, cargo hatches of this size were located aft of midships, suggesting that the remains of stern features on site would be closer to the reef. *Glamis* was reported to have wrecked stern first on the reef, which strengthens the correlation between the wreck site's feature locations and the account of the wrecking event.

Iron structures identified at GC013 were consistent with iron shipbuilding during the late 19th century. It is known that *Glamis* did not incorporate any steam technology or have steam-powered machinery aboard. No boilers of any size or shape were found on site. Clinker plating was found throughout the wreck scatter, and the registers of shipping for the Port of Dundee show this outer plating style was present on *Glamis*. Though a scantling list for *Glamis* was not available, frame spacing and construction features identified on site are similar to those of *Lofthus*, an iron barque of similar size built in the late 19th century. The wreck site's iron features and rigging elements represent those of an iron-hulled, iron-framed sailing ship.

Is this site the remains of *Glamis*? To answer this question without any doubt, comparisons between measured features on site and *Glamis*' scantlings would need to be made. Though no scantling list is available from historical sources, evidence in the form of bow and

stern feature locations, accounts of the wrecking, and the location of the site all strongly support the argument that the archaeological site GC013 is the remains of *Glamis*. Enough physical remains of the ship are identifiable to categorize the site as that of a sailing iron barque of the late 19th century. I am confident that the site investigated is most likely the remains of *Glamis*, and I suggest further archaeological investigations seek diagnostic artifacts that can provide additional proof.

Conclusion

Norway's development into an international shipping leader occurred in the 18th to early 20th century. World economic changes and industrial development during the 19th century forced some Norwegian ship owners to focus on shipping industries that required ships with large cargo capacities. Profits from operating old sailing ships often came at the risk of losing the ship itself, but the initial investment was so low that loss did not incapacitate the owner. *Glamis*' service as a Norwegian-owned bulk cargo shipper eventually ended with its wrecking on Grand Cayman, but only after tremendous careers with the Dundee Clipper Line and the Lydersen family. The accounts of *Glamis*' wrecking event appear to be consistent with archeological remains, strongly suggesting that site GC013 is *Glamis*. Sailing iron ships' role as passenger carriers and favored shippers during their initial usage changed by the end of the 19th and beginning of the 20th century. Chapter 5 will explain this new role for iron barques and define their significance during the transitional period between sail and steam vessel technology.

CHAPTER 5

CONCLUSION

Sailing iron barques built during the late 19th century experienced a transition in their roles in the shipping industry. Ships such as *Glamis* began their careers transporting a variety of cargoes ranging from hundreds of passengers to timber. The widespread use of steam vessels by the 1880's prompted many shipping companies in countries including England, Germany, France, and Belgium to sell their fleets of large sailing ships (Johnsen 2000). Ship owners that bought these second-hand sailing vessels benefited financially, as did the sellers.

The majority of sailing ships Norwegian ship owners purchased after 1893 were built in Great Britain, with peak years of purchase from 1896-1901 and 1904-1907 (Johnsen 2001:1-2). By 1910, the Norwegian shipping fleet consisted of more iron than wooden ships for the first time in history (Ville 1993:60). Part of the reason British shipping companies sold their sailing vessels was because of the trades in which they participated. Steam vessels were better suited as passenger liners, with their greater consistency in arrival and departure times. The ability of steam vessels to travel regardless of weather conditions was also an advantage over sail for trades targeted by British ship owners (Johnsen 2001:3). Steam vessels, however, were not sought after by all shipping companies.

In Norway, both iron and steam vessels were built during the late 19th century, but newly built iron sailing ships proved to be more expensive to operate than second-hand British ships because of higher tonnage prices (Johnsen 2001:4). According to Einarsen's study on reinvestment cycles in Norwegian shipping, "replacements," or ships acquired after losing elder ships, were less expensive than "new investments," or ships that were newly built and purchased (Einarsen 1938:124-132). Relatively low tonnage prices on second-hand vessels provided for higher profits. Minimal risks were also involved because the purchase price was often close to wreck or hulk values (Johnsen 2001:4).

Despite an overall decline in international freight tonnage between the 1870's and 1911, iron sailing ships continued to maintain a steady profit margin (Einarsen 1938; Johnsen 2001). This period also marked a gradual transition between sail and steam in the shipping industry. Norwegian ship owners who chose to purchase and use second-hand iron sailing ships did so in order to guarantee a profit from transporting bulk cargoes. Conservative business practices based on traditional technology made many Norwegian shipping companies successful, despite a worldwide decline in the shipping economy.

In this thesis, I have shown how the development of iron ships from composite ships was driven by needs of the shipping industry. Types of cargoes dictated the type of vessel that carried them, and this division was often between sailing and steam ships. Evidence of iron-hulled ships of this period was presented with three archaeologically and historically studied shipwrecks, including site GC013, the probable remains of *Glamis*. The story of *Glamis* provides an example of how the role of a valued ship in a major shipping line could change during the late 19th-century transition between sail and steam. *Glamis*' second career under Norwegian ownership was equally important, but a change in value of sailing ships is evident because of the low selling price. Their role as bulk shippers, however, made them profitable to those who took risks in operating iron sailing ships.

Though I have clarified the role of iron barques and benefits they provided their Norwegian owners during the late 19th century, I have not fully explained why numerous ships of this type wrecked during this period. It is entirely possible that several ships were wrecked purposely, while others wrecked during accidents and tragedies. An economic analysis of European shipping companies that operated a large number of second-hand sailing ships would be necessary to model any patterns. Insurance policies placed on wrecked iron sailing ships would also need investigation because of the possibility of insurance fraud. Norwegian ship owners and shipping companies could be a focus for future studies by analyzing numerous Norwegian-owned wrecks identified around the world.

Though *Glamis* wrecked at a specific time and place in history, it actually represents much more including many years of one family's shipbuilding tradition, a period of technological transition, and economic practices of a Norwegian shipping company. It is evident that iron sailing ships were adapted to become profitable and successful in their role as bulk shippers even though their aging hulls made them prone to disaster at sea. By preserving their

physical remains and retelling their colorful stories, these ships will continue to have a role in maritime culture far into the future.

APPENDIX A

CAYMAN ISLANDS

In 1503, Christopher Columbus first sighted the Cayman Islands during his fourth voyage to the New World (Williams 1992 [1970]). Lacking gold, Indians, and a smooth landscape, the Islands remained unsettled under Spanish control, and it was over a century before British colonists came from nearby Jamaica (Williams 1992:6 [1970]). Lying in the path of the trade winds, the Islands eventually became known as a useful source of freshwater after its documented discovery in 1592 (Williams 1992:3 [1970]). For the next 200 years, the three islands that comprise the Caymans, Grand Cayman, Cayman Brac, and Little Cayman, were used to re-supply ships with necessary items for sea travel. Most of the first inhabitants were either seasonal turtle fishers or traders of logwood (Craton 2003:27). There is also some evidence of early Jamaican living huts on Little Cayman as early as 1670, suggesting more than seasonal occupation (Craton 2003:33).

During Spain's control of the Caymans, no attempts were made to colonize any of the three Islands. In the 1670 Treaty of Madrid, Spain ceded the Cayman Islands and Jamaica to England, along with all other islands occupied at that time by England in the West Indies (Williams 1992:10-11 [1970]). In 1734, the first recorded land grant was given to settlers, leading to an influx of immigrants from Jamaica for the turtle fishing and logwood industry (Williams 1992:17 [1970]). Over-fishing led to a dramatic decline in the turtle population by the end of the 18th century, and many Caymanians began new occupations in shipbuilding using the fine mahogany and other hardwoods found on the Islands (Smith 2000). Caymanians developed their own shipbuilding traditions by constructing schooners as early as 1793 for the turtle fishing industry further offshore and commerce with Jamaica and other settled areas (Smith 2000:128).

