Glenfields Beach timber inspection and identification

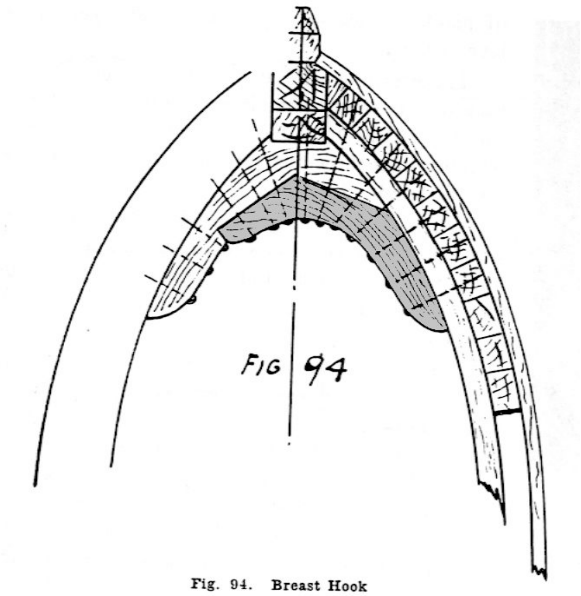


Fig. 94. Breast Hook

Ross Anderson

Report—Department of Maritime Archaeology
Western Australian Museum, No. 264
2010

Cover images:
Glenfields Beach timber (Jonathan Pomeroy).
Diagram of bow timbers showing the breasthook, a favoured possibility for the function of the Glenfields Beach timber (Desmond 1919: 104).

Background

In March 2010 Geraldton resident Jonathan Pomeroy reported discovering a timber believed to be from a shipwreck on Glenfields Beach, 7 km north of Geraldton. The timber was subsequently removed from the beach. Catherine Belcher, Manager WA Museum, Geraldton arranged for a local media release to be issued requesting anyone who had recovered the timber to report it to the WA Museum, Geraldton. As a result Geraldton resident Ross Bennett responded by reporting his discovery, and recovery of the timber. James Thompson (Technical Officer, WA Museum) and the Department of Maritime Archaeology arranged with Ross for the intermediate care, and later recovery of the timber and transport to storage at WA Museum, Geraldton in May 2010.

On Thursday 4 – Friday 5 June Ross Anderson (WA Museum, Department of Maritime Archaeology) and Jon Carpenter (WA Museum, Department of Materials Conservation) travelled to Geraldton for the purpose of inspecting and recording the timber, and taking samples.

Both Jonathan Pomeroy and Ross Bennett provided further information on the circumstances of their respective discoveries of the timber. Jonathan initially discovered it washing around at the surf/ tide mark following a heavy swell that had eroded away part of the beach, exposing the timber. He dragged it out of the surf with his 4WD vehicle. Ross Bennett subsequently discovered the timber in this location high up on the beach, and recovered it by digging a trailer into the sand and using his 4WD vehicle's winch to winch it onto the trailer in order to remove it from the beach.

Original site location and environment

Ross Bennett took us to the location of the timber on Glenfields Beach, which was 28° 41' 38" S, 114° 36' 36" E (WGS84), 3.83 km north of the Chapman River mouth. Glenfields Beach is an exposed sandy beach with consolidated dune system and offshore limestone reefs, exposed to prevailing south-west groundswell, surf, currents and tide conditions.
Ross described the location of the find as being where the flat part of the beach becomes steeper, and the beach sand becomes softer and deeper. There is normally a deep gutter between the beach and outer sandbar.

