

The concept of the Atlantic Vessel

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In 1982, this author joined other graduate students at Texas A&M University's Nautical Archaeology program on the excavation of the Molasses Reef wreck in the Turks & Caicos Islands, BWI., an early 16th-century Spanish shipwreck (Kieth et al., 1984), a project undertaken by the Institute of Nautical Archaeology (INA) at the request of the Government of the Turks & Caicos. For the graduate students, this project was the beginning of a long-term course of study, which they organized and ran themselves, on the ships of the Age of Exploration and Discovery of the New World. For our own purposes this period was denoted as between 1492 and 1520, or from the discovery of the New World by Columbus to the year when Magellan entered the Pacific, Alonzo Álvarez de Piñeda determined there was no western outlet from the Gulf of Mexico to the Pacific, and Cortéz conquered Mexico (Keith, Carrel and Lakey, 1990, p. 123).

Eight sites or localities were identified by our research: 1. The Molasses Reef wreck; 2. The Highborn Cay wreck, Exumas Islands, Bahamas; 3. The Bahia Mujeres wreck, Quintana Roo, Mexico; 4. The harbour of La Isabella, the Dominican Republic; 5. Carocal Bay, Haiti, the site of the *Santa Maria*; and the four caravels of Columbus' last voyage; 6. The *Gallega* at Rio Belen, Panama; 7. The *Viscaina*, Porto Bello, Panama; and 8. The *Capitana* and the *Santiago de Palos* at St Ann's Bay, Jamaica. Of these eight localities, shipwrecks were located and investigated at the first three, but only the Highborn Cay and the Molasses Reef wrecks have produced significant hull remains.

The author's responsibility as part of INA's Exploration and Discovery Research Team (EDRT) was the study of the hull remains of the Molasses Reef and Highborn Cay wrecks, as well as the study of other sites from the same period. At the time, there were a total of seven shipwrecks from the period that yielded intact hull remains: Rye Vessel A in Sussex, England (Lovegrove, 1964); the *San Juan* in Red Bay Labrador (Ringer, 1983, 1986; Grenier, 1985; Stevens, 1986; Waddell, 1986); the Cattewater wreck, Plymouth, England (Redknap, 1984); the *San Esteban* of the 1554 New Spain Fleet at Padre Island, Texas (Olds, 1976; Arnold and Weddle, 1978; Rosloff and Arnold, 1984); the Highborn Cay wreck (Oertling, 1987, 1988, 1989b; Peterson, 1974; Smith, Keith and Lakey, 1985); the Molasses Reef wreck (Keith and Simmons, 1985; Oertling, 1988, 1989c); and the Studland Bay wreck (1475-1550 A.D.) (Hutchinson, 1991), which was then a new discovery near Poole in Dorset, England. These vessels could be grouped together because of an Iberian association in the correct time period and because they shared 12 distinct traits. These traits were presented at the Conference on Underwater Archaeology at Baltimore in 1989 as a beginning for the classification of this type of vessel (Oertling, 1989a).

Since then, quite a number of other 16th-century shipwrecks have been discovered and investigated. Information from some of these sites relating to the 12 aforementioned traits is presented in this paper. These new sites are: the Emanuel Point wreck, Pensacola Bay, Fla. (Smith et al., 1995); the Western Ledge wreck, Bermuda (Franklin et al., 1994; Morris, 1993; Watts, 1993a, 1993b); the St. John's Bahamas wreck, BWI (Malcom, 1996); the Ria de Aveiro-A wreck, Portugal (Alves, 1997); the Angra D wreck, Azores, Portugal, and the *Nossa Senhora dos Mártires* (Alves et al., 1998), Cais do Sodré and Corpo Santo wrecks, all in Lisbon, Portugal (Alves and Rodrigues, 1998, pers.comm.). The collected data is shown in Table A.

TABLE A

Characteristics of 16th-century Shipwrecks Defining the Atlantic Vessel.