The political structure of the Cayman Islands remained unstable until the colony was formally named a dependent of Jamaica in 1863 (Williams 1992 [1970]). Formation of the

Federation of the West Indies provided an opportunity for the Caymans to end its dependency on Jamaica in 1959, while still maintaining a close political relationship (Williams 1992: 85 [1970]). After the Federation dissolved in 1962, Jamaica received its independence, but the Cayman Islands chose to remain under British rule with a revised constitution allowing for a direct responsible government in 1972 (Craton 2003:318-322).

While under British rule, the Cayman Islands' economy has become one of the strongest in the Caribbean with the highest standard of living for its people (Craton 2003). Nearly 75% of the economy is based on the tourism industry, creating a thriving and growing economy that supports new business. Since 1966, the Caymans have served as a tax haven for banks and companies seeking more flexible tax laws. This has moved the Cayman Islands within the top five banking centers in the world, while providing a boost to the Cayman government's revenue through bank and trust license fees (Craton 2003:331). With tourism being such a vital aspect of their economy, the Caymans have sought to expand upon the activities for visitors. In 2003, the 500th anniversary of Christopher Columbus' sighting of the Cayman Islands was celebrated with a multitude of historical and cultural celebrations. The opening of the Maritime Heritage Trail, marking areas of significance to Cayman history, was also included in the celebration. Because of the vast number of shipwrecks around the Islands, plans have been made to create preserves for a shipwreck trail. *Glamis*, the ship studied in this thesis, is planned to be the first shipwreck incorporated into the maritime heritage shipwreck trail. The maritime culture of the Cayman Islands has been highlighted through the creation of the Cayman Islands Maritime Heritage Trail, focusing on a unique maritime history that left remnants throughout the landscape.

Maritime Culture

Over the last four centuries, the Cayman Islands have developed a maritime culture marked by a variety of activities related to the sea (Smith 2000; Leshikar 1993). Archaeologically and historically significant sites include shipwrecks, careening places, and military forts that represent points in history within the last five centuries. Located in the path of the Leeward Passage, the Caymans have long been identified as a source for fresh water, turtle meat, and hardwoods for ship repair, as well as treacherous reefs and rocky shores. The rich history of the Cayman Islands has been studied in Smith's (2000) *Maritime Heritage of the*

Cayman Islands, and this section will only highlight major aspects and events in the maritime history of the Caymans.

As stated above, the Cayman Islands were noted early for the abundant turtles and fresh water. By the 1520's, it was already known that sea turtles were an excellent source of protein, but it is not clear whether the Spanish used them as a primary food source (Smith 2000:56-57). Within the next century, the Dutch, English, and French began regular expeditions to exploit the turtle resource, and soon the Cayman Islands became an important destination in the Western Caribbean as a source for food and water (Smith 2000:58). Permanent settlements were not made until much later in time when the English settled shortly after occupying Jamaica in 1655. However, resources in the Caymans had already been exploited previously for a number of years (Smith 2000:58-83).

As the Cayman Islands became more of a scheduled destination for ships instead of a navigational marker, maritime activity increased and broadened. During the 17th and 18th centuries, famous privateers and pirates, like Henry Morgan, Manuel Rivero Pardal and Edward Teach, utilized the islands for their resources and as a safe-haven (Williams 1992 [1970]; Smith 2000:89-106). Land grants were made and permanent settlers took residence on Grand Cayman in the mid 1700's, mostly coming from British Jamaica (Leshikar 1993; Smith 2000). In Leshikar's (1993:370) study of Wreck of the Ten Sail, she states that regular trade with Jamaica ensued by the last quarter of the 18th century, and at least one 60-ton vessel was built in Cayman in 1793.

Shipbuilding continued to be a part of the maritime culture of the Cayman Islands. Remnants of ship launches are present on all three islands, as well as historic anchorages used for commercial shipping. Invented for the turtle fishing industry, the Caymanian catboat was designed to be more maneuverable than a canoe, including both oars and sails for propulsion (Smith 2000:122). Using local hardwoods, like mahogany and cedar, Caymanians built catboats using temporary frames in a frame-first technique, with permanent frames added after securing planking (Smith 2000:123). Fishermen on these small boats were able to fish for turtles in the shallows and maintain the boat's stability in the surf and rougher waters. Details of the construction and development of the Caymanian catboat are discussed further in Smith's (2000:122-128) *Maritime Heritage of the Cayman Islands*.

Over several centuries, the people of the Cayman Islands developed a rich maritime culture built upon constant interactions with an international array of seamen and shipping (Williams 1992 [1970]; Leshikar 1993; Smith 2000). As evident in historic documentation and archaeological evidence in the form of shipwrecks, European activity in the Caymans is indisputable and well represented. During the 17th and 18th century, the role of the Cayman Islands was to be a source for re-supplying ships with fresh water and protein in the form of turtle meat (Smith 2000). Maritime activities expanded in the 19th century, as permanent settlements grew and expanded port services. Shipbuilding, ship salvaging or “wrecking”, and establishing anchorages for commercial shipping all became important activities and professions for the Caymanians (Smith 2000). The large quantity and variety of shipwrecks in the Caymans from the 19th and early 20th century provide examples of industry activities in which these ships were involved. Fishing schooners, iron-hulled shipping barques, and freighters are only a few examples of shipwrecks found around the Islands that represent the maritime activities of the last two centuries (Cayman Islands Maritime Heritage Trail Partners 2003).

Effects of the strong maritime culture and dependency on the sea can be seen today throughout the landscape of the Cayman Islands. Cannons, shipwrecks, and place names are only a few of the physical examples found in and around the Islands that represent the past. Supported by these historic remnants, the Caymans have benefited economically by attracting visitors with unique and interesting stories of the Western Caribbean. Recreational diving and sport fishing are two of the major tourism activities that rely on first-hand knowledge of the Islands’ waters and reefs. Local residents who work in these tourism industries, commercial fishing, or boat charters often have a unique knowledge of the surrounding waters from information passed down for generations. By using their knowledge of the sea, Caymanians are able to adapt to new professions and industries, while strengthening their maritime traditions and maritime culture.

Previous Archaeological Research

Archaeological research in the Cayman Islands began in 1979 with surveys of all three islands on land and underwater (Smith 1980, 2000). Led by Roger C. Smith of the Institute of Nautical Archaeology (INA) at Texas A&M University, the team identified 17 archaeological sites on Little Cayman, 5 sites on Cayman Brac, and 55 sites on Grand Cayman during field seasons in 1979 and 1980 (R.C. Smith 1980; 2000:xvii). In Smith's (2000) *The Maritime Heritage of the Cayman Islands*, many shipwreck sites are discussed in archaeological and historical detail, focusing on the maritime history that is unique to the Islands.

With the number of shipwreck sites discovered by the INA expeditions, few wrecks were examined extensively and identified by name. In the mid 1980's, Charles Beeker of Indiana University's Department of Physical Education, Scuba Research and Development Group (SRD) focused on investigating sites related to the Wreck of the Ten Sail (Leshikar 1993: 290). Though Beeker's work was limited in academic scope, valuable information was gathered and shared. In the early 1990's, an extensive archaeological and historical study on the Wreck of the Ten Sail was conducted by Margaret Leshikar-Denton of INA and Texas A&M University (Leshikar 1993).