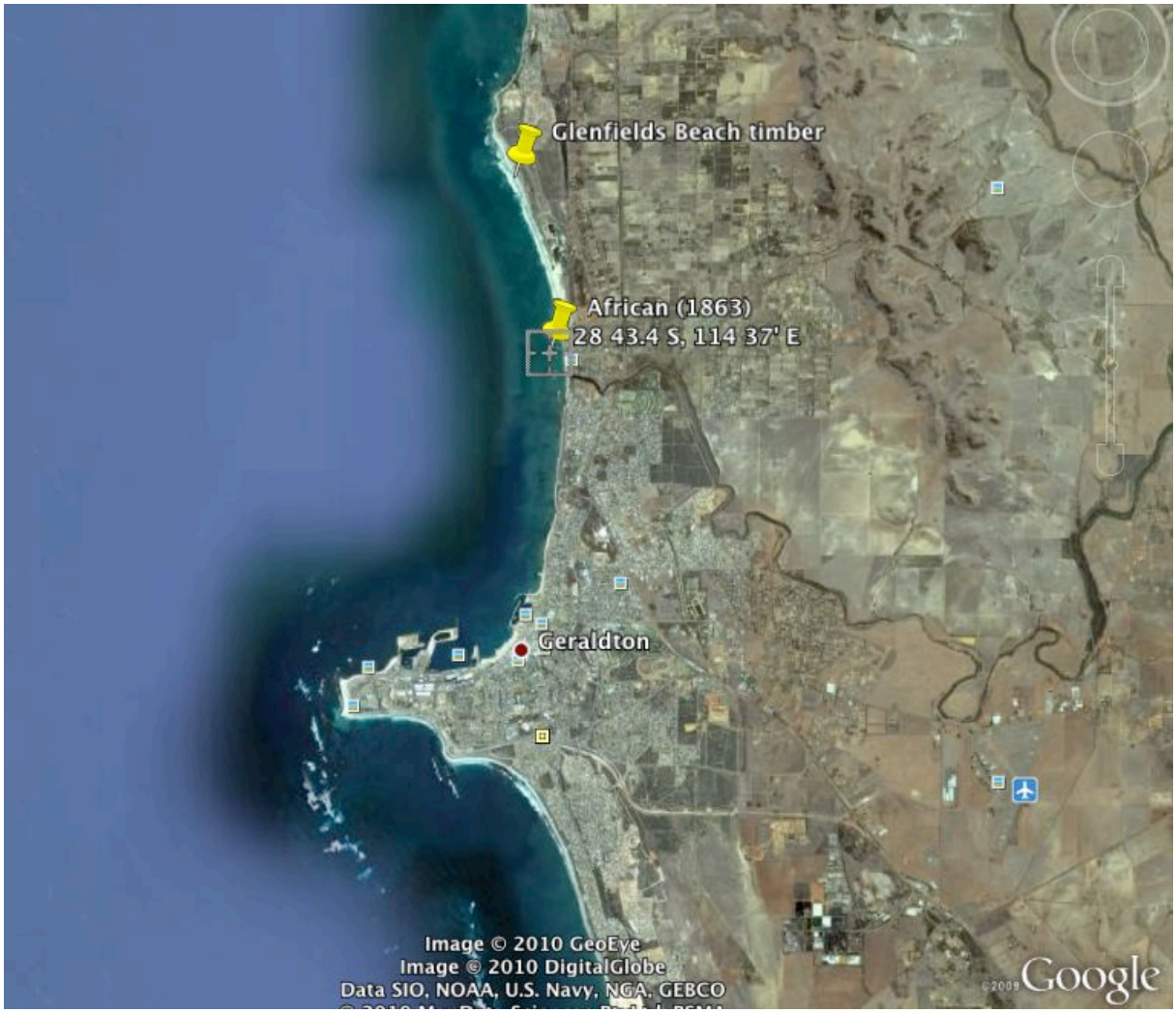


Figure 1. Map of Geraldton showing Glenfields Beach and location of timber (Google Earth)

There was a small amount of weed growth on the timber when found which was subsequently removed. It appears that the timber had been mostly or partially buried in the beach and/or subject to periodic exposure, such as on this occasion when it was exposed by a heavy swell removing sand from over it. Jonathan reported that when he discovered the timber in the surf zone there were possibly other timbers though it was difficult to see due to the surf. Following the beach erosion, the sand quickly re-accumulated and stabilised.

Description and constructional features of timber

The timber has a number of interesting features, with both trenail and copper alloy metal fastenings evident. Two sides are very well preserved, one side is reasonably well preserved and one side has suffered from degradation from physical and biological factors.

Overall length of the timber is 3418 mm, with a molding of 220–490 mm and siding of 140-270mm, with at least 18 fastening holes. Remaining fastenings consisted of five trenails and two copper alloy bolts. The type and size of the timber and fastenings indicate a large (400-900 tons) mid-late 19th century shipwreck. The fastening bore holes are 32-34 mm allowing for fastenings of 1 ¼ - 1 5/16 ” diameter.

Figure 2. View showing siding profile. Scale 2 m. (Jon Carpenter/ WA Museum)

Figure 3. View showing molding profile. Note four distinct straight edges and direction of grain. Scale 2 m. (Jon Carpenter/ WA Museum)

The timber is shaped following the direction of grain of the wood, with heartwood visible at the butt end. Both the molding and siding is thicker and wider at one end than the other. Maximum siding is 270 mm (10.6 inches). There are fastening holes through both the molding and siding of the timbers. The timber has four distinct straight edges, unlike a ship's frame/ futtock that is usually shaped in the form of a curve to fit the shape of the hull.