	RYE	SJ	PI	HCW	MRW	CW	STB	EPW	RAA	WLW	SJB	AGD	NSM	CDS	CST
I. Pre-assembled central frames, dove-tailed mortises, transverse treenails	-	Y	-	Y	Y	Y	Y ¹	Y	Y	Y	-	Y	Y ²	Y	-
2. Planking nails: treenails per plank/frame join at midship	0:?	2:2	stern 2-3:0	-	2+2	2:2	2:1-2	2:1	2:1	?	3:2	?	2:0	2:0	stern 2:1
3. Sternpost scarphed to upper arm of keel knee	-	Y	Y	-	-	-	Y	N	Y	Y	-	?	-	-	Y
4. Single stern deadwood knee	-	Y	Y	-	-	-	Y	Y	Y	Y	-	?	-	-	Y
5. Y-timbers tabbed to deadwood	-	Y	Y	-	-	-	N	Y	N ⁴	Y	N	Y	-	-	N ⁴
6. Keelson notched over floor timbers	Y	Y	-	Y	-	Y	?	Y	Y	Y	-	Y	-	-	-
7. Mast step is expanded part of the keelson	Y	Y	-	Y	-	Y	?	Y	Y	Y	-	Y	-	-	-
8. Buttresses and stringers	Y	Y	-	Y	-	N	?	Y ⁵	Y ⁴	Y ⁴	-	Y	-	Y	-
9. Ceiling and filler planks	Y	Y	-	Y	Y	Y	Y	Y	N	Y/?	-	Y	-	Y	-
10. Rigging chain assemblies	-	Y	Y	Y	Y	-	Y	?	N	?	Y	-	N	N	-
II. Flat transom, sternpost proud of transom	-	Y	Y	-	Y	-	Y/?	N	N	Y	-	Y	-	-	N
12. Carved garboard	-	Y ²	Y	-	-	N	N	-	N	?	-	?	N	-	Y ⁶

IDENTIFICATION KEY:

- Information not available. That portion of the wreck was either not found or not preserved.
- ? Information was not recorded, but could be recovered at a later time.
- RYE** Vessel A, Rye, Sussex, England.
- SJ** The *San Juan*, Basque whaler at Red Bay, Labrador, Canada.
- PI** The *San Esteban* of the 1554 New Spain Fleet, Padre Island, Texas.

- HCW** The Highborn Cay wreck, Exumas Islands, Bahamas, BWI.
- MRW** The Molasses Reef wreck, Turks & Caicos Islands
- CW** The Cattlewater wreck, Plymouth, England.
- STB** The Studland Bay wreck, Poole, England.
- EPW** The Emanuel Point wreck, Pensacola Bay, Fla.
- RAA** The Ria de Aveiro wreck, Portugal.
- WLW** The Western Ledge wreck, Bermuda
- SJB** The St. John's Bahamas wreck, Bahamas; BWI.
- AGD** The Angra D wreck, Azores.
- NSM** The *Nossa Senhora dos Mártires*
- CDS** The Cais do Sodré wreck, Lisbon, Portugal
- CST** The Corpo Santo wreck, Lisbon, Portugal

- ¹ Although not dove-tailed, the floor and futtock are scarphed together and fastened transversely.
- ² The San Juan possessed an unusual curved keel which was "T"-shaped at midship and "Y"-shaped at its ends (Waddell, 1986: 139) obviating the need for a garboard.
- ³ The mortises in this case are not dove-tailed, but square with male and female on each timber.
- ⁴ There are no tabs. The frames are toe-nailed into the deadwood.
- ⁵ In these cases the buttresses do not touch the stringers.
- ⁶ The garboard has a carved top internal edge (Francisco Alves, pers. com. 2/10/99).

The wreck at Calvi in France was not included through an oversight by this author, but certainly appears to be an Iberian vessel (Villié, 1989). Other vessels which may or may not contain significant hull remains include: the Boudeuse Cay wreck, Seychelles (Blake and Green, 1986); Cape Carbonara wreck, Sardinia (Martín-Bueno and Tafalla, 1992); the Cavalaire wreck, France; and two more galleons from Red Bay designated M-27 and M-29, Canada.

