

Angra A: the Copper-fastened Wreck at Porto Novo

(Angra do Heroísmo, Terceira island, Azores-Portugal)

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A B S T R A C T The *Angra A* wreck – or Copper-fastened wreck – at Porto Novo; Angra Bay, Terceira Island, Azores, was briefly examined during the general survey of the inner harbor area in 1996. The frames of *Angra A* exhibited very low dead rise, suggesting that the vessel was nearly flat-bottomed with a pronounced turn of the bilge, indicating that the hull was designed for maximum cargo capacity amidships. The presence of copper fasteners on the wreck in Porto Novo tells us that the hull was built sometime after 1783, very likely dates to the 19th century, and most probably was built after 1840.

R E S U M O Os destroços de *Angra A* – ou navio cavilhado a cobre – de Porto Santo, baía de Angra do Heroísmo, Terceira, Açores, foram sumariamente examinados, em 1996, durante uma prospeção geral da área do porto interior da baía. O cavename de *Angra A* demonstrava um levantamento muito fraco, parecendo indicar que o navio era quase de fundo chato, com uma pronunciada carena, indicando que deve ter sido desenhado para ter uma capacidade de carga máxima a meia nau. A presença de cavilhas de cobre nos destroços de Porto Novo indica que o casco foi construído depois de 1783, provavelmente datando do século XIX, tendo sido construído muito provavelmente depois de 1840.

Overview

The “Copper-fastened Wreck” at Porto Novo was briefly examined during the general survey of the inner harbor area in 1996. This wreck lies off the northern corner of Porto Novo, beneath approximately 5 to 7 m of water (Fig. 1). It is oriented along a northwest-southeast axis, but the stem and the stern of the vessel have not been identified due to the lack of endposts, deadwood timbers, or diagnostic features on the keel (Fig. 2). The site is characterized by an oval ballast mound measuring 35 m in length by 11,5 m in width; beneath the ballast mound is an articulated lower hull structure measuring 40 meters in length by approximately 11,5 m in breadth. The northwestern end of the wreck is lodged between two large boulders.

The wreck underwent preliminary recording on September 16 when a MAH*/INA** team photographed the timbers and prepared a sketch of the site showing the relative positions of the ballast, timbers and boulders. Measurements were also taken of selected hull timbers. During a follow-up dive on September 20 the gross dimensions of the ballast mound and exposed hull structure were recorded.

Hull Timbers

The wreck consists of a 40m length of structure from the bottom of a heavily-built wooden vessel. Ballast covers much of the hull, but exposed timbers along the southwestern side and southeastern end of the wreck provided much information about the construction of the ship. Identifiable timbers include the keel, the lower portions of frames (consisting of floor timbers and futtocks), a bilge stringer, and both external planking and internal (or ‘ceiling’) planking. The condition of the visible timbers varied: the keel, frames, and planking at the southeast end of the wreck have long been exposed to decay and the depredations of marine wood-boring organisms such as *teredo navalis* (teredo worms) and as a result are in very poor condition, frame timbers amidships appear to have been — until recently — protected by sand and ballast, and in some places retain their original surfaces, complete with tool marks. The wreck timbers still buried under the ballast should be in good condition.

A 5,42 meter length of the ship’s keel protrudes from the ballast pile at the southeastern end of the wreck. This timber was of substantial dimensions, 38 cm moulded by 29 cm sided. The keel’s surfaces were considerably degraded, and we could not identify typical keel features such as the outer planking rabbets, a shoe (or ‘false keel’), or timber scarfs.

The wreck’s frames were, like the keel, of very substantial size, with the sided dimensions averaging between 23 and 28 cm and the moulded dimension averaging about 20 cm. The frames were very closely spaced amidships on 59 cm centers, with an average space of 5 cm between each set of frames. The frames exhibited little deadrise - the angle of rise above the horizontal plane of the keel - suggesting that the vessel was nearly flat-bottomed with a pronounced turn of the bilge, giving the hull a U-shaped section rather than a V-shaped section. The minimal deadrise indicates that the hull was designed for maximum cargo capacity amidships.