Figure 4. Fastening bore holes at oblique angle (Jon Carpenter/ WA Museum)

Some cracking has occurred to the timber that was not apparent at the time of initial discovery, indicating that the timber is adjusting to its change in environment. Conservation advice was to wrap the timber in polythene plastic to allow a controlled drying process to occur. Jonathan Pomeroy also said that since his discovery the protruding copper-alloy fastening appeared to have been damaged by somebody (unsuccessfully) attempting to hammer it out, presumably while it was lying on the beach.

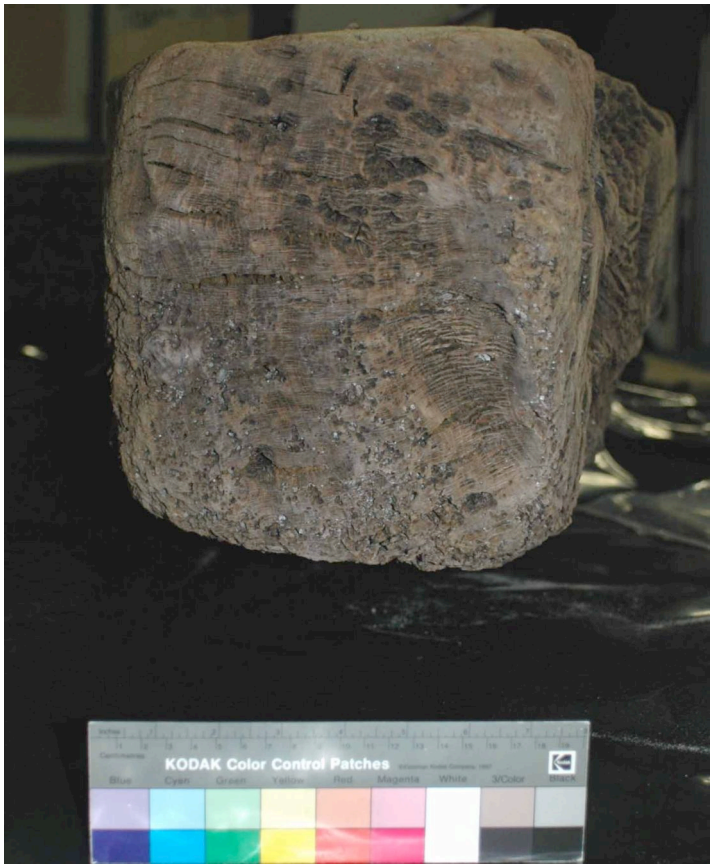


Figure 5. Heartwood visible at butt end (Jon Carpenter/ WA Museum)

Figure 6. Detail of butt end showing straight edges, trenail fastenings and recent cracking (Jon Carpenter/ WA Museum)

Timber and trenail samples were collected for timber species identification, and also metal and corrosion product samples of the two remaining copper alloy fastenings.
On the basis of the timber's grown shape, distinctive angular surfaces and obliquely drilled fastening holes, it is considered to be a knee of some kind, fitted into a curved part of the ship.

Timber knees are used in various ways in wooden shipbuilding, most commonly to support the deck beams either vertically ('hanging' and 'riding' knees) or horizontally ('lodging' knees). Knees are also used vertically and horizontally to support shelf clamps, transoms, and bow timbers, such as the breasthook (supporting the bow timbers) or transom knees. Knees are made of selected grown timbers, as being required to suit a particular shape in the ship's structure they are selected for the strength inherent in the shape of their grain. Wooden hanging and lodging knees usually take the form of an 'L' shape.

The breasthook is a major structural timber placed horizontally in the bow to give strength to the bow frames, shelf, apron and clamps. 'Breasthook ecking' is a term used to describe breasthook timbers used to lengthen and increase the size of the breasthook, where a grown timber of a suitable size and shape could not be sourced (Bill Leonard, pers. comm.. 14/6/10).