Characteristics of 16th century Iberian ships

1. *A given number of central frames, assembled before they were set up on the keel, whose futtocks are joined to the floor with a dovetail mortise and tenon, and transverse treenails and nails.*

The *San Juan* had 14 pre-erected frames in the middle of the ship. In standard shipbuilding practice, the futtocks were attached to the forward side of the floors forward of the master frame and on the aft side of those floors on the aft side of the master frame. The master frame itself had futtocks attached on both the forward and aft with the dovetail mortises and iron fasteners (Grenier, 1988, p. 75). The master frame and futtocks of the Western Ledge wreck are similarly connected (Watts, 1993b, p. 112).

There are two different orientations of the mortises and tenons. On the Molasses Reef wreck (Oertling, 1989c, p. 233) the tenon is on the floor with the large side up. The Western Ledge wreck (Watts, 1993b, p. 112), the *San Juan* (Grenier, 1988, p. 75), the Cattewater wreck (most examples of six observed joins) (Redknap, 1984, p. 26), and the Highborn Cay wreck (Oertling, 1989b, p. 249 and fig. 7) are reversed with the tenon on the futtock with the large side down. The Ria de Aveiro A wreck is of the latter type, except that one floor-futtock join is of the former type (Alves, 1997, fig. 41). The *Nossa Senhora dos Martires* has double-lapped keys rather than dovetail joins (Alves et al., 1998, p. 203-204).

2. *The carvel planking is fastened with a combination of nails and treenails joining plank and frame. The nails are at the plank edge on the frame centreline and the treenails alternate across the centreline of the frame.*

Point 2 has been changed from a Yes/No answer on the 1989 Table to a qualitative answer of a ratio of nails to treenails per plank per frame ($(n:t)/p/f$). This was to allow more information in the table caused by variations, which do occur. The Padre Island and Western Ledge vessels show that mainly iron nails are used at the ends of the vessel where the planks come into the stem and sternpost (Rosloff and Arnold, 1984, p. 292-293 and fig 1.; Watts, 1993b, p. 114). Robert Grenier reports a reversal of the orientation of the treenails from one side of the frame to the other (Grenier, Loewen and Proulx, 1994, p. 139-140).

In the Molasses Reef wreck, this change occurred near the master frame. This wreck had a third nail in each plank/frame that is interpreted as a re-fit, not a repair, since nothing was replaced. These nails were readily apparent since they had round heads and cross sections compared to the usual nail with a square head and square section. At some point, the lower part of the hull was strengthened (Oertling, 1989c, p. 235).

The *San Juan* and Molasses Reef wreck had nail heads that were countersunk and pitched over. Several sites report hair or fibre wrapped around the nail shaft under the head. The Ria de Aveiro wreck has only a single treenail for each plank/frame junction (Alves, 1997), and the *Nossa Senhora dos Martires* has no trunnels at all in the lower hull planking (Alves et al., 1998, p. 208-209).

3. *The aft end of the keel is a naturally grown knee whose upper arm is scarphed to the sternpost.*

The Emanuel Point shipwreck was the only one to have the sternpost sit directly on top of a flat keel. This part of the hull has not been dismantled, so the exact nature of this joint is not known at this time (Roger and Smith, 1998, pers. comm.).

4. *A single piece deadwood knee timber sits on top of the keel knee. This timber reinforces the juncture of the sternpost and keel, provides a surface for fastening the lower hull planks and is the base for the aftermost Y-shaped frames.*

5. *The stern Y-timbers are tabbed into the deadwood knee (the tabs supported the timbers until the planking was added).*

The St. John's Bahamas wreck (Corey and Malcom, 1998, pers. comm.) and the Ria de Aveiro wreck did not have tabs on the Y-timbers, the latter wreck had its timbers toe-nailed into the deadwood.

6. *The keelson is notched over the tops of the floor timbers.*

7. *The mast step is an expanded portion of the keelson, part of which is cut away to seat the ship's pump.*

The Cattewater vessel was the only wreck with the pump sump cut through the centre of the keelson (Redknap, 1984, p. 29-32).

