

Catalogue of Previously Unpublished Data
from Thai–Australian Excavations of the
Ko Si Chang One and Two, Ko Khram,
Ko Rin and Prachuap Khiri Khan Wreck
Sites in the Gulf of Thailand during the
1980s

by

Rosemary Harper

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Cover Photograph: Brian Richards

Photo of artefacts from the Ko Si Chang One Wreck site taken in the 1980s on the Island (Ko) of Kham Yai with the Island of Si Chang in the background. Note the protected waters between the two islands and what are possibly tamarind trees after which the island is named.

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Preface

This report has been collated for the purpose of completing the record of artefacts recovered during excavations undertaken by joint Thai-Australian expeditions in the 1980s. This group represented the Thai Fine Arts Department Underwater Archaeology Division, Silapakorn University, the Thai Ceramic Archaeological Project, the Western Australian Museum, the Australian (now Australasian) Institute for Archaeology, the University of Adelaide, the Art Gallery of South Australia and on occasion, participants of the Southeast Asian Ministers of Education Organization (SEAMO), Special Project in Archaeology and Fine Arts (SPAFA). Participants represented Thailand, Australia, Indonesia, Malaysia, the Philippines, Canada, Poland and the United States of America.

Included is information recorded by the author whilst participating in excavations of kiln sites at Si Satchanalai, Sukhothai Province and the Bang Rachan or Mae Nam Noi Kiln site, Singburi Province, Thailand during the 1980s. A brief visit was also made to the Ban Bang Pun Kiln site, Suphanburi. The author was also privileged to have been given access to the ceramic sherd collection of the National Museum of the Philippines, Manila and those of the regional museums of Butuan and Cebu cities.

The report was written with the participants of the Thai expeditions in mind, in an endeavour to bring a greater understanding and appreciation of where the ships fit into the history of exploration and trade as well as social aspects and economics of the region. Some sections were collated with the more specialised researcher in mind. It should be acknowledged that the author is not an authority on botany, chemistry or Thai history and apologises for any inaccuracies which may be found throughout the text.

Early accounts illustrate the situation faced by early sailors. At the beginning of the 19th century, Crawford, whilst travelling up the eastern seaboard of the Gulf of Thailand toward the mouth of the Chao Phraya river, followed a route used for centuries. Crawford (1828: 69) after encountering 'A numerous group of islands...' recounts on 21 March, 1825:

With the view of shortening our course, we passed the channel which divides them from a promontory on the main, called by the Siamese, Sam-me-san, and in our charts, Lyant. This channel, which is about a quarter of a mile wide, and about two miles in length, we passed with a light, but a leading wind, encountering no danger, and never having less than four and a half fathoms of water. Our boat went a head of us all the way, sounding. We found two small junks lying at anchor here, and we afterwards heard that the channel was a common route for the largest vessels of this description.

He continues, March 22

A great many islands were in sight last night, and we had them this morning on our starboard, for we did not think it safe to proceed during the night in the channel between them and the main. This, however, we afterwards learned is a common route of the largest Chinese junks, and is perfectly safe....

Crawford was unaware of the terrible fate of many vessels lying beneath those waters. The sites excavated by the joint

Thai-Australian team, and other investigations undertaken by the Thai Department of Fine Arts on the east coast of the Gulf of Thailand include the Ko Samae San, Ko Rin, Rang Kwien, Pattaya, Ko Khram and the three Ko Si Chang sites. Precarious conditions existed further south as illustrated by the Ko Kradat site and on the other side of the Gulf, the Prachuap Khiri Khan and Ko Samui sites.

Abbreviations

AC – Abbot's collection (when referring to the Bang Rachan kiln site)
AC – Also occurs as part of group numbering by the the Amdel Laboratory
Amdel – Australian Mineral Development Laboratories
BR – Bang Rachan Kiln site (Mae Nam Noi)
Cap – Capacity
CSIRO – Commonwealth and Scientific Industrial Research Organisation
d/D – Diameter
EW – Earthenware
GT/GD – *Vergulde Draeck* wreck site
H – Height
I – Inside
ID – Inside Diameter
IJNA – *International Journal of Nautical Archaeology*
JSS – *Journal of the Siam Society*
KB/KKB – Kota Batu Brunei
KKH – Ko Khram wreck site
Klg – Kalong
KN – Ko Noi kiln site
KL/KR – Ko Lin/Rin wreck site – KNSF – Ko Noi Special Find
KR/KL – Ko Rin/Lin wreck site
KSC – Ko Si Chang (1,2,3 wreck sites)
KS – Ko Samui wreck site
LASW – Later Stoneware
LOI – Loss on Ignition
MASW – MON associated stoneware
MNN – Mae Nam Noi (Bang Rachan kiln site)
MNY – Mae Nam/Menam Yom (Yom River)
MON – Most Original Mode
Munsell – (Colour Test Result)
NT – Nakhon Thai kiln site
O – Outside
OD – Outside diameter
PY – Ban Pa Yang kiln site
Phit. – Phitsanulok kiln site
P/Pat – Pattaya wreck site
PK/PKK – Prachuap Khiri Khan wreck site
PYSF – Pa Yang Special Find
r – radius
R – Rim
RK/RW – Rang Kwien wreck site
S/Suph. – Suphanburi kiln site
RD – Rim Diameter
San/ST – *Santiago* wreck site
SB – *São Bento* wreck site
SD – *San Diego* wreck site

SEAMO – Southeast Asian Ministers of Education Organization
 SF – Special Finds
 SJ – *São João* wreck site
 SN – Samed Ngam site
 sp. – Species
 SPAFA – Special Project in Archaeology and Fine Arts
 SS – Ko Samae San Site
 Suk. – Sukhothai
 SW – Stoneware
 T/Th – Thickness
 VG – *Vergulde Draeck* wreck site
 VOC – *Vereenigde Oost-Indische Compagnie* (United Dutch East India Company)
 Vol. – Volume
 W – Width
 WL – *Witte Leeuw* wreck site
 Wt. – Weight

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Many people and organizations have been essential in the excavation of the wreck sites and the production of this report. In Thailand: the Director and staff of the Fine Arts Department, Thailand, Khun Pisit Chareonwangso, Khun Prachote Sangkhanukit, Khun Sayanne Praichanjit, Khun Seehawat Naenna, Khun Jarum Vilaikaew, Khun Erpbhrem Vatcharankul, Khun Pathom Lasitanon, the Head Abbot Suwan Sumunkonkao and monks of Wat Praprang, Chanasut, archaeologists, staff and community members at Si Satchanalai, Sukhothai and Chanasut. Additionally, Khun Vidya Intakosai, Head of the Thai Underwater Archaeology Division kindly opened his home at Nong Chub Tao, Sattahip to all expedition staff. Khun Sayanne Praichanjit lead the 1988 excavation at Bang Rachan, Chanasut, Singburi Province. All gave their upmost support. In the Philippines: The Director and staff of the National Museum in Manila and regional museums of Cebu and Butuan, Dr Frederick Evangelista, Dr Jesus Peralta, Dr Florante Henson, Mr Larry Alba, Mr Fred Orogo, Ms. Rita Cembrano, Ms Mary-Rose Calderon and Ms Joy Geera played an integral part in the outcome. The Australian Ambassador to the Philippines offered assistance and hospitality. My colleague in the Philippines, Rosemary White, was a thorough researcher and good travelling companion. In Australia: The Australian Research Grant Council, the Director, Trustees and staff members of The Western Australian Museum, Dr Jeremy Green, Head of the Department of Maritime Archaeology and staff, Dr Peter Burns and staff of the Centre for the Study of Southeast Asian Ceramics at the University of Adelaide, the Thai Ceramics Archaeological Project, Thai Airways International, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Division of Forestry and Forest Research and the Australian Mineral Development Laboratories were integral to the project. Ms Lyn Day oversaw the analyses of ceramic sherd samples at Amdel. Dr Mike Barbetti of the NWG Macintosh Centre for Quaternary Dating at the University of Sydney undertook Carbon 14 dating services. Dr Don Hein and Toni Hein, Dick Richards and Gwen Hordern, all part of the joint Thai-Australian project were supportive at all times. From the Western Australian Museum Brian Richards was responsible for most of the on-site photography, with the assistance

of Tim Smith on occasion. Patrick Baker, Sue Cox, Myra Stanbury, Dr Mike McCarthy and Ross Anderson offered their experience when needed. Dr Ian MacLeod assisted with technical analyses. The late Ms. Barbara Harrison who donated her research documentation on jars to the WA Museum is acknowledged. Dr Tim Maggs made available sherds for analyses from jars recovered off the African coast. The late Dr Roxanna Brown showed great tenacity in visiting Ko Kham Yai during excavations and offering information on various ceramic sherds as did Dr John Guy. John Burns enthusiastically shared his extensive knowledge of ceramics. Rita Ringis and Prapaya Piggott helped with translation. Gunilla Friis has given continual moral and practical support throughout this lengthy project. Particular thanks go to Jeremy Green who has formatted and edited this report. I am exceedingly grateful. All inadequacies are mine. Foremost I wish to acknowledge my partner David Meredith and our son Karri Charles Harper-Meredith for giving the utmost support in the endeavour to complete this project, including ongoing financial support over a substantial period.

Much of this publication was collated having in mind those who participated in the excavations. Hopefully it offers a greater understanding of the trading patterns and cargoes of the Gulf of Thailand as it opened up to the wider world (or the wider world to it). To all of you who have played an integral part in extracting the historic substance within the shipwrecks and their cargoes, many thanks. Those who took part include the following, in no particular order: Khun Vidya Intakosai, Jeremy and Susan Green, Pathom Lasitanon, Sayanne Praichanjit, the late Udom Nateroj, Tid Nateroj, Veera Panfug, Yok Nuanpaeng, Kamanit Direksilp, Meun Proompradab, Prameurn Amphon, Samruey Wongchamras, Montrey Tavanannop, Jarvoil Sittitum, Somjai Preinjai, Somnuk Sutam, Harry Widiyanto, the late Santoso Pribadi, Soeroso Mp, Jose Santiago, Larry Alba, Maharlika Cuevas, Ibrahim Kalali, Peter Koon, Peter Molijol, Andrezij Kola, Gerard Wilke, Czeslaw Pietrzykowski, John Guy, Guy and Beatrice Dauphin, Brian Richards, Nick Sander, the late George Green, Michelle Berry, Nancy Mills-Reid, Rod Van der Merwe, Sandy McKendrick, Antonia Syme, Kevin Robinson, Bruce Coppystone, Dena Garratt, Geoff Glazier, Ian Warne, Ken Vickery, Prue Griffin, Chris Mattner, Maureen Trinder, the late Phil Clegg, Pippa Ransom, Raina Robinson, Richard Megaw, Rick Fordham-Edwards, Rob McKinnon, Scott Carpenter, Sheila Robinson, Tim Smith, Tom van Leeuwen, Paul Clark, Jan and Abbey Rodda, Jon Carpener, Nic Clark, Myra Stanbury, Paul Hundley, Geoff and Helen Kimpton, Dr George Magaletta, Dr Noel Jones, Tim Smith, the late Ross White, Dr Bob Jarvis, Pippa Jarvis, Dr Allan Walley, Maureen Trinder, Dr Roxanna Brown, Dr David Miller, Karen Atkinson, Sayward Ayers, Bob Richards, Nikki King-Smith, Jo Buckee, Nualla Randall, Dr John Williams and Ben, Jemma and Kate Green. Sincere apologies if anyone has been inadvertently omitted from the list.

Maps



Figure 1. Map of Southeast Asia Showing Main Site Referred to in Text.



Figure 2. Southeast Asia including Indonesia and the Philippines

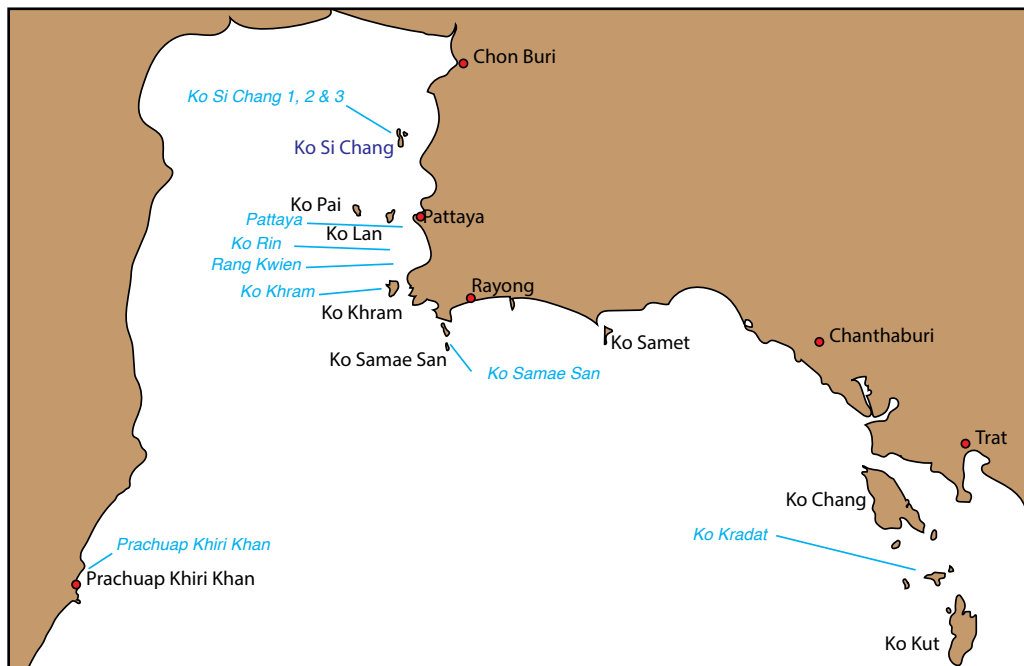


Figure 3. Main Wreck Sites in Thailand



Figure 4. China Showing Towns Referred to in Text.

PART 1. Artefact Catalogue

This catalogue details previously unpublished artefacts recovered from shipwrecks in the Gulf of Thailand between 1982–1988. Represented are the Ko Si Chang 2 (1982; 1985 & 1987), Ko Khram (1987), Ko Rin (1988), Prachuap Khiri Kan (1987) and the Ko Si Chang 1 (1982, 1983 & 1985). Relevant details of published reports are given at the introduction to each wreck site. The Ko Kradat, Pattaya and Ko Si Chang 3 wreck site investigations can be found in Green, Harper and Prischanchit (1981); Green and Harper (1982) and (1983) and Green, Harper and Intakosai (1987) respectively. Access was also made available to some material from sites excavated by the Underwater Archaeology Division of the Fine Arts Department, Thailand. This includes the Rang Kwien, Ko Samae San, Ko Samui and Samed Ngam sites. Drawings were made of some of the Ko Samae San and Ko Samui items, particularly when a sample of a sherd was taken for material analysis. It should be noted that the names Ko Rin and Ko Lin refer to the same site.

Classification of wares emanating from kiln sites in Sukhothai Province, central Thailand, can be confusing. Many authors have grouped all under the banner of ‘Sukhothai Ware’, others have them under ‘Sawankhaloke’. In fact there were distinct production areas. One was based near the old city of Sukhothai located approximately thirteen kilometres from the modern town of Sukhothai. The other area was situated approximately fifty kilometres north, on the banks of the Mae Nam Yom, south of Amphoe Si Satchanalai (alternatively referred to as Hat Siaw) and north of the modern day town of Sawankhalok. There is sometimes confusion between the old city of Chalieng and the old city of Si Satchanalai. For further discussion regarding nomenclature refer to Vickery (1990), Hein (2001) and others.

In this report, Si Satchanalai wares refer to wares from the kilns along the banks of the river Yom (Mae Nam or Menam Yom) situated north of the ruins of the old city. Distinction may be made between particular areas such as Ban Pa Yang, Ban Ko Noi or Ban Nong O. All of these sites are within approximately an eight to ten kilometre range along the Mae Nam Yom. It should be acknowledged that owing to the Indian derivation, the name should be Sri Satchanalai, however, the modern name of Si Satchanalai is in common usage.

An attempt has been made to arrange the ceramic finds from lower-fired to higher-fired wares and as such the ceramics have been allocated earthenware, earthenware-stoneware or stoneware body groupings, followed by porcelain. This is a rough estimate since all artefacts were recorded on site and remained in Thailand. More specific examination has not been possible.

Samples of some sherds included in this report have been tested for composition by the Australian Mineral Development Laboratories (Amdel), Adelaide, South Australia. Those tested have been marked with an asterisk and can be related to Tables 4–29. Unfortunately, a limited number of samples was taken from the sites, including production sites, making conclusions difficult. Any determination of a proposed provenance by this author is an estimate only.

Many of the artefacts listed below can be compared to finds from sites throughout Asia and further afield. For example,

Harper (1988(i) a & b) has listed, from the Philippines, many reported finds likely to have their origin at the Thai kiln sites. These include celadon glazed plates, bowls, jarlets and *potiche*; brown glazed jarlets and *potiche*; painted covered bowls, Sukhothai fish plates and bowls; glazed jars, earthenware lids and pressed pots. Some of these ceramics bear close comparison to items recovered from the wreck sites detailed below, however, due to restraints it is not possible to list all the Philippine finds in this report.

In Thailand, glazed jars are known to have been produced at the kilnsites of Si Satchanalai, Phitsanulok and Bang Rachan (Mae Nam Noi). Many ceramic items recovered from the wreck sites compare with items manufactured at these kiln sites. An initial attempt to correlate shipwreck finds with kiln site production, including jars, was made by Green and Harper (1987).

Because of the nature of the wares and the ability for earthenware ceramics to be produced in almost any environment, it is not easy to provenance these items. Where possible, an attempt has been made to suggest a possible source but generally this is based on the form of the item rather than a close analysis of a common clay source.

The basis of this report, compiled in 1988, was unable to be completed until now due to unavoidable constraints. An attempt has been made to include as much new information as possible, with the understanding that there have been many archaeological discoveries in the past years which update and enhance previous knowledge in this area.

Additional information pertaining to artefacts and historic background can be found in PARTS 2–6 below.

Scale: Drawings 1:4, Photographs 1:2 unless otherwise specified (Approx.) Some photographs have been enlarged in order to emphasize a particular feature in which case no scale is given.

In most cases measurements were estimated from sherds as accurately as possible.

An asterisk next to a registration number denotes that the item was tested by Amdel.

The registration numbers given to items from the Ko Samae San and Ko Samui sites are of this author only.

Reference numbers given for the Philippines items may be those used by each particular museum in the Philippines or a number particular to this author.

The Sites

KO SI CHANG 2 WRECK SITE

The initial report on this wreck site is to be found in Green and Harper (1983) under Wreck Site S. Further information can be found in Atkinson *et al.* (1989). Carbon 14 dates resulting from tests undertaken on wood fragments collected from the Ko Si Chang 2 wreck site in 1987 give a result of 1290 ± 60 years. One of the coins recovered from the wreck site has been dated to the Emperor Ch'eng Tsu, reigning 1403–1424/5.

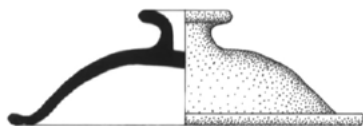
The material recovered from the Ko Si Chang 2 wreck site appears to have its source in several localities extending from Thailand to China. Analyses by Amdel (1987–89) points towards a probable Si Satchanalai provenance with a close association to the Sukhothai kilns, for underpainted wares and a possible Si Satchanalai-Nong O place of manufacture for glazed jars. The Longquan kilns in Southern China appear to be the source for at least some of the celadon material whilst a Vietnamese source for other material is possible.

A group of unglazed ceramics with grey-black surface was recovered from this wreck site. Based on the appearance and ornamentation, these items compare with ceramics produced at the Ban Bang Pun kiln site, Suphanburi, as described by Sutchit (1984) and Vilaikaew (1989) in Thai. Vilaikaew also indicated that similar material has been recorded at Bang Phak, Amphoe Bang Sai, Ayutthaya Province.

Ceramics

Earthenware

LIDS



KSC2 33

Incomplete lid with tubular handle. Ridge under rim. Beige-grey body. Ref: Green and Harper (1987) 16a, the Ko Si Chang 1 wreck site KSC1 1983 602; Ko Kradat wreck site, Green *et al.* (1981) KK No.41; Green (1983) KSC1 51; the Ko Samui wreck site and the 'Medieval Vessel', Christie's (1989) Nos. 50, 51. A lid of this type, of similar size, was also recovered from the Brunei Darrusalam wreck, (WA Maritime Museum Exhibition 2004–5). Also on display were a smooth beige lid and a red-beige lid, perhaps of a rougher nature than the Ko Si Chang 2 item. Brown (2004) Plate 5 (RK186) shows a lid of this type from the Rang Kwien site.

KSC2 29

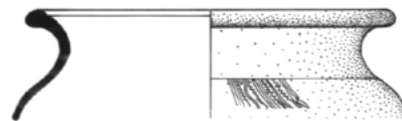
(Not illustrated)

An incomplete lid with knob handle, as Green and Harper (1983) S13, was recovered. Resin was attached to the convex rim edge. The knob appeared to be positioned lower within the concave upper surface of the lid than that shown in Green

and Harper (1987: Fig. 16c). Ref. as above and the 'Medieval Vessel', Christie's (1989) No. 42.

POTS WITH PRESSED DECORATION

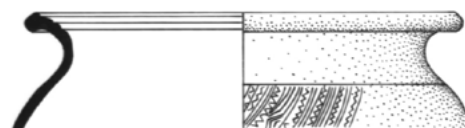
This type of earthenware is almost ubiquitous on the Southeast Asian sites such as detailed under the Ko Khram wreck site (below).



KSC2 41

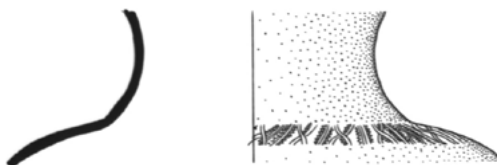
15 mm

Rim sherd. One incised line inside. Beige-grey body.



KSC2 1247*

Rim sherd. Incised inside rim. Dark grey body with black inclusions surrounded by light grey layers. Orange exterior with orange inclusions.



KSC2 1217*

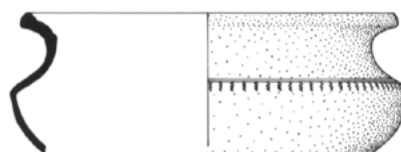
Neck sherd. Medium to dark grey body with black inclusions. Ref: Green and Harper (1987: Fig. 17c). There are many parallels between ceramics from the Ko Si Chang 2 and Turiang site (*c.* 1370). Brown and Sjostrand (2002) CP25 illustrate a similar pot.

KSC2 1297*

Not illustrated

Shoulder sherd. Grey to beige body with brown inclusions.

BASIN WITH PRESSED DECORATION



KSC2 37

Upper section of basin. Incised inside rim and on shoulder.

PART 1

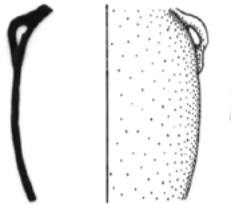
JAR OR BOTTLE WITH INCISED DECORATION



KSC2 40

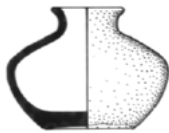
Shoulder sherd, incised. Grey to orange-beige body with smooth surface (similar to kendi found on the Thai wreck sites).

JARLET



KSC2 1296

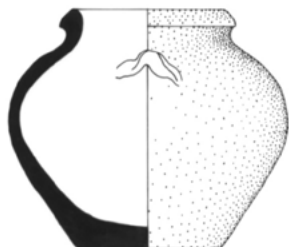
Sherd with lug handle.



KSC2 1291

Orange-red body. Very thin, degraded, patchy olive green glaze, possibly lead, extending inside rim.

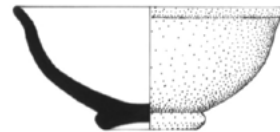
JAR



KSC2 26

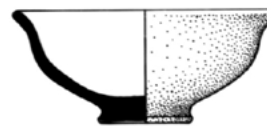
Incomplete small jar. 1 small lug handle visible. Orange body. Clear, thin greenish glaze extends to base and just inside rim. Ref: Christie's (1989) Fig. 18, 29 etc. from 'Medieval Vessel'.

BOWLS



KSC2 27

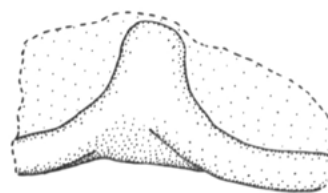
Incomplete bowl. Orange-grey body. Clear, very thin, greenish-yellow glaze interior and exterior.



KSC2 1259

Complete bowl. Red body. Thin yellow-green, possibly lead glaze, inside and out.

STOVE



KSC2 1246

Top view of stove lug sherd. Refer: PART 2 (below) Stoves.

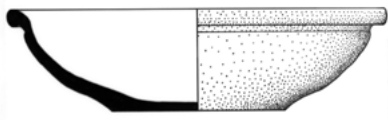
Earthenware—Stoneware

BASINS—UNGLAZED



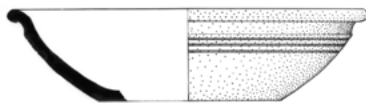
KSC2 1067 (1:8)

Upper section sherd. Pink-grey body. Dark grey exterior.



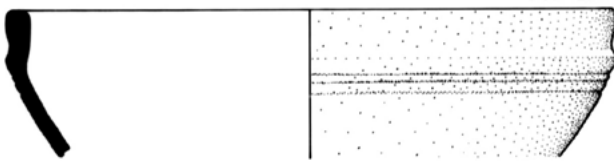
KSC2 56 (1:8)

Incomplete basin. Warped. Medium grey body. Beige-grey exterior.



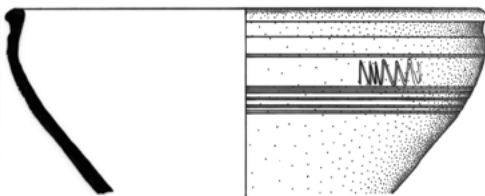
KSC2 1240 (1:8)*

Incomplete basin. Grey body. Black exterior. Incised on shoulder.



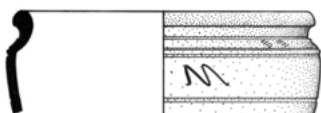
KSC2 1226 *

Incomplete basin. Grey body. Black exterior. Incised on shoulder.



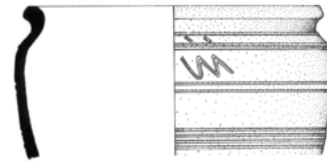
KSC2 1079 (1:8)*

Incomplete basin. Grey body. Some internal bloating. Medium-grey exterior. Incised on shoulder.



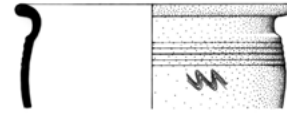
KSC2 54 (1:8)

Incomplete item. Beige-grey body. Medium grey exterior. Incised on upper body.



KSC2 1229 (1:8)*

Incomplete item. Stamped decoration on neck, incised on body. Grey body. Black exterior.



KSC2 60 (1:8)

Incomplete item. Beige-grey body. Medium grey exterior. Incised on body.

JARS – UNGLAZED

Refer: PART 3 (below).

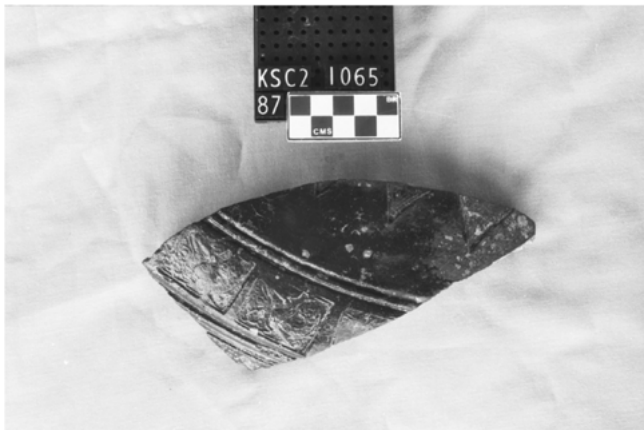


KSC2 1061*

Jar wall shoulder sherd. Dark grey exterior. Impressed decoration includes interpretation of the lotus bud *krachang*, see Warren & Invernizzi Tettoni (1996: 106, 109).