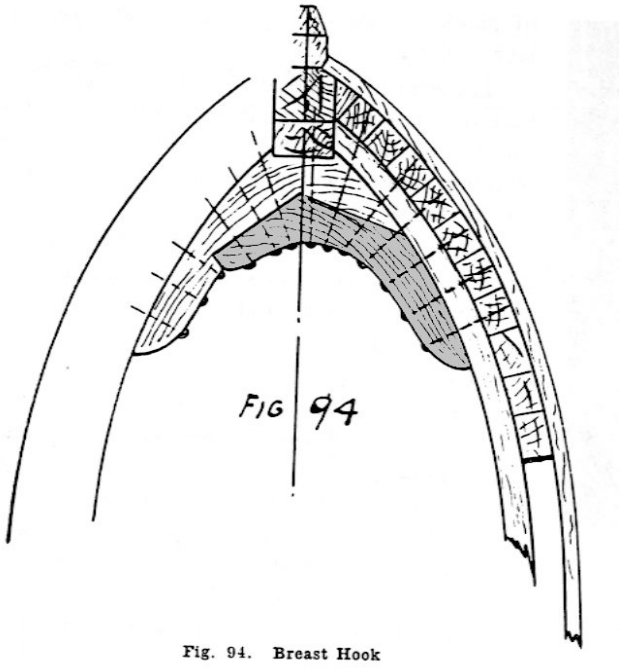


Figure 7. Plan view of bow timbers showing a breasthook made up of two large timbers (Desmond 1919: 104). Note angled surfaces and oblique line of fastenings on the shaded timber, and directions of grain to impart maximum strength. This timber is described as 'breasthook ecking' (Leonard, B. pers. comm. 14/6/10).

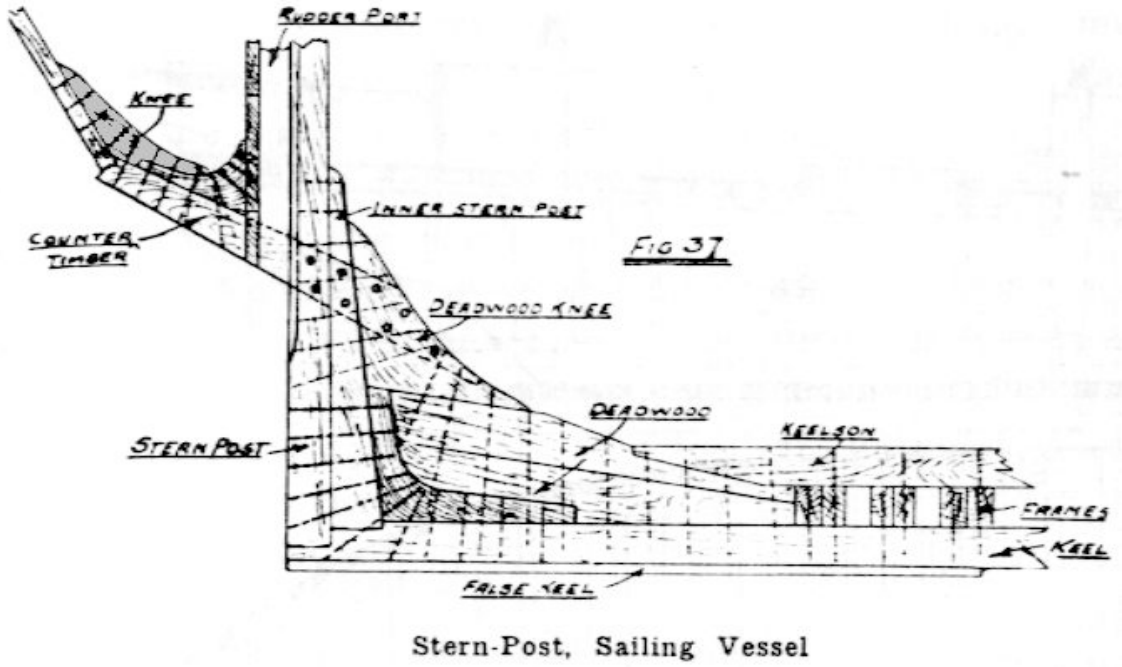


Figure 8. Transom or counter knee at stern of vessel (shaded), note angular shape to fit counter timber and transom, though this knee is scarph-joined with another knee (Desmond 1919: 51).