In 1991, Leshikar-Denton led fieldwork studies on the Wreck of the Ten Sail site to locate the shipwrecks associated with HMS *Convert*. Details of Leshikar-Denton's research and the historical and archaeological study of the Wreck of the Ten Sail are published in her dissertation (Leshikar 1993). Leshikar-Denton has continued archaeological research since 1993 on the Islands under the auspices of the Cayman Islands National Museum by conserving, protecting, and documenting historical archaeological material. Numerous sites, both terrestrial and submerged, are continually added to the database of archaeological sites on the Islands (Margaret Leshikar-Denton, personal communication 2003).

Also in the 1990's, the Ministry of Culture created a Marine Archaeology Committee to examine the effectiveness of the Abandoned Wreck Law of 1966 (Leshikar-Denton 2002:284). This led to a government mandate that new legislation be drafted to better protect the submerged cultural resources of the Cayman Islands (Leshikar-Denton 2002:284). Creating the shipwreck trail will hopefully aid in the protection of underwater sites and establish awareness for the significance of preservation.

Archaeological investigations in 1993 by Stokes and Keegan (1996) suggest that no prehistoric activity occurred on Grand Cayman prior to 1503. Researchers from University College London conducted surveys for prehistoric material in 1992 and 1995 with similar conclusions (Leshikar-Denton 2002:285). Systematic test excavations on Cayman Brac and shovel tests completed on Grand Cayman showed only historic fauna and artifacts, suggesting that few if any prehistoric people occupied the Islands. Possible natural site disturbances, such as hurricanes, sea level changes, or human agency could have destroyed prehistoric remains, but most conclude that the Islands were either never or only sparsely occupied in prehistory (Stokes and Keegan 1996; Scudder and Quitmyer 1996).

Underwater archaeological work in the late 1990's included a shipwreck survey of Little Cayman and archival research on the schooner *Geneva Kathleen* (Leshikar-Denton 2002:285). Shipwreck sites identified as part of the INA survey in 1979 were revisited in 1999 to verify their locations. Results of the survey included a new patrol program for the Little Cayman Marine Parks Officers to implement into their protection plan (Leshikar-Denton 2002:285). An undergraduate field school from Ball State University has focused on *Geneva Kathleen*, using oral histories, archival information, and some archaeological mapping to exhibit the story of the ship (Leshikar-Denton 2002:285). The CINM is continuing efforts to document archaeological sites and expand their ever-growing database. Education and public outreach are constant goals of the CINM, and their leadership in creating the Maritime Heritage Trail is a prime example of their efforts to reach those goals.

Archaeological research for this thesis was done under the direction of the Cayman Islands National Museum in November of 2003. A number of volunteers participated in the *Glamis* Mapping Project on what will become the first shipwreck preserve on the Cayman Islands Maritime Heritage Shipwreck Trail (Figure A.1).

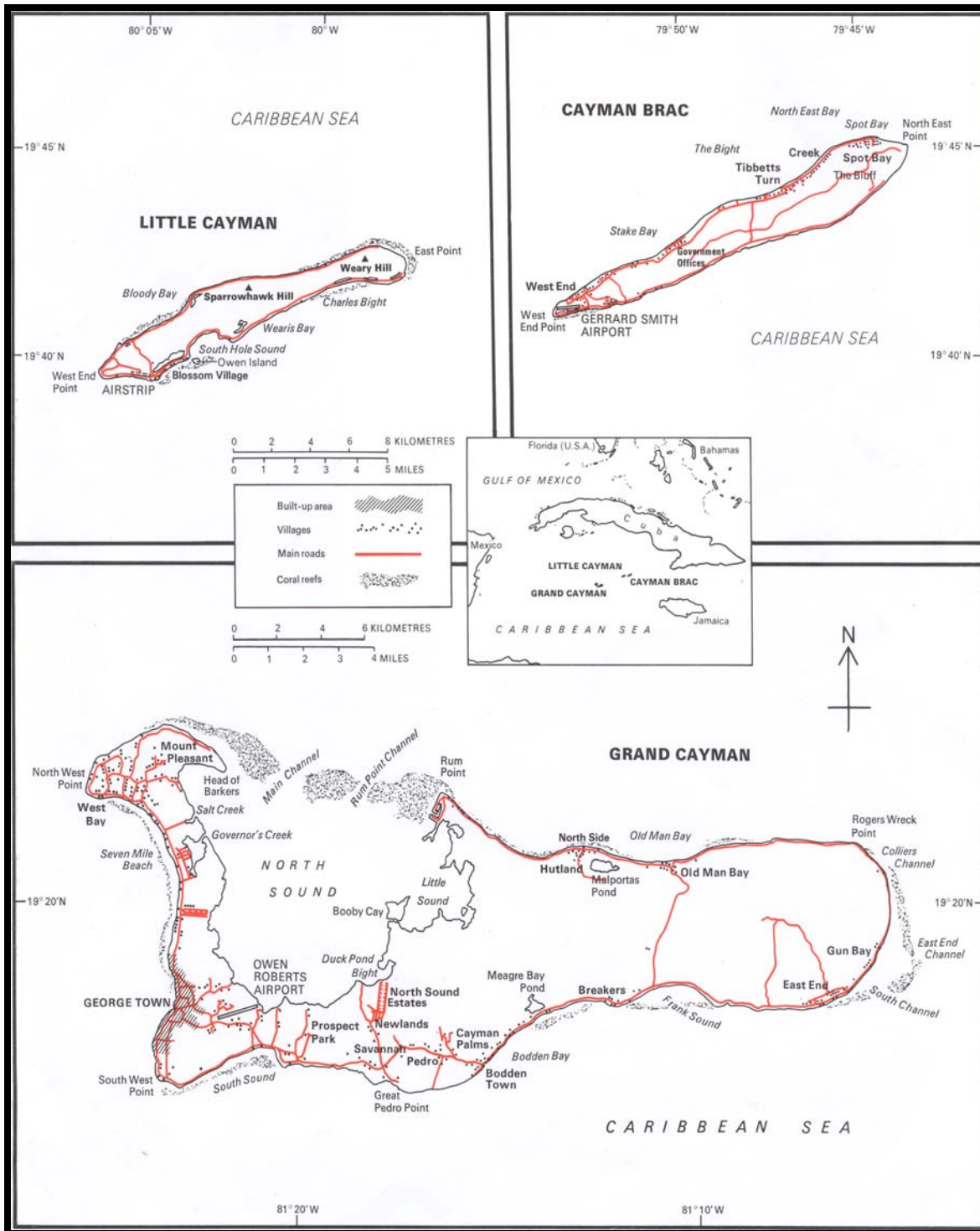


Figure A.1: Map of Cayman Islands

(Central Office of Information 1990)

APPENDIX B

Feature Key		
<u>Number</u>	<u>Feature</u>	<u>Location</u>
1	Large hull section	center of site
2	Inverted keel section	NE of center of site
3	Inverted hull section	NW of keel section
4	Hull fragment	SE area of site
5	Cargo hatch	West side of site
6	Rudder stock with tiller	North of keel section
7	Jibboom	Far northeast in canyons
8	Cutwater	SE area of site
9	Rudder frame	NE of keel section
10	Anchor with chain	East side of site
11	Anchor with stock	south central area of site
12	Windlass	East by datum A
13	Capstan	North central
14	Bollard	by wheel center
15	Bollard	south central area of site
16	Wheel	SE of keel section
17	Lifeboat Davit	NE of main mast
18	Possible bow section	Extreme NE area of site
19	Bollard	Far North area of site
20	Wheel center-brass	East/SE of wheel
21	Anchor chain pile	East end of site
22	Iron member-twisted	East of cutwater feature
23	Open mast/yard ring	East of cutwater in channel
24	Single spar ring	East of cutwater in channel
25	Round encrusted feature/compass	East of cutwater in channel
26	Hull fragment-turn of bilge	N of center, E of Feature 1
27	Hull fragment	West side, before hatch
28	Hole with square frame	West side, before hatch
29	Keelson fragment	West side, NE of hatch
30	Hull section w/ external porthole	North by Feature 19
31	Eastern most chainplate on F-1	Center of site
32	Topgallant, Royal, or yard ring	East, North of Datum A
33	Bollard by anchor chain	East side
34	Main mast	Center of site
35	Hull section	
36	Inverted hull section	
37	Hull section	
38	Staghorn Bollard	

Figure B.1: Feature Key.¹

(Leshikar-Denton and Ho 2004)

¹ Feature Key and descriptions are from Leshikar-Denton and Ho (2004).