KSC2 1234*

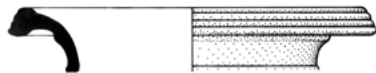
Jar wall shoulder sherd. Impressed decoration includes rouletting and stamping. Decoration includes what is probably a stylized leaf of the sacred fig (*Ficus religiosa*). Dark grey exterior.



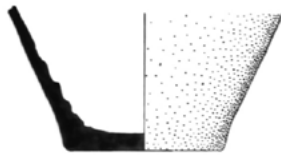
KSC2 1065*
Jar wall sherd. Dark grey exterior. Impressed decoration includes either lotus bud or leaf of sacred fig and design within square (possibly a mythical bird).



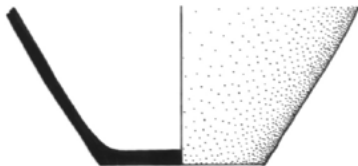
KSC2 63 (1:8)
Rim sherd. Flared and turned out. Incised and ridged. Medium grey body. Beige to grey exterior.



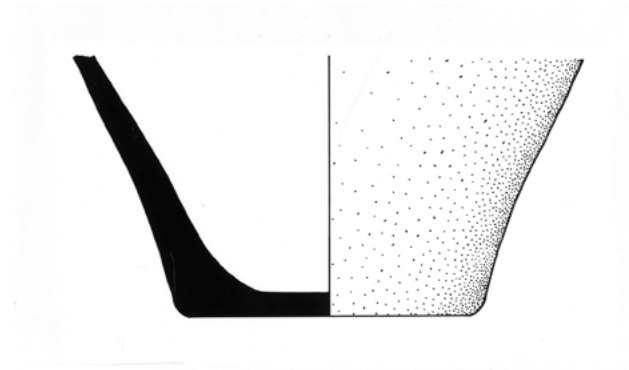
KSC2 1231 (1:8)*
Rim sherd. Incised lines on rim. 2 ridges. Beige-grey body with black inclusions. Black exterior.



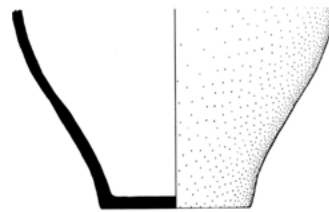
KSC2 1238*
Lower section sherd. Beige to dark grey body with black inclusions. Black exterior.



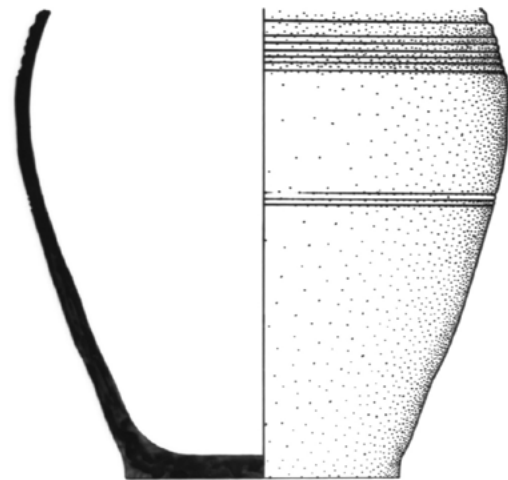
KSC2 1213*
Lower section sherd. Orange-beige-grey body with black inclusions. Black exterior.



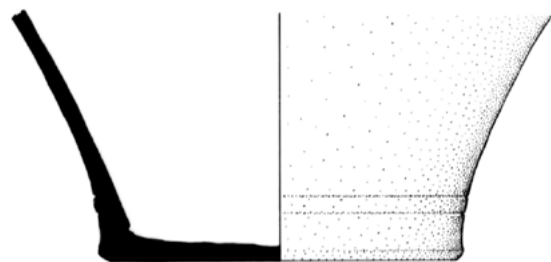
KSC2 1239*
Lower section sherd. Medium grey body with black inclusions. Black exterior. Interior of item is roughly finished.



KSC2 1237 (1:8)*
Lower section sherd. Light mauve-grey body.

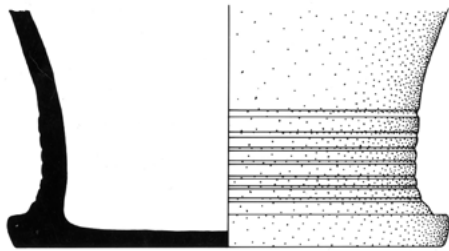


KSC2 1221*
Lower section sherd. Two sets of incised lines. Medium grey body. Black exterior.



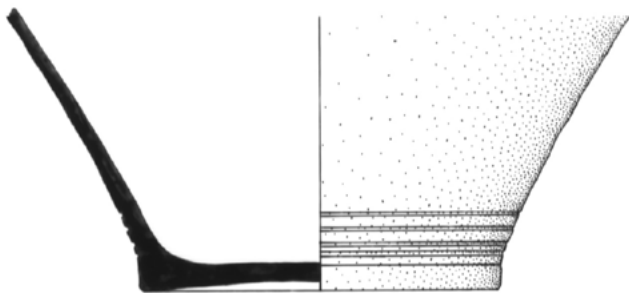
KSC2 1232*

Lower section sherd. Two incised lines near base. Light mauve-grey body matrix with black inclusions. Black exterior.



KSC2 52

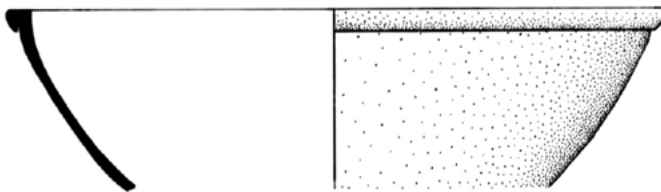
Lower section sherd. Seven incised lines near base. Grey body. Grey-beige exterior. Ref. KKH7 below.



KSC2 1236*

Lower section sherd. Five incised lines near base. Grey body. Black exterior.

Stoneware
BASINS



KSC2 1228*

Rim sherd. Folded out. Brown-grey body. Medium grey exterior. Exterior is unglazed, interior has brown glaze extending from just below rim.



KSC2 1002*

Rim sherd. Folded out. Remains of clay buttons on rim. Brown-grey body. Thin yellow-brown glaze inside until just below rim. No ceramic sherds with these clay attachments

have been noted in other collections seen by the author, however, there are notable similarities in the use of some sort of support—clay or otherwise—used around the rim during firing. Modern items with the ‘shadow’ mark of a support, similarly positioned, can be seen today in Bangkok markets (Southeast Asian Ceramic Society, 1985: 76), a basin with marks on the rim where attachments have rested. Comparable items, No. 86 and Fig. 6, were recorded from Allaippiddy in Sri Lanka. Similarities also exist with Nos 189a and 189b acquired in Manila. Moore (1970: Fig. 16 e & f) illustrates correspondingly shaped basins. Locsin (1967, Plate 109) also shows a similar item from the Puerto Galera land excavations in the Philippines. Harper (1988(i) a) has recorded wares with some likeness in the collection of the National Museum of the Philippines, from Laguna in Luzon and also from Butuan, Mindanao. The Overseas Ceramic Society of Hong Kong (1979: Fig. 229) in discussing a similar item (Fig. 229) comment that basins of this type were produced at the Go-sanh kilns and the Hsi-ts’un kilns of Canton (Guangzhou, Guangdong Province, Southern China). An item from the Philippines, estimated to have a Guangdong provenance, compares through chemical analyses, with KSC2 1002.

Lammers and Ridho (1974: Nos. 4A5/2842 from the middle of South Sulawesi) and PA6/552 resemble the items discussed above. A Vietnamese provenance is given for this material. Brown (1977: Plate H.4) also denotes a basin of this type to a Vietnamese (Cham) origin. See also KSC2 1042 below.

It should be noted that the Ko Si Chang 2 items are not necessarily the same as those referenced but that the similarities relate to the spur marks on rim, the vertical shape of the walls and the colour of the glaze. The Ko Si Chang 2 items are unique in that parts of the spurs have been fired on to the item.

BOWLS AND PLATES—BLACK PAINTED UNDER GLAZE OVER SLIP

Although it is certain that this group is of Thai origin some of the items below pose a quandary in that as a group they tend not to fit neatly into either a model Sukhothai or Si Satchanalai classification estimated through testing undertaken by Amdel. In general the body paste and slip are more typical of a Sukhothai ware. The Si Satchanalai painted under glaze product is generally represented by a light grey body with small black inclusions—whereas many of these items are coarse and much darker in colour. Brown (1988: 68) says of Sukhothai glazed wares the clay body is ‘...so coarse and grainy that it necessitated heavy, solid potting, and a thick layer of slip before underglaze decoration could be applied’. The decoration and glaze of the Ko Si Chang 2 items have a Si Satchanalai appearance. A number were blackened and worn from their immersion in the sea water. As such it was not always easy to see the design. Some items had marks on the base where tubular supports were used, however others did not. There was no evidence of spurred supports being used inside the plates and bowls except perhaps on the plate KSC2 1308 (below).

It was found that of the bowls, compared through material analyses by Amdel, all had a fairly similar chemical composition. The range of ferric oxide values was 1.69–2.52%. In comparison an item from the Ko Khram shipwreck (KKH38

with the traditional Sukhothai style fish design) had a ferric oxide value of 2.96%, slightly higher than the range found for the Ko Si Chang 2 underpainted wares. Amdel stated that it was possible that the Ko Si Chang 2 wares are of Si Satchanalai origin although ferric oxide values much in excess of 2.0% were unusual in the tested items from the Si Satchanalai kilns. Amdel concluded that the samples were definitely not of Sukhothai origin since their ferric oxide values were far too low apart from KSC2 1012 which fitted the Sukhothai profile with a Fe_2O_3 of 2.52%.

Of the sampled painted under glaze plates Amdel established that they were all of similar composition. The only significant variant was in sodium oxide values, some of which (KSC2 1265, 1292 and 1308) were relatively low at approximately 0.45% which was the case with most of the underglazed bowls. However, four of the samples (KSC2 1081, 1254, 1306 and 1315) were much higher at 1.07–1.88%. This type of variation for sodium oxide has been observed in the Ban Ko Noi, Si Satchanalai wares. The ferric oxide values for these samples was in all cases less than 2.0% which is consistent with the wares from Ban Ko Noi. Amdel concluded that like the bowls above, the plates from the Ko Si Chang 2 site are definitely not of Sukhothai origin.

Another feature of significance regarding the black under glaze items is that some items have the ‘angled ‘Yuan’ foot, a feature of the larger Transitional Stoneware (TRSW) bowls at Sawankhalok’, which Hein (2001: 149) says was;

...less commonly used at Sukhothai in favour of the square cut foot...’

The square cut foot appears on the Ko Si Chang 2 bowls. It is generally on those items which have a tendency to fall more towards the Sukhothai criteria as estimated through material analyses or through physical features. Hein *et al.* (1986: 29) inform that:

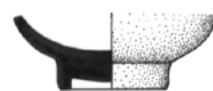
Nearly all of the wares of Sukhothai have a parallel variety at Sisatchanalai and the kilns and potting techniques are very similar to those of the early above-ground kilns at Sisatchanalai. There are fewer variations of potting style and mannerism evident at Sukhothai, which is consistent with the small number of potters and the fewer kilns. The forms and glazes on present knowledge appear to have undergone very little change... At Sukhothai there appears to have been little or no developmental period and that (sic) a rather complete system was introduced. In fact the complete order of ceramic production at the beginning of Sukhothai could have been, and probably was, drawn from Sisatchanalai. All of the designs and forms were being produced at Sisatchanalai at that time. The potting methods were the same, as were the firing techniques... Descriptions of the two sites using different methods in this respect are wrong. Use of white slip and underpainted designs of fish, floral motifs and the chakra were common at Ban Ko Noi at the time and indeed some pieces from both sites of this period are difficult to tell apart, especially as the range of forms including the trimming of the footrim, are identical.

The majority of these painted under glaze wares fit, or almost fit, the Ban Ko Noi pattern of material composition and

the overall trend is that it is the source of manufacture. Despite this declaration, it can be seen that some Amdel results for this group (Tables 4, 24 and 25) also fall into the Sukhothai range.

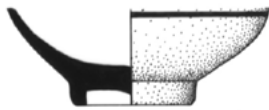
It may be that further analysis of KSC2 105 (described below) may aid in defining more closely the relationship in time between the demise of the Ko Si Chang 2 ship and the production of painted wares from the Si Satchanalai and Sukhothai kilns. This heavily potted item has the remains of an off-centre tubular support still attached and poor quality (bleeding) decoration. Material analysis came close to both Ko Noi and Sukhothai ranges except in both cases varying from the given range of Fe_2O_3 . What is intriguing is that a similar product to KSC2 105, (S15 AC1219/89) Table 25, recovered from the riverbank adjacent to the Suphanburi kiln site falls into the Sukhothai range. This may be significant in pinpointing a particular point of contact between the three sites when related to the Ko Si Chang 2 ship with a known date post-1403.

As an additional point of interest, comparison should be made between this group of items from the Ko Si Chang 2 wreck site and those recovered at Kalong (northern Thailand), Shaw (1981).



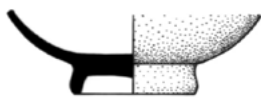
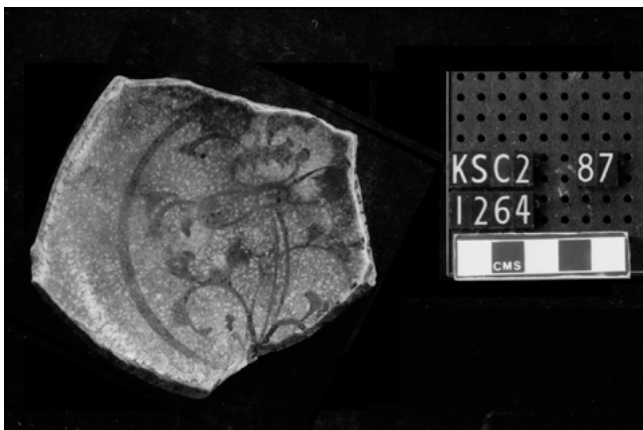
KSC2 98

Base sherd. Coarse grey body. No support mark evident. Brown (1988: CP xxviii) gives a Sukhothai provenance for items similarly decorated to KSC2 98, 97, 1264, 1110, 1012 and 1011. Likewise Hein (2001: Fig. 48c) shows items with a very similar decoration to these Ko Si Chang 2 items, denoted as Sukhothai products.



KSC2 97

Base sherd. Coarse grey body. No support mark evident.



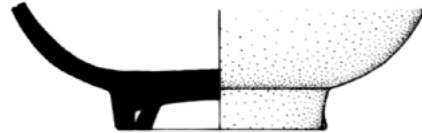
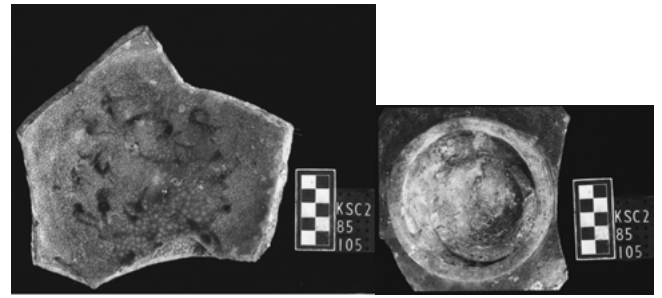
KSC2 1264*

Base sherd. Dark grey body with inclusions. Interior floral decoration. Possible exterior decoration. Ref: Brown (1977: Plate N 1a), for a similarly decorated item.



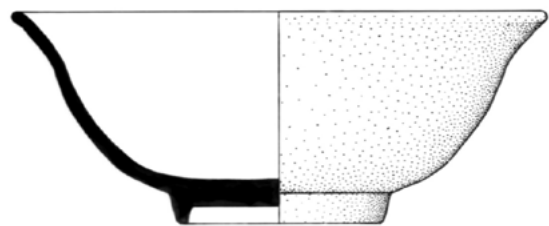
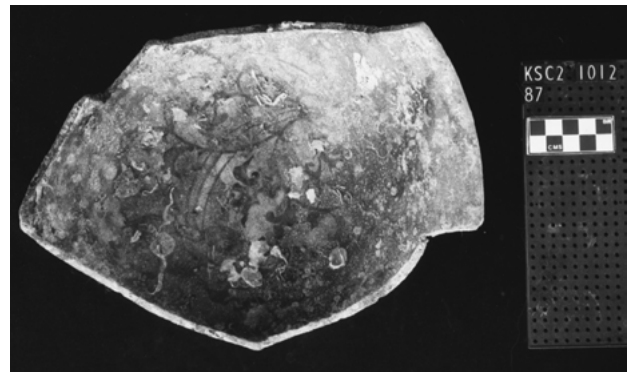
KSC2 1084*

Base sherd. Fairly coarse grey body with black inclusions. Thin white-green glaze over thick slip. Possible interior floral decoration, linear exterior.



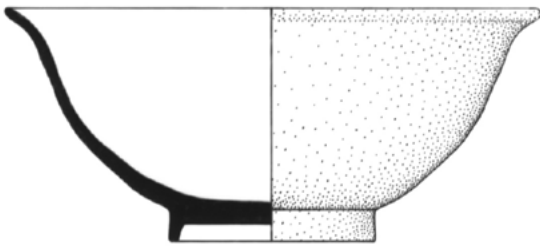
KSC2 105*

Base. Very poor quality item. Beige-grey body with black inclusions. No slip apparent. Paint bleeding. Very thick light green cracked glaze particularly on one side of bowl and extending over footrim. Bloating. Remains of a heavy, off-centre tubular support attached. This author recovered a sherd with similar appearance on the surface of the river bank adjacent to the Suphanburi kiln site, in 1988. The latter sherd fitted the Sukhothai profile through Amdel analysis.



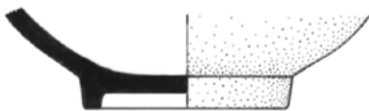
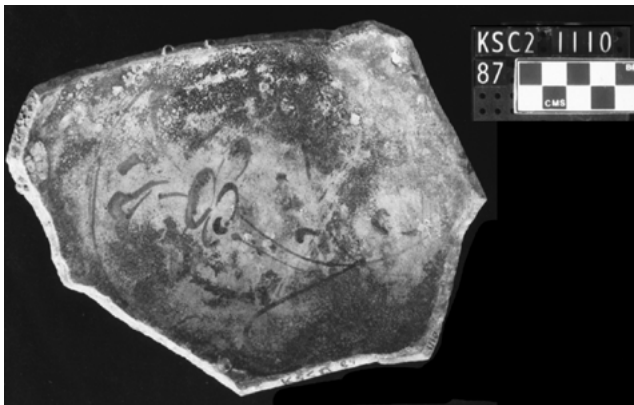
KSC2 1012*

Incomplete bowl. Grey body with black inclusions. Interior floral decoration, exterior decoration deteriorated. Thin, degraded glaze. Tubular support mark on base (see Brown, 1988: Plate XXVIIIa; Willetts, 1971: No. 148).



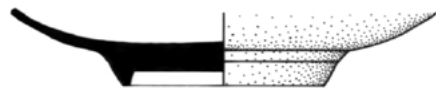
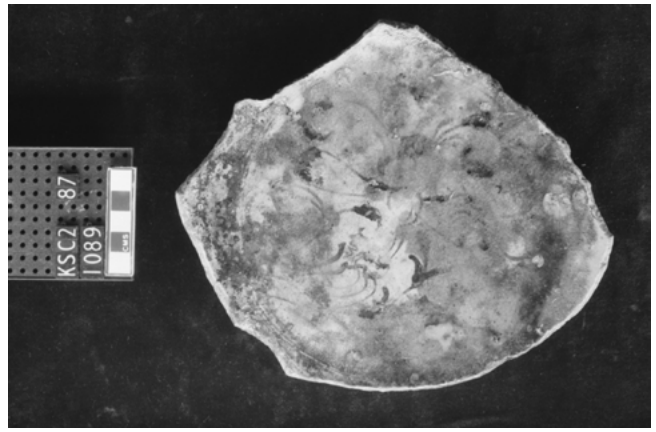
KSC2 1011*

Incomplete bowl. Dark grey body with black inclusions. Central floral decoration. Scrolling inside rim. Degraded light green glaze. No tubular support mark. Ref: Robb & Beyer (1930: Fig. 27), a similarly designed item recovered from a Cebu grave site, the Philippines. The Southeast Asian Ceramic Society (1982: Fig. m) compares similar designs on plates denoted Sukhothai and Vietnamese provenances.



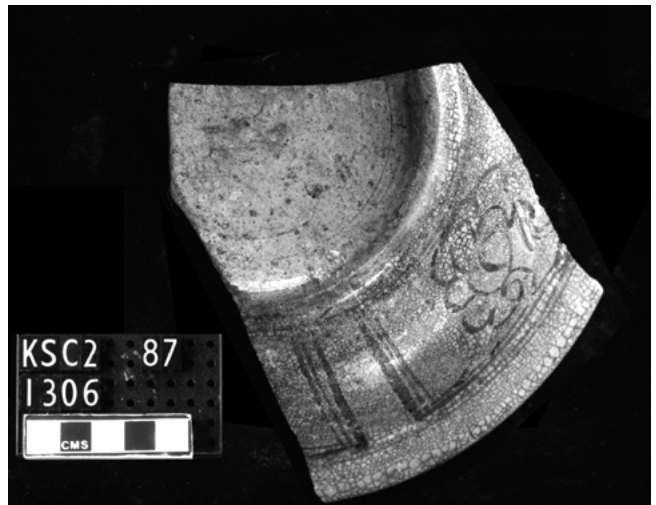
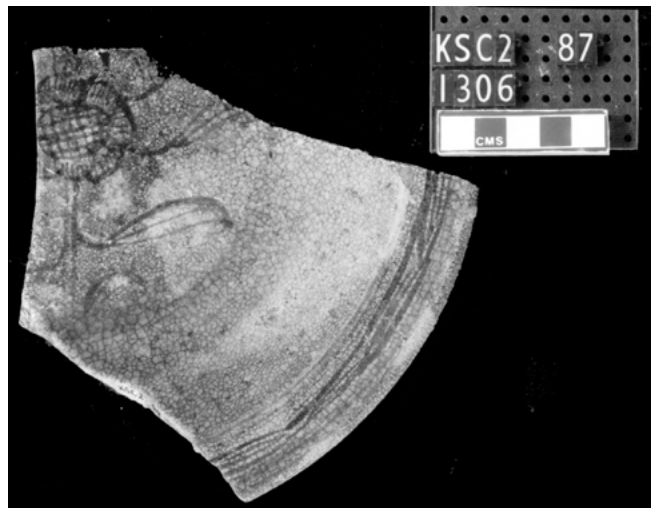
KSC2 1110*

Lower section. Central floral decoration. Medium to dark grey body with black and white inclusions. Thick slip. Degraded glaze.



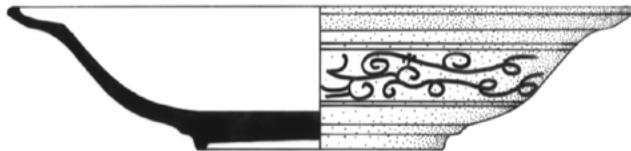
KSC2 1089*

Lower section. Central floral decoration. Fairly coarse grey body with black and white inclusions. Thick slip. Degraded glaze. No evidence of support mark on base.



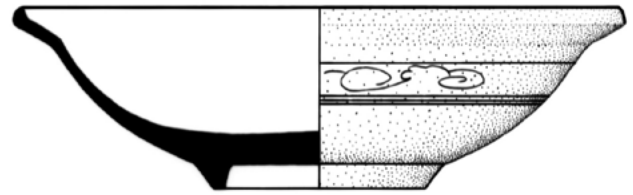
KSC2 1306*

Incomplete plate. Light grey body with fine black inclusions. Glassy, crazed light green glaze. No evidence of slip. No support mark. Harper (1987: No.143) illustrates a similar design from a bowl found in the area of Kiln 54, Si Satchanalai. Brown (1988: Plate XXIXc and Plate XXXIa) shows items with similar elements of decoration. Similarities to Hein *et al.* (1986: Fig. 13 left hand side).



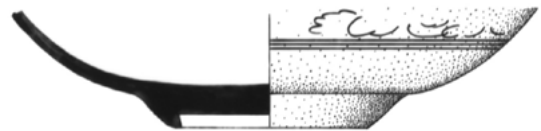
KSC2 1081*

Incomplete plate. Grey body with grey-black inclusions. Light green glaze. Ref: Harper (1984) and Harper (1987: No. 137-9) illustrate many sherds from the Si Satchanalai kiln site with fish design of the style seen on the Ko Si Chang 2 wreck site.



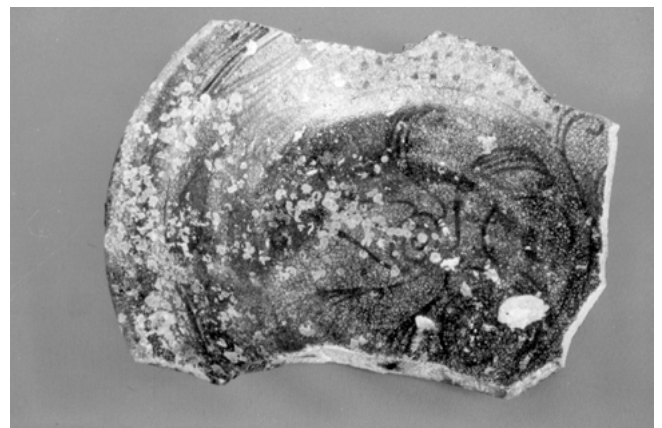
KSC2 1265*

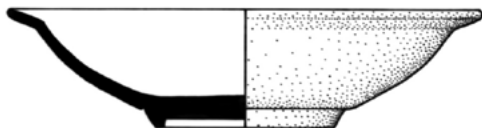
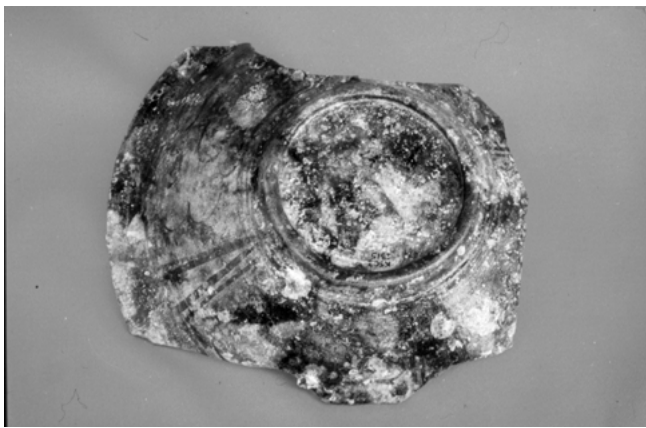
Incomplete plate. Grey body with some white and relatively large black inclusions. Bloated. Thick slip. Thin, light green glaze. Tubular support mark on base. Brown (1988: 63) in describing 'Transitional' underglaze iron decorated wares says '...layer of white slip beneath the glaze, spur marks in the well, and some similar motifs, transitional Sawankhalok wares have sometimes been mistaken for Sukhothai pieces, but the formalised, almost stilted quality of their underglaze drawing belies them...'.¹



KSC2 1292*

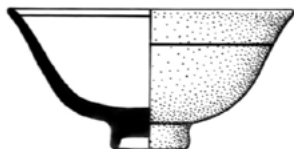
Plate base sherd. Medium grey body with black and white inclusions. Thick slip. Degraded light green glaze. Tubular support mark on base.