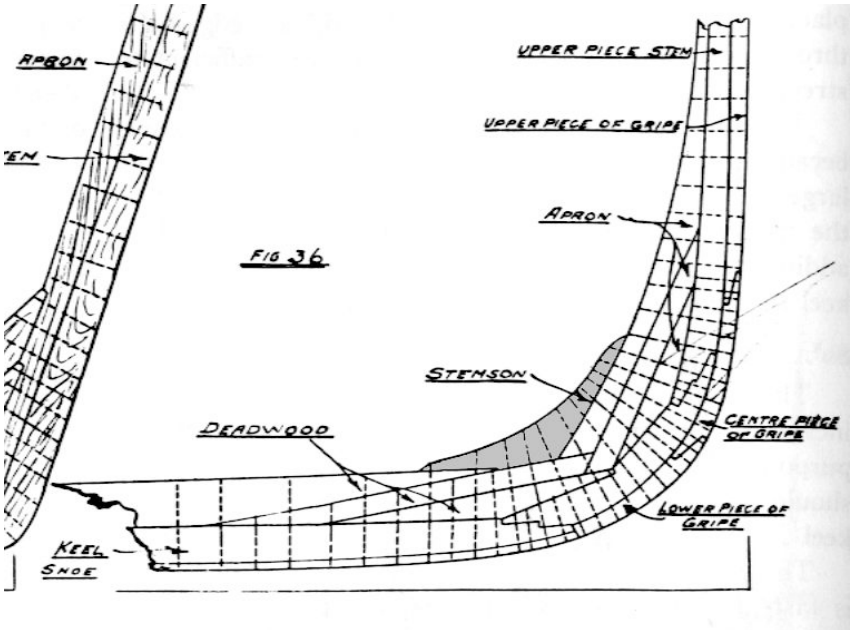


Figure 9. Stemson knee in bow of vessel (shaded) - note straight sides (Desmond 1919: 50).

If the timber is a stemson knee or breasthook, the size of the fastening holes and fastenings is in the range of 32-34 mm allowing for fastenings of 1 ¼ - 1 5/16 ” diameter, consistent with Lloyds specifications for heel-knee, stemson and deadwood copper alloy/ yellow metal bolts for a vessel between 450 tons (1 ¼”) and up to 899 tons (1 5/16”) (Desmond 1919: 21).

It is also consistent with Lloyds specifications for copper alloy/ yellow metal keelson bolts, throats of transoms, throats of breasthooks and throats of hanging knees to hold or lower deck beams for a vessel of between 900 (1 ¼") – 1349 (1 6/16") tons.
The hardwood trenail sizes are consistent with Lloyds fastening specifications for a vessel between 450 tons (1 ¼") and up to 899 tons (1 3/8") (Desmond 1919: 21).

An interesting feature of the fastening holes is the concentration at the butt end where it appears the timber was bolted to another structural timber. If it is a breasthook, it could have been bolted to a lower deck beam or bow timber such as the stemson.

Metallographic analysis
A metallographic analysis using an X-ray fluorescence (XRF) spectrometer was undertaken on a sample from one of the two remaining copper alloy bolts to determine its likely age and provenance. Muntz originally patented his 'yellow metal' alloy in 1832. Muntz patented another version of his alloy in 1846, including a small percentage of lead to improve malleability, and decrease loss of copper through oxidisation. Variations of between 59-64% Cu, 34.5-40% Zn, Pb 0.8-1.4% and Fe 1% have been recorded from Muntz metal samples (Carpenter, J., pers. comm.. 16/6/2010). XRF analysis results for the Glenfields Beach timber were that the bolt contained 63% Cu (62.69), 32% Zn (31.8) and 0.7% Pb (Table 1 and Appendix A).

Figure 10. Detail of copper alloy bolt sampled for metallographic analysis (Jon Carpenter/ WA Museum)

The presence of 0.7% Pb suggests that the alloy was made following Muntz's patent of 1846. Allowing for some variation due to the nature of XRF analysis and metal loss through aerobic and/or anaerobic corrosion, the concentrations of metal in the alloy are consistent with a post 1846 date for Muntz yellow metal.

XRF analysis of copper alloy bolts from the Sunset Beach (SB) wreck/ *African* and *Hadda* was undertaken by Kalle Kasi, Department of Materials Conservation. The results shown in Table 1 shown that some of the SB bolts–notably SB1750, SB2424F and SB2424G–were comparable with the Glenfields timber bolt with similar concentrations of copper, zinc and lead. It is interesting to note the variation between bolts on the SB/ African (i.e. SB2429A, SB1746, SB2424D and SB1802 share similarities in alloy composition, but differ to the above), and also the difference in alloy composition in the washer SB2429A. The *Hadda* bolt results are distinctively different, however this is because the surface sampling of the bolt is likely to have been affected by substantial corrosion products and cannot be regarded as conclusive (K. Kasi, pers. comm.. 29/6/10). Nevertheless the similarities with certain of the SB/ *African* bolts provide a firm basis on which to link the Glenfields timber with the SB/ *African* wreck.