FEATURE DESCRIPTIONS

1. Large hull section

A large hull section of the central port side of the vessel is located in the central area of the site, bisecting the baseline. Broken into three distinct pieces, the section includes frames, reverse frames, angle bars, outer hull planking, butt plates, angle bar stringers, and remains of the standing rigging. Its length at its most extreme edge is 98.2 feet, with broken iron ends. Approximate width from the far south to the far north side is 45 feet. Standing rigging pieces, like the shroud plates, indicate that these portions of hull are the upper sides of the hull to the bulwarks. It should also be noted that the northern section has pinned a portion of the lower main mast. The upper portion of the main mast (Feature 34) is located southeast of the hull. Frame spacing, from center to center, is consistently 4.4 feet apart. Vertical hull planking from the center of the angle in the angle bar is 4 feet in length. There are also two portholes on a fallen inverted portion of the hull, which lays flat, between two of the major three sections of the hull. The largest portion, which lies in the center, has a variety of longitudinal iron rods, possibly pillars or stanchions, scattered throughout the eastern end. These pieces are found throughout the site, and they range in length from two to 10+ feet. There are also two smaller curved sections of the hull found lying on the eastern side of this central portion of the feature. All three sections of hull in the feature have several holes through the outer hull and jagged edges from breaks. No evidence of the wooden deck remains, but frames on the large center section and the northern section are deck frames.

2. Inverted keel section

Lying northeast of Feature 1, is a large section of the bottom hull with a keel and a broken piece of a keelson. Garboard strakes have been identified as well as several floors and possibly a sister keelson, which projects from under the hull. Dimensions are 80 feet in length from the tip of the projecting keel to the edge of the outer hull. Its width from its greatest extremes is approximately 36 feet. Hull planks project off the northwest side from the keel and from the south east side from the keel. The western portion of the feature also has floors

projecting south from underneath the hull, and remains of the keel point westward, with a bent portion of the keelson projecting northwest. The curvature of the hull from the centerline further indicates the location of the keel and keelson. Remains of a possible bilge keelson project from the south side of the keel westward. It should also be noted that there are several possible pillars or stanchions projecting from underneath the large hull section (Figure B.2).



Figure B.2: Feature 2, portion of keelson. (CINM photograph by Bert Ho)

3. Inverted hull

Another inverted hull section lies just northwest of Feature 2. It is a rectangular section of hull measuring 28.6 feet in length and 15.7 feet in width. There are 4 frames projecting west from underneath the hull, one projecting east, and a stringer extending southeast. A disarticulated

stringer extends diagonally from the south east end of the feature. Four frames can also be seen in an exposed portion of the hull, and the northern most frame is in line with one of the projecting frames on the west side of the feature. There are also four plank seams on the outer hull surface that run parallel with the stringers. Numerous holes through the hull planking are located throughout the outer surface. Edges appear to be broken fairly cleanly on the north east side, with more jagged breaks on the southwest corner.

4. Hull fragment

A smaller portion of the hull is found west of Feature 8 in the extreme southeast area of the site. It measures 12.3 feet in length and nearly 11 feet in width at its widest point. Five frames spaced 2.4 feet apart lie parallel with each other and the remains of the outer hull planking are found below with four butt plates. There is a piece of iron plank covering one end of 3 of the frames measuring 4.8 feet in length and 3.5 feet wide. A stringer lies perpendicular and on top of three frames. Jagged edges are found on one side, leaving the frames extending beyond the outer hull planking below the frames.

5. Cargo hatch

On the west side of the site, in the area that is possibly the stern, there lays a cargo hatch with a lip or base extending around its bottom edge. It sits flat on the bottom surface in the shallowest part of the site, and it stands 1.7 feet off the bottom. Dimensions are 10.6 feet by 11.6 feet, making nearly square. On the north side of the feature, there is an indentation in the lip that is 6.4 feet long centrally located on the lip edge. The actual hatch opening measures 8 feet by 6.4 feet wide and it is positioned in the center of the base. On the inside of the hatch, there is a lip on the two 8 foot sides, and it extends towards the center three inches. The base also has four rings on the surface, equally positioned 1.3 feet in from the hatch ends. They are possibly representative of how the hatch was secured to the wooden deck.

6. Rudder stock with tiller

A steering feature lies in the northern portion of the site beyond Feature 2. It appears to be the iron stock, tiller, and mechanism for the iron rudder. Dimensions are 19.8 feet in length and $\frac{1}{2}$ foot in diameter, with varying diameters for the mechanisms on the end with the possible tiller. The central most piece of the tiller mechanism is pentagonal in shape surrounding the rudder stock. It is 1.8 feet wide and is possibly the mounting base at the stern deck level. Connecting to the base piece is a ring measuring 1.3 feet in diameter and $\frac{1}{2}$ foot in width. The tiller ring sits $\frac{3}{10}$ foot above the larger base ring, and it has a diameter of $\frac{8}{10}$ foot and $\frac{6}{10}$ foot in width. The tiller arm extends 5 feet in a gradual arch. Above the tiller ring, the rudder stock is uncovered for $\frac{8}{10}$ foot until a U-shaped iron structure is fixed to the stock, which measures 2.4 feet in length and 1.6 feet wide. The remainder of the iron stock extends one foot into a taper. A curve extending from the lower end of the iron rudder stock is the upper most portion of the iron rudder frame that is found on Feature 9. Lying at an angle to the rudder stock is a 13 foot iron shaft with a diameter of $\frac{6}{10}$ foot. Fastened to the lower portion of this shaft is a tapered block-shaped ring that is $\frac{7}{10}$ foot in length tapering to $\frac{4}{10}$ foot, with a width of 1.3 feet. This small feature is located 1.6 feet from the end of the shaft. References for the iron rudder stock are found in *The Lore of Ships* (Kihlberg 1972: 43)

7. Jibboom

Located in the extreme north east area of the site, within a finger canyon, is a 25 foot section that is possibly the remains of the jibboom. It measures 25 feet in total length with a diameter of 1.4 feet throughout. There are a number of rings spaced variably on the iron jibboom, suggesting that they were areas for connecting rigging. It is also located in the extreme northeast area of the site next to a portion of the bow. Three similar sized rings are located on the Jibboom at distances of 4.6 feet, 16.8 feet, and 23.4 feet from the eastern most end. A larger ring with a clamp or ring assembly is located 5.7 feet from the east end, and it has a width of $\frac{4}{10}$ foot. It is likely to have secured the jibboom to the bowsprit or to stays. On the west end of the feature, a large crack splits and bends the jibboom, but does not completely separate the section. A small hole is also found at 16.8 feet from the east end of the feature, and it has a shape of a key hole (Figure B.3).



Figure B.3: Feature 7, possible jibboom. (CINM photograph by Bert Ho)

8. Cutwater

In the south east area of the site, a cutwater portion of the bow has been found and identified. The remains include an iron cutwater that is S-shaped, with a portion of the hull splayed apart following the lines of the point of the bow. Inner sides of the hull have one butt plate and at least two butt straps, as well as a portion of what may be a bow stringer. The hull planks are still in the shape of the curve, but edges that have been torn are jagged and slightly distorted. Total length of the cutwater is 24.6 feet and 7/10 foot wide. Proximity of this feature to the bow area of the ship further indicates the cutwater.