8. *The mast step is supported by buttresses and bilge stringers.*

In contrast to earlier finds, the Emanuel Point wreck does not have the buttresses touching the bilge stringers (Smith et al., 1995, p. 26-27). The buttresses on the Ria de Aveiro A wreck are an integral part of the floor frame (Alves, 1997). This and other variations may be due to the vessels' small size. No stringers were reported on the Western Ledge, but it is not clear if the stringers were displaced or not present (Morris, 1993). This site was salvaged heavily in previous years, so some loss of structure is possible. The Cattewater wreck is the only ship that definitely has no buttresses or stringers (Redknap, 1984, figs. 54 and 56).

9. *Ceiling planking extends just above the ends of the floor timbers where the last ceiling plank is notched to accept the short transverse filler planks.*

10. *The ships have as part of their standing rigging a teardrop-shaped iron strop to accept a heartblock or deadeye which is attached to 2-3 lengths of chain and the last link through an eyebolt.*

11. *There is a flat transom stern with the sternpost proud of transom face as testified by rudder gudgeons on some of the vessels and the surviving transom of the San Juan.*

The Emanuel Point wreck is the only variant on this point. Dr. Roger Smith relates that four gudgeons have been identified and all have V-shaped straps. This indicates that the ship was round-sterned instead of transomed (Smith, 1989, pers. com.).

12. *The garboard is carved from an extra thick plank.*

In 1989, Robert Grenier disagreed with this last point. Only the Padre Island vessel has a true carved garboard in the stern. The *San Juan* was included because the unusual carved wings of the keel substituted for the garboard. The Corpo Santo wreck garboard is carved on the

upper internal edge (Alves, 1999, pers. comm.). Given the lack of supporting examples, this author now agrees with Mr. Grenier. This last point will be removed from future consideration.

This author's initial objective in studying the Molasses Reef and Highborn Cay wrecks was to identify the characteristics of a hull that would indicate a caravel. But instead, a fairly consistent set of features unrelated to size, purpose, or geographic location were found. What did these traits represent? A unified and accepted method of shipbuilding representative of the practices on the Basque, Portuguese and Atlantic Spanish coast. What this also meant, and it was something of a disappointment, was that the difference between a caravel and a nao, a nao and a galleon, etc., could not be discerned based on the construction features. The focus turned away from the features themselves, to what these structural elements were intended to do.

The stern structure of the keel-knee, deadwood knee, and sternpost tied the longitudinal spine of the ship together in the stern. The tabs on the Y-timbers are a signature of the constructional process in this part of the ship. The planking held all of the stern structure together. When the planking gave way in the stern during the wrecking process, the weight of the transom invariably caused the sternpost to break just below the point where the fashion pieces met the sternpost.

The most apparent, noticeable and identifiable structure was the midship area around the mast-step. This arrangement of the mast-step (expanded from the keelson), buttresses and stringers created an incredibly strong support for the base of the main mast. The lateral force exerted by the foot of the main mast was distributed to the rest of the hull through the buttresses to the stringer and also through the keelson, which was notched over the floors, to all of the frames. The Atlantic coast shipwrights developed these construction features to meet the specific demands of Atlantic Ocean conditions. These ships were a response to a need and the response is reflected in the traits listed here. This is how the "Atlantic Vessel" concept was developed.

But as with most ideas, it did not stand unchallenged. An objection to the "Atlantic Vessel" concept was summed up well in a letter to this author from John Patrick Sarsfield (pers. com.: April 1, 1989) a few months after the 1989 conference. In the presentation the word "class" was used to group the vessels together. This was not the best choice of words and probably led to some confusion.

Mr. Sarsfield says:

"I agree that Galleons, naos and caravels belong to the same class of vessel, but this "class" also includes all types of galleys, galzabras, carracks, fustas, faluas, fragatas, pataxos, etc. In other words, it is not so much a class as it is a boat/ship tradition: a mediterranean tradition of a plank-on-frame design and construction system. The Iberian Peninsula, before the Age of Discovery, was the western extent of that tradition. I, therefore, strongly disagree with the "Atlantic Vessel" thesis. This design/construction system predates Columbus by at least 100 years; and galley design had probably more to do with its inception than anything else. I didn't address this point during our session. However, when it was propounded during the INA sessions, I did make my objections known (I wasn't the only one who questioned the thesis).