Table 1. Comparison of XRF results between Glenfields timber, Sunset Beach wreck and *Hadda* bolts

		Bolt Glenfields beach timber (5)	SB1750_bolt (5)	SB2424F_bolt (5)	SB2429A_bolt (5)	SB2429_washer (5)	SB1746_bolt (5)	SB2424D_bolt (5)	SB2424G_bolt (5)	SB1802_bolt (long) (5)	Hadda Wr327_bolt (5)
Mn	Manganese	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe	Iron	0.0	0.0	0.0	0.5	0.4	0.2	0.1	0.1	0.0	3.7
Ni	Nickel	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Cu	Copper	62.7	65.5	66.1	52.1	76.1	56.8	55.6	67.4	55.9	47.0
Zn	Zinc	31.8	31.2	32.9	41.2	8.5	39.9	38.3	30.8	38.0	25.7
As	Arsenic	0.1	0.2	0.0	0.3	0.2	0.1	0.3	0.0	0.1	0.0
Pb	Lead	0.7	1.7	0.4	1.6	6.1	0.7	2.3	0.5	1.2	3.2
Bi	Bismuth	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.0
Ag	Silver	0.4	0.5	0.5	0.2	0.6	0.4	0.5	0.3	0.4	-0.5
Sn	Tin	0.0	0.0	0.0	0.0	3.8	0.0	0.1	0.0	0.0	0.2
Sb	Antimony	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1
		95.8	99.2	99.9	95.9	96.0	98.1	97.2	99.1	95.7	79.4

Timber analysis

Two timber samples were recovered from the timber itself, and from two trenail fastenings.
All samples were identified as being white oak (*Quercus* sp.), which could be of North American or European origin (Godfrey, I., pers. comm., 16/6/2010).

Identification in relation to shipwrecks in Geraldton area

The fastening sizes point to a large vessel of between 450-900 tons, the metallographic analysis points to a post-1846 construction and timber samples point to a vessel constructed in Europe or North America.

There are a number of shipwrecks in the Geraldton/ Champion Bay area but given the above, the size of the timber and its location at Glenfields Beach this timber is considered most likely to be related to the shipwreck of the 888 ton *African* (1862). No other shipwreck in the Geraldton/ Champion Bay area is of a similar size. An alternative explanation is that it is a timber washed ashore from an offshore wreck such as the *Hadda* (1877, 334 tons) in the Abrolhos Islands, or another, as yet unidentified shipwreck, though these possibilities are considered unlikely.

The *African* (Official Number 23091) was an 888 tons (New Measurement) wooden ship with dimensions of 157.5 x 33 x 21.6 ft (48 x 10 x 6.5 m) built in 1852 in Sunderland, UK. On 4 January 1863 the *African* dragged its anchors and struck between two reefs off the Chapman River mouth (Worsley 2008: 118). Soon afterwards its cargo, rigging, boats and gear were salvaged. On 11 July 1863 the Acting Collector of Customs and Receiver of Wreck in Geraldton Mr Clifton wrote to the Colonial Secretary in Perth that the *African* was no longer

afloat, but 'she is on the beach and about to be broken', thereby making any salvaged material subject to an '*Ad valorem*' import duty (Clifton to Colonial Secretary 11/7/1863, CSR Vol. 515/43). It seems it was at this stage while lying on the beach that the timbers and fittings of the *African* were salvaged to construct three smaller vessels - the *Maid of Geraldton*, *Mary Ann* and *Albatross*. For a full description of the wreck, salvage operations, and statement of significance of the site see Worsley (2008: 118-121).

The Sunset Beach Unidentified wreck discovered in 1977 was subsequently identified as the *African*. The site is scattered over a wide area 300 m north of the mouth of the Chapman River, ranging from the initial stranding site some 80 m offshore to the main site inshore. The main site consists of remaining timbers, scantlings and fastenings between 3 and 40 m off Sunset Beach in 4 m depth (McCarthy 1978; Totty 1979). Iron and copper alloy metal fastenings, iron staple knees, iron hanging knees, copper alloy sheathing and large ship's timbers including a spar and section of keel, and other materials can occasionally be seen in the vicinity. Coal is also occasionally washed up on Sunset and Glenfields Beach, but this may not be wreck related as it is common for coal that has been lost overboard during coaling operations in ports to be moved along the sea floor, and be washed up on beaches by prevailing currents and wave action.

The location and material from the Sunset Beach Unidentified wreck matches the *African*'s construction, and the location of the *African*'s loss and subsequent salvage. Maritime archaeological surveys have shown that salvage did not recover all timbers, and that the hull above the waterline was burnt to recover copper alloy fittings (McCarthy 1978; Totty 1979).