The wreck’s outer planking measured 9 cm in thickness; the badly-deteriorated state of the planking at the southeast end of the wreck did not allow us to identify planking seams, and the average width of the planks is therefore unknown. The outer planking was attached to the frames with copper-alloy spikes. We did not see any evidence on the outer planking or keel of any type of metallic or wooden sheathing to protect the wood from marine growth or teredo worms.

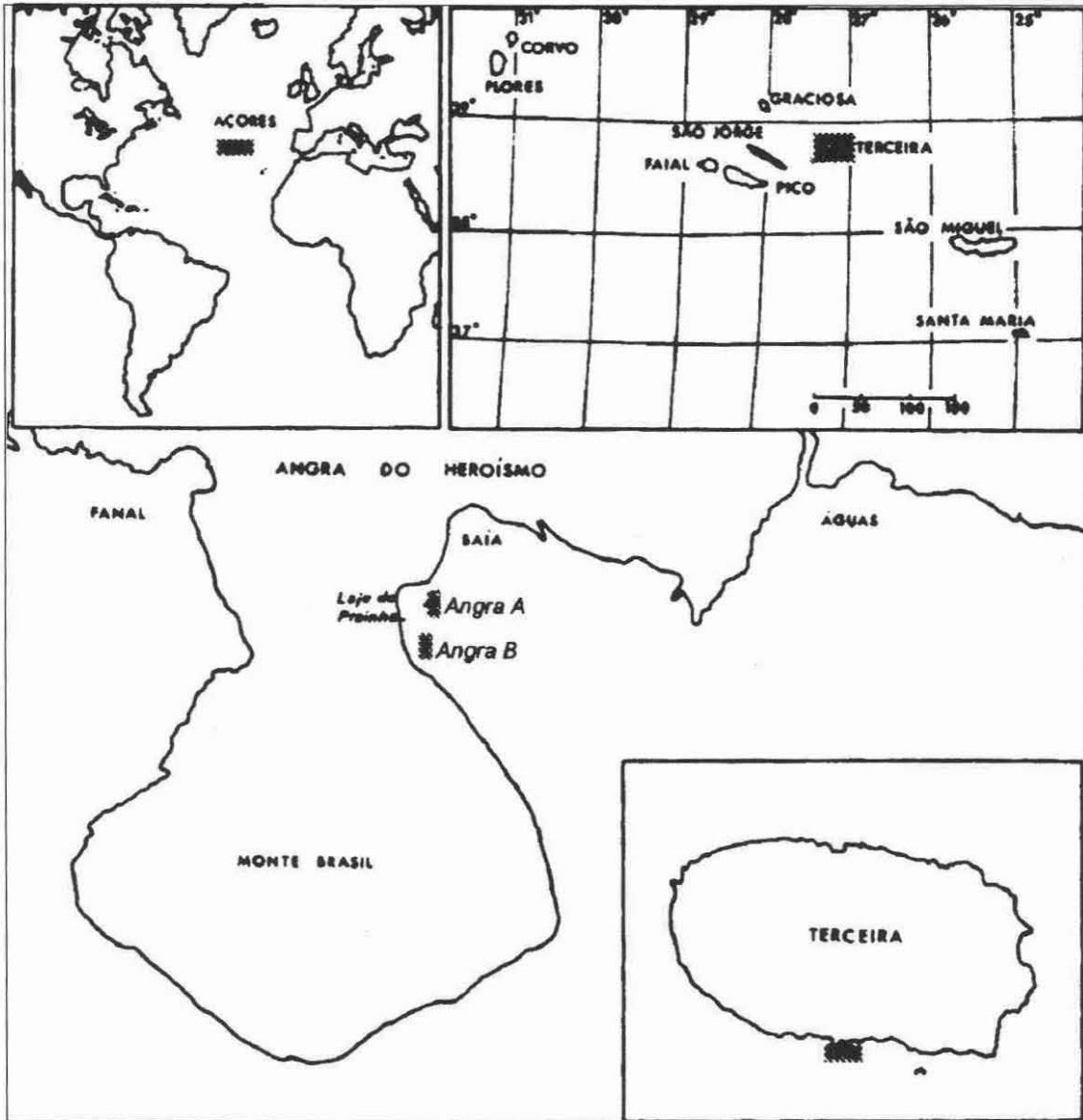
