

Identification of materials of the Quanzhou ship and Samed Nagam ship

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Abstract

This report is a result of wood species identifications on ship timbers from the Quanzhou and Samed Nagam ships. *Cunninghamia lanceolata* (Lamb.) Hook., *Cinnamomum camphora* (L.) J. Presl, and *Pinus* subgen. *Diploxylon* (*Sylvestris* group) are identified to the Quanzhou ship. Woods identified on the Samed Nagam are *Pinus* subgen. *Diploxylon* (*Sylvestris* group) and a diffuse-porous wood. Except for the diffuse-porous wood specimen, all the specimens shows distinct growth rings and this suggests that they originated from trees that grew in subtropical areas, including the areas of lower Yangtze River or Taiwan. In contrast, the diffuse-porous wood specimen does not have growth rings and is from a tropical area.

要旨

泉州船およびSamed Nagam船の部材の樹種を同定した。泉州船にはコウヨウザンとクスノキ、マツ属複雑管束亜属（シルベストリス・グループ）が使われており、Samed Nagam船にはマツ属複雑管束亜属（シルベストリス・グループ）と熱帯産の散孔材一種が使われていた。未同定の散孔材を除くといずれも成長輪界が明瞭で、揚子江下流域や台湾といった亜熱帯域に生育していた樹種である。それに対し、未同定の散孔材は成長輪界をもたず熱帯域の樹種であった。

Introduction

This report is a result of wood species identifications on ship timbers from the Quanzhou and Samed Nagam ships. *Cunninghamia lanceolata* (Lamb.) Hook., *Cinnamomum camphora* (L.) J. Presl, and *Pinus* subgen. *Diploxylon* (*Sylvestris* group) are identified to the Quanzhou ship. Woods identified on the *Samed Nagam* are of *Pinus* subgen. *Diploxylon* (*Sylvestris* group) and a diffuse-porous wood.

In 2010, six wood samples from the Quanzhou ship at Quanzhou and four wood samples of the

Samed Nagam ship were submitted by a Flinders University Department of Archaeology PhD student to researchers at the Forestry and Forest Products Institute, Tsukuba, Japan for identification. The Quanzhou ship was discovered at Quanzhou in Fujiang Province, China, and is dated to 1260–70. The Samed Nagam ship was discovered at King Taksin's dock at Chanthaburi, Thailand, and is dated to the early 17th century. Among the ten samples, two coniferous and two dicotyledonous taxa were recognized (Table 6.1).

Specimen No.	Taxon	Ship	Part
BUN-544	<i>Cunninghamia lanceolata</i> (Lamb.) Hook	Quanzhou ship	sample 1
BUN-545	<i>Cunninghamia lanceolata</i> (Lamb.) Hook	Quanzhou ship	sample 2
BUN-546	<i>Cinnamomum camphora</i> (L.) Presl	Quanzhou ship	forward keel
BUN-547	<i>Cinnamomum camphora</i> (L.) Presl	Quanzhou ship	stem
BUN-548	<i>Cinnamomum camphora</i> (L.) Presl	Quanzhou ship	frame
BUN-549	<i>Pinus</i> subgen. <i>Diploxylon</i> (<i>Sylvestris</i> group)	Quanzhou ship	aft keel
BUN-550	<i>Pinus</i> subgen. <i>Diploxylon</i> (<i>Sylvestris</i> group)	Samed Ngam ship	keelson
BUN-551	<i>Pinus</i> subgen. <i>Diploxylon</i> (<i>Sylvestris</i> group)	Samed Ngam ship	strake 10 portside
BUN-552	<i>Pinus</i> subgen. <i>Diploxylon</i> (<i>Sylvestris</i> group)	Samed Ngam ship	bulkhead 14
BUN-553	Diffuse porous wood	Samed Ngam ship	bulkhead 14

Table 6.1 Identification of materials from Quanzhou and Samed Ngam ships.

The samples were sectioned with razor blades and mounted with Gum Chloral (a mixture of Chloral Hydrate 50 g, Arabic Gum 40 g, Glycerin 20 ml, and pure water 50 ml). Specimen numbers BUN-544 to BUN-553 were applied to the preparations. The preparations are deposited at the xylarium of Forestry and Forest Products Research Institute (TWTw).

Here we describe the wood anatomical features of the specimens with microphotographs of representative specimens and show the basis of identification. The taxonomic treatment of identified taxa follows Wu & Raven and Wu *et al.*¹. All samples are presented in Figure 6.1.

Cunninghamia lanceolata
(Lamb.) Hook. (Taxodiaceae)
(BUN-544 – BUN-545)

Cunninghamia lanceolata is a coniferous wood without resin canals and distinct growth rings. Tracheid diameter changes vary gradually from early- to latewood; volume of latewood is medium, with lumina visible in latewood tracheids. Axial parenchyma with dark brown resin; diffuse or in discontinuous tangential lines occurring usually in

latewood. Rays consist only of parenchyma cells, occasionally with brown resin; cross-field pits large taxodioid, with two per cross-field.