9. Rudder frame

A portion of the rudder frame is found northeast of Feature 6 (Kihlberg 1972: 43). Its close proximity to the iron rudder stock indicates that this is the lower portion of the rudder frame, which held the rudder plate. Dimensions are 3.5 feet at its widest point, with the frame

tapering until it is broken. The total length is 11.6 feet along the rudder stock, which features a bracket where a gudgeon would be fastened. A small portion of the rudder plate exists in the corner where a horizontal iron frame runs perpendicular into the iron rudder stock. The upper end of the stock is broken, as is the bottom end. There is no clear indicator of how far the rudder frame would extend its curve, but the taper at the bottom end of the frame does indicate it is very close to the bottom.

10. Anchor with chain

Two anchors have been found on site. Feature 10 is located on the east end of the site, just south of Datum A. It is an iron stocked anchor completely in tact, lying nearly flat, in association with a pile of anchor chain and a single bollard. It is 10.6 feet in length and 7.5 feet in width from bill to bill. There is no iron stock in the stock ring. The shank of the anchor begins with a width of 1 foot at the crown and tapers to 7/10 foot at the stock ring. Flukes are 1.8 feet wide and 2.1 feet in length. The diameter of the stock ring measures 1.2 feet, with an inner diameter of a ½ foot. It lies with its crown facing east, southwest of the pile of stud link anchor chain. Judging by the pile of anchor chain and its disbursement, it appears to have fallen during the breakup of the ship during foundering.

11. Anchor with stock

A second anchor is found due south of the center of the site. It is similar to feature 10, but it has its stock in place standing it off the bottom at an angle. There is no anchor chain associated with the feature and no bollards. Dimensions of the anchor vary slightly from Feature 10. The total length is 9.8 feet and the width from bill to bill is 7.9 feet. Tapering of the shank is nonexistent, as the width remains an even 1 foot throughout. The length of the stock ring and the anchor ring measure 1.5 feet. Though the ball end of the stock is partly encrusted into the coral bottom, the stock still measures approximately 9.4 feet in length, with some deterioration on the upper end. There is also an anchor ring in the ring on the top of the anchor shank, but no anchor chain is connected. It has the highest point of relief on the site, standing nearly ten feet off the bottom surface, and it will most likely serve as a visual marker for the wreck site (Figure B.4).



Figure B.4: Feature 11, anchor with stock amidst wreck scatter. (CINM photograph by Dan Schaar)

12. Windlass

Located on the East end of the site's baseline, lies a mid to late 19th century windlass associated with the raising of the bow anchor. Its length is approximately 6.2ft long with a large gear rotated by a pinion powered by the capstan on the deck of the forecastle. The windlass appears to be similar to that of an Emerson and Walker patent windlass. Power created by the rotation of the capstan above the deck would drive the pinion's teeth into a large gear on the right side of the windlass (MacGregor 1984b: 116) (Figure B.5).



Figure B.5: Feature 12, windlass. (CINM photograph by Dan Schaar)

13. Capstan

Located in association with some deck frames and beams, the capstan is found north-central of our baseline. It appears to be a common capstan made of wood with iron bracing. The barrel is complete with sockets around the rim of the drum. Remains of the capstan do not include the base or any hand spikes. Dimensions of the windlass are as follows: 2.9 ft in height, 2.6 ft width of base, and 1.8 ft width of drum head.

14. and 15. Bollards / Bits

With an iron-hulled ship, it was expected that several sets of bollards would be found. The wreck site has at least 5 bollard sets found, and they include a variety of designs. A single bollard was found near the anchor with chain in what has been interpreted as the bow area of the wreck site. Pairs of bollards have been found throughout the central area of the site, with equal-

height barrels found in the southeast quadrant and northwest quadrant of the site (Feature 14 and 15) All bollards found have their bases in tact, but none have been found in association with the part of the hull that they were originally placed.

16. Wheel

A possible wheel has been found in the east central area of the site, just south of Feature 2. It is an incomplete circle, with about 1/5th of the circle missing. There are also 4 remnants or small protrusions evenly spaced on the inside of the wheel. They could be remains of spokes that would have run to the center of the wheel feature. The molded diameter of the wheel is 3.4 feet, with an outer diameter of 4 feet. Protrusions extend 1.5 inches and are spaced at 1.6 feet. This feature is unique on the site, with no other object resembling it in anyway.

17. Lifeboat davit

A deck feature interpreted as a lifeboat davit has been found in the east central area of the site. It is a J-shaped davit that is often referred to as a radical davit (Kihlberg 1972: 66). Historical images of the *Glamis* indicate that there were four davits, supporting 2 lifeboats aft of the center of the deck. Dimensions of our davit are 12 feet in height and 5 feet at the width of the curve. The diameter of the davit shaft is 3/10 foot and it has a possible break on the end of the shaft. No other davits have been located, but the debris field of the wreckage may yield the other three.

18. Possible bow section

In the northern extremity of the site, within the deeper crevices, lies a possible portion of the bow section. Five frames extending from a distinct point of the bow splay out in the curvature and shape of the top of a cutwater, below a bowsprit. The section is 20.6 feet in length, with the frames at the widest point extending 13.5 feet. Frames in the feature are evenly spaced at 2.1 feet from center to center. A large portion of the outer hull covers half of the frames, and it is shaped appropriately for a bow section. It extends 5.6 feet over the frames and 4.1 feet from one end until it gradually curves back to the centerline of the feature, with a jagged or torn edge.

Remains of cement appear to be present within the converging point of the hull. Two butt plates are also found between the 1st and 2nd frames and 3rd and 4th frames, with two butt straps extending between all frames in a straight line. The outer hull plates are jagged at the edge and only remains as far as the frames extend. The portion that may represent part of the cutwater has a width of 7/10 foot, which is the same width of Feature 8 on the cutwater.

19. Bollard

Feature 19 is an even paired bollard with two short arms extending upward from the base on either side of one of the barrels. It is found in the far north central area of the site, near a portion of the hull with an external porthole. Unlike the other bollards, this one has two small arms extending ½ foot on one side of the base by one barrel. The bollards are also hollow throughout and even through the base. Dimensions are similar to the other even-paired bollards with a length of 4.6 feet and a width of 1.5 feet. The height of the barrels is 1.4 feet with a diameter of 1.2 feet at the upper end and 9/10 foot below the base. Once again, there is no evidence of the hull where the bollard would have been fastened.

20. Wheel center-brass

A possible wheel center has been located on the east side of the site near the large keel section. The feature has a total diameter of 1.4 feet and includes a ring with 3 small protrusions on three sides, equally spaced. The width of the ring is 4/10 foot wide. It has been noted that this feature is made of brass, based on the coloration of the object beneath some of the encrustations.

21. Anchor chain pile

The south east side of the site is marked by Feature 10 and the associated pile of anchor chain. It is impossible to determine how long the chain is because of the heavily encrusted pile that the chain has amassed. A majority of the chain lies in a mound approximately five feet high from the bottom surface, with chain drawn out to nearly 50 feet to an unidentified iron object and chain drawn underneath the anchor to about 25 feet from the pile. The chain pile extends nearly 20 feet long by 10 feet wide at its widest point. It is made up entirely of stud links that are one

foot by 7/10 foot in dimension, with a bisecting arm through the center. Links all appear to be connected with one another, with no single links disarticulated (Figure B.6).