"At least some of this disagreement is over confusion as to exactly what was meant. With ten years to ponder the situation, it can now be better explained. The problem then was the lack of the proper word that would adequately classify the set of ships under study. Yes, the other vessel types named by Mr. Sarsfield, at least those built on the Atlantic coast, would be included in the "Atlantic Vessel" type. The galley, however, and any of those which had a Mediterranean origin and use would be excluded. As John said, "The Iberian Peninsula was the *western extent of that tradition*. "That means it may have been influenced by other

traditions or free to invent new ones. The Iberian coast from the Straits of Gibraltar to Biscay Bay is quite a different animal than from the straits to the Gulf of Lyons. It is different in geography, hydrography, weather and sea conditions. One cannot fail to realize that these different conditions will have their influence on the ships built on the different coasts. Also, the location of the Iberian ports on the Atlantic coast placed them on the marine highway connecting the Mediterranean and Northern European worlds. The seamen, shipbuilders, merchants and ship owners who populated these ports were exposed to all the examples of ships which travelled by for many centuries before Columbus.

John says further, "This design/construction system predates Columbus by at least 100 years..." Yes, of course. Do not assume that the Atlantic Vessel is confined to the arbitrary period of time that the Exploration and Discovery Research Team defined. The Portuguese sailed these ships down the west coast of Africa and the Basques most likely crossed the Atlantic to the fisheries off the northeast coast of North America many years before Columbus set out on his first voyage.

John also said, "it [the Atlantic Vessel] is not so much a class as it is a boat/ship tradition: a mediterranean tradition of a plank-on-frame design and construction system." Yes, I largely agree with this, and this is the problem with terminology I had ten years ago. It is part of the Mediterranean tradition of boat/ship building, but different enough in construction and intent, that it is readily recognizable. The word "class" denoted too small a group and also has other connotations in the present time. "Tradition" denotes the larger "carvel" or "clinker" built traditions of the Mediterranean or Northern Europe. This word encompassed too large a group of ships and already defined the larger traditions. The Atlantic Vessel is an identifiable set of the larger tradition, and this author proposes "sub-tradition", much like the Viking ships which have readily identifiable features but which do not define all clinker built ships of the Northern European tradition.

Confusion may also have been engendered over the difference between design and construction. John Sarsfield was very much a student of the design methods. He was most likely right when he said that the Atlantic Vessel owed much to galley design, but this author maintains that the constructional aspects are quite different. The wreck sites studied by this author did not offer enough data for a full reconstruction, so the theory of hull design was not a high priority. Mr. Sarsfield and this author were looking at this topic from different perspectives.

In conclusion, it is this author's belief that the idea of the Atlantic Vessel is sound. This is not to say these were the only vessels built that could survive Atlantic conditions; other peoples and cultures did so. But, this is a system that worked for Iberian builders and their ships travelled the world. Of the list of 12 traits presented at the 1989 Conference on Underwater Archaeology, point 12, the carved garboard, has been eliminated; point 2 has been modified to show variation in the fastening pattern; and in point 8, it is recognized that the buttresses do not always touch the stringer.

These eleven points are a beginning and are intended to be used as a tool for identifying the ships of the Iberian-Mediterranean sub-tradition. The group of traits should be taken as a whole and not individually because each trait, such as the mortise and dovetail joins, can appear in wrecks outside the Atlantic Vessel type. These points can and should be debated, add to and/or subtracted from.