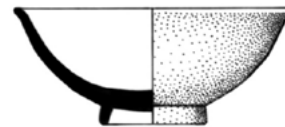
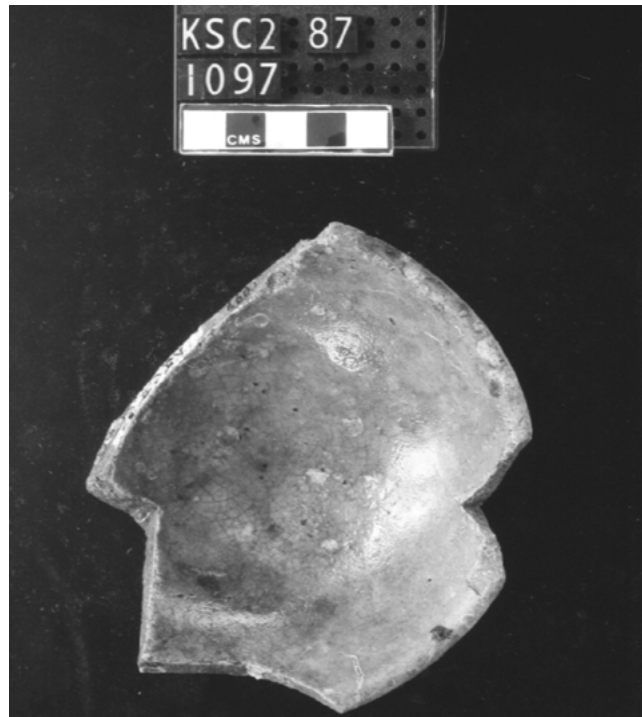
KSC2 1315*

Incomplete plate. Grey body with tiny black inclusions. Central floral decoration and fish on cavetto. Exterior has scroll within panel decoration outside. Light green degraded glaze. No evidence of tubular support. Of particular interest is an item illustrated by Hein *et al.* (1986: Fig. 13) right hand side, from the excavation of Kiln 42, Ban Ko Noi, Si Satchanalai, Thailand. A sherd from Si Satchanalai (Harper, 1987: No.141) is also representative of the floral design found on this plate. Harper (1984: KNSF651 and KNSF671) illustrates sherds with similar floral motifs recovered during a survey of an area of Ban Ko Noi, Si Satchanalai. A similar design is illustrated in Robb and Beyer (1930: Fig. 26), coming from a grave site in Cebu, the Philippines. Spinks (1959: Fig. 7) shows a plate with the floral design, without fish, from Lombok Island. Rau and Hughes (1985: Plate 4 No. 3) illustrate a similar plate from the Tak burial grounds. Woodward (1978: Fig. 5) illustrates an item from a burial site, Bo-od, Tubigon, Bohol, the Philippines. Brown (2004: Plate 24, M13/9), shows a plate from the Maranci shipwreck site, Indonesia, which has a simple central floral decoration with a plain cavetto and linear decoration on the rim. The Si Satchanalai floral decorated underglaze plates from the Turiang site as Brown and Sjostrand (2002: Fig. 17a CP20,21), resemble KSC2 1315 however the Turiang items have a plain cavetto.



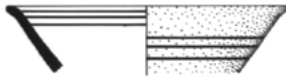
KSC2 1100

Incomplete bowl. Grey body with black inclusions. Linear decoration inside and out.



KSC2 1097*

Incomplete bowl. Grey body with black inclusions. Thin, transparent glaze. Pin-holing and crazing evident.



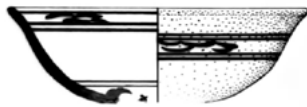
KSC2 1269

Rim sherd. Dark grey body with black inclusions. Linear decorated inside and out. Degraded light green glaze. Pinholed.



KSC2 101

Bowl base. Medium grey body with black inclusions. Red exterior. Unable to see design. Thin green glaze. No support mark evident.



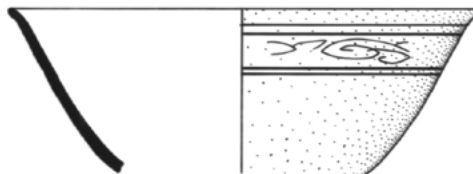
KSC2 117

Rim sherd. Grey body with tiny black inclusions. Light green, crazed glaze. Decorated interior and exterior.



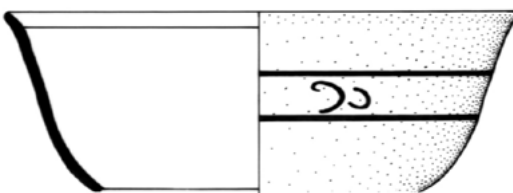
KSC2 107

Rim sherd. Grey body with chalky matrix and black inclusions. Remains of light green glaze.



KSC2 1160

Rim sherd. Dark grey body with black inclusions. Degrading, thick, light green glaze. Scrolling inside and out.



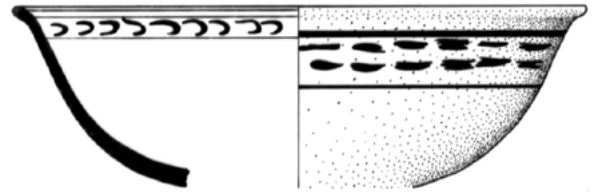
KSC2 122

Rim sherd. Beige-grey body with black inclusions. Light green glaze. Decorated interior and exterior.



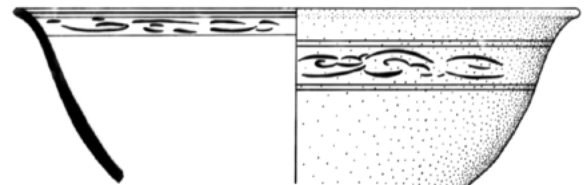
KSC2 108

Rim sherd. Grey body. Remains of light green glaze. Decorated interior with brush strokes and exterior with scrolling.



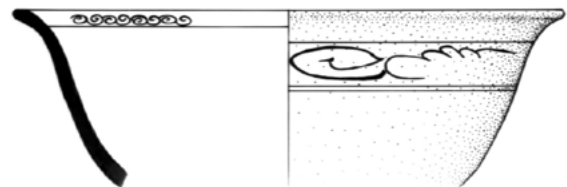
KSC2 1129

Rim sherd. Dark grey body with air pockets. Degraded greenish glaze. Decorated interior and exterior.



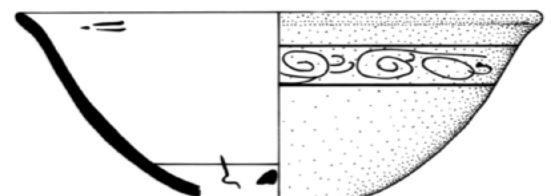
KSC2 1260

Rim sherd. Grey body with black inclusions. Very light green glaze. Decorated interior and exterior.



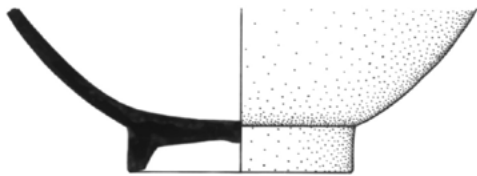
KSC2 110

Rim sherd. Grey body with fine black inclusions. Crazed light green glaze. Decorated interior and exterior.



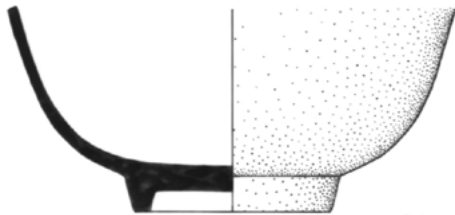
KSC2 109

Rim sherd. Beige-grey body. Crazed, shiny light green glaze. Pinholed. Decorated interior and exterior.



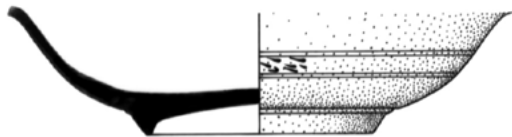
KSC2 103

Base sherd. Grey body. Underfired glaze. Floral decoration inside. No support evident. The decoration appears to be similar to KSC2 1089 (above).



KSC2 104

Base sherd. Grey body. Underfired light green, crazed glaze.



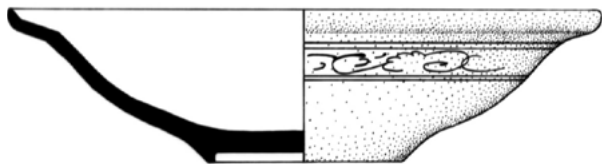
KSC2 1088

Base sherd. Fairly coarse dark grey body matrix with black inclusions. Interior floral decoration, exterior brush stroke. Painted base. Tubular support mark on base.



KSC2 1254*

Incomplete plate. Light grey body with fine black inclusions. Thinner slip than was usually found on this type of item from this wreck site. Crazed, light green, opaque glaze. Design appears light blue. Tubular support mark on base.



KSC2 1308*

Incomplete plate. Grey body with black and white inclusions. Light green glaze. Fish tail decoration. Possibly 2 spur marks inside.

BOWLS AND PLATES—CELADON GLAZED

Refer: PART 2 Chinese Celadon (below)

Two main groups of celadon glazed wares were recovered from the Ko Si Chang 2 wreck site. Generally these celadons have a potassium oxide reading above 3.6% (mostly 4–5.50%) which is in accordance with the Amdel's somewhat limited experience of Chinese items. There also appears to be an intermediary group of poorer quality than the first group but of higher quality than the second. This may indicate that the items have in fact all come from the same source but of varying grades of production—particularly as the material analyses results are very similar. The first group is more typical of the product described as having been produced in the district of Longquan in the prefecture of Ch'u-chou, province of Chekian (Zhejiang) which Hobson (1976: 76–87) indicates was noted for its potteries as early as the beginning of the Sung dynasty (960–1279). Neave-Hill (1975) indicated that up to seventy kilns had been located. Hobson, speaking of the Longquan products states that:

The ware, as a general rule, has a greyish white mass varying from porcelain to stoneware, and with the peculiar quality of assuming a reddish brown tint wherever the glaze is absent and the 'biscuit' was exposed to the fire of the kiln'. Hobson continues 'The decoration is either carved, etched with fine point, or raised in relief by pressing in an intaglio mould or by the application of small ornaments separately formed in moulds. All these processes are applied to the body before the glaze is added, and the glaze, though covering them over, is transparent enough to allow the details to appear fairly distinctly.

Hobson concludes:

The Lung ch'uan celadon glaze is singularly beautiful with its soft, smooth translucent texture and restful tints, which vary from olive green through grass green and sea green to pale greenish grey, occasionally showing a decidedly bluish tone.

The first group of Ko Si Chang 2 celadons fairly accurately fits this description.

The second group is of inferior quality in terms of body matrix which is grey to red in colour. The body is more coarse as is the glaze which in many cases does not cover the central medallion. It is possible that this group also come from the Longquan region. Gompertz (1980: 159) notes that:

...there is considerable variation in the shards collected at different kiln sites near Lung-ch'uan, so that what we have termed the 'Lung-ch'uan type' must be understood to cover a much wider field than would normally be the case.

Hobson (1976: 80), further states:

The manufacture of celadon must have been extensive in the Lung-chuan district. Besides the principal factories at Liu-t'ien Shih, there were minor works at Chin-ts'un...and according to the T'ao lu (1) at Li-shui Hsien (2) in the Ch'u chou Fu, the latter already operative in the Sung dynasty. Its wares were included in the comprehensive term Ch'u yao and 'the material was coarse

and thick, the colour similar to that of Lung-ch'uan, both dark and light, but the workmanship was coarser.

Neave-Hill (1975: 118) mentions that:

The period between the end of the reign of Hsuan-te in 1435 and the classical reign of Ch'eng-hua, which began in 1465 is almost a blank in the history of porcelain for the Chinese records give little information...Regarding celadons, it was during this period that the celadon kilns moved from Lung ch'uan to Ch'u-cho, but production did not cease entirely at the former kiln sites.

Hobson(1976: 84) adds:

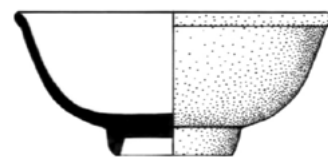
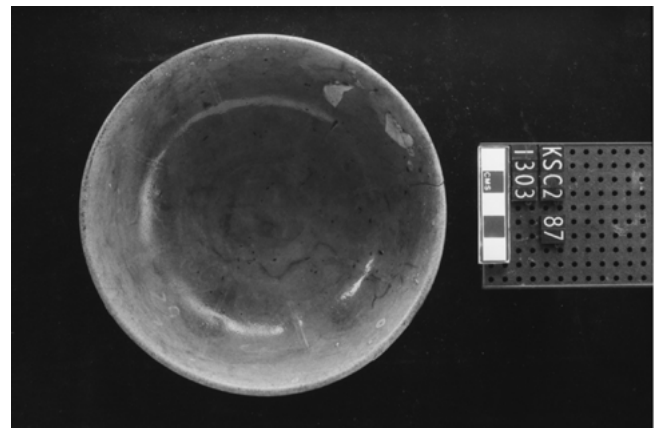
Another factory which made free use of the celadon glaze was that of Yang Chiang, province of Kuangtung. As a rule, the ware is recognisable by its reddish brown stoneware body, but in cases where the biscuit is lighter in colour and more porcellaneous in texture, confusion may easily arise.

The Amdel results seem to confirm a Chinese origin as the potassium oxide content is generally 4–5.50% for all this group—good quality and poor: Material analyses of the celadon glazed bowls and plates KSC2 1048, 1170, 1120 and 1249 is significantly revealing in that despite the contrast in design between for example KSC2 1048 and KSC2 1249, the chemical composition is very similar. KSC2 1048 and KSC2 1170 are both high in potassium oxide at 4.68% and 4.86% respectively. KSC2 1249 has a potassium oxide value of 5.35%. KSC2 1120 has a level of 3.64%. All the Thai wares tested up to that time had potassium oxide values of less than 3.6%. Amdel had no wares from the Chinese Longquan kilns as such to allow a direct comparison with the Ko Si Chang 2 items, but notes that those Chinese wares so far analysed at that time had always been much higher in potassium oxide (i.e. greater than 3.6%) than any other ceramic wares tested in the laboratory. It appears conclusive that all the material in this section has a Chinese provenance. Of note however is Hein (2001: 199, Fig. 71) demonstrating that an item made of alluvial clay (like MON Ko Noi items) found at Bakar (near Si Satchanalai) has a K_2O content of 4.5%.

Chinese celadon plates recovered from the Turiang wreck site, Brown and Sjostrand (2002: CP2–6 & 23), have similarities to the first group of celadon wares from the Ko Si Chang 2 wreck site. CP2 and 23 have shallow vertical striations on the cavetto similar to Ko Si Chang 2 though the colour of CP2 differs. It is likely that many of the Ko Si Chang 2 items were decorated by impression in a mould, whilst Brown and Sjostrand CP4, for example, is said to be finely carved. The colour of the items resemble more CP23 than CP 1–6. Like some of the Ko Si Chang 2 items the Turiang items CP3 & 5 show scars on the base where they have rested on supports during firing.

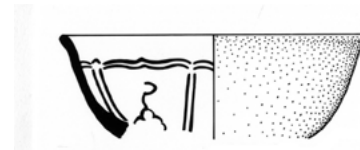
Brown and Sjostrand (2002: CP42) show a Chinese celadon plate from the Longquan site (c. 1400) which is also similarly decorated to KSC2 1087.

BOWLS—CELADON GLAZE OVER DESIGN



KSC2 1303

Complete bowl. Impressed decoration. Thick glaze. Support scar within unglazed ring on base. Ref: A similarly styled item is shown in Southeast Asian Ceramic Society (1979: Pl.192). The centre of the latter item is unglazed.



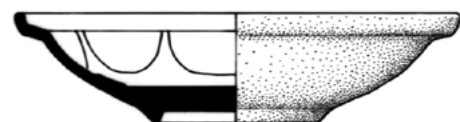
KSC2 193

Rim sherd of bowl. Rough, grey body. Crazed glaze. Impressed decoration.

KSC2 1170*

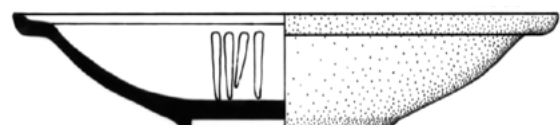
Not illustrated

Rim sherd. Grey to red body. Impressed decoration.



KSC2 1120*

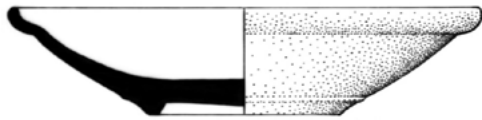
Incomplete plate. Grey body. Crazed glaze until approximately 10 mm inside base. Pressed or incised on cavetto.



KSC2 163

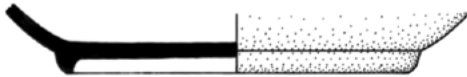
PART 1

Incomplete plate. Fine grey body. Smooth, good quality celadon glaze. Incised decoration.



KSC2 1117

Incomplete plate. Grey body. Ridge above footrim. Undecorated.



KSC2 1013

Base sherd. Unglazed ring on base. Internal floral decoration.



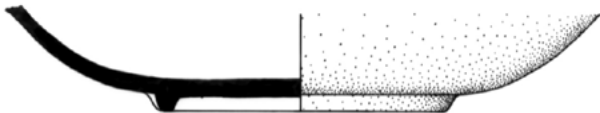
KSC2 1272

Base sherd. Grey body with black inclusions. Thick glaze. Evidence of a support scar within unglazed ring on base.



KSC2 191

Base sherd. Grey body. Unglazed base ring. Decoration indeterminable.



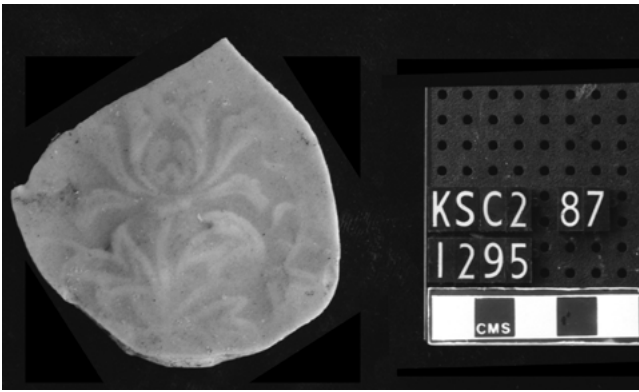
KSC2 184

Base sherd. Smooth grey body. Thick celadon glaze extends inside footrim to a point where it appears to have been scraped off after firing. Support scar within central unglazed base ring.



KSC2 1249*

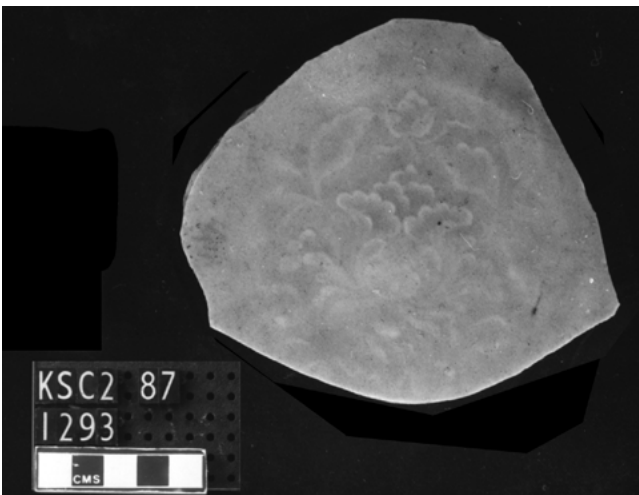
Base sherd. Light grey body with fine black inclusions. Central impressed floral decoration. Support scar within unglazed base ring. Ref: Southeast Asian Ceramic Society (1985: No. 374). Misugi (1981: A.232 and A.233) also shows similar items from the Arbedil Shrine Collection. Plate 124, from the Arbedil Shrine, Pope (1956) shows a type similar to KSC2 1249 but with a different design, described as 'Celadon dish with flattened rim and raised edge. The cavetto is fluted radially, and in the center is a lotus spray impressed in the clay with a mould. The foot is small in diameter but very thick, sloping outside and vertical inside; the base is completely glazed and the broad rim is bare.'



KSC2 1295
Base sherd. Central floral decoration. Unglazed ring on base.
Ref: Southeast Asian Ceramic Society (1979: Pl.142 and 143).



KSC2 1284
Base sherd. Central floral decoration.



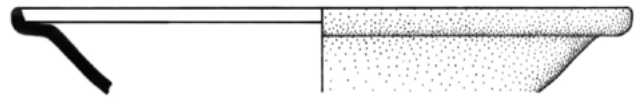
KSC2 1293
Base sherd. Unglazed base ring. Central floral decoration.



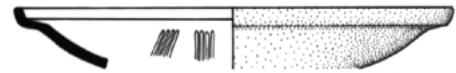
KSC2 1016
Rim sherd. Decorated.



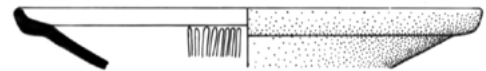
KSC2 175
Rim sherd. Grey body. Incised decoration.



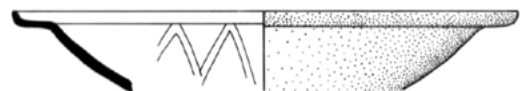
KSC2 173
Rim sherd. Smooth grey body.



KSC2 170
Rim sherd. Contrary to the above, the body matrix is not fine grey. Decorated cavetto.



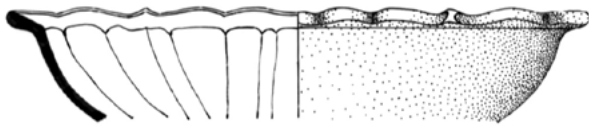
KSC2 169
Rim sherd. Pink-grey body. Thin olive-green glaze. Decorated cavetto.



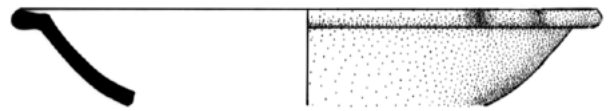
KSC2 176
Rim sherd. Grey body. Glaze possibly underfired. Decorated cavetto.



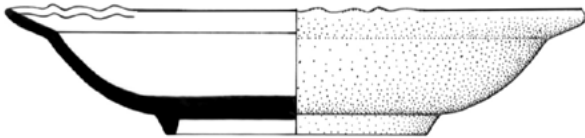
KSC2 180
Rim sherd, foliated. Smooth, grey body. Decorated cavetto.



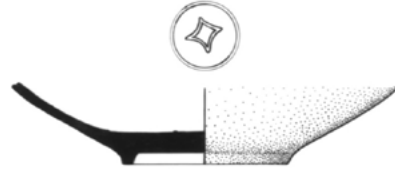
KSC2 1087*
Rim sherd, foliated. Decorated with wide vertical grooves on cavetto.
Ref: Brown and Sjostrand (2002: CP23).



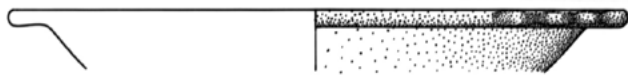
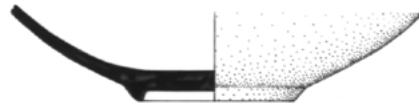
KSC2 177*
Rim sherd, foliated. Lightly ridged interior. Grey body.



KSC2 1086
Foliated rim and base sherd.



KSC2 1281
Base sherd. Central impressed design, resembles 'cash' sign. Two light interior ridges. Orange-red body. Craze glaze extending to approximately 10 mm inside base.

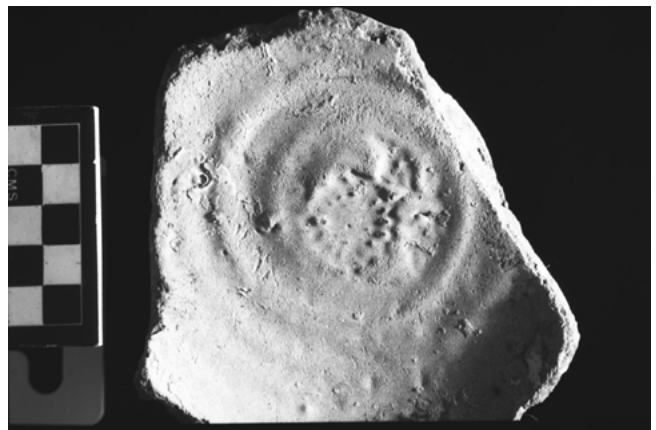
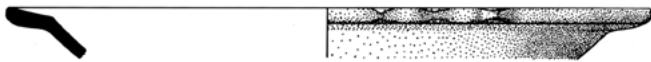


KSC2 162
Base sherd of bowl or plate. Beige to grey body. Light green-white glaze. Glaze extends over footrim.

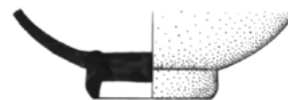
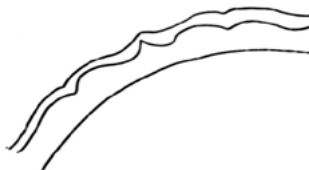
KSC2 178
Rim sherd, foliated. Smooth grey body.



KSC2 1262
Base sherd. Grey body. Thick green, crazed glaze. Base unglazed.

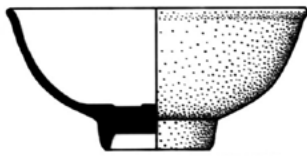


KSC2 179
Rim sherd, foliated. Appears to be lightly ridged on interior and exterior. Grey body.



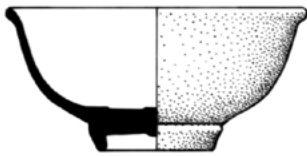
KSC2 161
Base sherd. Orange-red body. Light green-white glaze extending to footrim. Light ridge surrounds design.

BOWLS—CELADON GLAZED—CENTRAL UNGLAZED RING



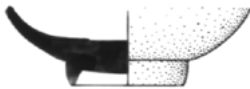
KSC2 1128

Incomplete bowl. Grey to red-grey body. Craze glaze. Central impressed or incised floral decoration.



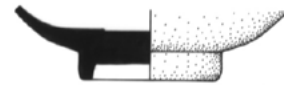
KSC2 1263

Incomplete bowl. Red body. Thick craze glaze. Some crawling. Unglazed base.



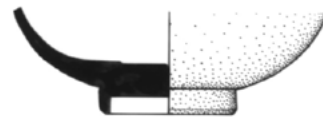
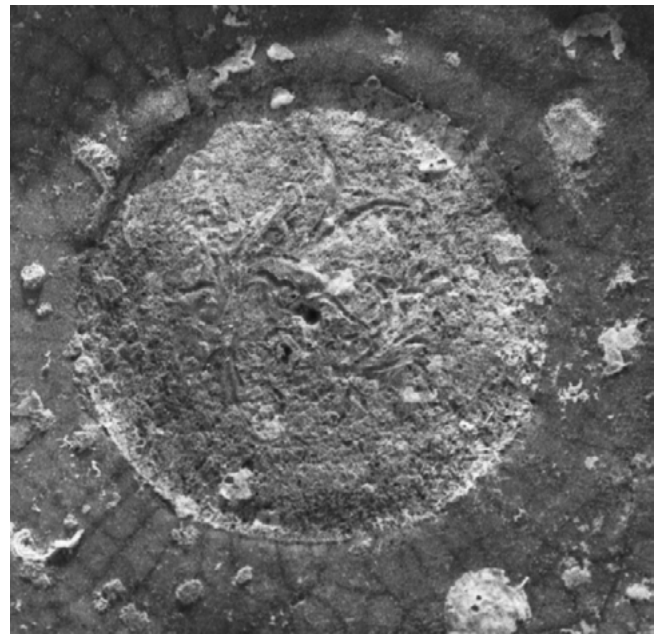
KSC2 155

Base sherd. Grey body. Central incised design. Thin glaze layer over the design. Glaze extends over footrim and inside base.