Figure B.6: Feature 21, anchor chain pile. (CINM photograph by Dan Schaar)

22. Twisted iron member

East of the cutwater in the southeast corner of the site, lays a twisted iron member, possibly part of the framing within the ship's hull. It is 13.2 feet in length, 1.8 feet at its widest end, and 7/10 foot at its thinner and twisted end. The iron fragment widens about 5.6 feet from the thicker end and then remains at a constant width to the twisted end. There is a small hole on the thicker end of the iron feature. This piece is most likely related to framing in the bow section of the hull.

23. Open mast/yard ring

Lying east of the cutwater in one of the finger channels is an open iron mast or yard ring. It is indeterminable whether it fastened to a yard ring, topgallant mast, or a royal mast. Its diameter is 1.3 feet, but it lays open with a length of 3.5 feet from one end of the clamp to the other. It has a thickness of 1/10 foot, and a bracket or clamp of 4/10 foot. There is no association to a yard or mast nearby, but because of its relatively small diameter, the wooden yard or mast is not expected to be found.

24. Single spar ring

Along with Feature 23, a closed, single spar, ring is found on the east side of the site within a finger channel. The diameter of the ring is 1.2 feet, and no clamp or bracket is found on the ring.

25. Round feature/possible compass

In the vicinity of Feature 23 and 24, a small circular object, resembling a navigational instrument, is located. Though slightly encrusted, the dimensions suggest that it may possibly be an instrument used for directing the ship. It is 4/10 foot in diameter and 1/5 of a foot in width.

26. Hull fragment-turn of the bilge

A hull section representing what is believed to be the turn of the bilge is located in the northwest area of the site. It consists of two longitudinal iron members that are interpreted as a sister keelson and a bilge keelson (Kihlberg 1975: 30). They both measure one foot in width with the sister keelson measuring 14.2 feet and the bilge keelson measuring 18.2 feet. There are 7 frames running perpendicular and underneath the two keelsons, with the frame on one end bent at a greater angle instead of a curve. Outer hull exists connected to the frames, with jagged edges on the end of the feature and running from one keel to the edge of the other. A number of holes through the hull are located between the 3rd and 4th frame, the 4th and 5th frame, and the 5th and 6th frame, counting from the southernmost end of the feature. The two keelsons are also spaced

5.3 feet apart from center to center, and the frames at the widest point are 10.1 feet. Frames extend beyond the hull plank at various lengths ranging from 2.2 feet to 6.5 feet.

27. Hull fragment with manhole

Another hull feature is found close to Feature 26 on the west side of the site. It measures 9.8 feet in length, 6.6 feet on one side, and 5.4 feet on the other side. There is also a circular manhole near the longer side measuring 2.9 feet in diameter. The edges of the hull are smooth on two sides, with more jagged and uneven edges on the other two.

28. Large porthole with square framing

A large porthole feature was found in the northwestern area of the site before the large hatch (Feature 5). Surrounding the circular hole are large iron members arranged to frame the hole. Two of the sides of the framing are longer, measuring 10.8 feet and 4.6 feet. The two sides running perpendicular to the longer members are both 4.3 feet in length. The diameter of the porthole (may also be a manhole) is 2.3 feet wide. It is indeterminable where this feature may have been located. Positioned in what is believed to be the stern area of the site, it could have possibly served as an internal porthole, a manhole between decks, or a large porthole on the outer hull.

29. Keelson

Lying on the western side of the site, slightly northwest, is an iron feature resembling the keelson on Feature 2. It has the same characteristics of the other keelson feature, and the dimensions are similar. The feature measures 16 feet in length, 1.5 feet in height, and 1.3 feet in width. Its location on the site suggests that it is associated with the stern area of the site.

30. Hull section with external porthole

In the northern area of the site, near Feature 19, lays a portion of hull, standing upright with a porthole on a flat surface of outer hull. It measures 11.85 feet in length with a

perpendicular section extending upward off the bottom surface approximately four feet. There are two larger frame sections extending outward from the perpendicular hull piece extending 2.7 feet and 3.7 feet. Two diagonal supports on the outer hull plank extend from the frames to the vertical, perpendicular hull. The port hole is located on the flat hull surface, and it measures 8/10 foot in diameter and 2.5 feet from the end of the edge of the hull surface on the eastern side. It is possible that this section is part of the stern deck, where a number of portholes can be seen in the photo.

31. Easternmost chain plate on Feature 1

Feature 1 has two chain plates extending from its easternmost hull section. Though the feature is missing its deadeye, another chain plate that is nearby and disarticulated from the hull does have a complete wooden deadeye. Drawings were done with a simulated deadeye in its appropriate orientation on the feature (Figure B.7).

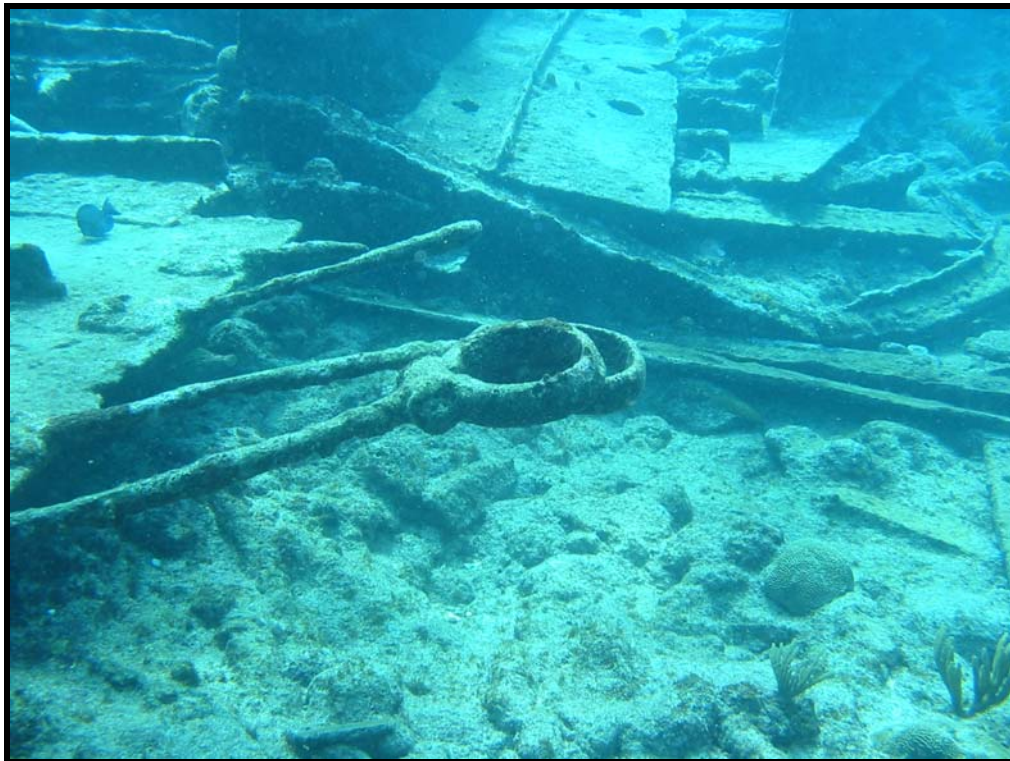


Figure B.7: Feature 31, chainplate. (CINM photograph by Dan Schaar)

32. Double yard, topgallant or royal mast ring

A single closed topgallant, royal mast or yard ring is located in the east side of the site north of Datum A. It has two close rings that are connected, with one having a diameter of 1 foot and the other .85 of a foot. Total length of the rings measured 2.8 feet, suggesting that this iron double ring fastened to a portion of the masts or yards higher on the ship.

