Field note: A Radiocarbon Date for the Koh S'dech Shipwreck, Koh Kong Province, Kingdom of Cambodia

Nancy Beavan[1], Tep Sokha[2], Ugo Zoppi[3], Blythe McCarthy[4], Michael Schilling[5], Louise Cort[4], Sylvia Fraser Lu[6]

1) University of Otago, Dunedin, New Zealand. email nancy.beavan@anatomy.otago.ac.nz
2) Royal University of Fine Arts, Phnom Penh, Cambodia
3) DirectAMS, Seattle, Washington, USA
4) Freer|Sackler Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, Washington, DC, USA
5) Getty Conservation Institute, Los Angeles, California, USA
6) Burma Studies Foundation, Northern Illinois University, Illinois, USA

Background

The shipwreck site which has come to be known as the "Koh S'dech Shipwreck" was found in February 2005 about 20 kilometres off the coast of Koh S'dech, Koh Kong province, Cambodia. A Cambodian government Senator, His Excellency Mr. Ly Yong Phat, privately funded the first of two recovery dives, and His Excellency Khim Sarith, Secretary of State the Ministry of Culture and Fine Arts (MoCFA) oversaw a second dive, which together yielded some 900 pieces of pottery consisting mainly of Maenam Noi (Singburi) storage jars of varying sizes, Sawankhalok, Sukhothai and Si Satchanalai ware. In November of 2011 the authors obtained permissions to examine the Koh Kong shipwreck cargo and to sample for radiocarbon dating one of two woven-bamboo core lacquered vessels (Fig. 1a-d) that were among the recovered ceramics cargo.

An Appendix of some examples of the ceramic wares accompanies this Field Note.

Radiocarbon dating of the Lacquered bamboo-cored vessel

The Conventional Radiocarbon Age for the lacquered vessel KK.2006.0069 is 475±22 years BP (Before Present). As radiocarbon years do not exactly correspond to calendar years due to the variation of atmospheric radiocarbon production, the radiocarbon age must be calibrated to a probable calendar age. The calibration of the resulting radiocarbon age of 475±22 years BP corresponds to cal AD 1440 to cal AD 1459 (at one standard deviation i.e. 68.2% probability) and to cal AD 1428 to cal AD 1482 (at two standard deviations i.e. 95.4% probability). The radiocarbon age for the bamboo-core lacquered vessel corresponds with ceramic finds in the Koh S'dech cargo (see Appendix) such as the Sawankhalok celadon-glazed bowls which bear the type of cross-hatch decoration that Roxanna Brown associated with late 15- 16 century AD shipwrecks (Brown 2009: 146,149). The Sukhothai bowls and Maenam Noi storage jars are also similar to the mix of Sukhothai bowls and Maenam Noi ware from the Singtai wreck that Brown (2009: 153) dated to the mid-16 century AD.

Lacquer Source

Lacquer and bamboo are some of the best materials for radiocarbon analysis. Raw lacquer originates from the sap of tree species of the Anacardiacae family, genus *Rhus*, which are related to sumacs. The raw sap from certain *Rhus* contains urushiol, which polymerizes to form lacquer (Webb 2000:3). Bamboo is a true grass from the family Poaceae. Both the raw sap to produce lacquer and the bamboo used in the construction of lacquered basketry have negligible "inbuilt age", i.e. their radiocarbon values are the contemporary atmospheric amounts of ^{14}C of the period in which the material was harvested, and therefore represent the true time of harvest and a presumption that artefact construction soon followed.

Figure 1a) The nearly complete lacquer vessel KK2006.070, measuring 8 x 12 cm; b) The vessel KK.2006.0069 from which samples were taken for radiocarbon dating and lacquer analysis; c & d) patterns visible on the vessels, which may be the remains of decoration and/or patterns of lacquer application that have been eroded by ocean currents while underwater.