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BIBLIOGRAPHY

- ALVES, F. J. S. (1997) - *Os destroços do navio do século XV, Ria de Aveiro A. Campanha de 1996*. Relatório Progresso para a Junta Nacional para a Investigação Científica e Tecnológica. Aveiro, Lisboa: Universidade de Aveiro, Instituto Português do Património Arquitectónico e Arqueológico.
- ALVES, F.; CASTRO, F.; RODRIGUES, P.; GARCIA, C.; ALELUIA, M. (1998) - Archaeology of a shipwreck. In *Nossa Senhora dos Mártires. The last voyage*. English version of the Catalogue of the Pavilion of Portugal in the Expo'98 (Portuguese and Spanish versions also exists). Lisbon: Editorial Verbo, p. 183-215.
- ARNOLD III, J. B.; WEDDLE, R. (1978) - *The Nautical Archaeology of Padre Island*. New York: Academic Press.
- BLAKE, W.; GREEN, J. (1986) - A mid XVI century Portuguese wreck in the Seychelles. *The International Journal of Underwater Archaeology*. 15:1, p. 1-23.
- FRANKLIN, M.; MORRIS III, J. W.; BROADWATER, J.; WATTS JR., G. P. (1994) - A Preliminary Description of the Excavation, Timber Recording, Hull Construction, and Cultural Material Analysis of a Sixteenth Century Vessel Wrecked on Western Ledge Reef, Bermuda. In WOODWARD, R. P.; MOORE, C. D., eds. - *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*. Vancouver, British Columbia: Society for Historical Archaeology, p. 47-62.
- GRENIER, R. (1985) - Excavating a 400-year-old Basque Galleon. *National Geographic Magazine*. 168.1, p. 58-68.
- GRENIER, R. (1988) - Basque Whalers in the New World: The Red Bay Wrecks. In BASS, G. F., ed. - *Ships and Shipwrecks of the Americas*. London: Thames and Hudson, p. 69-84.
- GRENIER, R.; LOEWEN, B.; PROULX, J. P. (1994) - Basque Shipbuilding Technology c. 1560-1580: The Red Bay Project. In WESTERDAHL, C., ed. - *Crossroads of Ancient Shipbuilding. Proceedings of the Sixth International Symposium of Boat and Ship Archaeology*, Roskilde, 1991. Oxford: Oxbow (Oxbow Monograph; 40), p. 137-141.
- HUTCHINSON, G. (1991) - The Early 16th-Century Wreck at Studland Bay, Dorset. In REINDERS, R.; PAUL, K., eds. - *The Fifth International Symposium on Boat and Ship Archaeology*. Amsterdam: Oxbow (Oxbow Monograph; 12.1), p. 171-175.
- KEITH, D. H.; DUFF, J. A.; JAMES, S. R.; OERTLING, T. J.; SIMMONS, J. J. (1984) - The Molasses Reef wreck, Turks and Caicos Islands, B.W.I.: A Preliminary report. *The International Journal of Nautical Archaeology*. 13.1, p. 45-63.
- KEITH, D. H.; SIMMONS III, J. J. (1985) - An Analysis of Hull Remains, Ballast and Artifact Distribution of a Sixteenth-Century Shipwreck: Toward a Better Understanding of Wrecking and Reconstruction. *The Journal of Field Archaeology*. 12.4, p. 411-424.
- KEITH, D. H.; CARRELL, T. L.; LAKEY, C., Denise (1990) - The Search for Columbus Caravel, Gallega, and the Site of Santa Maria de Belem. *Journal of Field Archaeology*. 17.2, p. 123-140.
- LOVEGROVE, H. (1964). - Remains of Two Old Vessels Found at Rye, Sussex. *Mariner's Mirror*. 50.2, p. 115-122.
- MALCOM, C. (1996) - St. John's Bahamas Shipwreck Project, Interim Report I: The Excavation and Artifacts, 1991-1995. Key West, Fla.: Mel Fisher Maritime Heritage Society.
- MARTIN-BUENO, M.; TAFALLA, J. A. (1992) - Remains of a Fifteenth-Century Spanish Ship Found in Sardinia. In KEITH, D. H.; CARREL, T. L., eds. - *500 Years of Change. Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*. Kingston, Jamaica: Society for Historical Archaeology, p. 85-91.
- MORRIS III, W. J. (1993) - The Preliminary Analysis of the 6th Century Vessel Remains Recovered from the Western Ledge Reef, Bermuda. *Bermuda Journal of Archaeology and Maritime History*. 5, p. 58-69.
- OERTLING, T. J. (1987) - *The Highborn Cay wreck: Limited Excavations, September 1-19, 1986*. A proprietary report to the Ministry of Transport, Government of the Bahamas, BWI. College Station, Tx.
- OERTLING, T. J. (1988) - The Molasses Reef and Highborn Cay wrecks: Two early 16th-century hulls. In DELGADO, J. P., ed. - *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*. Ann Arbor: Braun-Brumfield, Inc., p. 116-120.
- OERTLING, T. J. (1989a) - The Few Remaining Clues... In ARNOLD III, J. B., ed. - *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*. Pleasant Hill, Ca.: Society for Historical Archaeology, p. 100-103.
- OERTLING, T. J. (1989b) - The Highborn Cay wreck: The 1986 field season. *The International Journal of Underwater Archaeology*. 18.3, p. 244-253.
- OERTLING, T. J. (1989c) - The Molasses Reef wreck hull analysis: Final report. *The International Journal of Underwater Archaeology*. 18.3, p. 229-243.