The Glenfields Beach timber is 3.32 km north-east of the *African* wrecksite. Based on the timber and fastening analyses, and location of the find, the Glenfields Beach timber is demonstrably related to the *African* wrecksite. This can be logically explained as the *African* wrecksite is a widely scattered site with loose structural timbers. Contemporary salvage activities, and natural forces such as occasional storms and beach erosion events, prevailing winds, wave action and currents over the last 137 years, could have caused the timber to have become disassociated from the main site and moved northwards to the location where it was discovered.

Legal Status
The timber is protected as it has been identified as a relic associated with the *African*, which is protected as an historic shipwreck under the Commonwealth *Historic Shipwrecks Act 1976*.

Significance
The Glenfields Beach timber has historic significance for its association with the historic shipwreck *African* (1863).

The Glenfields Beach timber has archaeological and technical significance as a coherent and well-preserved structural timber exhibiting worked surfaces, and a exhibiting a variety of fastening types to provide diagnostic information.

The Glenfields Beach timber has educational significance as it can be interpreted to the general public to tell the story of the *African*/ Sunset Beach Unidentified shipwreck, wooden shipbuilding, colonial maritime historical activities in Geraldton/ Champion Bay, the significance of maritime archaeological sites and public wreck reports, and the conservation of maritime archaeological sites and relics.

Summary

1) The Glenfields Beach timber is identified as being associated with the *African* (1863) wrecksite.

2) Analyses of the timber's type, size, shape, worked features and fastenings leads to the conclusion that it is a knee of some sort, with the most likely possibility of it being breasthook ecking.

Recommendations

1) That the timber is monitored to assess its condition as per Department of Materials Conservation recommendations:

- Brush away and/or carefully vacuum away sand from crevices and fastening holes.
- Insert pins in opposing positions across selected cracks, measure separation weekly to ascertain if the timber is still drying.
- Inspect the wood after measuring the dimensions of the cracks to ensure that there is no mould activity while wrapped in polythene.
- To condition the timber to ambient storage or display conditions pierce a few holes in the polythene sheeting to permit gradual acclimatization.
- In the event that the cracks in the timber are becoming wider and if fresh cracks occur then notify the Materials Conservation Department for advice (Carpenter 2010).

2) That the timber is registered in the WA Museum's Department of Maritime Archaeology Collection;
3) That the timber is assessed for suitability for display and interpretation in WA Museum, Geraldton;

Appendices

Appendix 1 - X-ray fluorescence (XRF) analysis of copper alloy fastening

DEPARTMENT OF MATERIALS CONSERVATION
Western Australian Museum,
Shipwreck Galleries
45-47 Cliff Street, Fremantle, Western Australia, 6160
Tel: (08) 9431 8490 Fax: (08) 9431 8489