A sample of lacquer from KK2006.0069 was analyzed with pyrolysis gas chromatography mass spectrometry (Py-GCMS) at the Freer|Sackler's Department of Conservation & Scientific Research (DCSR). The closest match was to a reference of Thai lacquer collected by Donna Strahan in Thailand from the DCSR reference collection. It is a thitsiol resin, such as comes from the tree, *Gluta usitata*. It was not a perfect match, and there were a few additional peaks as well as doublets that might indicate the presence of an additional unidentified material. Only one reference of Thai lacquer was available for comparison. Variations are expected between lacquers from different species, and in addition the material may have changed due to aging. It is possible a better match would be obtained with analysis of further reference materials. Analysis results thus far completed therefore indicate that the major component of the lacquer is a Southeast Asian thitsiol lacquer; however, the exact tree species that produced the lacquer cannot be determined.

Discussion

The two bamboo-core, lacquered vessels appear to be the first recovered from a shipwreck in the Gulf of Thailand. Lacquered objects of likely Chinese origin have been recovered from other shipwreck sites in Southeast Asia, such as the Royal

Table 1. Radiocarbon dating result for Basket KK.2006.0069. The sample was prepared and measured at the DirectAMS Accelerator Mass Spectrometry facility at Accium BioSciences (Seattle, USA; Zoppi et al. 2007). (a) The results have been corrected for isotopic fractionation with $\delta^{13}C$ values measured on the prepared graphite using the AMS spectrometer. These can differ from $\delta^{13}C$ values of the original material, if fractionation occurred during sample graphitization or AMS measurement. (b) The Conventional Radiocarbon Age has been calibrated to calendrical date ranges with the internationally agreed curve for the Southern hemisphere (SHCal04) of McCormac *et al* (2004) using OxCal v4.1 (Bronk Ramsey 2010) with the ShCal04 curve and a -21± 6 offset (Hua, pers com 11.25.11; Hua et al. 2004).

Sample name	Laboratory number	$\delta^{13}C$‰ (a)	Coventional Radiocarbon Age (yrs BP)	Calibrated Calendar Age (b) (Confidence Intervals)
KKS.2006.0069B	D-AMS 1219-006	-16.1	475±22	68.2% probability **1440AD to 1459AD** 95.4% probability **1428AD to 1482AD**

Nanhai (c. 1450 AD) which was discovered in 1995, 40 nautical miles east of Kuantan in Peninsular Malaysia in 46 metres of water (Sjostrand 1996), the Sinan wreck (c. 1323 AD) discovered off the coast of Korea in 1975 (Rawson 1992: 178), and the Belitung wreck (c. 830 AD) found about 1.6 km off the coast of Belitung Island, Indonesia (Flecker 2011:119). The term lacquer does not seem to feature in Southeast Asian inscriptions and there is apparently no research on the beginnings of Southeast Asia lacquer industries, although there are historical records for the raw materials to make lacquer having been imported to Japan from Cambodia, Siam and Burma by at least the 17th century (Heginbotham and Schilling, 2011:97-99). Lacquer fragments have been found near the Minglazedi pagoda in Burma that date to the Pagan period (1044-1287); these fragments of plain lacquer do not appear to have any extra surface decoration. Lacquer does not seem to become widespread in Burma and Thailand (and possibly Cambodia) until later. Burma is also known to have a few early fragments of lacquer uncovered within the vicinity of the Laymethna Pagoda dating to the 13th century (Isaacs and Blurton 2000:22). It is possible that Vietnam might have had an early industry given the fact of their proximity and contact with China while under direct Chinese rule.

The substrate of woven basketry is standard for cylindrical lacquer boxes, such as those to store betel chew. The dimensions of the more complete of the two vessels, KK2006.070, are 8 cm at the base by 12cm in height. The base of both vessels, and the sides of KK2006.070, have the remains of decoration patterns (Fig 1, a-d).

The radiocarbon age for the badly broken lacquer vessel, KK.2006.069 places it as an object fashioned in the mid- to late 15th century AD, and the lacquer analysis indicates a likely Thai source for the thitsiol resin.

Extensive archaeological fieldwork has not yet been undertaken on the Koh S'dech wreck site. The site's discovery by fishermen in 2005 and recovery of an unknown percentage of its cargo in 2006 has involved the Cambodian Ministry of Culture and Fine Arts and the Koh Kong provincial Ministry of Culture, who continue to seek collaborating researchers with whom they may develop projects to address site archaeology and the ceramic finds.