- OLDS, D. L. (1976) - *Texas Legacy from the Gulf: A Report on Sixteenth Century Shipwreck Materials Recovered from the Texas Tidelands*. Austin: The Texas Antiquities Committee (The Texas Antiquities Committee Publication; 2).
- PETERSON, M. L. (1974) - Exploration of a 16th-Century Bahaman Shipwreck. In *National Geographic Society Research Reports, 1967 Projects*. Washington: National Geographic Society, p. 231-42.
- REDKNAP, M. (1984) - *The Cattewater Wreck: The Investigation of an Armed Vessel of the Early Sixteenth Century*. Greenwich: National Maritime Museum (Archaeological Series; 8, BAR British Series; 131).
- RINGER, R. J. (1983) - Progress Report on the Marine Excavation of the Basque Whaling Vessel San Juan (1565): A Summary of the 1982 Field Season. *Parks Canada Research Bulletin*. Ottawa. 206.
- RINGER, R. J. (1986) - A summary of marine archaeological research conducted at Red Bay, Labrador: The 1984 field season. *Parks Canada Research Bulletin*. Ottawa. 248.
- ROSLOFF, J.; ARNOLD, J. B. (1984) - The Keel of the San Esteban (1554): continued analysis. *The International Journal of Nautical Archaeology*. 13:4, p. 287-296.
- SMITH, R. C.; KEITH, D. H.; LAKEY, C., Denise (1985) - The Highborn Cay wreck: Further exploration of a 16th-century Bahaman shipwreck. *The International Journal of Nautical Archaeology*. 14:1, p. 63-72.
- SMITH, R. C.; SPIREK, J.; BRATTEN, J.; SCOTT-IRETON, D. (1995). *The Emanuel Point Ship: Archaeological Investigations 1992-1995*. Bureau of Archaeological Research Division of Historic Resources. Tallahassee, Fla.: Florida Department of State.
- STEVENS, W. (1986) - Progress report on the marine excavations at Red Bay, Labrador: A summary of the 1983 field season. *Parks Canada Research Bulletin*. Ottawa. 240.
- VILLIÉ, P. (1989) - L'Épave Calvi I. *Cahiers d'Archeologie Subaquatique*. 8, p. 19-56.
- WADDELL, P. J. A. (1986) - The disassembly of a 16th century galleon. *The International Journal of Nautical Archaeology*. 15:2, p. 137-148.
- WATTS Jr., G. P. (1993a) - A decade of ship research in Bermuda. *Bermuda Journal of Archaeology and Maritime History*. 5, p. 12-27.
- WATTS Jr., G. P. (1993b) - The Western Ledge Reef wreck: a preliminary report on the investigation of the remains of a 16th-century shipwreck in Bermuda. *The International Journal of Underwater Archaeology*. 22.2, p. 103-124.