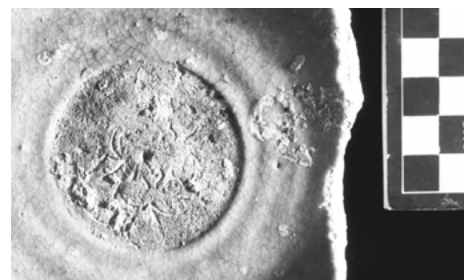
KSC2 1048*

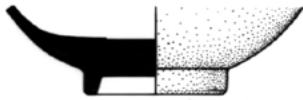
Base sherd. Red body. Thick, craze glaze. Incised decoration on central unglazed section. Unglazed base to footrim.



KSC2 156

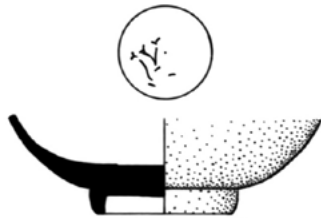
Base sherd. Grey body. Thin layer of glaze over the central incised design. Thick, opaque glaze extends to footrim. Tiny central hole.





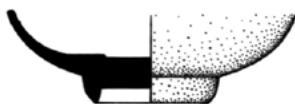
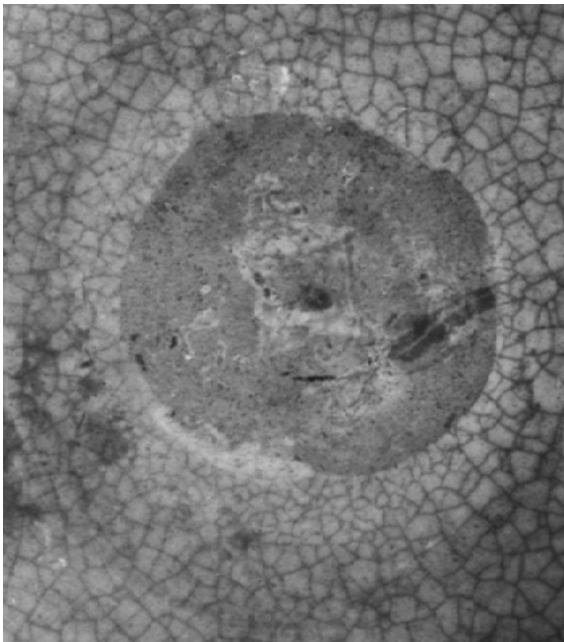
KSC2 154

Base sherd. Grey body. Thick, opaque glaze. Incised decoration on central unglazed section. Tiny central hole.



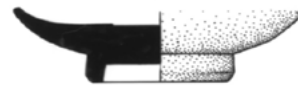
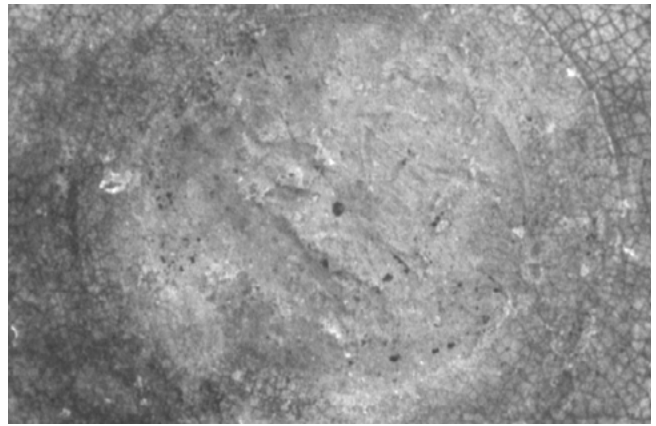
KSC2 1112

Base sherd. Coarse, grey body. Red exterior on base. Incised decoration on central unglazed section. Coarse, crazed glaze extending to footrim.



KSC2 1287

Base sherd. Incised decoration on central unglazed section—Chinese symbol and character (possibly 'cash'). Several bowls from this site have this inscription.



KSC2 1288

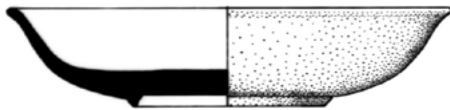
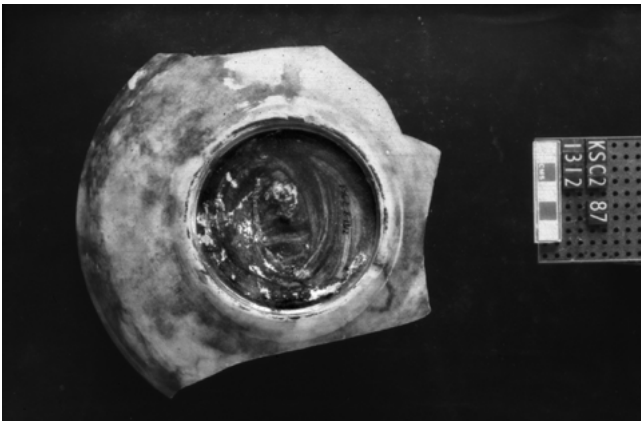
Base sherd. Coarse red body. Coarse, crazed glaze extending approx. 8 mm inside base. Incised decoration on central unglazed section—Chinese symbol and character.

SHALLOW BOWLS—MISCELLANEOUS

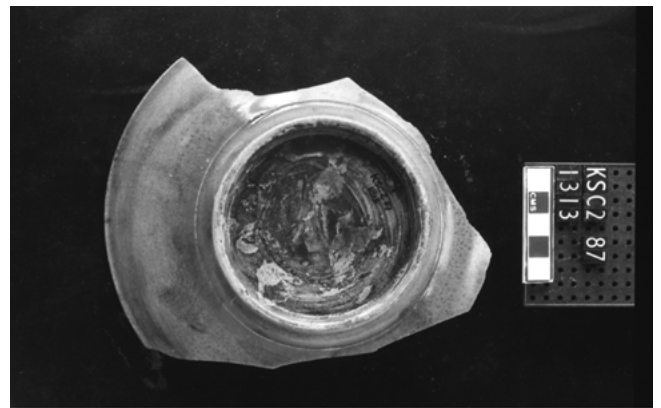
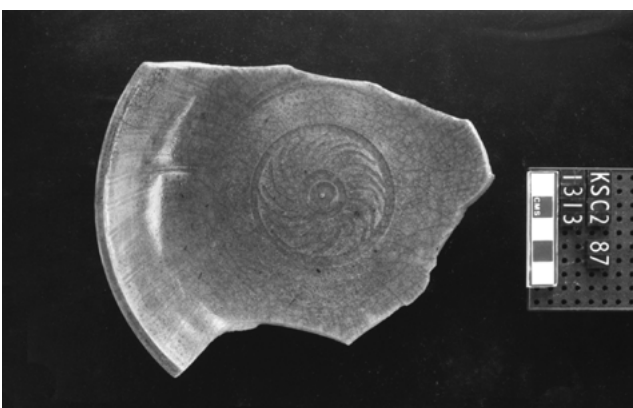
Material analyses of these bowls suggest that none of the examples is of Chinese origin as their potassium oxide values are much too low.

KSC2 1312 and 1313 are very similar to each other. There are differences however between these samples and KSC2 1042 which is higher in aluminium oxide and ferric oxide and lower in silicon dioxide and sodium oxide. Interestingly, the composition of the two former items is comparable to items from the Si Satchanalai kilns.

Comparison must be made between KSC2 1312, 1313 and Vietnamese products because of the brown painted bases, however this practice was not restricted to Vietnam. Brown painted bases are found at Si Satchanalai and some of the Northern Thai kilns particularly Kalong, Pa Dong and Payoom, Shaw (1981) and Southeast Asian Ceramic Society (1982). Other comparisons can be made between the Ko Si Chang 2 items and the products of the northern Thai kilns. Shaw (1981: 44) describes wares from Payoom with a deep rich olive, finely cracked glaze, with floral patterns incised within the dishes. Wares from Paan are described by Shaw (1981: 58) as: '...slightly yellowish-green of young rice, but shades do also range from straw-yellow to dark green and an olive that is nearly brown...'.
Profiles from Pa Dong, Wang Nua and Paan, Shaw (1981:44 (top), 45 (top) and 60 (top)), as well as descriptions of their colour, indicate close similarities to items in this section and also to the painted wares from Si Satchanalai (as above). There was a close connection between the Si Satchanalai, northern Thai kilns and the kiln of manufacture of KSC2 1312 and 1313. However, none of these items appear to correlate, through material analyses, with any of the northern Thai wares that have been tested from Om Kai and Kalong. Praichanjit (pers. comm. 1980s) said that the items illustrated here are unlikely to have come from any northern kiln known at that time.



KSC2 1312*
Incomplete bowl. Impressed decoration in centre and on cavetto. Grey body with fine black inclusions. Thick celadon type glaze. Brown painted base. Incomplete support scar on base.

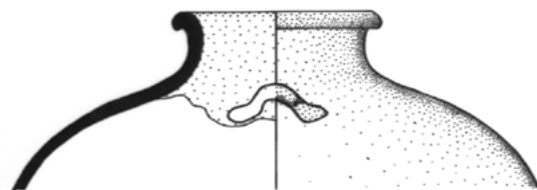


KSC2 1313*
Incomplete bowl. Pressed decoration internally and on cavetto. Light grey body. Celadon-like glaze. Brown painted base. Incomplete support scar on base.

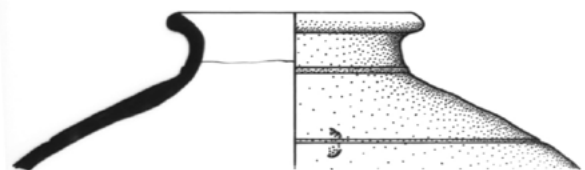


KSC2 1042*
Incomplete bowl. Grey body. Fine matrix with air pockets. Fine green glaze. Unglazed foot and lower exterior section. KSC2 1228 and 1002 (Stoneware Basins, above) and 1042 achieved similar results through material analyses. Brown (1985) indicated that KSC2 1042 was of Vietnamese origin. It is likely that the other two items are also Vietnamese.

JARS
Refer: PART 3 (below)

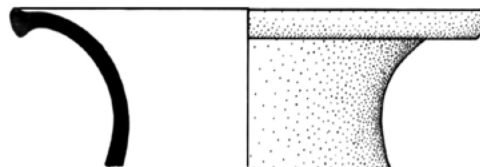


KSC2 66
Upper section sherd. Small lug handle. Yellow-grey body. Grey exterior. Deteriorated thin yellow-brown glaze extending inside rim. White-pink wash inside jar.



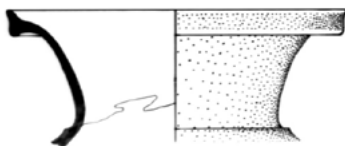
KSC2 67

Upper section sherd. Remains of lug handle. Ridge at base of neck. Roughly incised under lug. Coarse body with black inclusions. Degraded glaze extends inside rim.



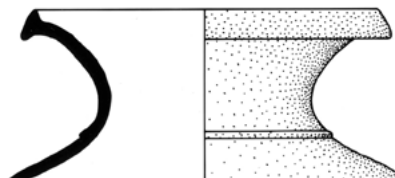
KSC2 74

Estimated width. Shoulder sherd with lug handle. Grey to beige body. Crawling, dark brown-black glaze.



KSC2 1069*

Rim sherd. Purple-red body. Dark grey exterior. Degraded green-brown glaze extending inside rim.



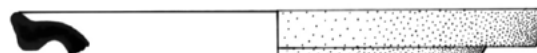
KSC2 69

Rim and neck sherd. Ridge at base of neck. Reddish body. Medium grey exterior. Degraded, thin, green-black glaze extends inside rim where it becomes mottled red-yellow.



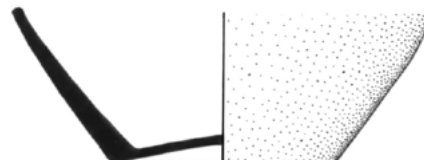
KSC2 73

Neck sherd. Light red body. Grey exterior. Degraded, thin green-black glaze extending inside rim.



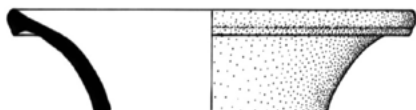
KSC2 1060*

Rim sherd. Black glaze with brown mottling.



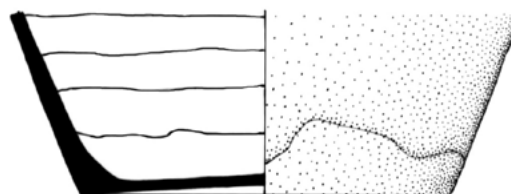
KSC2 1066

Rim sherd. Red-grey body with black inclusions. Tiny amount of black glaze evident.



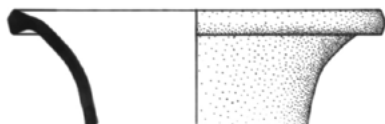
KSC2 1062*

Lower section sherd. Dark grey-blue body. Orange exterior.



KSC2 1230

Rim sherd. Red-grey body. Degraded green-brown glaze extending inside rim.



KSC2 1233*

Lower section sherd. Body brick red. Blue-grey exterior. Evidence inside of manufacture by coiling.

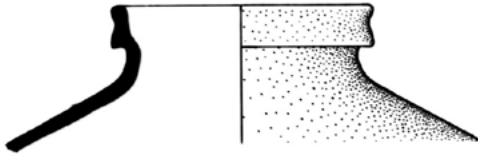
KSC2 70

Rim sherd. Mauve body with tiny red inclusions. Grey exterior. Deteriorated light green glaze which extends inside rim as yellow-black.

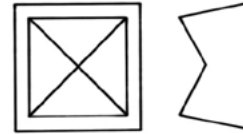
Metals

Refer: PART 4 (below)

LEAD OR TIN



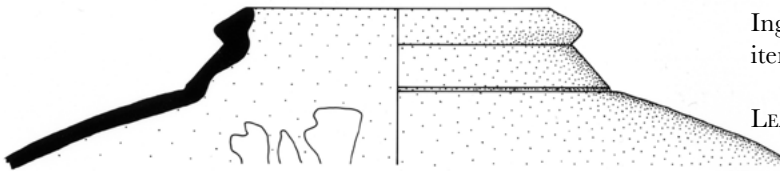
KSC2 1248
Rim sherd. Purple exterior. No glaze evident.



KSC2 1278

Ingot. Truncated pyramid base forming star on top. A similar item, KSC2 205 weighed approx. 600g.

LEAD



KSC2 68
Rim sherd. Rim folded out and pressed down. Ridge at base of neck. Beige-grey body. Thin light brown glaze extends inside rim.

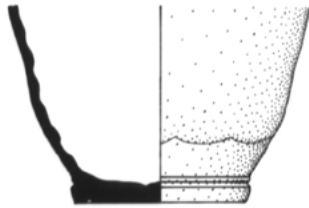


KSC2 1282

Unknown object, possibly sounding lead.

KSC2 204

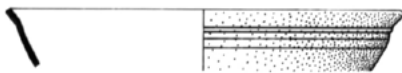
Not illustrated.
Lead sheeting.



KSC2 1241*
Base sherd. Red body. Grey exterior. Degraded thick, black glaze.

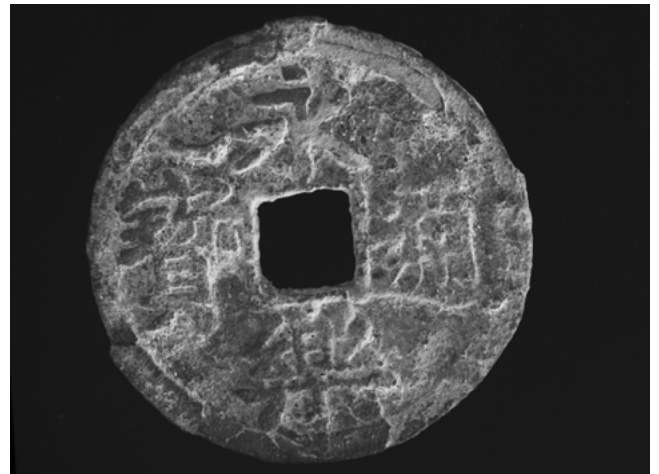
Porcelain

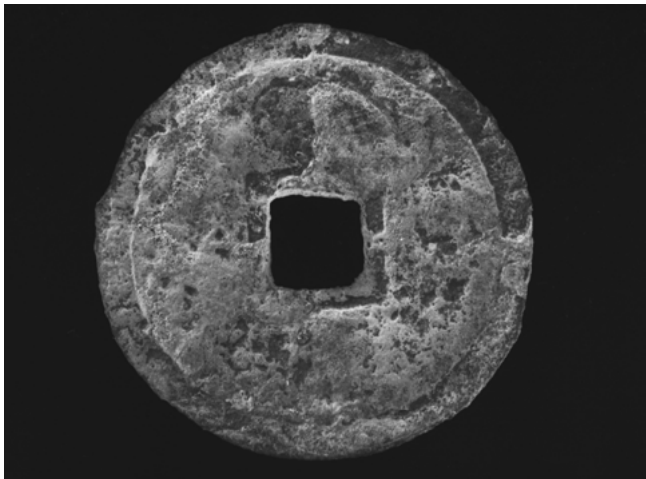
BOWL



KSC2 1051
Rim sherd—radius estimated. Exterior lightly incised. White body. Very light green crazed glaze.

COPPER ALLOY



**KSC2 206**

Coin (cash) with central hole (Not to scale, Diameter approximately 24 mm). Several other coins and coin parts were recovered including Chinese inscription identified by Bloom (pers. comm. 1999) as of Emperor Ch'eng Tsu, reign title Yung-le, personal name Chu Ti, reign years 1403–1424/5. Characters read from top to bottom: Yung Le 'is forever happy' and from right to left, T'ung Pao, translated as 'general currency'.

KSC2 207

Not illustrated.

Base of lime container. Ref: the Ko Si Chang 1 wreck site (below) gives other sites from which lime containers have been recovered.

IRON**KSC2 209**

Not illustrated.

Remains of nails in concretion: 9 mm x 10 mm ; 11 mm x 11 mm ; pointed 14 mm x 14 mm decreasing to 10 mm x 8 mm; 4.5 mm x 5 mm; 7 mm x 7 mm; 14 mm x 7 mm.

KSC2 1310

Not illustrated

Square nail fragment 92 mm long.

Organic Material

Refer PART 5 (below)

IVORY

KSC2 208, 1243 and 1279 etc.

Not illustrated.

Part of tusk.

TIMBER

Several samples were taken for dating and identification purposes.

KSC2 1309

Not illustrated.

Wood fragment impregnated with iron.

KO KHRAM WRECK SITE

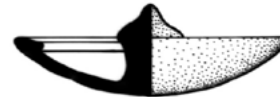
A very short survey of this wreck site was undertaken by the joint Thai Australian team and as such a limited amount of material was excavated in order to gain an overview of the array of material on the site. A more extensive range of material was recovered from this site by the Thai Fine Arts Department in the 1970s and has been discussed by Brown (1975, 1977 and 1988).

Radio carbon dating of a timber sample collected in 1987 resulted in a date of 1380 ±50 years.

Without doubt, part of the ceramic cargo of the Ko Khram wreck site originates at the Si Satchanalai and Sukhothai Kiln sites. It is possible that some material also comes from the Ban Tao Hai kiln site, Phitsanulok whilst other may have its origin at the Mae Nam Noi kiln site, Singburi Province, Thailand. Vietnam, or south China appear to be the provenance for another group of ceramics.

Ceramics**Earthenware**

LID

**KKH12**

Complete lid with lotus bud handle. Beige body. Ref: Green and Harper (1987) Fig. 16b. Solheim (1967) Plate IIIb also illustrates similar material from a southern Thailand archaeological site. This type of lid is illustrated by Christie's (1989) No.42, said to be from a 'Medieval South Asian vessel'. Earthenware lids of similar type have been recovered from excavations at Cebu city, Hutterer (1973) Plate IIIB and Harper (1988(i)b). Other finds have come from the Phu Quoc shipwreck, Blake and Flecker (1994) Fig. 17 and the *Witte Leeuw*, Pijl-Ketel (1982) inv. no. 12266. Lids like this were also recovered from the Brunei Darussalam wreck site (exhibition Western Australian Maritime Museum 2004–5). Brown (2004) Plate 5 (RK195) shows a lid of this type from the Rang Kwien shipwreck site. It is likely that this type of lid was a common, practical item manufactured at many places throughout Thailand. Comparison can be made between lid sherds recovered at the Ban Tao Hai kiln site, Phitsanulok, Thailand, Hein and Sangkhanukit (1987) Figs 12, 13. It should be noted that lotus bud handled earthenware lids have been found at the old city of Si Satchanalai and in the environs of the Mae Nam Noi kiln site. They have also been recovered from the Suphanburi kiln site according to Vilaikaew (pers. comm. 1988).

POT WITH PRESSED DECORATION

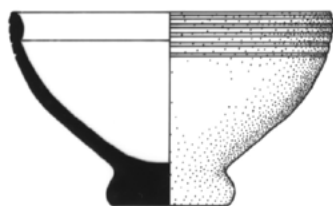


KKH9

Incomplete pot. Portion of mouth rim missing. Purple-grey body. There is evidence that some serrations may have been missing from the chop used to make the decoration on shoulder. Ref: Green and Harper (1987) Fig. 17a. Many complete pots with pressed decoration have also been recovered from the Rang Kwien wreck site in the Gulf of Thailand. There have been comparable finds in the Philippines: Harper, (1988(i)b, noted in the collection of the San Carlos University Museum, similar sherds in terms of body and design, recovered from Mactan Island, Cebu. Hutterer (1983) Plate IIIB illustrates sherds recovered from an excavation within Cebu city. Roales (1987) indicated that similar finds have been recovered from Siquijor Island. Peralta (1982) No. 87 also illustrates this type of ware recovered from Puerto Galera. Solheim (1967) Plate III a, b & d shows similar material in Plate 111 d, from Bohol and from Southern Thailand. Rice pots have also been recovered off Tioman Island, Malaysia, Southeast Asian Ceramic Society (1985) Nos 282,3. Christie's (1989) Nos. 45-51 illustrate pots recovered from 'a medieval South Asian trading vessel'. Hein and Sangkhanukit (1987) illustrate a variety of pressed sherds recovered from the Ban Tao Hai kiln site, Phitsanulok. Brown (1988) Plate 47c shows an item also from the Ko Khram site which she describes as being a probable Phitsanulok ware, early 15th century.

Earthenware-Stoneware

MORTAR



KKH10*

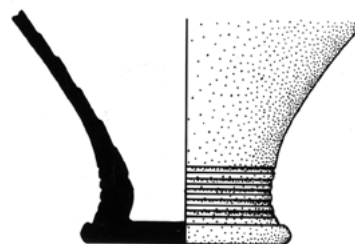
Incomplete mortar with section of neck missing. Incised. Small area showing potter's cord marks on base. Bright brick-red body with black inclusions. Outer surface appears

quite blue. Hein and Sangkhanukit (1987) Fig. 27 illustrate similar items from the Ban Tao Hai kiln site, Phitsanulok. The item also compares with mortars manufactured at Si Satchanalai, Harper (1984) PYSF 1257, 1406 and KN 562, 633. Mortars manufactured at the Mae Nam Noi kiln site are of a different style.

Material analysis of this item confirms that the composition differs to a mortar from the Prachuap Khiri Khan site (below). A ferric oxide content at 8.30% further rules out the possibility that the Ko Khram item has a possible origin at the Mae Nam Noi kilns. Again, the composition is quite different to that of a mortar from the Ko Si Chang 1 wreck site (ferric oxide content 5.60%). In fact the mortar almost falls into the 'MON' Ko Noi compositional range ('MON' interpreting as Most Original Node as determined by Hein *et al.* (1986)).

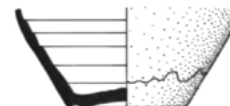
JARS

Refer: PART 3 (below)



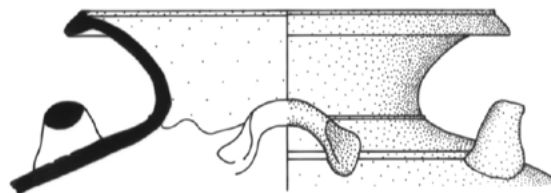
KKH7*

Jar lower section, incised above out-turned foot. Rough base. Coarse grey body with black inclusions.



KKH53

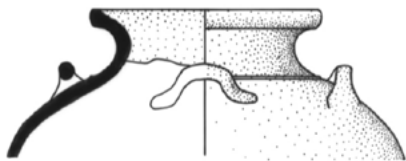
Jar lower section. Concave base. Beige-grey body. Dark brown glaze which is smudged just above base. A thinner dark brown glaze covers roughly finished interior surface. This item is possibly of Vietnamese origin.



KKH1*

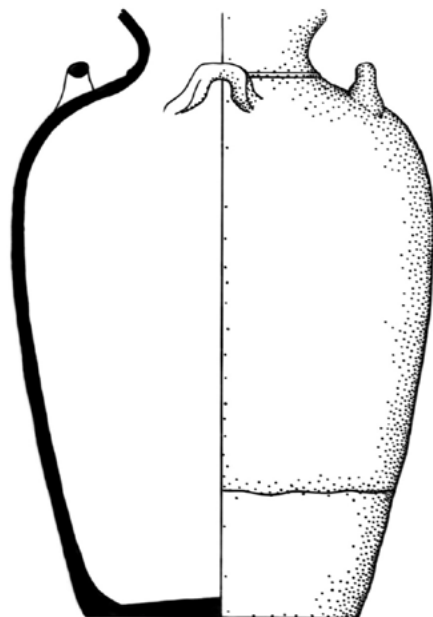
Incomplete large jar, upper section. Only 1 handle evident, positioned over incised lines. Ridge at base of neck. Red-grey

body, purple exterior. Green-brown glaze extending inside rim. Ref: Green and Harper (1987) Fig. 26b.



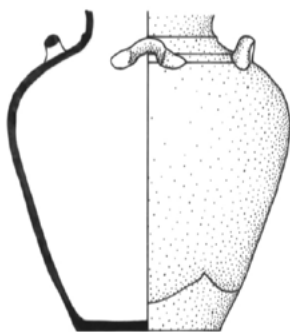
KKH5

Jar neck sherd. Four lug handles. Ridge at base of neck. Brick-red body. Grey-blue exterior. Degraded brown-black glaze extending inside rim. Ref: Green and Harper (1987) Fig. 24.



KKH3

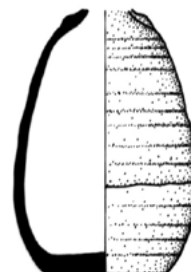
Incomplete jar. Mouth rim missing. Four lug handles. Ridge at base of neck. Purple-red to dark grey body. Brick red base. Degraded dark brown glaze. Ref: Green and Harper (1987) Figs 24 & 25.



KKH6

Incomplete small jar with neck rim missing. Four lug handles over incised lines. Ridge at base of neck. Mauve-grey body with some very large (5 mm) red inclusions. Degraded, thick, mottled olive green-brown glaze in parts. Ref: Green and Harper (1987) Fig. 27 Pattaya and Ko Si Chang 3 wreck sites, Thailand; the Philippines (Calatagan), Sarawak, Brunei and Java.