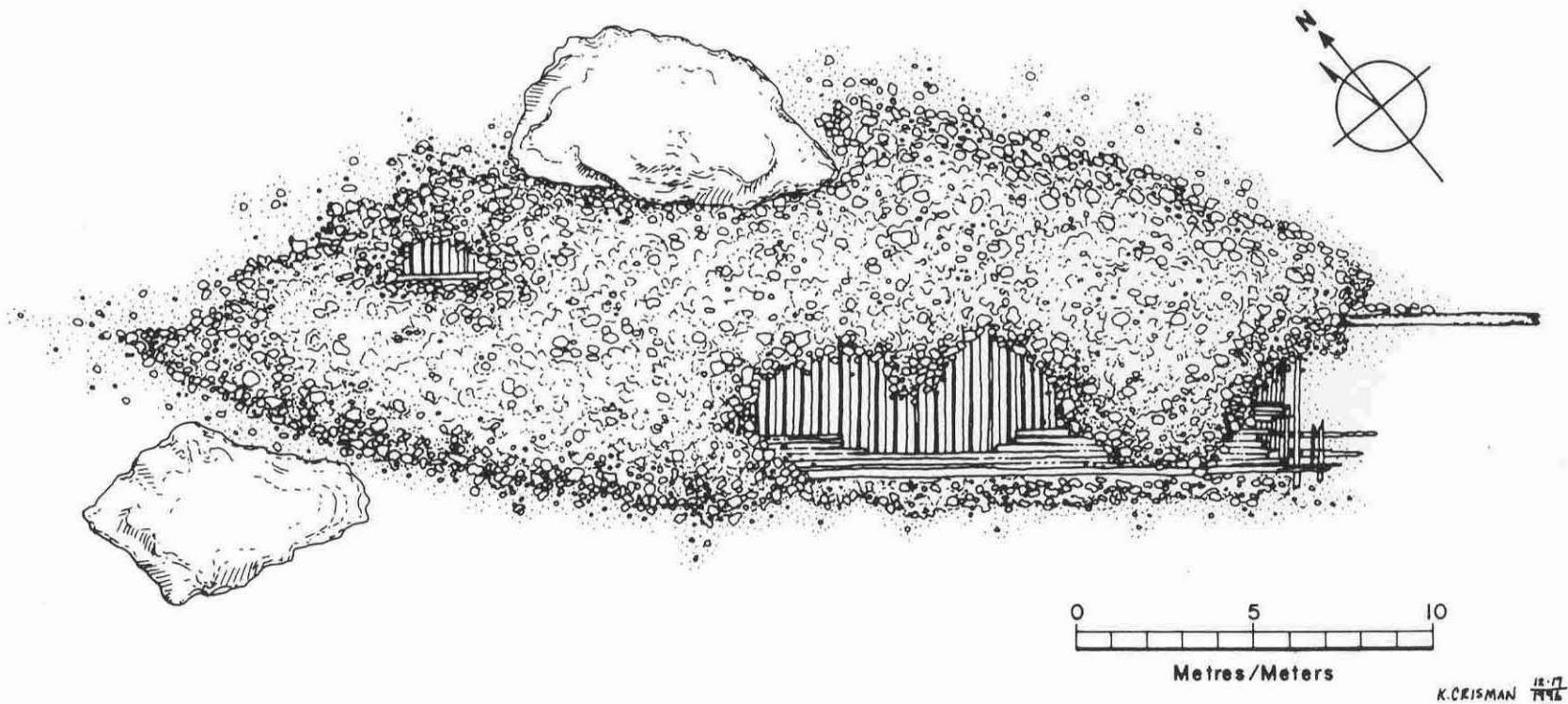


Fig. 1

THE COPPER-FASTENED WRECK



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1996

Fig. 2

Several strakes of ceiling planking were exposed on the southwestern side of the hull, and averaged 29 cm in width by 8 cm in thickness. A heavy timber extending along the southwest side of the wreck was identified as a bilge stringer. The stringer was quite large, 29 cm moulded by 23 cm sided, and was fastened to the frames with copper-alloy bolts.