33. Single bollard

Along side the anchor chain, lays a single bollard with a long base. It has a height of 2.9 feet with a diameter of 1 foot. The base measures 1.2 feet in width and 2.7 feet in total length. Single bollards have not been found anywhere else on site, suggesting this bollard was most likely associated with the anchor lying next to it.

34. Main mast

A portion of the main mast lies in the center of the site just below Feature 1. It is broken into two pieces, 21.9 feet and 19.9 feet in length. The longer portion has a mast ring fastened on one end that is complete and hollow. It has a large hole approximately 8 feet in length between the mast ring and the iron mast top. Both sections of the main mast are hollow, leaving only the iron plating that surrounded the original wooden mast. Near the broken end of the larger portion is a ring that most likely connected rigging and stays. The shorter section of mast has two rings on its lower end. One ring is in its original location and it appears to be a portion of a shroud, minus the extending ring (Kihlberg 1972: 83). The larger displaced ring circles the mast at an angle, and it may represent a ringed cap or support above the location of the shroud ring. A third portion of the main mast is pinned under the northern end of Feature 1, and based on its location and orientation to this feature, it has been interpreted to be part of the main mast (Figure B.8).



Figure B.8: Mast ring on Feature 34, main mast. (CINM photograph by Dan Schaar)

APPENDIX C

J.N. 574/13 S.S. Journalens drag. 15-8 kl 4 anorden kom lodsen ombord for at se skibet Alcyon. Blevet ankeret og sat seilen eftermeret og styret ut efter lodsen anvisning, kl 7 pnd beriktes denne. Blevet trykssende efter peilinger indtil kl 4 end, siden styrtet med hen. Kl 8 end peiltes tegne fyr i N 10' at e. g. og fyret holdtes i peilinger indtil kl 6 pnd da det tabtes isigke i N 10' at e. g. siden styrtet N 4 1/4 W hen. Blevet natten til Lørdag 16-8 vinden løj samt stille uden styring og det viste sig ved at kaste ut styrtet at strømmen sat i vestlig retning. Dagen løj bris med kold luft og nat til Søndag 17-8 stille uden styring samt løj vin. Dagen ganske løj bris med styrtet luft og nat til mandag 18-8 løj bris samt stille uden styring. Det bemærktes at Lørdag, Søndag, og mandag holdtes rustik fra riggen efter land, men uden resultat. Og efter formening antok vi at skibet maatte vere paa vestsiden af Great Cañon efter strømsaevningen. Mandag 18-8 ganske løj bris med byget luft. Udpaaften hilpristen vind. Styrde Bidsenid for et halvt N 4 1/4 W til midnag siden N 4 1/4 W til midnat, da de kom en haard byge som trængede skibet voldsomt over bålet ind anesanen, gav op begge Røiler og Røiruseil. Friaften kom paa det vobleklig.

Review for transmission
to Commission Office.
W. McCracken
Vice Consul
Grand Cayman.
24 Sep. 1913.

RECEIVED
VICTOR CONSULAT
SEP 24 1913

Figure C.1: Norwegian account of the wrecking of the Glamis by Captain Thorbjornsen, the 1st Mate, and the Boatswain. (Courtesy of the Norwegian Maritime Museum)

Da man holdt paa med St. Torbjørnsen
 klarer det pludselig op i la og land
 viste sig, men ingen fyr. Skibet
 blev straks vendt for og i muligt at
 ligge her ud, men vinden skifter ofte
 vendingen saa fartøier gik med stærk
 fart ind paa kysten. Bunden bestaar
 af koral saa skibet lugget voldsomt.
 Gjorde klar livbåtsene, sat saa alle
 seil paa og forsøgte hele natten
 igjennem at seile eller vide det af,
 men umuligt. Pumperne spillede stadig
 skibet holdt sig til til 5 morgen
 da det viste sig 6 Tommer vand.
 Det fyldtes nu rask og til 7 fund var
 der 17 fot i rummet. Skibet kæng
 over til B. B. og blev liggende i denne
 stilling. Gjorde fast seilene, sjøen
 brøkket stadig ind og dækket. Kronometret
 har til alle tider vist sig at være rigtig og
 i Par-la Ma var det umuligt at
 faa kontrollert standen, da oven stod
 over land. Efter al sandsynlighed har
 strømmen i den høi vind og stille
 sat skibet ~~under~~. Anm = Søjelover.
 Beriduel af undertegnede.

M. M. Mortensen
 Bøtsmand

J. Josephsen.
 1st Skjens.

Tho Thorbjørnsen
 fører
 af Glamis

Figure C.2: Norwegian account of the wrecking of the Glamis by Captain Thorbjørnsen, the 1st Mate, and the Boatswain. (Courtesy of the Norwegian Maritime Museum)

APPENDIX D

Albert E. Panton's notarized account of the loss of the Glamis from Captain Thorbjornsen, the 1st Mate and the Boatswain.

J.N. 514/13 S.S.

Copy
Cayman Islands
Island of Grand Cayman To Wit...

By this public Instrument of Declaration be it Known and made manifest unto all people that on this 26th day of August in the year, 1913. Before me Albert E. Panton Notary Public duly authorized admitted and sworn, and practicing in the Island of Grand Cayman B.W.I. personally came and appeared Thomas Thorbjornson the Master and Commander, of the late 'Barque' Glamis of the burthen of Eleven hundred and Eleven tons or thereabouts per register, belonging to the port of Tweedstrand Norway. Jens Josephsen, Chief Mate, and Morten Mortensen, Boatswain on board of the said vessel, who in pursuance, and extension of a protest duly noted with me and entered by me, the said Notary. On the 21st day of August Inst. And being duly sworn and by these presents, unanimously affirm, testify and say; that on August 15th last, the said vessel being light Staunch and strong, well equipped manned, provided with all things necessary and essential for a vessel of her burthen on her intended voyage and being loaded with a cargo of Logwood, They the said appearers, set sail in and with the said vessel, from and out of the port of Savlamar, Jamaica, bound to the port of Riga in Russia. At 6 A.M. Fine Weather all day. At 8 P.M. Negril Point bore N.N.W. distance 15 miles. Wind from various points, Pumps well attended too. At 6 A.M. the 16th we lost sight of Jamaica distance 25 Miles. Bearing E.N.E. Very light winds during the day, so that the ship could not steer. According to bits of wood thrown overboard we found that the current was setting westward. Observation at noon, Lat. 18.34. Long. 79.01. 17th Very light winds, pumps well attended to. Observation taken Lat. 19.01. Long 79.37. At 6. A.M. the 18th the weather was fine with very light winds. At noon it gathered up cloudy so that no observations could be taken. Supposed Lat. 19.10 Long. 80.24. Course steered N.W.1/4. At 6 P.M. gave strict orders that a proper lookout should be Kept, which was done. At midnight the wind increased with heavy squalls and Rain, we began to shorten sails. Took in the Spanker, and Royals, clued up the top gallant sails and whilst working at the Main top gallant sail, the weather cleared a little, and at that time we saw land under the lee. All hands were on deck attending to the sails when the land was seen, orders were immediately given for the ship to be put about, and whilst bracing over the yards, the wind Shifted again, and about ten minutes after the Ship struck on a Coral Reef off the east point of

the Island, thumping very heavily aft, we backed the fore yards to port in order to swing the Ship's head round, very heavy seas were running shifting the vessel on the port side, and a strong current which prevented the Ship backing round. The Ship was still sticking very heavily. Pumps sounded all the time. At 5 A.M. we found six inches of water in the hold at 7 A.M. sounded again and found 17 feet of water in the hold. All the sails were clued up. The Ship fell deck to sea, which caused the water to come over her side. Between 6 and 7 A.M. several boats came alongside from the shore. A messenger was sent immediately to Lloyd's Agent in GeorgeTown who resides at a distance of 24 miles. The next morning he arrived, and after examining the Ship a survey was held on the Ship, and the surveyors decided that she was a total wreck, there being eighteen feet of water in the hold, and recommended that she should be taken in charge for whom it may concern. The Master seeing that there was no hope of his being able to save the Ship decided to send his crew ashore in charge of the Norwegian Consul. (Vice) The Master and two officers remained onboard until the 21st Inst. when they decided to leave the Ship, she being full of water heavy seas washing over her, and not safe to remain any longer. The Ship was passed over to the wreckers to dismantle her and save what of the Cargo Could be Salved.