Cunninghamia lanceolata is distributed in southern China and Taiwan and includes two varieties, var. *lanceolata* and var. *konishii*.² It is impossible to distinguish the two varieties from wood structure.

Pinus* subgen. *Diploxylon
(*Sylvestris* group) (Pinaceae)
(BUN-549 – BUN-552)

Pinus is a coniferous wood with axial and horizontal resin canals and distinct growth rings. The transition from early- to latewood is rather abrupt; latewood is voluminous, with lumina visible in latewood tracheids. Axial and horizontal resin canals are lined with thin-walled epithelial cells. Rays consist of parenchyma cells and tracheids; horizontal wall of ray tracheids dentate; cross-field pits window-like, with one to two per cross-field.

Pinus subgen. *Diploxylon* (*Sylvestris* group) includes species such as *P. massoniana* Lamb. and *P. taiwanensis*. Hayata growing in southern China and Taiwan, and *P. densiflora* Siebold et Zucc. growing in northeastern China. The identification of *Pinus* species in the *Sylvestris* group from wood structure is difficult. Two species of *Pinus* growing in southeast Asia (*P. merksii* and *P. kesiya*) differ in wood structure from the species in the *Sylvestris* group.

Cinnamomum camphora
(L.) J. Presl (Lauraceae)
(BUN-546 – BUN-548)

Cinnamomum camphora is a semi-ring-porous wood with distinct growth rings. The transition of vessel size from early- to latewood is gradual: earlywood vessels 150–180 µm, latewood vessels 40–70 µm in tangential diameters; solitary or in radial multiples of 2–3 vessels. Vessels and vessel multiples are rather sparse, with ample ground tissue even in earlywood and simple perforation plates. Axial parenchyma are vasicentric and diffuse, often with large, axially elongate oil cells filled with brown oil. Rays heterocellular with 1(–2) row(s) of upright cells often including oil cells; 2 cells wide.

Cinnamomum camphora grows in southern China and Taiwan. Based on the distinct ring-porosity and large oil cells, BUN-546–548 can be identified to this species.

Diffuse-porous wood
(BUN-533)

This sample presents a diffuse-porous wood without growth ring boundaries; vessels solitary or in radial multiples of 2; vessels (40–) 100–200 µm in tangential