JARLET

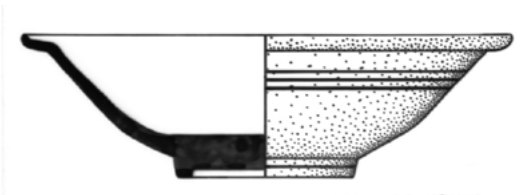
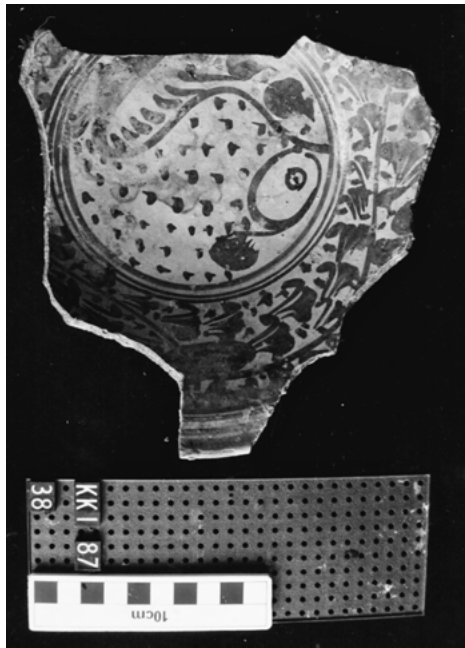


KKH8*

Incomplete jarlet/ovoid bottle. Evidence of 2 vertical handles. Lightly ribbed body. Rough base. Red body matrix. Degraded glaze, probably green-brown.

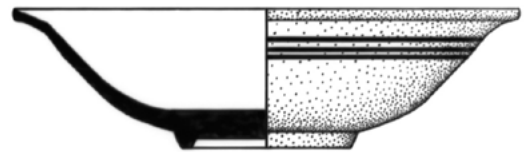
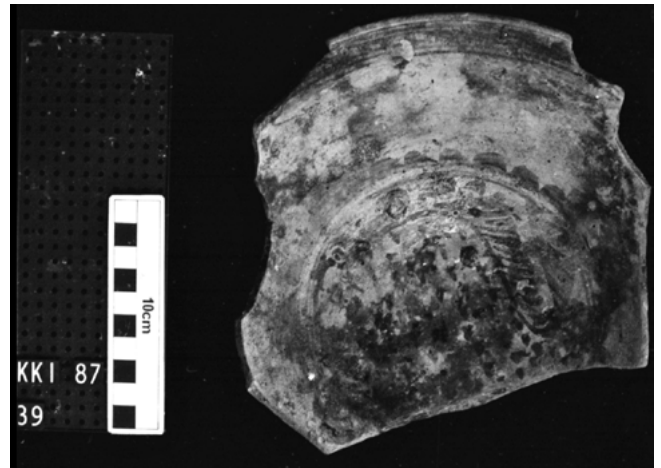
PLATES AND BOWLS—PAINTED UNDER GLAZE OVER SLIP, EXTERIOR LINEAR DECORATION

Brown & Sjostrand (2002) CP7–11 show Sukhothai fishplates from the Turiang wreck site (*c.*1370). The fish motif is also represented on Sukhothai plates from the Longquan wreck site (*c.*1400), however the motifs are much simpler than those on the Ko Khram plates excavated by our team; some of the Ko Khram items are decorated with brush strokes on the cavetto but even when this is not the case (KKH39), the decoration is more detailed. Fish plates recorded from the Rayong site, Green and Harper (1983) were also more sophisticated. Fish plates from the Maranei site, Indonesia, Brown (2004) Plate 26 (M15/23 and M13/15) show a simple fish, plain cavetto and linear decorated rim. Plate 47 (Pn4013) from the Pandana site is similar to the Maranei items. The Ko Si Chang 2 site has a different selection of fish and floral designs, more towards those recorded at the Si Satchanalai kiln site, Harper (1984) & (1987) though the body type and application of decoration differs.



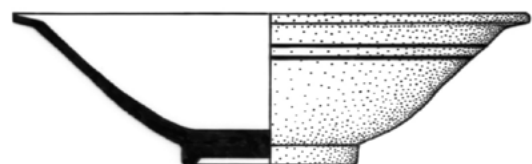
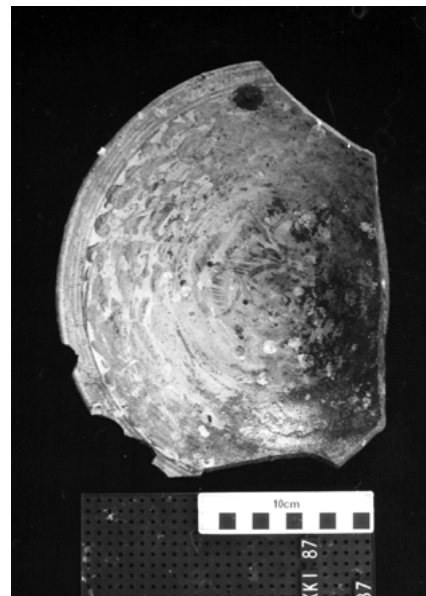
KKH38*

Incomplete plate. Red-grey body. 5 spur marks inside. Red base within tubular support mark, bluish outside that area. Thin, degraded glaze. Centrally decorated with fish. Floral decoration on cavetto. External linear decoration. Material analysis of this Ko Khram item confirms that the composition is consistent with a Sukhothai provenance. Ref: Green and Harper (1987) Fig. 14b. Fish plates of a Sukhothai provenance have also been noted in the collection of the National Museum, Philippines from the Carolina Site, Bolinao, Pangasinan, Luzon; and Lumban, Laguna, Luzon by Harper (1988(i)a). Harper (1988(i)b) gives sources of recorded finds from Bohol, Butuan, Cebu, Intramuros and Puerto Galera, the Philippines. Woodward (1978) Fig. 4 shows a similar item from Sugan Cave, near Loay, Bohol, the Philippines. Similar fish plates to the Ko Khram items are also illustrated by Christie's (1989) Nos 4–11, from the 'Medieval Vessel'. Harper (1988 (ii)) illustrates Sukhothai fish plate sherds recovered near the Mae Nam Noi kiln site, Singburi Province, Thailand.



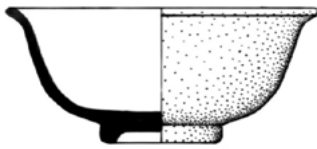
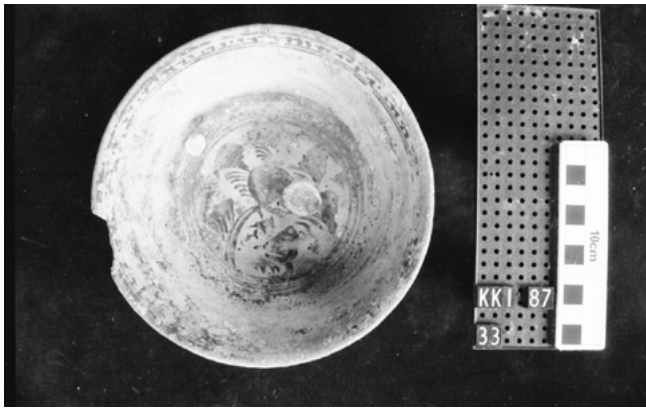
KKH39

Incomplete plate. Four spur marks. Centrally decorated with fish. External linear decoration. Brush stroke mark on base. Ref: Spinks (1959) from Central Bali Fig. 18(No. 1440), Rau and Hughes (1985) Plate 1 from the Tak burial site and Locsin (1967) No. 153, Puerto Galera grave site.



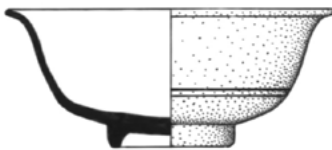
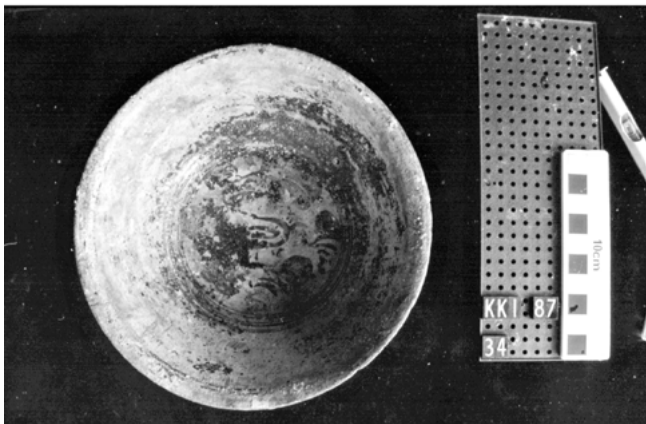
KKH37

Incomplete plate. Five spur marks. Centrally decorated with fish. Floral decorated cavetto. External linear decoration.



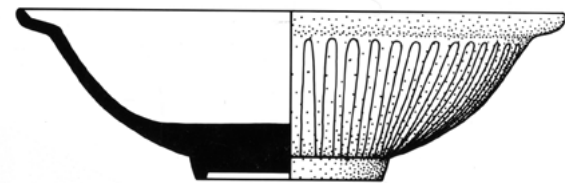
KKH33

Almost complete bowl. Coarse red-grey body. Centrally decorated with abstract floral design painted over slip. Clear, degraded glaze.



KKH34

Complete bowl. Centrally decorated with abstract floral design. External linear decoration. Red-grey body. Degraded glaze. Ref: Brown (1988) Plate 34e shows a similarly decorated item also from the Ko Khram wreck site. The painted under glaze floral decoration of these items differs slightly from that of the Longquan site (c. 1400), Brown and Sjostrand (2002), CP 48, 51. The Longquan items have no brush stroke decoration on the rim (apart from linear). Items from the Rayong site represent both styles, Green and Harper (1983) R1 and R5.



JARLET—CELADON GLAZED



KKH13

Complete jarlet with 2 vertical handles. Degraded glaze. A similar item from this wreck site (KKH14) has a thick, crazed, degraded blue-green glaze. Ref: Locsin (1967) Plate 171 from a Puerto Galera grave site. Brown and Sjostrand (2002) show jarlets CP37 left, from Nanyang and CP64 from the Royal Nanhai, with some differences to the Ko Khram item. Jarlets were also recovered from the Phu Quoc site, Blake and Flecker (1994) Fig. 15 and the 'Medieval Vessel', No.30 & 41, Christie's (1989).

PLATES – CELADON GLAZED – INCISED DECORATION

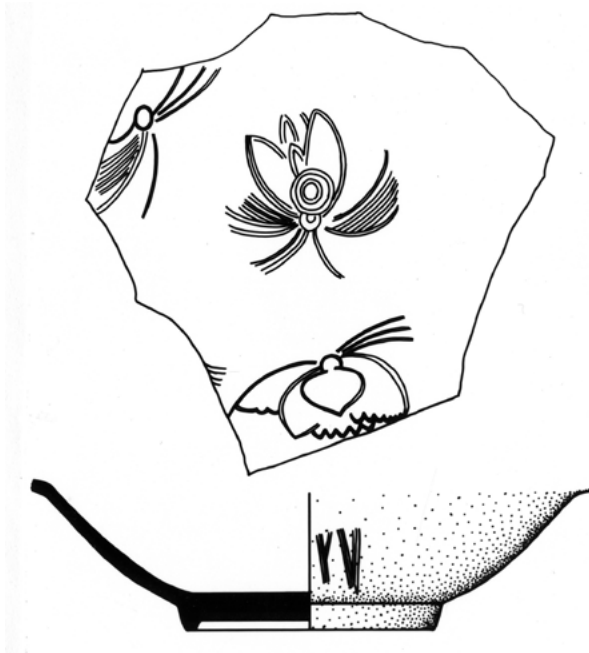
Similar items to those illustrated below and those recorded by Brown (1975,7 & 1988) have been recovered from the Tak Burial Grounds, Rau and Hughes (1985) Plates 3 and 5. Similar designs are also illustrated from the 'Medieval Vessel' by Christie's (1989) Nos 24–26, 28–34. Many similarly decorated items have been recorded at Ban Ko Noi and Ban Pa Yang, Si Satchanalai, Harper (1984). Comparison can be made with items from the Royal Nanhai wreck site (estimated at c. 1460). Incised celadon plates and jarlets from the Nanyang site (c. 1380) can also be compared with the Ko Khram items. Some items from the Nanyang wreck had spur marks on the central medallion (Brown & Sjostrand (2002) Fig 17b) and CP28), apparently indicating earlier Si Satchanalai wares, Brown and Sjostrand (2002: 47). Some items said to be from the Hoi An ship were noted by this author to have four spur marks (WA Art Auctions (2006)). Tubular support marks were recorded on the Ko Khram items, thus indicating a later production date. A Si Satchanalai celadon bowl from Nanyang (CP32) has a different shape to the Ko Khram celadon bowls but the same shape as the painted under glaze bowl KKH34.

Compared with the Si Satchanalai produced celadon plates and bottle (KKH31, 26 & 29), items from the Lonquan ship (c. 1400) Brown and Sjostrand (2002) CP39,40,41,43 are quite similar in decoration but the Lonquan items are said to have a plain exterior whilst the Ko Khram items are linear incised.

KKH30

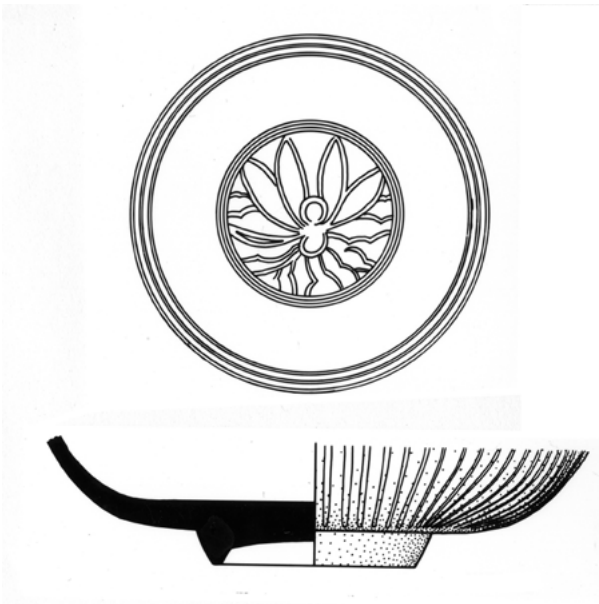
Incomplete plate. Light grey body with black inclusions. Thick green glaze. Centrally decorated with lotus flower. 'Feather' pattern on upper cavetto. External ribbing. Tubular support mark on base. Ref: A similarly decorated plate sherd has been

recovered by the National Museum of the Philippines from Balibago, Talim Island, Rizal Province, Luzon, the Philippines, Harper (1988(i)a)



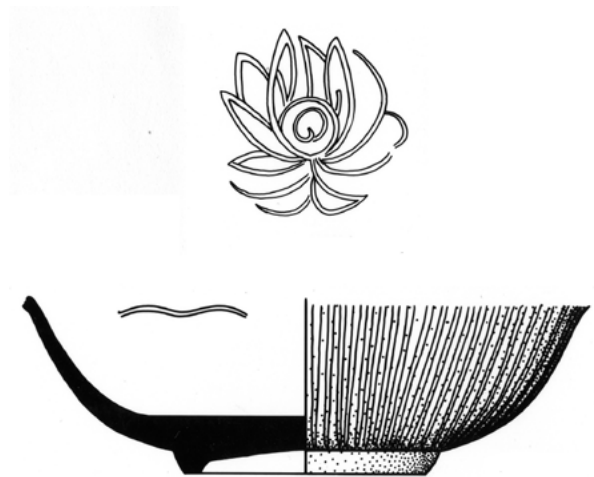
KKH31*

Incomplete plate. Centrally decorated with lotus flower and also on cavetto. External ribbing. Craze glaze. Grey body with fine specks. Tubular support mark on base. The chemical composition of this item is consistent with celadons produced at the Si Satchanalai kilns. Ref. Brown and Sjostrand (2002) Fig. 17d from the Royal Nanhai shipwreck site.



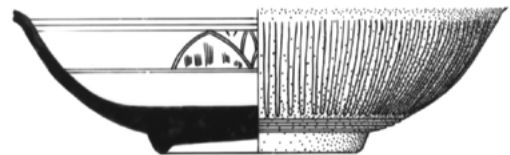
KKH28

Incomplete plate. Centrally decorated with lotus flower. External ribbing. Light grey body with black inclusions. Tubular support mark on base.



KKH26A

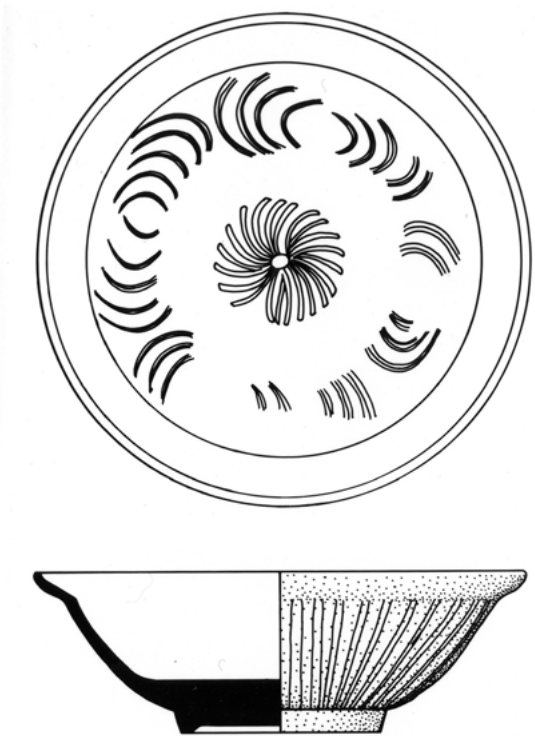
Incomplete plate. Light grey body. Centrally decorated with lotus flower. Upper cavetto decorated. External ribbing. Tubular support mark on base. Ref. Brown and Sjostrand (2002) Fig. 17d from the Royal Nanhai shipwreck site.



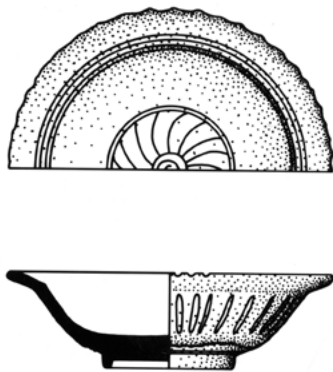
KKH26

Incomplete plate. Light grey body with fine black inclusions. Floral decoration. External ribbing. Tubular support mark on base. Ref: Brown (1975) Plate 4 shows an item with a similarly decorated cavetto also from the Ko Khram site. Another, from Marinduque, the Philippines, in the collection of the National Museum of the Philippines, has been noted by Harper (1988(i)a). Locsin (1967) Plate 164 lower right hand and Plate 165 upper right hand also shows similarly decorated material from Puerto Galera, the Philippines, as does the Southeast Asian Ceramic Society (1985) Plate 388, from Kampong Juara, Malaysia.

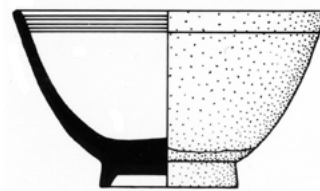
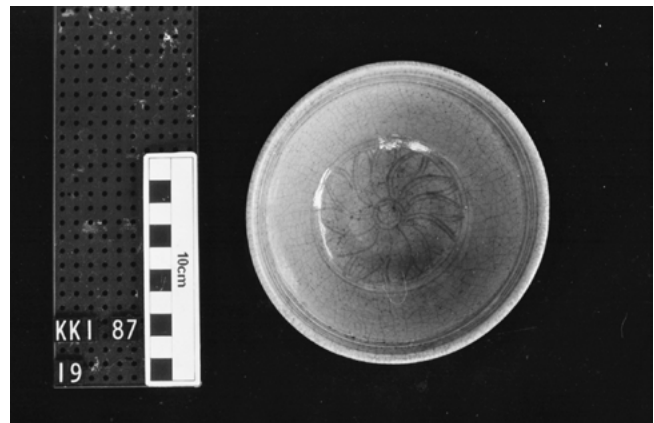
BOWLS – CELADON GLAZED – INCISED DECORATION



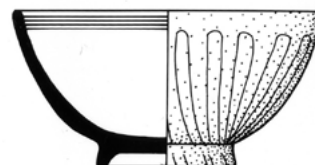
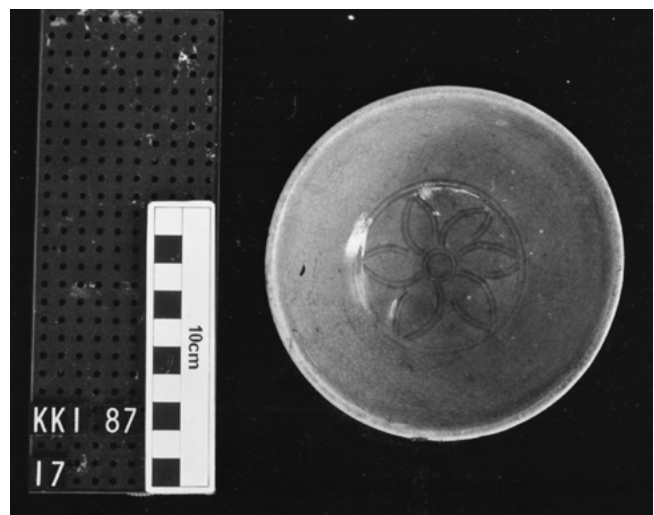
KKH29
Incomplete plate. Light grey body. Coarse, crazed glaze. Centrally decorated with floral design. 'Onion skin' (opening lotus flower) decoration on cavetto. External ribbing. Tubular support mark on base.



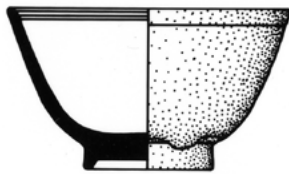
KKH24
Incomplete plate. Foliated rim. Grey body with small black inclusions. Crazed glaze. Centrally decorated with floral design. Linear decoration on upper cavetto and outside near footrim. External ribbing. Ridge above footrim. Tubular support mark fitting compactly into footrim. Ref: Richards (1977) Fig. 280.



KKH 19
Bowl. Good quality celadon glaze. Centrally decorated with lotus flower. Linear decoration on upper cavetto. Tubular support mark on base. Ref: Green and Harper (1987) Fig. 9i from the Si Satchanalai kilns. Frost *et al.* (1974) Fig. 1 also illustrate a similar design on a celadon bowl said to be from the Sha Tsui wreck site.

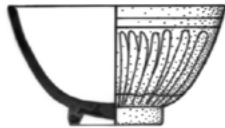


KKH17
Bowl. Centrally decorated with lotus flower. Linear decoration on upper cavetto. Oblique marks around footrim. Ref: Richards (1977) Fig. 281 central design.



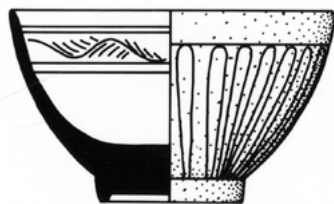
KKH18

Bowl. Lopsided. Lightly crawling glaze. Underfired. Centrally decorated with lotus flower. Linear decoration on upper cavetto. Tubular support mark on base.



KKH16

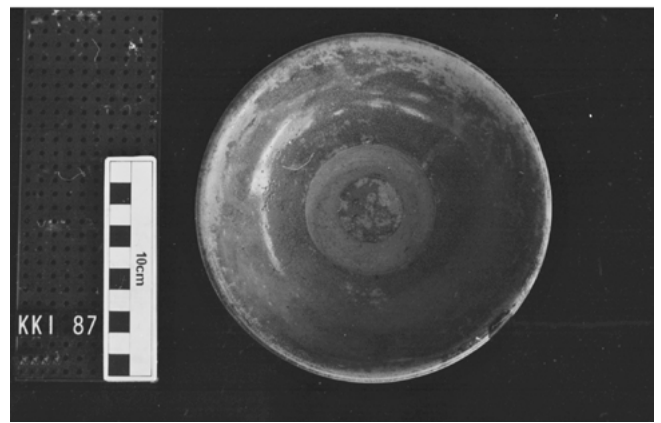
Bowl. Light grey body with very small black inclusions. Glaze slightly blue-green. Centrally decorated with lotus flower. Ref: Green and Harper (1987) Fig. 9f external ribbing. Southeast Asian Ceramic Society, Singapore (1979) Plate E/2 shows a similarly decorated item from an excavation at Bukit Sandong or Tebing Tinggi, Sarawak. None of the decorations of the Si Satchanalai produced celadon plates from the Royal Nanhai wreck site, Brown and Sjostrand (2002) CP55-60, resemble any of the Ko Khram items exactly, however CP63 celadon bowls may resemble KKH16.



KKH23

Incomplete bowl. Light grey body. Red exterior. Underfired, very degraded glaze. Centrally decorated with indistinct lotus flower decoration. 'Feather' decoration on upper cavetto. Externally ribbed. Tubular support mark on base. Ref: Brown (1975) Plate 7; Richards (1977) Fig. 267 & 268; Locsin (1967) Plate 167 Puerto Galera; Harper (1988(i)a) No. 26, Palapat Melian, No. 220 Bahuguhan Cave, Marinduque and No. 190 Balibago, Talim Island, Luzon, the Philippines; and the wreck off Phu Quoc Island, Blake and Flecker (1994) for similarly decorated items.

SAUCERS



KKH44

Note: Photographs are of a similar item KKH40. Incomplete saucer. Grey body with black inclusions. Green-brown glaze extends 2/3 of the way down the exterior. A mark is evident within the central unglazed area where a support or foot rested during firing. Ref: Brown (1975) Plates 10 & 10a show this type of item, also from the Ko Khram wreck site. Brown denotes the origin as probable Cham wares from the Go-sanh kilns in central southern Vietnam and says if so, they probably do not date later than 1471. Harrison and Shariffuddin (1969) Plate XVI show similar items from the Sungai Lumut site in Brunei giving the provenance as southern China. They indicate that similar items were recovered from a Ming burial site at Niah. Brown (1988) also indicates that similar finds have been recovered from Indonesia and the Philippines. Another item from this site, KKH50, is similar to the above but with no mark inside the unglazed area and with lightly crazed green glaze in good condition. Many of this type of item from the Ko Khram wreck site have a very degraded glaze.

KO RIN WRECK SITE

Visually, many of the items from this site are similar to material from the Mae Nam Noi kiln site, Singburi Province, Thailand and indeed almost fit into the material range of this kiln site, as tested by Amdel. However, as with all these sites, caution must be expressed as this is not necessarily a confirmed indication of provenance. The samples often fit more than one test site, as is the case here. In fact the Ko Rin items have, in general, a high MgO content and this could indicate that they have been produced at another kiln site with a close affinity to the Mae Nam Noi site. It could also be a result of contamination from the marine environment in which they were immersed. Other material from this wreck site is from the Si Satchanalai kilns whilst a further group is of Chinese origin.

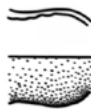
*Ceramics**Earthenware*

KENDI



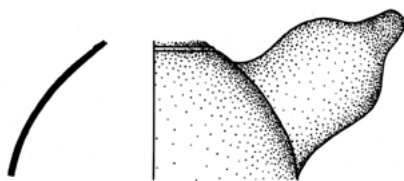
KL 21*

Spout sherd. Grey body, tight matrix. Beige exterior.



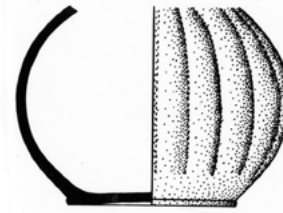
KL 226

Spout sherd. Red body.



KL 113*

Section of shoulder wall and spout. Dark grey body with white inclusions. Beige exterior. Smooth surface. Ref: Brown (1988) Fig. 52 (item with a similarly shaped spout given as 'Sawankhalok'); Harper (1988(ii) Mae Nam Noi kiln site AC23.



KL 115

Base section. Fluted. Dark grey body with white inclusions. Beige exterior. Smooth surface.

Ref: Green (1983) KSC1 1983 62 etc. from the Ko Si Chang 1 wreck site, Thailand.

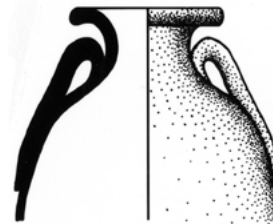


KL 114

Base section.