A manuscript on the dating of the Koh S'dech shipwreck is currently in preparation for peer-reviewed journal submission, which will include a complete reportage of the

methodologies employed in the scientific analyses and further discussion of the associated ceramic and other artefacts in the recovered cargo.

References

Bronk Ramsey C. 2010. OxCal Program v4.1. Oxford Radiocarbon Accelerator Unit. http://c14.arch.ox.ac.uk/embed.php?File=oxcal.html

Brown, Roxanna M. 2009. *Ming Gap and Shipwreck Ceramics in Southeast Asia: Towards a Chronology of Thai Trade Ware*. District of Columbia: River Books. 206pp.

Flecker, Michael. 2011. A Ninth-Century Arab Shipwreck in Indonesia. In *Shipwrecked: Tang Treasures and Monsoon Winds*. Regina Krahl, John Guy, J. Keith Wilson, and Julian Raby (eds). Washington, DC: Smithsonian Institution. 328pp.

Heginbotham, Arlen and Michael Schilling. 2011. New evidence for the use of Southeast Asian raw materials in seventeenth century Japanese export lacquer. In *East Asian Lacquer: Material Culture, Science and Conservation*, S. Rivers, R. Faulkner and B. Pretzel (eds). Archetype Publications, London: 92-106.

Hua Q, Barbetti M, Zoppi U, Fink D, Watanasak M , Jacobsen GE. 2004. Radiocarbon in tropical tree rings during the Little Ice Age. *Nuclear Instruments and Methods in Physics Research B*, V223-224:489-494.

Isaacs, Ralph and Richard Blurton. 2000. *Visions from the Golden Land: Burma and the Art of Lacquer*. London: British Museum Press. 240pp.

McCormac, F. G., Hogg, A. G., Blackwell, P. G., Buck, C. E., Higham, T. F. G., & Reimer, P. J. (2004) SHCal04 Southern Hemisphere calibration, 0–11.0 cal kyr BP . *Radiocarbon*, 46(3), 1087-1092.

Rawson, Jessica, ed. 1992. *The British Museum Book of Chinese Art*. London: Thames & Hudson. 395pp.

Sjostrand, S. 1996. The Royal Nanhai Shipwreck and its Ceramic Cargo, including preliminary report on the excavations to date, written for the *Malacca Museum Corporation,* unpublished.

Stuiver, M and Polach, H.A. 1977. Discussion: Reporting of ^{14}C Data. *Radiocarbon*, 19 (3):355-363

Webb, Marianne. 2000. *Lacquer: technology and conservation: a comprehensive guide to the technology and conservation of Asian and European lacquer*. Oxford: Butterworth-Heinemann.

Zoppi U., Crye J., Song Q., Arjomand A.2007. Performance Evaluation of the New AMS System at Accium BioSciences. *Radiocarbon* 49, 171-180.

APPENDIX: The Koh S'dech shipwreck cargo

The ceramics in storage, Provincial Courthouse, Koh Kong city, Koh Kong province. (Left) Piles of intact pottery; (Right) Ceramic fragments and planks from the shipwreck.

(From top left to right) The selection and photography of representative objects from the collection; (Bottom) Measuring each object.

Examples of the Ceramics

Figure 1) Highly fired, glazed and unglazed stoneware.

Figure 2) Unglazed earthenware cooking pots with lids, decorated with different impressed or paddle-marked designs.

Figure 3) Earthenware stove.

Figure 4) Celadon and Porcelain wares.

Other objects recovered from the Koh S'dech shipwreck cargo

Figure 5) Metal object with an incised design which could be part of a spear, or a flag mast; the hollow end of this object had wooden remains from a wooden insert.

Figure 6) Lead objects with flattened bottoms and pinched tops.

a)

b)

Figure 7a) One of two elephant tusks found in the recovered cargo. **b)** Rust stains in the middle of the shaft, which may indicate the tusk was once fastened to a metal object.