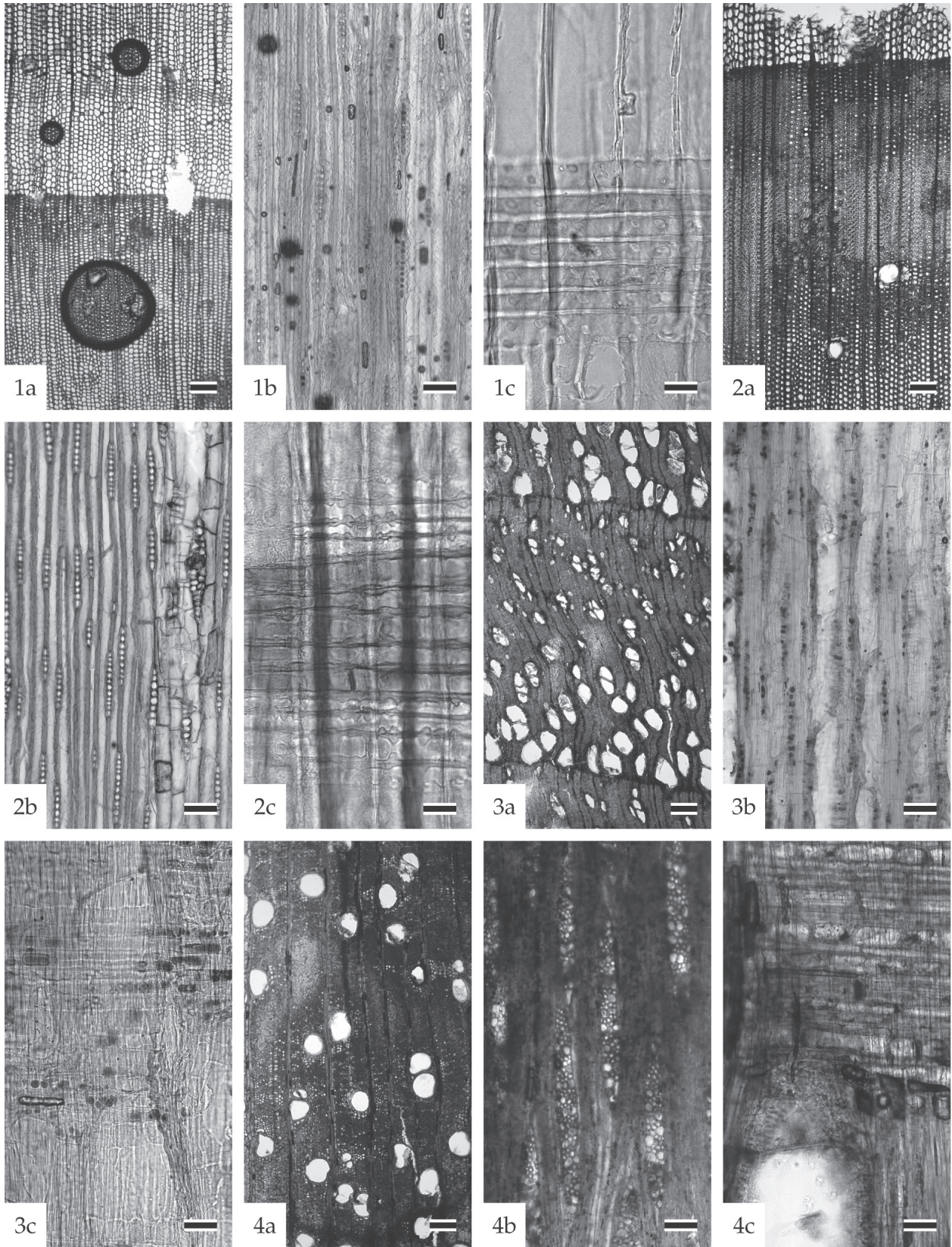


Figure 6.1 Microphotographs of materials of the Quanzhou ship and the Samed Nagam ship.
1a–1c: *Cunninghamhamia lanceolata* (Lamber) Hooker (BUN-544), **2a–2c:** *Pinus* subgen. *Diploxylon* (*Sylvestris* group) (BUN-552), **3a–3c:** *Cinnamomum camphora* (L.) Presl (BUN-546), **4a–4c:** Diffuse-porous wood (BUN-533). **a:** Transverse section (scale bar = 200 μm), **b:** Tangential section (scale bar = 100 μm), **c:** Radial section (scale bar = 25 μm (1c, 2c), 50 μm (3c, 4c)).

diameters, 4–5.5 vessels/mm². Axial parenchyma are vasicentric with diffuse-in-aggregates. Rays heterocellular consisting of a mixture of procumbent, square and upright cells, ca. 3–5 cells wide, 0.55–1 mm tall, marginal rows 1; vessel-ray pitting small with distinct borders, usually alternate, occasionally scalariform. Crystals are absent.

Distribution of axial parenchyma and composition of rays is characteristic of diffuse-porous wood but the specimen could not conclusively be identified.

Except for one diffuse-porous wood specimen, all the specimens had distinct growth rings and were derived from trees that grew in subtropical areas with cessation of growth during winter. However, latewood tracheids of two coniferous taxa had visible lumina, and winter cessation does not seem to be as drastic as that in the temperate zone. Thus, southern China or Taiwan seems to be the primary origin of material timber for these ships. Contrarily, the diffuse-porous wood used for the Samed Nagam ship bulkhead 14 did not show any effect of winter and seems to be derived from a tropical area.

The three identified taxa, *Cunninghamia lanceolata*, *Pinus* subgen. *Diploxylon* (*Sylvestris* group) and *Cinnamomum camphora*, agree with the previous report for the Quanzhou ship, that of the Shinan wreck³ and historical study of ships making timber of the Song period.⁴ Although Chen and the National Maritime Museum of Korea attributed *Pinus* materials to *Pinus massoniana* Lamb., we avoided the species-level identification considering possible use of other species of the *Sylvestris* group growing in southern China or Taiwan. The agreement of the three taxa to those in the previous reports and the above discussion on the formation of growth rings seem to indicate that both the Quanzhou ship and the Samed Nagam ship were probably made in or around southern China, and the bulkhead of the Samed Nagam ship was added somewhere in southeastern Asia.

Notes

- ¹ Wu, Zh. and Raven, P.H. (eds.). (1999). *Flora of China*, vol. 4. Beijing, Science Press, Beijing & St. Louis, Missouri Botanical Garden Press; Wu, Z., Raven, P.H. and Hong, D. (eds.). (2008). *Flora of China*, vol. 7. Beijing, Science Press, Beijing & St. Louis, Missouri Botanical Garden Press.
- ² Chen, Z. (1987). ‘Quanzhouwan Chutu Song Dai Haizhuan Mucai Jianding (Timber species identifications on the Song Dynasty’s ship discovered in the Quanzhou Bay 泉州湾出土宋代海船木材

鉴定)’, in Museum of Overseas Communication History (ed.), *Quanzhouwan Song Dai Haichuan Fajue yu Yanjiu*. Beijing, Ocean Press.

- ³ Chen, 1987; National Maritime Museum of Korea. (2004). *The Conservation and Restoration Report of Shinan ship*. National Maritime Museum of Korea, Mokpo.
- ⁴ Shiba, Y. (1968). *Commercial Activities during the Sung Dynasty*. Tokyo, Kazama Shobo.