Earthenware–Stoneware

BOTTLE

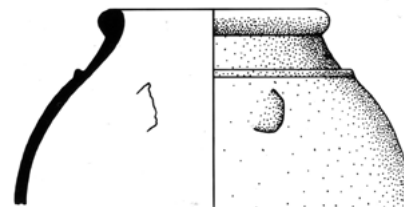


KL 18*

Upper section. Long tongued handles. Light grey-orange body with orange and white quartz and black inclusions. Ref: the Prachuap Khiri Khan site PK3 (below) for other finds.

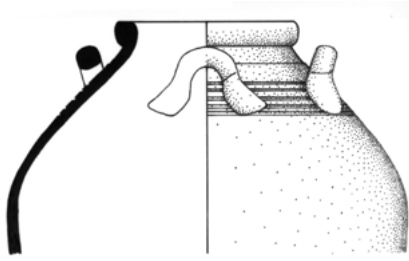
JARS

Refer: PART 3 (below)



KL 34*

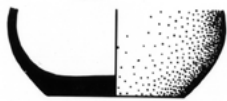
Upper section sherd. Ridge at base of neck. Remains of lug handle. Orange and grey body with quartz-like inclusions. Pink-grey exterior with bluish tinge.



KL 19* (1:8)

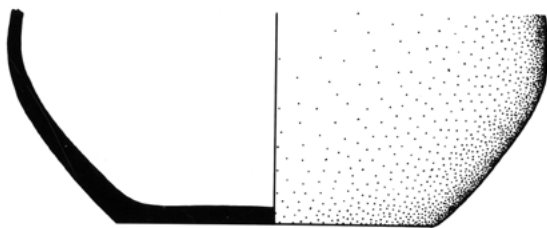
Upper section. Ridge at base of neck. 4 lug handles over incised lines. Orange body with many quartz-like inclusions. Blue exterior. Appears friable.

JAR/BOTTLE



KL 17*

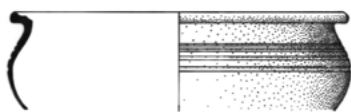
Base sherd. Dark grey with orange body.



KL 20

Base sherd. Orange body with quartz-like and orange coloured inclusions. Appears friable.

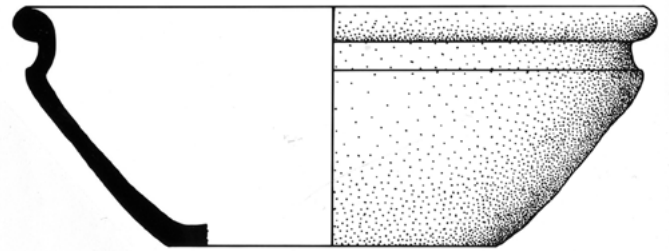
BOWLS/BASIN—EVERTED RIM



KL 189

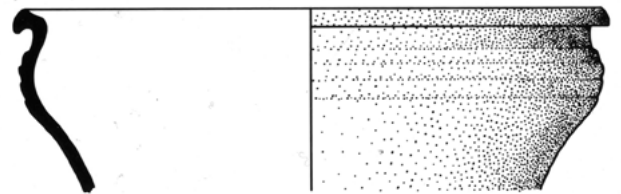
Rim sherd. Incised on shoulder. Dark grey body. Ref: the Ko Si Chang 1 wreck site (below) for further sites with similar items.

BASINS



KL 33*

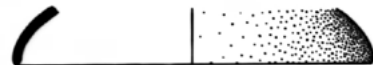
Incomplete basin. Grey-red body with white and yellow inclusions. Ref: the Ko Si Chang 1 wreck site (below). This basin is similarly shaped to sherds recovered at the Mae Nam Noi kiln site, Harper (1988(ii)) however the body matrix, from a visual appearance, is dissimilar.



KL 33A

Incomplete basin.
Incised on shoulder.

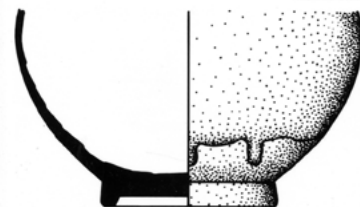
POSSIBLE LID



KL 30

Rim sherd.

Stoneware
BOTTLES



KL 35

Bottle base sherd. Grey body with black inclusions. Brown glaze, running. Ref: Prachuap Khiri Khan site (above) PK12. An item of this shape, also brown glazed, was recovered from the Española site, Brooks Point, Palawan, Brown (2004) Plate 66 (ES0512).



KL 24

Neck rim sherd. Ridge at base of neck. Remains of handle. Grey body with black inclusions. Brown glaze.

JARLET

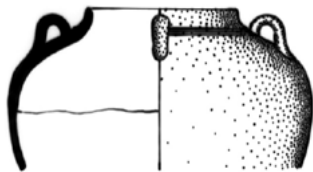
Refer: PART 2 – Small Painted Containers



KL 23

Complete item. Incised on shoulder. Grey body with black inclusions. Beige exterior. Brown glaze extending inside rim. This type of item is generally attributed a Si Satchanalai provenance. Ref: Green and Harper (1987) Fig. 6. and Prachuap Khiri Khan (PK15 below). Richards (2003:57) shows a similarly shaped celadon glazed bottle from the Brunei Darrusalam site. Brown (2004) Plate 67 (ES0338) shows a brown glazed jarlet from the Española, site. Fox (1959: 352 & 355) shows large Chinese or Thai jars containing skeletons of infants at Pulung Bakaw and K. Tomas sites, Calatagan, the Philippines. Smaller items such as these jarlets were placed in the jars together with the human remains.

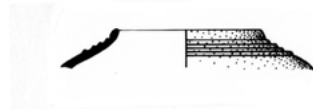
POTICHE



KL 26*

Neckrim and upper body wall sherd. One handle evident. White-grey quartz body with black inclusions. Brown glaze. Ref: Similarly shaped items with a white glaze have been recovered from the kiln site at Ban Ko Noi, Si Satchanalai;

Calatagan site, the Philippines, Fox (1959) Plate 118 ; and from Palapat, the Philippines, Harper (1988(i)a). Spinks (1959) Fig. 13 (No. 3077) illustrates a similar item from Indragiri, Sumatra. The item, with a degraded brown glaze, also appears from the Ko Samae San site, Thailand. A *potiche* of this shape came from the Española site, Brown (2004) Plate 67 (ES0516).



KL 25

Neckrim sherd. Incised. Grey body with black inclusions. Brown glaze.

JARLET—PAINTED UNDER GLAZE



KL 27

Incomplete jarlet. Grey body with black inclusions. Ref: Ko Kradat wreck site, Thailand, Green *et al.* (1981).

COVERED BOWLS



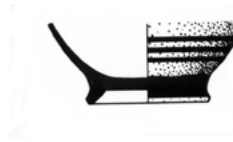
KL 28

Lid sherd. Ref: Harper (1987) illustrates items from Ban Pa Yang, Si Satchanalai; Green and Harper (1987) Fig. 3a, the Ko Kradat wreck site, Thailand; the Calatagan site, Philippines; and from Java. Brown and Sjostrand (2002) CP80 show that this type of item was recovered from the Singtai and Xuande sites. Painted under glaze lids, also appear on the Ko Samae San site, Thailand. Covered bowls have been recovered from many sites in Southeast Asia including the Philippines, Harper (1988 (i)a & b). Hadimuljono (1985: 13) states, in reference to such items that they were used as grave furniture for the common people whereas blue and white and polychrome ware was used for royalty or prominent people.

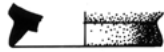


KL 29

Base rim sherd. Ref: Green and Harper (1987) Fig. 3g, the Si Satchanalai kiln site area, the Ko Kradat wreck site, Thailand; the Calatagan site, Philippines; and Java. This type of covered bowl base has also been recovered from the Ko Samae San site, Thailand.

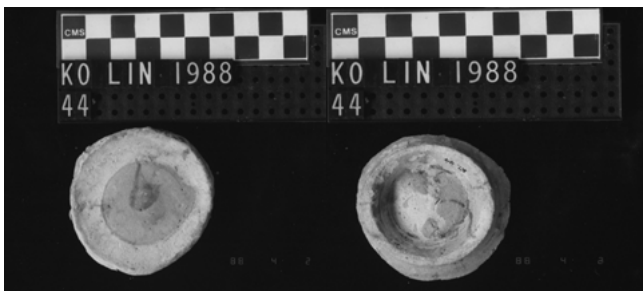


KL 184
Base footrim sherd. Brown painted foot.
Ref: As above.



KL 31
Base footrim sherd. Grey body with black inclusions. Glazed inside. Brown painted foot.

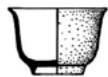
MISCELLANEOUS



KL 44
Bowl base sherd.
Chalky body matrix. Central glazed area surrounded by unglazed ring. Central brush stroke decoration. Two painted external horizontal lines. Exterior is glazed to footrim

Porcelain

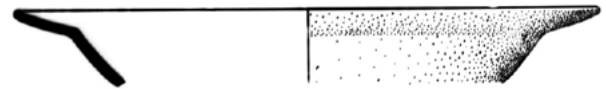
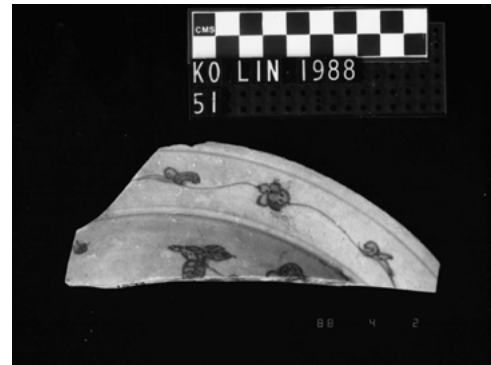
Refer: PART 2 (below)
CUP/SMALL BOWL



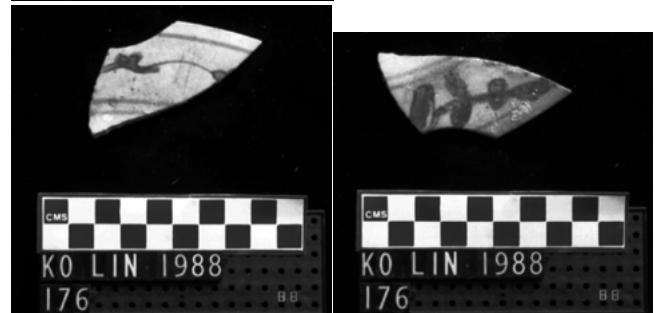
KL 143
Decoration: Interior—floral, exterior—Eight Trigrams.
Inscription on base.

PLATES—FLAT RIMMED
Rim sections.

DECORATION: EXTERIOR—FLORAL SCROLL, INTERIOR—BIRD AND VEGETATION

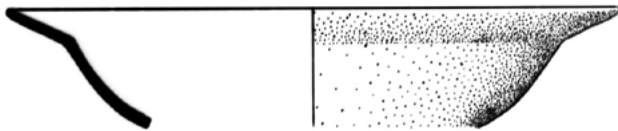
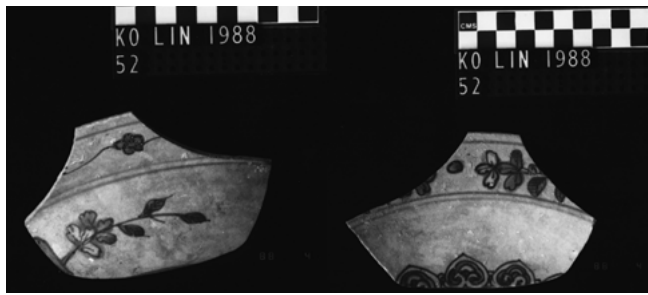


KL51 (Rinaldi (1989) Pl.55 (c. 1575–1600) has a similar pattern under a flat rim),



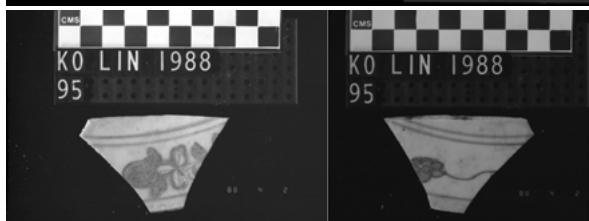
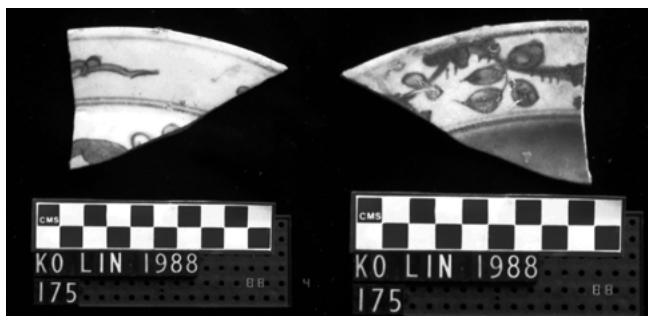
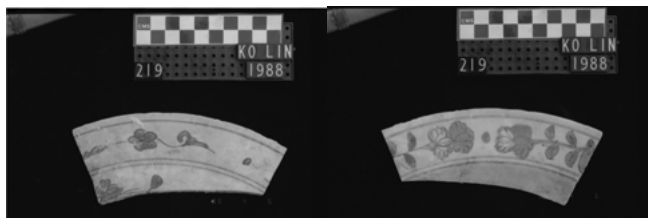
KL94, 176. Ref: *Witte Leeuw* (Pijl-Ketel, 1982: 190 top right and p.192 inv. no. 11542); Casa-Museu Dr Anastácio Gonçalves (1996) Plate 13 (where it is given a Jia Jing dating, the central motif has many attributes of KSC1 G1 below); Auret and Maggs (1982) Fig. 18 (1 & 2), *São Bento*.

DECORATION: EXTERIOR—FLORAL SCROLL, INTERIOR—FLORAL AND JU'I (RUI) LAPPET



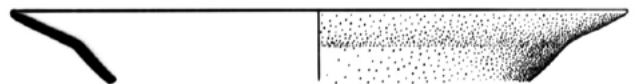
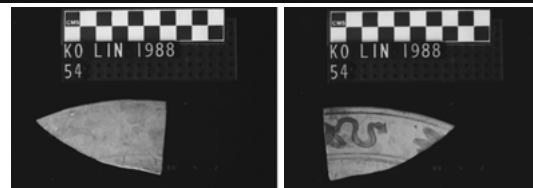
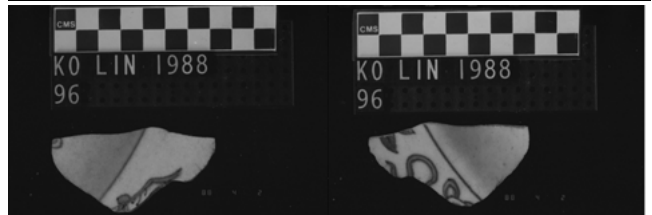
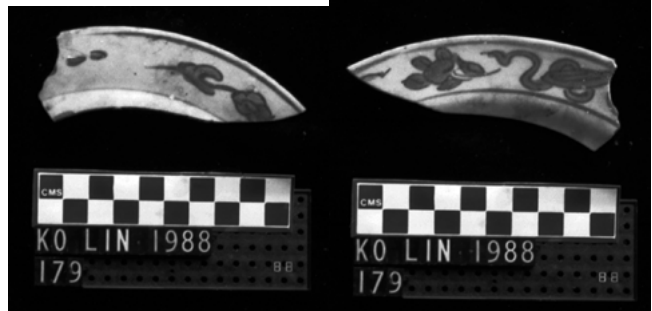
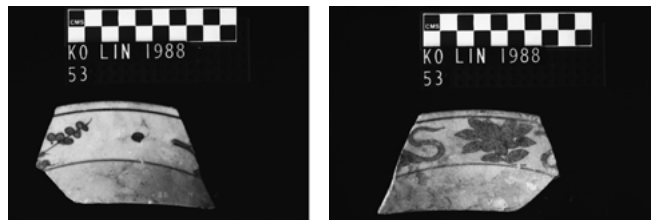
KL 52

DECORATION: EXTERIOR—FLORAL SCROLL, INTERIOR—FLORAL



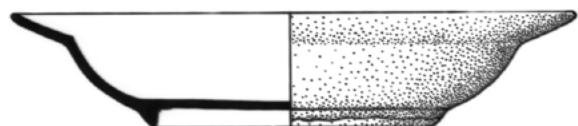
KL219 (possibly decorated with chrysanthemum), KL175, KL95.

DECORATION: EXTERIOR—VARIOUS, INTERIOR—RIBBONS AND FLORAL



KL 53, 179, 96, 54 (possibly decorated with lychee). Ref: *Witte Leeuw* (Pijl-Ketel (1982: 190) similar interior decoration to KL179).

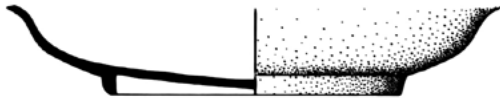
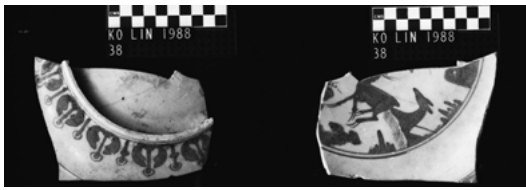
DECORATION: EXTERIOR—BIRD. AND FOLIAGE CHARACTER ON BASE, INTERIOR—BIRD AND FLORAL SCROLL, VEGETAL



KL 174 Ref: The crane on the rim is represented in a similar manner as *Oriental Ceramic Society* (1981) CP2 though the Ko Rin drawing is less precise.

PLATES—BASES

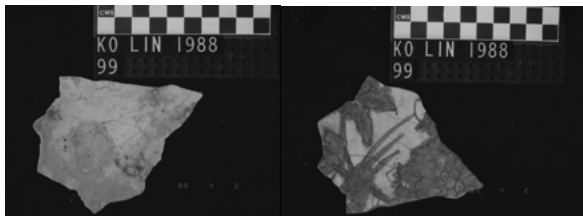
DECORATION: EXTERIOR—POSSIBLY STYLIZED CRAB, INTERIOR—DEER IN LANDSCAPE



KL38, KL140

Ref: Rinaldi (1989) Pl. 157 (c. 1575–1605).

DECORATION: INTERIOR—BIRD AND FLORAL



KL99.

SAUCER—BOWLS

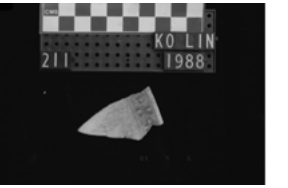
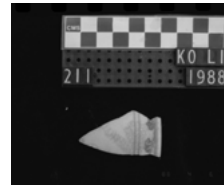
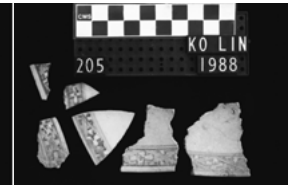
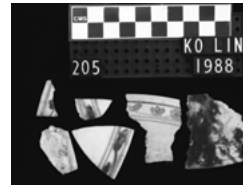
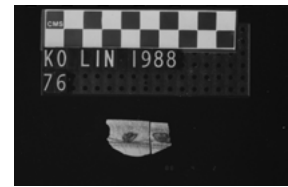
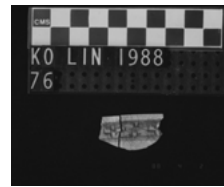
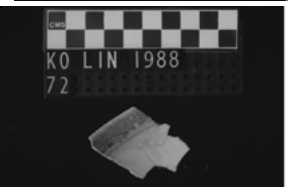
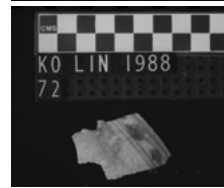
DECORATION: EXTERIOR—FLORAL, INTERIOR—BIRD AND PEACHES



KL 198, 43, 93, 137 (some with inscriptions)

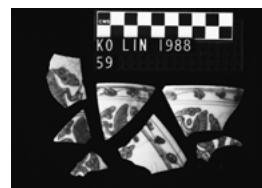
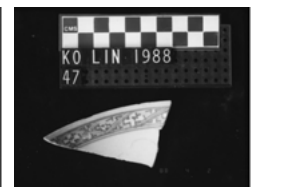
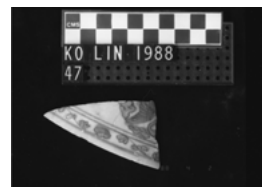
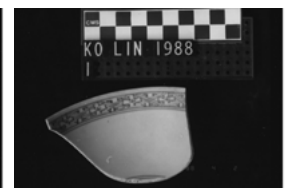
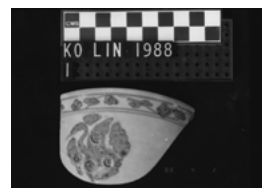
BOWLS—RIMS

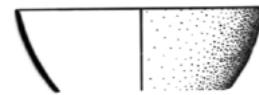
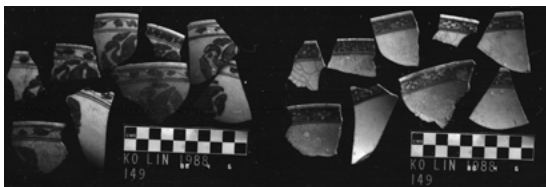
DECORATION: EXTERIOR—FLORAL SCROLL, INTERIOR—DIAPER



KL 7, 61, 72, 76, 150, 205, 211.

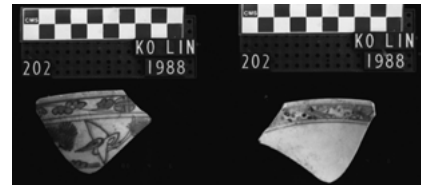
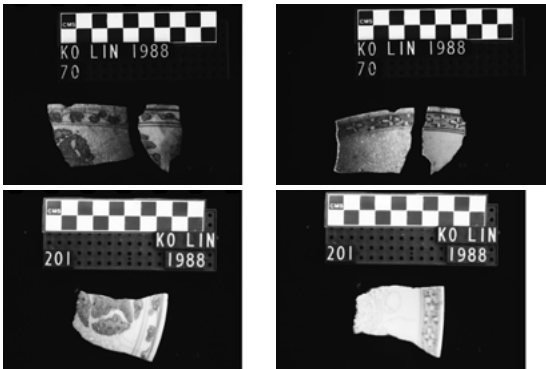
DECORATION: EXTERIOR—FLORAL SCROLL AT RIM, CRANE, INTERIOR—DIAPER





KL 46, 69, 161, 199.

DECORATION: EXTERIOR RIM—FLORAL SCROLL, PROBABLE PHOENIX, INTERIOR—DIAPER



KL 202.

Ref: Compare more complex phoenix, Rinaldi (1989) Pl.73 (1590–1610). Garner (1970) Plate 56B shows an item with simply drawn birds on rim (second half of 16th century).

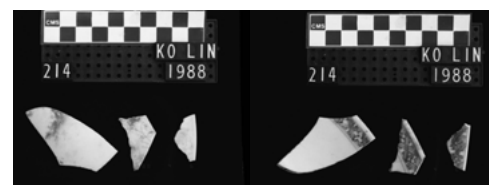
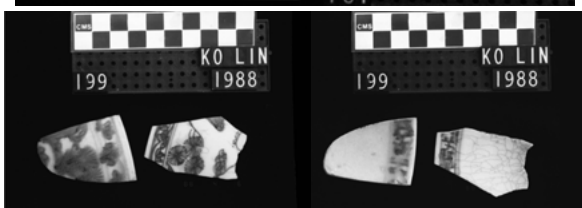
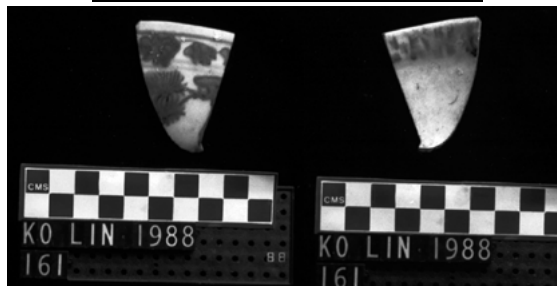
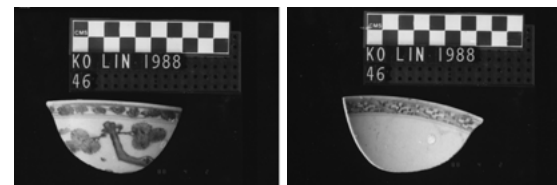
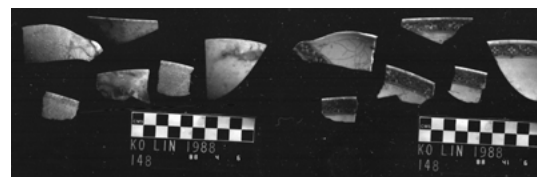
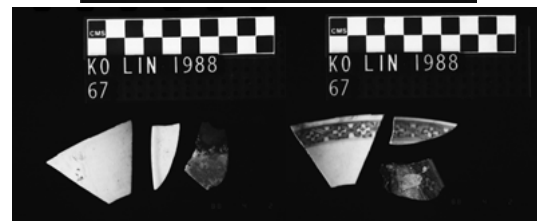
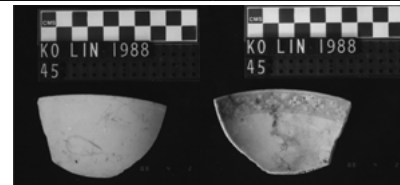
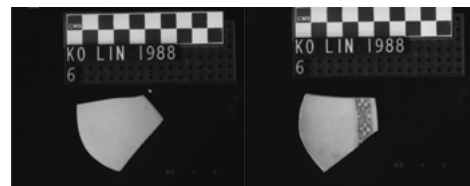
DECORATION: EXTERIOR—PLAIN. INTERIOR—DIAPER



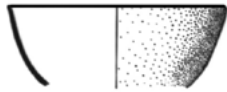
KL 1, 47, 59, 70, 149, 201.

This decoration also appears on an item from the Ko Samae San underwater site, Thailand. Compare KSC1 G1 (below) crane and interior diaper decoration.

DECORATION: EXTERIOR—FLORAL SCROLL AT RIM WITH PINE, INTERIOR—DIAPER

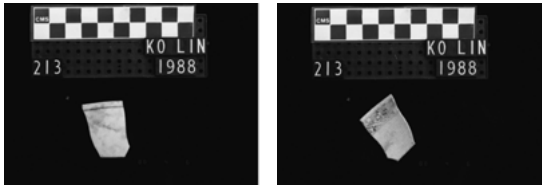


KL6



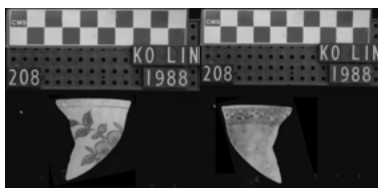
KL 6, 45, 67, 148, 214.

DECORATION: EXTERIOR—LINEAR, INTERIOR—DIAPER



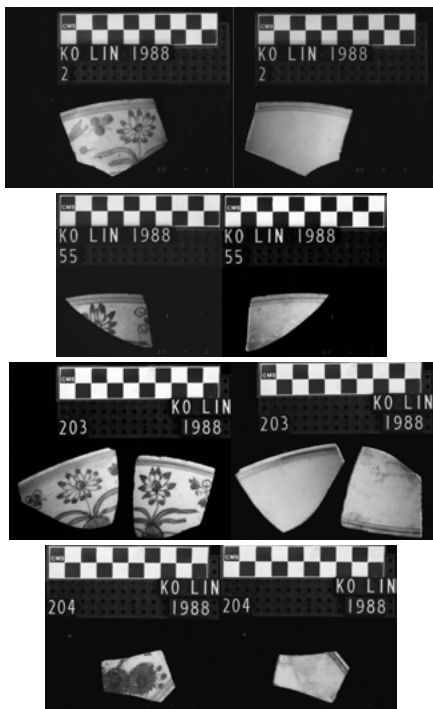
KL213.

DECORATION: EXTERIOR—LINEAR AND POMEGRANATE, INTERIOR—DIAPER



KL208.