And the said appearers further declare that they attribute the stranding of the said Ship to a very strong current, heavy squalls, and the light at Gun bluff was not seen.

Wherefore the said appearers have protested, and by these presents do solemnly protest all and every person and persons whom it doth, shall or may concern in any way or manner, for all losses, prejudices and indicated costs, charges, damages, and expenses already suffered and sustained or that shall or may be hereafter suffered or sustained by the owners of the said vessel or others interested in the said vessel, by reason, or on account of the premises afore said, and which losses, costs, charges damages and expenses shall or may be recoverable from and against underwriters and others concerned in time and place convenient. And as of right appertains such losses and damages having happened and occurred as aforesaid, and not having been occasioned by or through the neglect of any of its said vessels Company, who and every of whom did their utmost for the preservation of the said vessel.

Thus declared and protested at Grand Cayman in My office.

In testimony whereof the said appearers have herewith set their hands, I the said Albert E. Panton, have here-unto subscribed My name and affixed My seal of office this 26th day of August in Year of our Lord 1913.

(Sgd.) Thomas Thorbjornsen,
Master

(Sgd.) Jens Josephsen
1st Mate

(Sgd.) M.M. Mortensen
Boatswain

(Sgd.) Albert E. Panton
Notary Public
Within the Cayman Islands

Transcribed by Whitney Anderson and Margaret Leshikar-Denton. (Courtesy of the Norwegian Maritime Museum).

APPENDIX E

Report of W.M. Cochran, Norwegian Vice Consul for the Cayman Islands

Wm. Cochran,
General Merchant,
Grand Cayman

JN 514/13SS

George Town September 17, 1913

To the Secretary
Commercial Office
Christiania
Norway

Sir,

I beg to report that on the 19th Inst the Norwegian Barque, "Glamis" 1111 tons [Master T. Thorbjornsen] bound from Sav. la. Mar Jamaica to Riga with 1246 tons of logwood on board went ashore on the East End of Grand Cayman and became a total wreck. The Captain attributes the disaster to hazy and squally weather, treacherous currents, and his inability to distinguish the light at East End. He states that he left Sav. la Mar on the 15th Inst. with everything aboard in good condition, and experienced calm, light favourable winds, and varying currents until the 18th Inst. when at noon he was about 30 miles from Grand Cayman. Between midnight and 1 a.m. a heavy squall struck the vessel and all hands were called on deck. Shortly afterwards, the land was seen and every effort was made by putting the vessel on the outer tack to get her out from the land. At this time, the wind shifted, and the current drove her on the reef. The ship was afloat forward, and on the rocks from midship to aft. As soon as the captain could communicate with the shore, he sent me a message and I dispatched a trustworthy representative to assist the captain in every possible way. He has since been in close attendance. The ship was surveyed and condemned, there being not the slightest chance of saving her. Her cargo has been salvaged for 50%, these being the best terms obtainable.

Subsequently, the sale took place, but very poor prices were realized. The scene of the wreck being difficult of access, and the surrounding districts inhabited but sparsely, and by a comparatively poor class of people.

The wreck was taken in charge by the Government Wreck Agent who superintends salvage operations, and what was saved was afterwards sold by him.

From the strict inquiries I have made into this matter, I can see no reason for doubting that the cause of the disaster was as stated by the Captain, viz. hazy and squally weather, treacherous currents, and his inability to distinguish the light at E.End.

I have the honour to be, Sir,
Your obedient Servant,
W. M. Cochran
Vice Consul for the
Cayman Islands

P.S. The scene of the wreck is 25 miles distant from George Town and not easily reached. I omitted to mention that the Sails of the Glamis, 33 in number, were in poor order. W.M.C.

Transcribed by Margaret Leshikar-Denton and Sue Gibb. (Courtesy of the Norwegian National Archive)

APPENDIX F

PERMISSION TO USE UNPUBLISHED SOURCE

Date: Tue, 16 Mar 2004 15:56:01 +0100
From: Berit Eide Johnsen <Berit.E.Johnsen@hia.no>
To: Bert Ho <bsh0953@garnet.acns.fsu.edu>
Subject: Re: your 2001 paper

Dear Bert Ho,

Please feel free to refer to my paper with the necessary references. I am sorry to say that it has not been published yet. The paper may be cited with a reference such as "title + paper presented at the conference" etc... Please contact me again if you need any further information.

Regards
Berit Eide Johnsen
Associate professor
Agder University College
Kristiansand
Norway

GLOSSARY OF IRON SHIP PARTS²

Angle bars: An angular bar articulating between beams and frames, similar to a knee in a wooden ship.

Bollard: A hollow iron post usually affixed on deck level to secure running line and mooring lines. Also referred to as bitts on vessels.

Bulwark: The area of a vessel's side that extends above the deck.

Caprail: An iron rail attached to the top of a vessel's frames.

Capstan: A short, cylindrical column of wood and iron fitted on the main deck that is used for raising cables, rigging, or anchors by revolving with hand power.

Clinker-built: An overlapping outer plating configuration, usually fastened with rivets and butt straps and plates.

Composite construction: A method of shipbuilding using iron frames and internal supports with wooden outer planking.

Composite ship: A type of vessel built during the mid-19th century that incorporates iron frames and supports with a wooden outer hull.

Frame: Transverse iron beam that defines the body shape of the vessel and where keelsons, stringers, and outer plating are fastened.

² Definitions are adapted from Paasch's *Illustrated Marine Encyclopedia* (1977) and Steffy's *Wooden Ship Building and the Interpretation of Shipwrecks* (1994).

Gunwale: The upper edge on a vessel's side.

Joggled: Molded notches on an iron plates' exterior surface in clinker-built ships.

Keel: The main, central longitudinal iron member that articulates with frames.

Keelson: The main, central, internal longitudinal iron member that is mounted atop the keel and connects to frames.

Knee: An angular piece of timber that reinforces to joining surfaces of differing planes.

Plating: Iron plates used for covering the outside of frames.

Sheathing: A layer of metal covering the external face of wooden planks to prevent fouling and to protect the outer hull.

Winch: A machine worked by hand or steam-power, used to aid in the loading and discharging of cargo.

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BIOGRAPHICAL SKETCH

Bert Shiping Ho was born in April of 1979 in Knoxville, Tennessee. He is a first generation Chinese-American, and spent his entire childhood in West Knoxville with his mother and two older brothers. As a child, Bert participated in a variety of sports and outdoor activity, and also became an accomplished violinist by his teen years. As a young adult he spent time in the San Jose area of California experiencing the tech-industry boom, while developing a strong interest in all things related to the sea. Bert attended the University of Tennessee, Knoxville, for his undergraduate education and graduated in 2001 with a degree in Anthropology. His focus was broad, as he developed a strong background knowledge of historic and prehistoric archaeology in North America, Mesoamerica, and Europe. In the fall of 2001, Bert enrolled at Florida State University as a graduate student in Anthropology, concentrating on nautical and maritime archaeology. He strengthened his diving skills, while learning in the classroom and on various field projects. Bert has enjoyed his experience in graduate school and hopes to work in marine policy related to the protection and preservation of submerged cultural material.