There were no visible remains of the hull structure above the level of the bilge stringer, although it is possible that part of the vessel's keelson may still exist beneath the ballast.

Fasteners

As noted above, the wreck contained copper-alloy fasteners in the form of spikes and bolts. We did not note any treenails in the construction of the frames or attachment of the planking, but the survey was limited in extent, and it is possible that such fasteners may have been overlooked. The presence of copper fasteners permits approximate dating of the vessel, since spikes and bolts of this material appear to have been uncommon in large wooden ships built prior to the nineteenth century.

The use of copper for ship fasteners dates back to the classical era, and they appear on wrecks dating to the 5th and 4th centuries BC in the form of clenched nails. By the Roman era, however, iron replaced copper in shipbuilding, due its greater strength and lesser cost. Fasteners of iron or wood remained the standard through the medieval and early modern eras until the last quarter of the 18th century. The appearance of copper and copper-alloy fasteners was a result of the Royal Navy's experimentation with copper sheathing to protect the bottoms of wooden ships. Copper sheathing was first used in 1761 and was a great success in terms of improving sailing speed, keeping ships' bottoms free of marine growth, and repelling teredo worms. There were drawbacks to copper: it was expensive, it wore out quickly, and perhaps most seriously, copper sheathing over iron-fastened hulls created a galvanic reaction that quickly destroyed iron. By 1783 the Royal Navy learned to build its warships with copper spikes and bolts below the waterline which greatly relieved the problem of galvanic corrosion.¹

From the 1780s to the 1830s copper-fastened and sheathed vessels became more common, particularly for naval vessels and larger merchant craft, but the great expense and short life span of pure copper plates were still a problem and kept this type of sheathing from being widely adapted. The problems were finally overcome in 1832 when George F. Muntz of England patented 'yellow metal' or 'Muntz metal', an alloy of 60% copper and 40% zinc that was hotrolled into thin sheathing plates. Muntz's alloy was flexible enough to adapt itself to a wooden hull, corroded at a much slower rate than copper, and because of the high percentage of inexpensive zinc cost substantially less than pure copper. Muntz aggressively marketed his new alloy during the 1830s, and it began to see very widespread use by the 1840s.²

Discussion

The copper-fastened wreck in Porto Novo represents the bottom of a relatively large wooden vessel. The ends of the vessel could not be determined during the survey due to the lack of a stem or stempost or their related structures; the low angle of deadrise of the frames suggests that the vessel was quite boxy amidships, and was most likely a cargo-carrying vessel. The presence of copper fasteners on the wreck in Porto Novo tells us that the hull was built sometime

after 1783, very likely dates to the 19th century, and most probably was built after 1840. While no copper alloy sheathing was noted on the wreck, we can assume that it was probably sheathed during its career. Further investigation of the wreck's construction and of artifacts located in the ballast or between the frames might permit closer dating of the wreck. The percentage of copper and other metals in the fasteners could also be tested to see if the fasteners conform to Muntz's 1832 patent specifications.

*MAH - Museu de Angra do Heroísmo

** INA - Institute of Nautical Archaeology

NOTES

¹ CHAPELLE, 1967, p. 207-208.

² Patent Granted to George F. Muntz, Metal Roller, for his invention of an improved manufacture of Metal Plate, for Sheathing the Bottoms of Ships and other Vessels (1833). *Franklin Journal and American Mechanics Magazine*. 16, p. 195-196; FLICK, 1975, p. 74-78.

BIBLIOGRAPHY

CHAPELLE, H. L. (1967) - *The Search for Speed Under Sail*. New York: Bonanza Books.

FLICK, C. (1975) - Muntz Metal and Ships' Bottoms: The Industrial Career of G.F. Muntz. *Transactions of the Birmingham and Warwickshire Archaeological Society*. 8, p. 74-78.