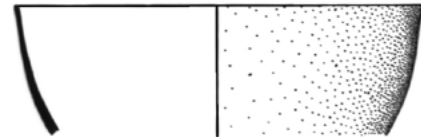
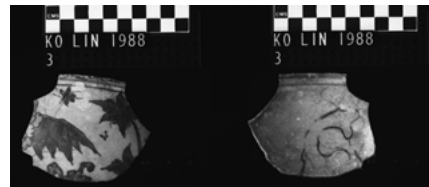
DECORATION: EXTERIOR—LINEAR AND FLORAL, INTERIOR—LINEAR



KL 2 (fish tail & lotus flower), 55 (lotus flower), 74, 75, 203 (lotus flower) (ref: *Witte Leeuw*, Pijl-Ketel, 1982: 192 bottom left; Garner (1970) Plate 56B shows plate with flowers similar

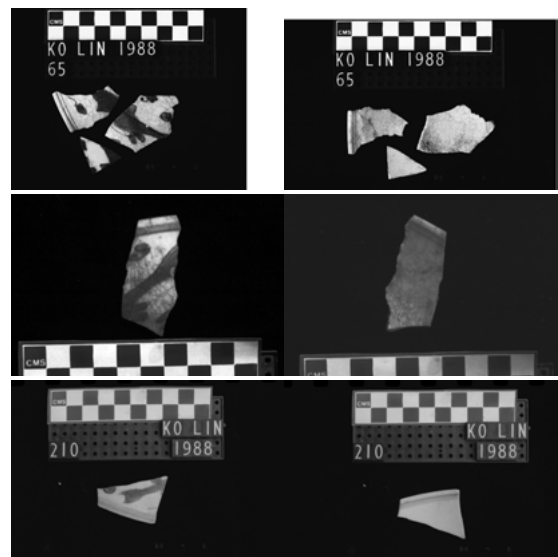
to KL203, this item has the 'clearness' of the Ko Rin item), KL204 (chrysanthemum).

DECORATION: INTERIOR—LINEAR



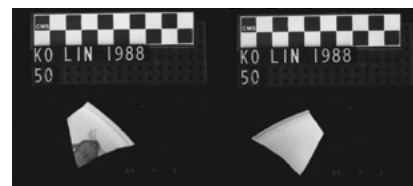
KL 3 (possible peony flower, foliage & insect).

DECORATION: EXTERIOR—FISH, INTERIOR—LINEAR



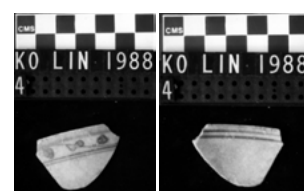
KL 65, 162, 210.

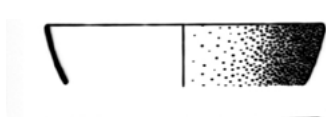
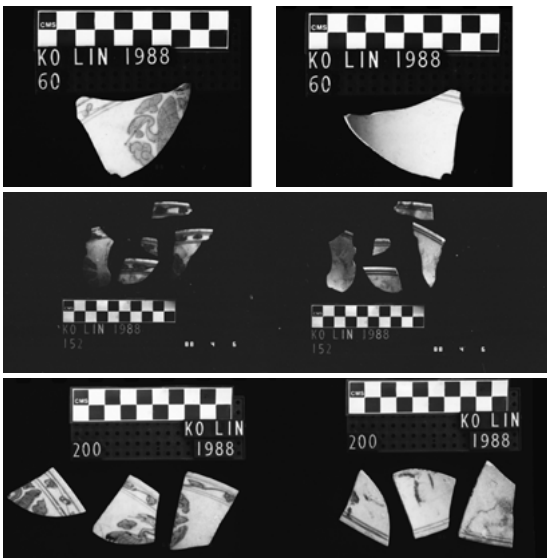
DECORATION: EXTERIOR—CAT OR RABBIT, INTERIOR—LINEAR



KL 50.

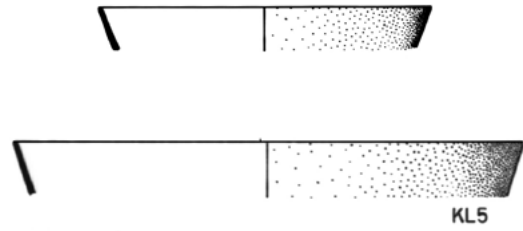
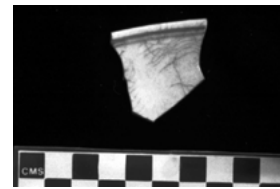
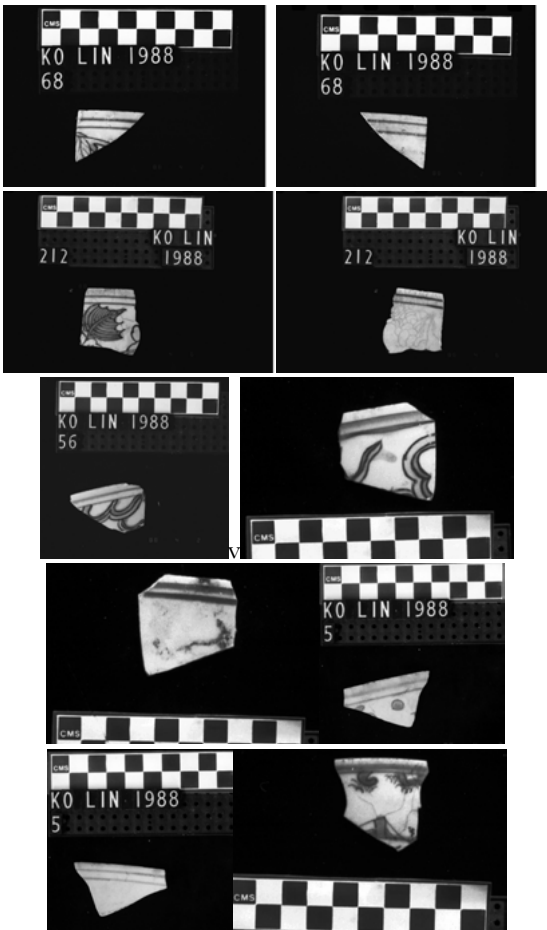
DECORATION: EXTERIOR—FLORAL SCROLL AND CRANE, INTERIOR—LINEAR





KL 4, 60, 152, 200. Ref: Compare KSC1 G1 crane (below).

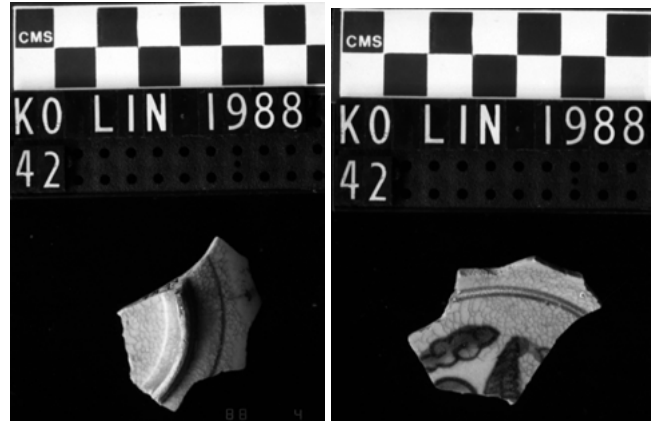
DECORATION: EXTERIOR—MISCELLANEOUS, INTERIOR—LINEAR



KL 68, 212, 56, 163, 5,160.

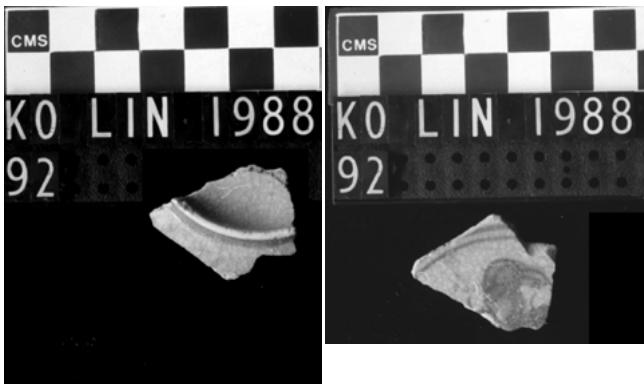
BOWLS/PLATES—BASES

DECORATION: INTERIOR—CRANE



KL42

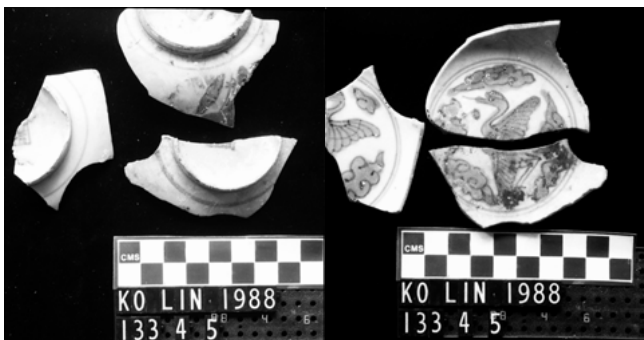




KL 42, 48 (Maker's mark on base) 92.

Ref: Decoration identical to Ko Samae San, Green and Harper (1983) Plate 30. Casa-Museu Dr Anastácio Gonçalves (1996) No. 13 shows a plate with many of the same elements as the Ko Rin material, denoted Jia Jing 1522-66. The birds of KL48, 133, 134, 135 etc. are similar except that the treatment of beak differs.

DECORATION: EXTERIOR AND INTERIOR—CRANE



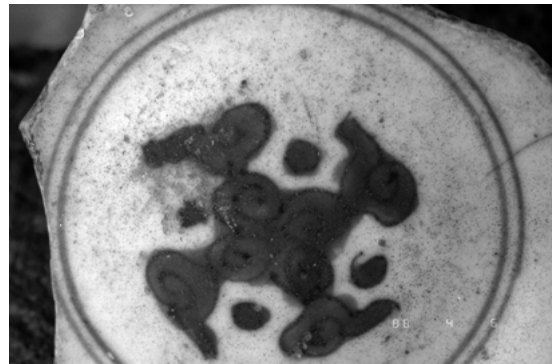
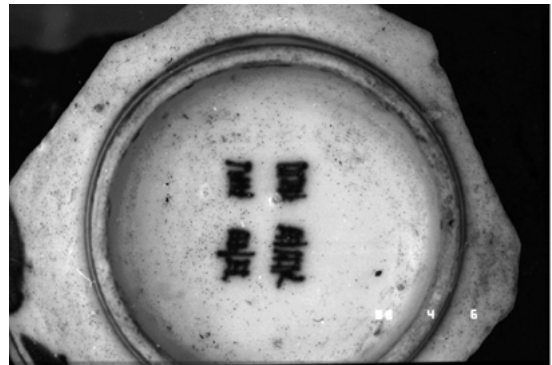
KL 133, 134, 135, 136. Some have inscription on base.

DECORATION: INTERIOR—CAT



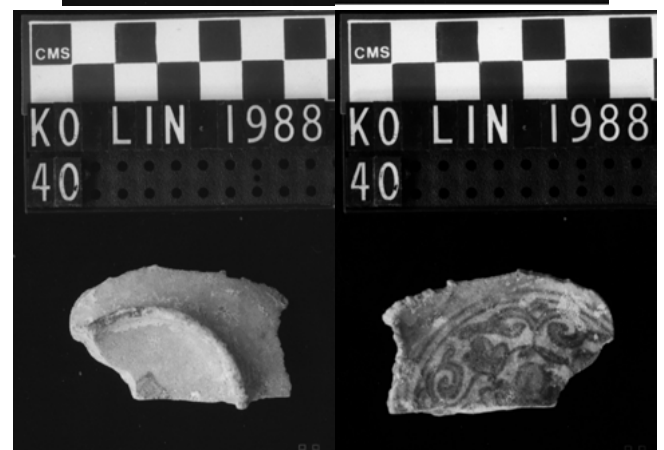
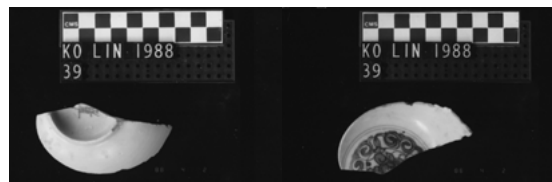
KL 59 (Cat on cushion. Maker's mark on base), 138, 139.
Ref: Yeo and Martin (1978) PL36.

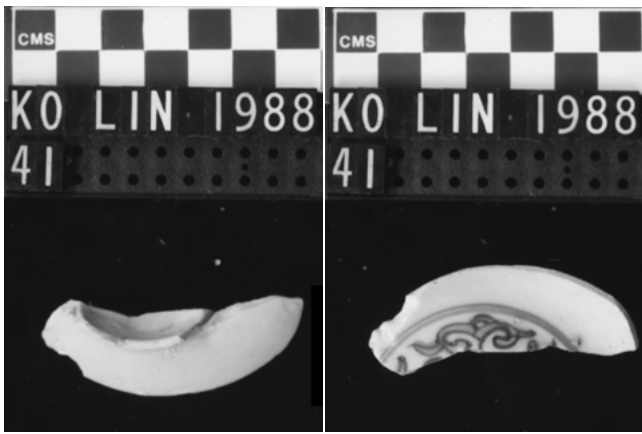
DECORATION: INTERIOR—CLOUD



KL 130. Inscription on base. Decoration similar to Ko Kradat item (Green, *et al.* (1981)), however, inscription differs.

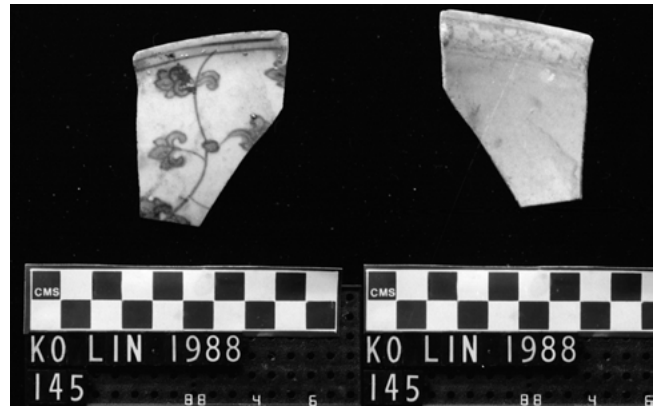
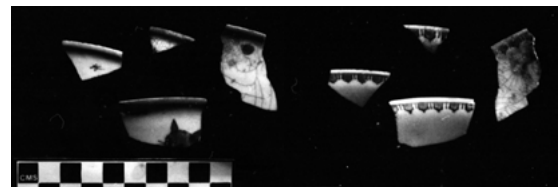
DECORATION: EXTERIOR—PLAIN, INTERIOR—FLORAL





KL 57A, 57B, 62, 157.

DECORATION: EXTERIOR—LINEAR AND FLORAL, INTERIOR—DIAPER



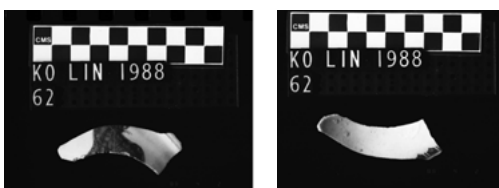
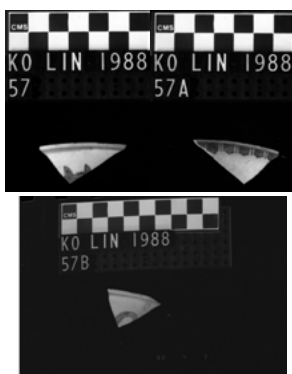
KL 39, 40, 41, 131, 132. Inscription or Makers' marks on base.

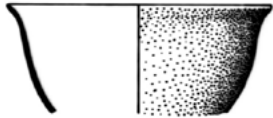
BOWL—RIM SECTIONS. LIGHTLY FLARED.

DECORATION: EXTERIOR—LINEAR AND CAT, INTERIOR—QUERY LOZENGE



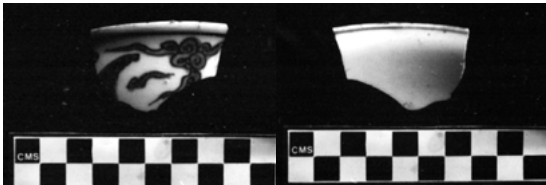
KL 145 Compare KSC1 955 (below) and Ko Kradat (Green *et al.* (1981: 39), 147, 209.





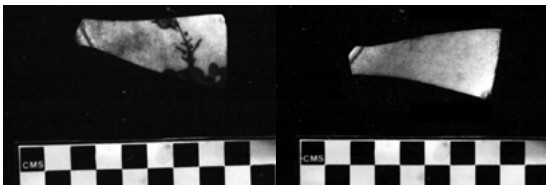
KL 73,144. Ref: Casa-Museu Dr Anastácio Gonçalves (1996) Plate 5 given as Zhengde (1506–21) has some similarities in decoration though quality differs (the Zhengde item is superior). The quality is more like Plate 32, given as Jia Jing.

DECORATION: EXTERIOR—LINEAR AND CRANE, INTERIOR—LINEAR



KL 151.

DECORATION: EXTERIOR—LINEAR AND FLORAL, INTERIOR—LINEAR



KL 153.

DECORATION: EXTERIOR—FLORAL, INTERIOR—FLORAL



KL 146.

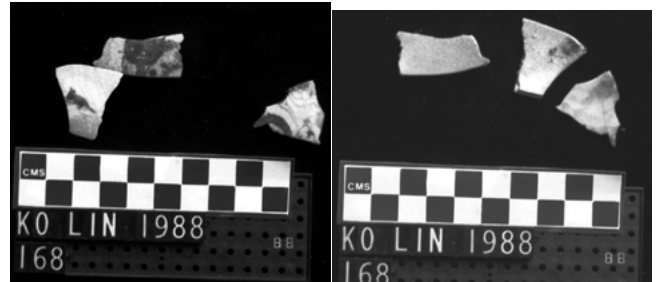
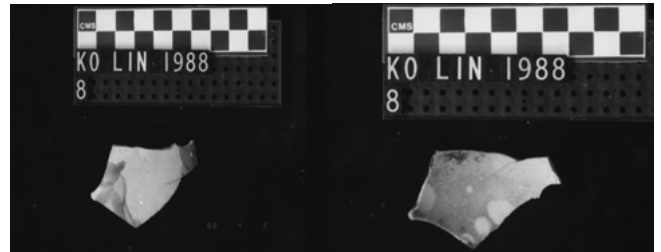
MISCELLANEOUS WALL SHERDS

DECORATION: EXTERIOR—CRANE, INTERIOR—PLAIN



KL 11, 78, 83, 85.

DECORATION: EXTERIOR—CAT AND MOUSE, INTERIOR—PLAIN



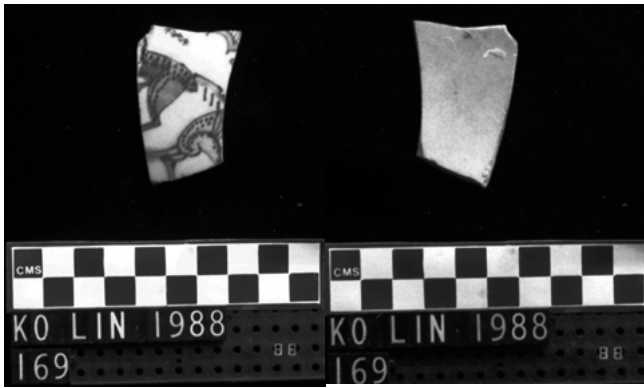
KL 8, 168.

DECORATION: EXTERIOR—FLORAL POSSIBLY ACANTHUS, INTERIOR—LINEAR



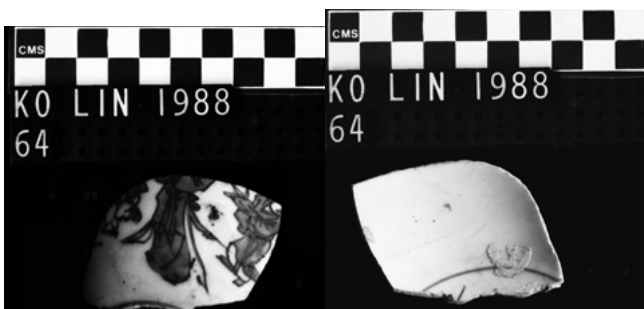
KL 90.

DECORATION: EXTERIOR—DEER, INTERIOR—PLAIN



KL 169.

DECORATION: EXTERIOR—FIGURES IN ROBES



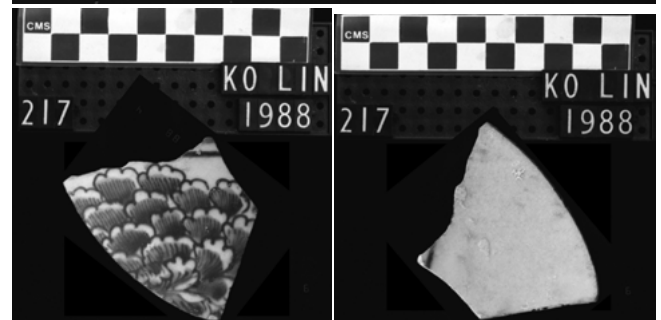
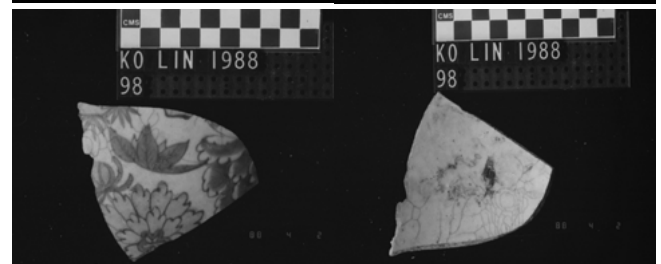
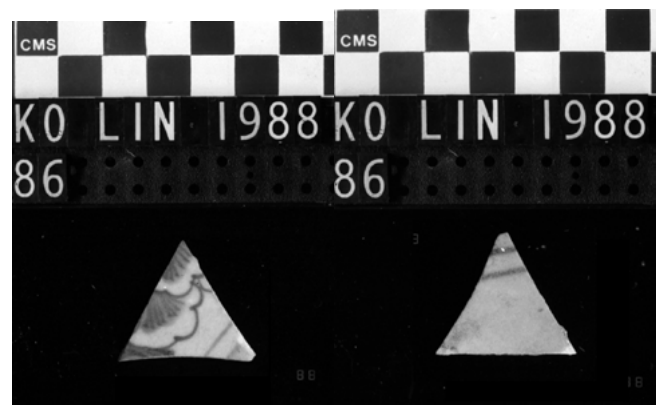
KL 64.

DECORATION: EXTERIOR—POSSIBLY ROCKS IN LANDSCAPE



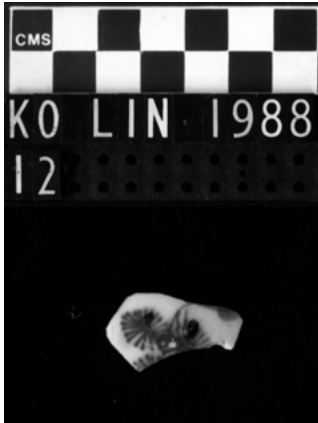
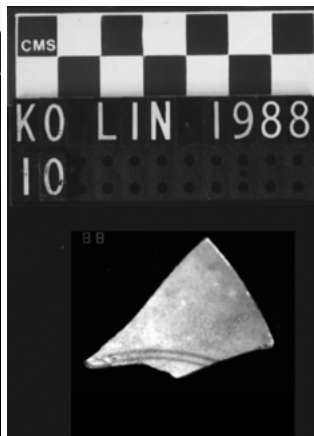
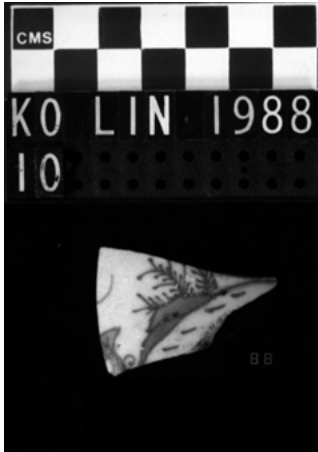
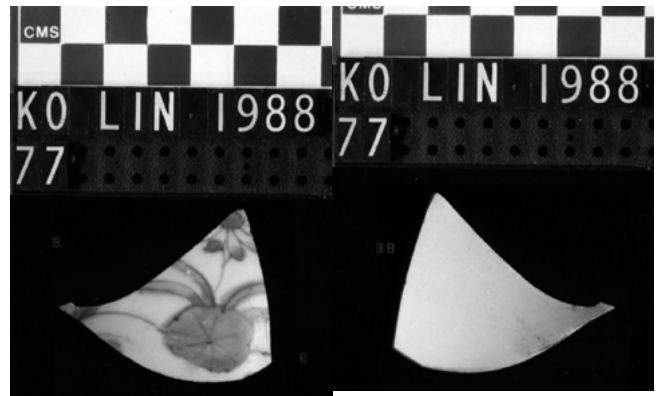
KL 166, 82.

DECORATION: EXTERIOR—FLORAL



KL 71, 86, 98, 217, 218.

DECORATION: MISCELLANEOUS



KL 66, 9, 10, 12 (pine), 13, 15, 16, 63, 77 (lotus leaf & flower), 79, 80 (pine), 81, 84, 87, 89, 91, 165 (includes pine & lotus), 216 (lotus).

Metals

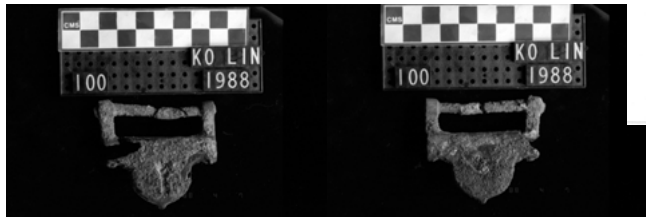
COPPER ALLOY

Refer: PART 4 (below)



KL 197

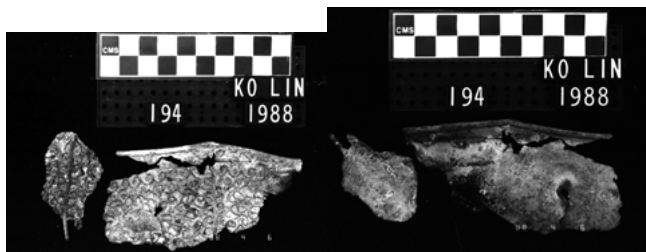
Part of a Chinese-type lock with a lion on top.



KL 100

(15 mm)

Lock, broken. Partly made of lead.



KL 194

Section of an unknown item, possibly a box. *Cloisonné*.

KL 195

Not illustrated.

Bowl rim fragment.



KL 192

Bowl rim section.

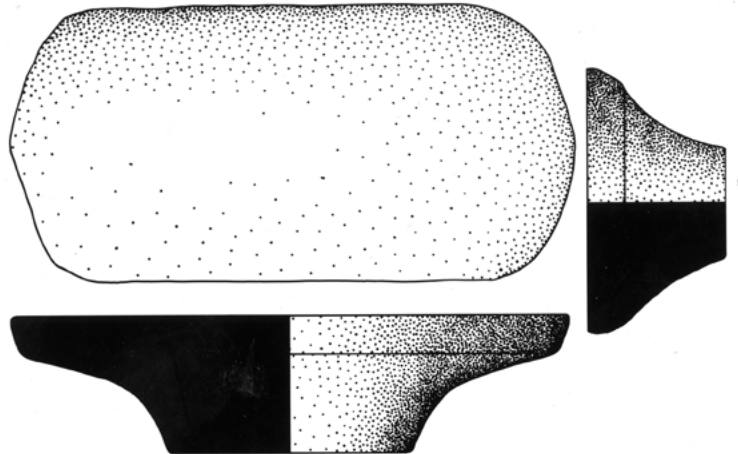
Ref: Green (1983) KSC1 1983 02 for similar item from the Ko Si Chang 1 wreck site, Thailand.

LEAD

KL 196

Lead rods. Not illustrated

Stone



KL 37

Grindstone

Flat upper surface. Stonemason's marks on base.