XRF ARTAX - ELEMENTAL ANALYSIS

Listed at 10/06/2010 3:12:23 PM

Method: 600µA-100S

Spectrum: Bolt from Geraldton Glenfields Beach timber etc 3-4 June 2010

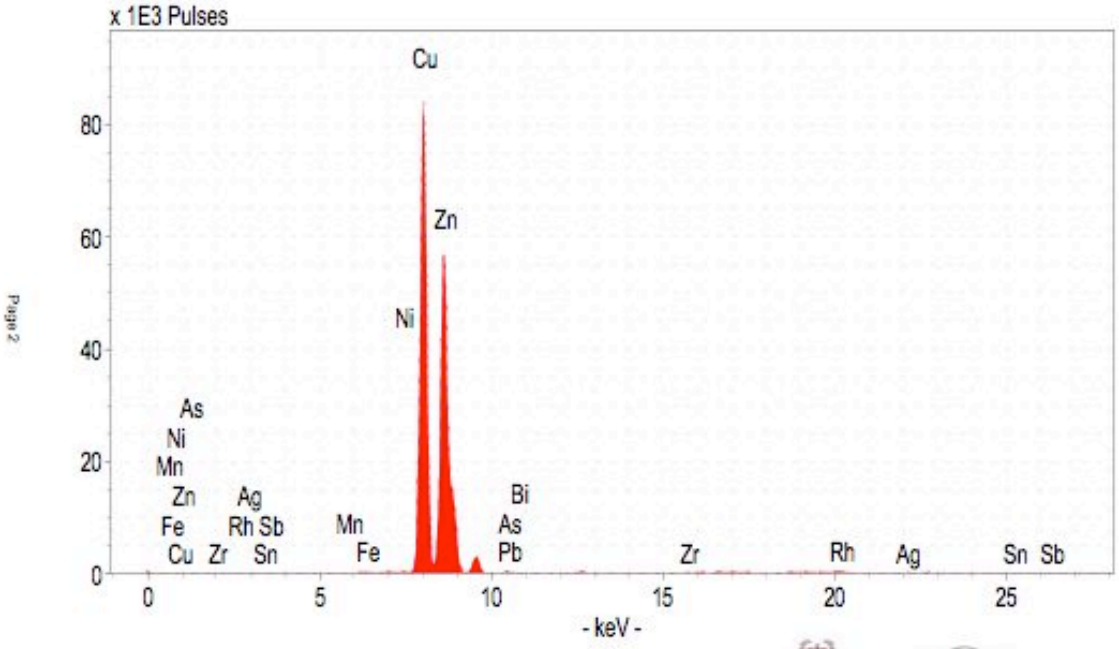
Element	Line	Conc./	Net area
Mn	K12	0.000	188
Fe	K12	0.000	755
Ni	K12	0.000	208
Cu	K12	0.000	481564
Zn	K12	0.000	338076
As	K12	0.000	75
Zr	K12	0.000	955
Rh	K12	0.000	2557
Rh	L1	0.000	3
Ag	K12	0.000	315
Ag	L1	0.000	130
Sn	K12	0.000	139
Sn	L1	Not det.	
Sb	K12	0.000	99
Sb	L1	0.000	23
Pb	L1	0.000	1596
Pb	M1	0.000	54
Bi	L1	0.000	76
Bi	M1	Not det.	

Bruker Tracer III-V
SerNo: K0670
Settings:
Voltage: 40 kV
Current: 1.5 micro amps
Filter: 12mil Al + 1mil Ti
No Vacuum
Live time: 180 sec

Bolt from Geraldton Glenfields Beach timber etc 3-4 June 2010	Concentration (CU1) %
MnKa1	-0.01
FeKa1	0.02
NiKa1	-0.09
CuKa1	62.69
ZnKa1	31.82
AsKa1	0.08
PbLb1	0.70
BiLb1	0.16
ZrKa1	-0.04
RhKa1	0.00
AgKa1	0.37
SnKa1	0.03
SbKa1	0.07
SUM (%)	95.79

Page 1

Method: 600µA-100S



Acknowledgements
Grateful thanks are expressed to finders Jonathan Pomeroy and Ross Bennett for their recovering and reporting their discovery of the timber to the WA Museum.
Discussions with shipwright Bill Leonard, Maritime History Department, WA Museum greatly assisted the identification process.
Dr Ian Godfrey, Head, Department of Materials Conservation undertook the timber identifications, and Kalle Kasi, Department of Materials Conservation conducted the XRF analysis of the copper alloy fastenings. Jon Carpenter, Department of Materials Conservation took photographs and provided conservation advice.
Thanks to Catherine Belcher, Manager WA Museum, Geraldton and James Thompson, Technical Officer for assistance with logistics and liaison.

References

Carpenter, J., June 2010, Inspection and conservation recommendations for a shipwreck timber recovered from Glenfields Beach, Geraldton, unpublished report, Department of Materials Conservation, WA Museum, Fremantle.

Desmond, C., 1919 (reprinted 1984). *Wooden ship-building*, Vestal Press Ltd, New York.

Clifton, Acting Collector of Customs and Receiver of Wreck, Geraldton to Colonial Secretary, 11/7/1863, CSR Vol. 515/43.

McCarthy, M, 1978, Sunset Beach wreck, Report on Wreck Inspection, unpublished report, Department of Maritime Archaeology, Western Australian Museum, Fremantle.

MA-2009/0061/SG Collection Management-Maritime Archaeology-Shipwrecks-*African* (formerly Sunset Beach Geraldton) (formerly MA 20/79), unpublished file, Department of Maritime Archaeology, WA Museum, Fremantle.

Steffy, J.R., 1994. *Wooden shipbuilding and the interpretation of shipwrecks*, Texas A&M University Press/ Chatham Publishing, London.

Totty, D., c.1979, WA's central mainland coast – Jurien Bay – Port Gregory: Sunset Beach wreck, unpublished notes, MA-2009/0061/SG file (previously MA-20/79)

Worsley, J. and P., 2009, *A windswept coast: Western Australia's maritime heritage between the Moore River and the Zuytdorp Cliffs*, Australian National Centre of Excellence for Maritime Archaeology, Special Publication No.11, Western Australian Museum, Fremantle.