Ref: Ko Kradat wreck site, Thailand, Green *et al.* (1981) No. 174.

KL 230

Stone

A sample not illustrated.

PRACHUAP KHIRI KHAN WRECK SITE

Situated on the eastern seaboard of the Thai Peninsula this wreck site serves as a reminder that districts in Prachuap Khiri Khan Province (Kui and Pran), are believed to have served as part of a trans-peninsular route between Phetchaburi and Tenasserim (under Thai protectorate for hundreds of years).

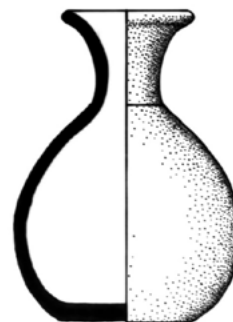
The Prachuap Khiri Khan site lies adjacent to the Tenasserim/Mergui area. It lies in the vicinity of the village of Khao Samroirot from which Harris through Anderson (1890: 28) explains: '...a pass crosses the mountains to Tenasserim, and apparently at a low altitude'. According to Harris it was from this place and from Kiu just north of Prachuap Khiri Khan that '...all junks bound to China or Cochin-China steer, in order to take in good water before they strike due east across the Gulf of Siam'. Harris noted, in the early 19th century 'As the distance from Bangkok to Kiu is only about 140 miles, and as the junks were not in a condition to proceed on their voyages to the east, until they had taken in water from the mountain-streams of Samroirot, they may be said to have begun their navigation from that point'. It is a consideration that the cargo from the Prachuap Khiri Khan site may have been associated with the overland trade across the Peninsula, or at least the ship could have been procuring fresh water from the Samroirot streams.

Unfortunately no ship's timber was able to be excavated from this shipwreck to enable C14 dating to be carried out. Many of the ceramics described from this site have similarities in terms of shape, to items from the Mae Nam Noi kiln site, Singburi Province, Thailand, Harper (1988(ii)) and Praichanjit (1988). Further, material analyses supports, but does not necessarily confirm, the possibility that this kiln site may in fact be the place of origin for the Prachuap jars and other ceramics.

*Ceramics****Earthenware–Stoneware*****MORTAR****PK10**

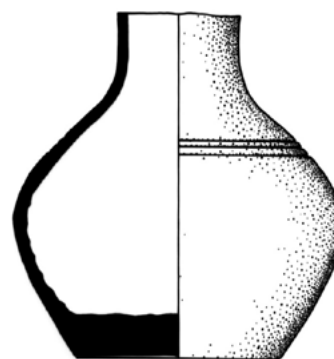
Complete mortar. two incisions at rim. Flat base. Coarse orange-red body. Blue exterior. Several similar items were recovered. The shape of this item is very much like those made at the Mae Nam Noi kiln site, Harper (1988(ii)). Similar items appear on the Ko Si Chang 1 wreck site (below), and are also believed to have been recovered from the Ko Samui wreck

site, Thailand (Harper (unpub.)) and from Punta Sunog, the Philippines, Harper (1988(i)a).

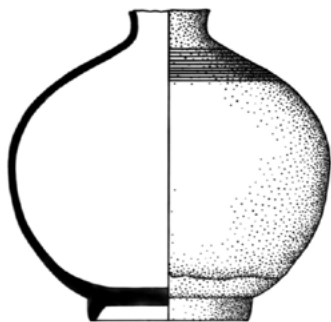
BOTTLES**PK6**

Complete bottle. Globular body. Everted rim. Ridge at base of neck. Coarse orange to deep red body. Blue exterior. Ref: This item is of similar shape to an item viewed in a private collection near the Mae Nam Noi kilns, Harper (1988(ii)) AC15. Similarities may be found between the Ko Si Chang 1 wreck site item (KSC1 1983 234; Green, 1983) and the Ko Kradat wreck site item No.147, Green and Harper (1981).

Items from the Brunei Darussalam site also have some similarities to PK6, with the same flared rim. However, the Brunei items have a foot. They have degraded green-brown glaze, the undersurface appears blue where it has degraded and the unglazed surface has a pink hue, Ref: Elf Aquitaine (undated).

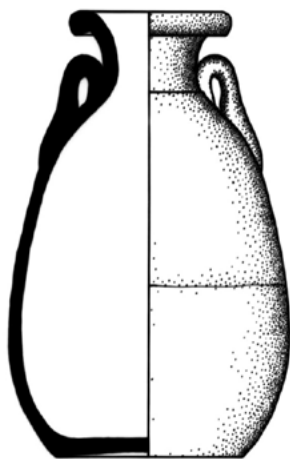
**PK9***

Incomplete bottle. Incised on shoulder. Coarse orange to deep red body with dark purple inclusions of up to 1 mm. Blue exterior. Material analysis reveals that the composition falls within the range of the Mae Nam Noi kilns. Ref: Ko Si Chang 1 wreck site, KSC1 3836 (below).



PK12

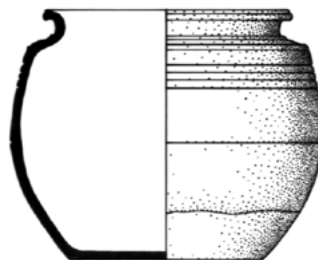
Incomplete globular bottle with foot. Incised at shoulder. Degraded, probably brown glaze. Tubular support mark on base. Ref: Green and Harper (1987) Fig. 10 (Ko Samui, Pattaya, Ko Khram wreck sites, Thailand).



PK3

Pear shaped bottle with everted lip and 2 elongated handles. Coarse body matrix which appears red with a bluish tinge. Probable degraded glaze. Ref: Green and Harper (1987) Fig. 20 from the Ko Si Chang 1 wreck site Thailand and the *Witte Leeuw* wreck site, St. Helena. The Ko Rin ship (above) also carried material of a similar nature. Similarly shaped material has been recorded by Harper (1988 (ii)) from a private collection near the Mae Nam Noi kiln sites. Material analysis of a similarly shaped item from this site (PK19) reveals that the composition falls within the Mae Nam Noi kiln site range.

BOWL

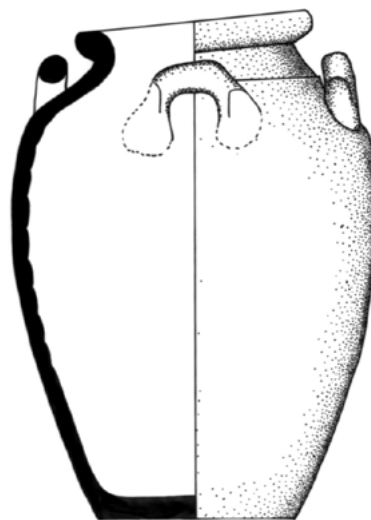


PK21 (1:8)

Complete wide mouthed bowl. Everted, incised rim. Ridged at shoulder and through central body. Flat base. Suggestion of a mark on base where another item may have been fired. Coarse, light orange body. Degraded brown glaze. Ref: Green and Harper (1987) Fig. 23 from the Ko Si Chang 3 wreck site (KSC3 3) though the Prachuap item has a coarser appearance. Similar bowls have been recovered in Sarawak and Brunei. Harper (1988(ii)) has recorded bowls of this shape, with a size variance, from several collections in the Philippines including the J. Toralba site, Mindanao, No. 227. Hutterer (1973) Plate VI A shows a bowl recovered from an excavation in Cebu City, the Philippines. Item CP66 from the Royal Nanhai site (c. 1460), Brown and Sjostrand (2002) has some similar features to the Prachuap Khiri Khan item. Brown and Sjostrand denote a Mae Nam Noi provenance to the Royal Nanhai item. An item from the Ko Samae San site (SS18) more closely resembles the product of the Mae Nam Noi kiln site, Harper (1988(ii)), in shape and general rim treatment. In fact Amdel tests reached a BR/NT result. The Ko Si Chang 3 and Prachuap Khiri Khan items were unable to be tested.

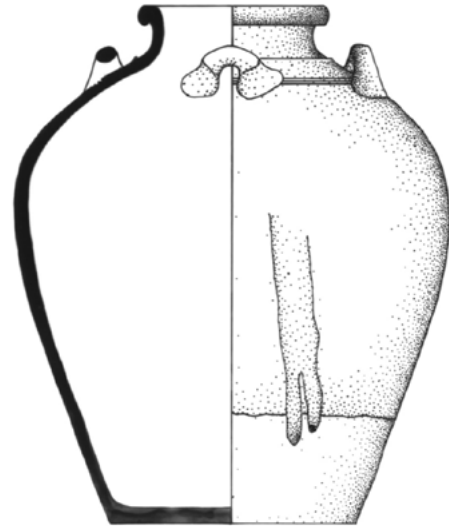
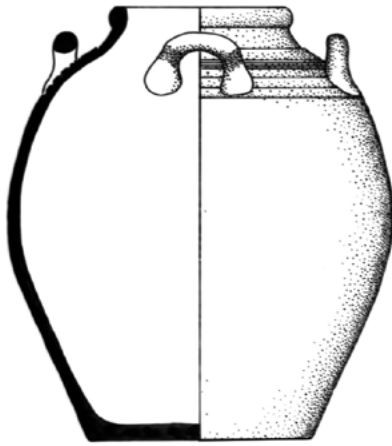
JARS

Refer: PART 3 (below)



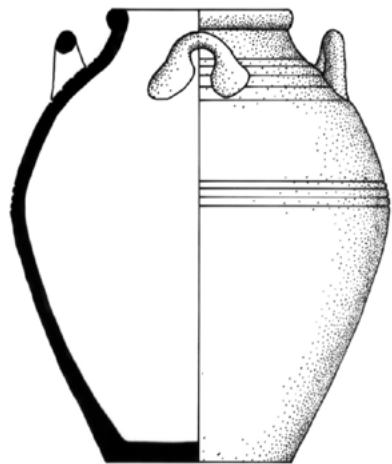
PK1

Complete jar with 4 lug handles. Ridge at base of neck. Coarse dark beige-grey body. Red exterior. Possibly glazed but degraded. Evidence of another item resting on rim during firing.



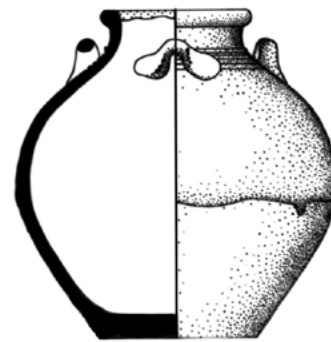
PK24 (1:8)

Almost complete large jar. 4 lug handles. Ridge at base of neck, incised on shoulder. Rough, flat base. Orange-red body. No evidence of glaze. A bundle of iron blades or sickles which had formed a concretion was found inside a jar of this type (PK27). Ref: Green and Harper (1987) Fig. 29. Another jar has also been recorded by Linehan (1930) Plate X from Pahang and South Kedah, Malaysia.



PK25 (1:8)

Complete large jar. Rolled rim, longer neck than PK14 and PK24. 4 lug handles. Ridge at base of neck and incised at shoulder. Sherd attached to side of jar. Purple-red-grey body. Thin, degraded olive green-brown glaze. Ref: Green and Harper (1987) Fig. 25. Another source of this jars is Pahang, Malaysia, Southeast Asian Ceramic Society (1985) Fig. 290. This type of jar has been recorded by Harper (1988(ii)) from the Mae Nam Noi kiln site and also from private collections in that vicinity.



PK14 (1:8)

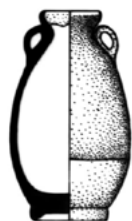
Almost complete large jar. 4 lug handles. Ridge at base of neck, incised on shoulder and waist. Coarse orange to brick red body with blue exterior. No glaze evident.

PK13 (1:8)

Medium jar. 4 lug handles. Mark on rim and also on base where other items may have been positioned during firing. Ridge at base of neck and incised at shoulder. Coarse grey body. Large dark grey inclusions. Degraded green-brown glaze.

Stoneware

JARLET



PK15*

Almost complete ovoid jarlet with 2 ring handles and a foot. Medium coarse pink-grey body with granular matrix. Degraded brown glaze. Jarlet PK30 was of a similar shape but with rings at the neck-shoulder join. Ref: Green and Harper (1987) Fig. 6, the Ko Kradat wreck site and the Samae San site, Thailand; Calatagan and Cebu sites, the Philippines; Sumatra, Java and Kalimantan, Indonesia. A similar item, celadon glazed, came from the Ko Samui wreck site, Thailand, Harper (unpub.).

Items from the Longquan site, Brown and Sjostrand (2002) CP52 left and Ko Rin KL23 (above) are variations of this item, indicating that a jarlet such as this was produced over a long period of time.

Material analyses reveal that this item has a similar composition to products from the Si Satchanalai kilns and as such, these kilns may be considered the possible origin. On the other hand, products from the Mae Nam Noi kilns appear to have a very different composition. As such this area, or at least the area from which the sherds tested by Amdel came, is not considered a possible source for this jarlet as the ferric oxide content of the Prachuap item is far too low.

Metals

IRON

Refer: PART 4 (below)



A bundle of iron blades or sickles was recovered in concreted form from inside Jar PK27. Sixty three iron cleavers in a bundle of 40 cm x 6 cm were recovered from the Pulau Buaya wreck site according to Ridho and Edwards-McKinnon (1998: 84). Warren and Tettoni (1996) Fig. 91 illustrate a variety of devices which may have been of a similar nature.

KO SI CHANG 1 WRECK SITE

This wreck site, investigated briefly in 1982, was reported as wreck site G in Green and Harper (1983). Further excavations took place in 1983 and 1985 and have been briefly described by Green (1983), Green, Harper and Intakosai (1986), Green and Harper (1987), Atkinson, Green, Harper and Intakosai (1989) and Green (1990).

The date of this shipwreck was established in 1983 through the recovery of a porcelain bowl bearing the Chinese inscription 'Da Ming Wanli Nian Zhi (made in the Great Ming year Wanli). Wanli reigned from 1573–1619. Radio carbon dating of timber samples from the vessel resulted in a reading of 1570±90.

Artefacts from the Ko Si Chang 1 ship appear to have originated in Thailand, China, possibly Vietnam and Europe. Excavations at the Thai kiln sites of Mae Nam Noi, Singburi Province, Harper (1988(ii)) and the Ban Tao Hai kiln site, Phitsanulok, Hein and Sangkhanukit (1987) reveal possible sources for some of the material. It is unlikely that any Ko Si Chang 1 wares had their origin at the Sukhothai or Si Satchanalai kiln sites.

*Ceramics***Earthenware**

FIGURINE



KSCI 85 4009

Beige body. Square hole underneath.

LIDS



KSCI 1168

Incomplete item. Smooth, light grey body with rough base. Ref: Green and Harper (1987) Fig. 16(d), Ko Samae San site and Pattaya wreck site.

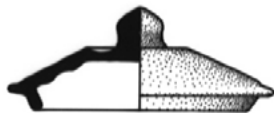


KSCI 3905

Incomplete item. Smooth, grey-beige body.



KSC1 3896
Incomplete item. Smooth black body.



KSC1 2308
Complete item. Soft black body.



KSC1 3548
Incomplete item. Smooth black body.



KSC1 3895
Orange-beige body. Ref: Ko Khram, KKH12 (above). This style of lid was recovered from many sites throughout Southeast Asia. It was also recovered from the Brunei Darussalam wreck site together with dome shaped lids with tubular handles of the same style as Green and Harper (1987) Fig. 16a, from the Ko Si Chang 1 wreck site, but smaller and of a smoother body than the item from Brunei on display at the Fremantle Maritime Museum in 2005. The Ko Si Chang 3 ship also had a somewhat similar style of dome shaped lid, Green *et al.* (1987) KSC3 472.



KSC1 3546
Orange-beige body. Like on some of the lids of this style illustrated in previous Ko Si Chang 1 reports, an item from the Phu Quoc site, Blake and Flecker (1994) Fig. 17 had a sealant attached to the convex surface.



KSC1 486
Slightly coarse body, with mica flecks. Beige-grey body. Potter's string marks on undersection.

POTS—WITH PRESSED DECORATION

See Green and Harper (1987) Figs. 17b and c for sites with similar items. Reference should also be made to similar items from the Ko Khram site (above) and to the 'Medieval Vessel',

Christie's (1989) Nos 47–50. It is noteworthy that some of the designs from the Bang Tao Hai kilns, Phitsanulok, Hein and Sangkhanukit (1987) are similar to some shown here. This author does not assume that this kiln site is the place of manufacture of the Ko Si Chang 1 items since this type of material could be produced throughout the region.

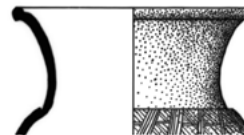
This type of item has often been referred to as a 'rice pot'. The shape does not concur with such usage in cooking. It is possible that such a pot was used for the dry storage of rice in combination with an earthenware lid. Because there are variations in size and shape of these jars, it is likely that they were of multipurpose usage.



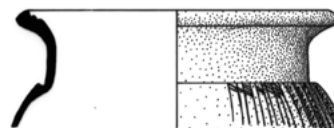
KSC1 483
Beige-grey body.



KSC1 426
Beige-grey body.



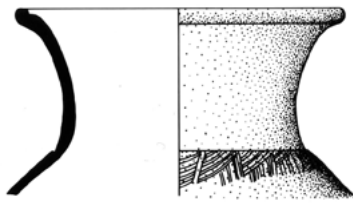
KSC1 156
Beige-grey body.



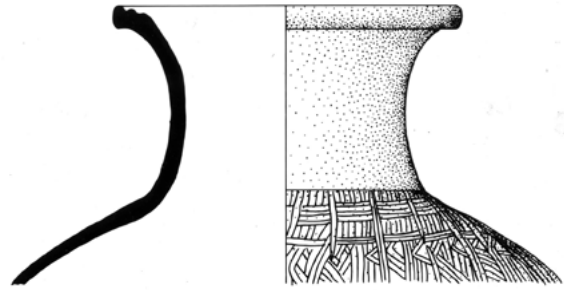
KSC1 603*



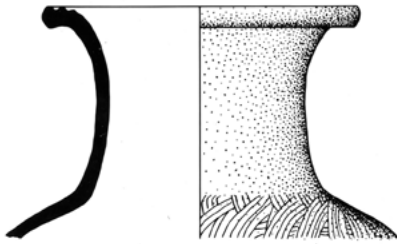
KSC1 604
Beige-grey body.



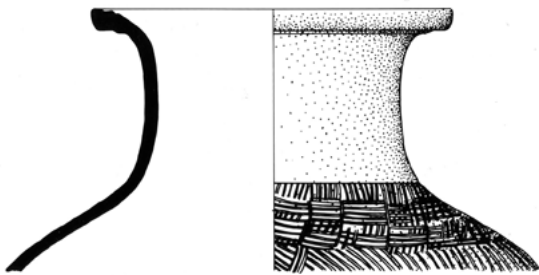
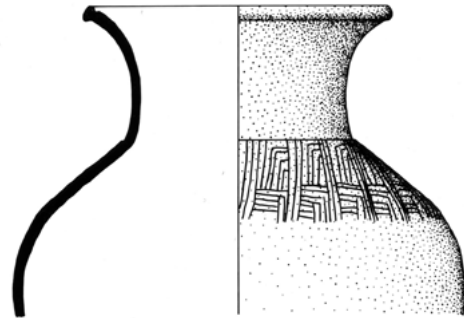
KSC1 85
Beige body.



KSC1 631
Light orange-beige body.

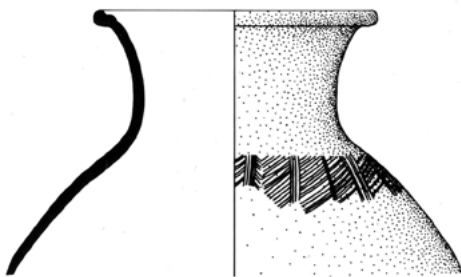


KSC1 547
Light orange body.

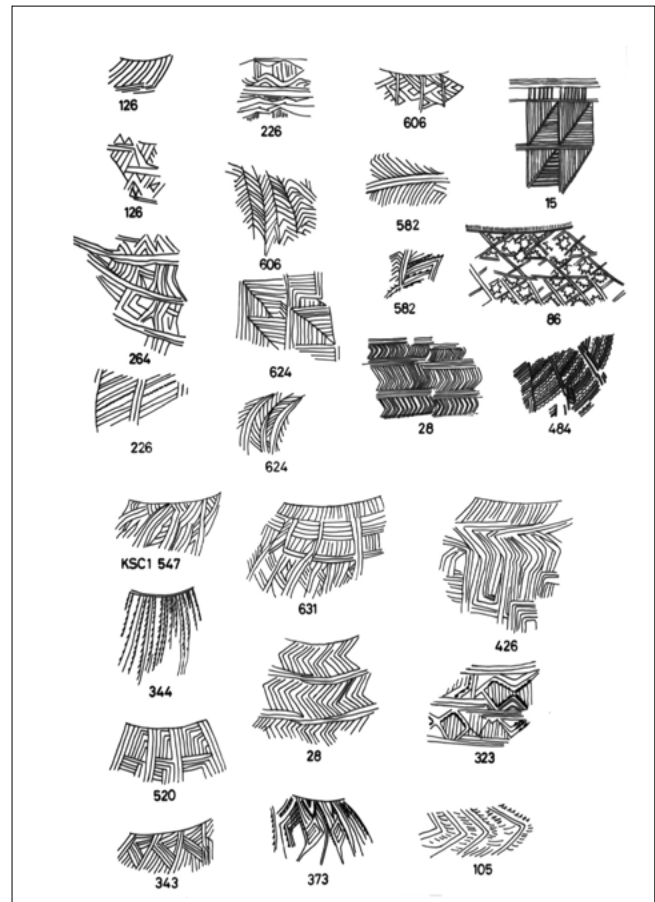


KSC1 520
Beige-grey body.

KSC1 50*
Beige body.



KSC1 425
Beige-grey body.

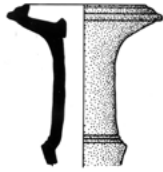


Examples of pressed decoration on earthenware sherds. Almost all had beige-grey body. In reference to KSC1 86 see Soldheim (1967) Plate 111b from a southern Thailand archaeological site. Note drawings not to scale.

KENDI

A large number of fluted kendi were excavated from this wreck site. The neck sherds recorded here differ to the more common types illustrated in previous Ko Si Chang 1 wreck site reports. The fluting on the body was added after the kendi was formed. The volume of a complete kendi (KSC1 1983 515) was measured as around 1760ml. Ref: Ko Rin wreck site (above).

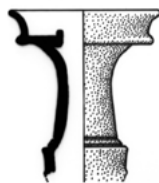
Some scholars believe that the grey-black fluted kendi of the type recovered from the Ko Si Chang 1 and Ko Rin sites were manufactured in the south of Thailand. The kendi has played an integral part in Islamic ritual—for instance, the pouring of water over the feet before prayer. Spinks (1976: 190) ‘Originally in Thailand and elsewhere in Southeast Asia, the kendi appears to have been used primarily for dispensing medicines to a patient in a prone position, or as ritual vessels for pouring lustrations...’ At the same time, various types of kendi sherds have been recovered from many Thai sites including Si Satchanalai and the Mae Nan Noi kiln site areas indicating that they may have been used for everyday domestic purposes.



KSC1 35
Kendi neck.
Smooth, dark-grey body.



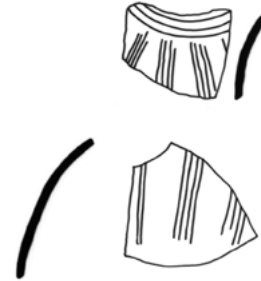
KSC1 69
Kendi neck.
Fluted rim, medium-grey body.



KSC1 112
Kendi neck.

Smooth, black body. Ref: Harper (1988(ii)) SF2, AC28 special finds from the environs of the Mae Nam Noi kiln site. Apparently this particular shaped neck has been seen on white earthenware kendi at Songkhla Museum, Thailand. According to Adyhatman (1981: 140), some kilns producing kendi have been found near Songkhla.

PROBABLY KENDI—SOFT, SMOOTH BODY



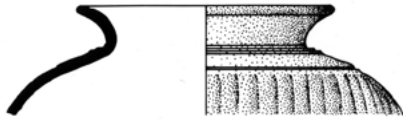
KSC1 783 etc.
Black body, incised. Ref: Pijl-Ketel (1982: 263 bottom) from the *Witte Leeuw*.



KSC1 2317/3457/3536
Beige to medium grey body. Lightly fluted. Interior wheel turn marks. Black decoration incised then possibly filled with colour, as kendi neck KSC1 610, Green (1983). Appears to

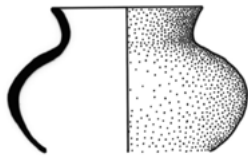
depict a perching bird amongst lotus and leaves. Another deteriorated sherd of this type, possibly forming part of a spout, was found. 5 mm thick.

BOWL—SOFT, SMOOTH BODY

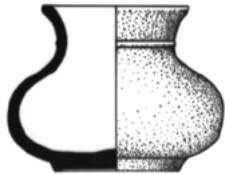


KSC1 3821
Black body, fluted.

JARLETS



KSC1 2334
Soft, smooth grey-beige body.



KSC1 4010
Beige-grey body.

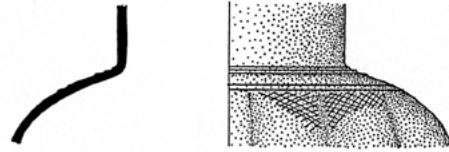


KSC1 3587
Lightly fluted, incised, sgraffito type. Smooth grey-beige body.

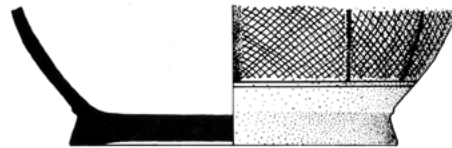


KSC1 3966
Lightly fluted, incised/sgraffito.

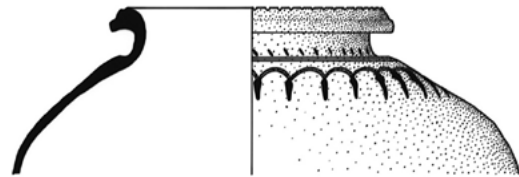
BOTTLE/JAR



KSC1 88
Fluted, incised.

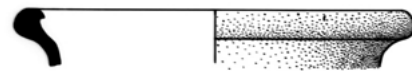


KSC1 3436
Fluted, incised. Mark on base 2-3 mm wide, 6 mm from footrim.

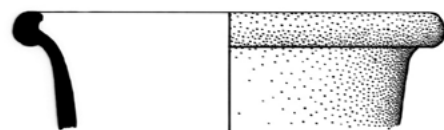


KSC1 54
(35 mm)
Everted rim, 2 lines incised on top of rim. Fluted on top of rim. Incised at neck. Pressed design on shoulder. Light grey-beige body.

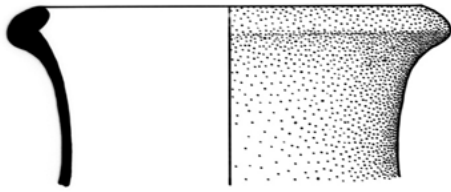
JARS



KSC1 265
Orange-beige body.



KSC1 287
Orange-beige body.

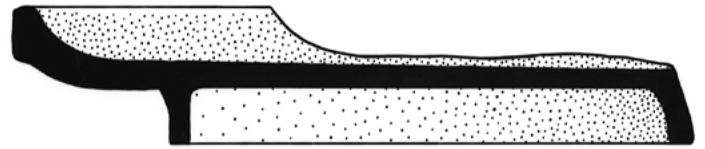
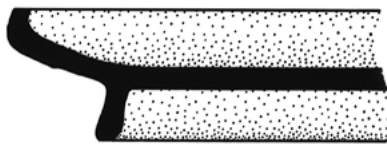


KSC1 543/636
Coarse, sandy, grey-beige body.

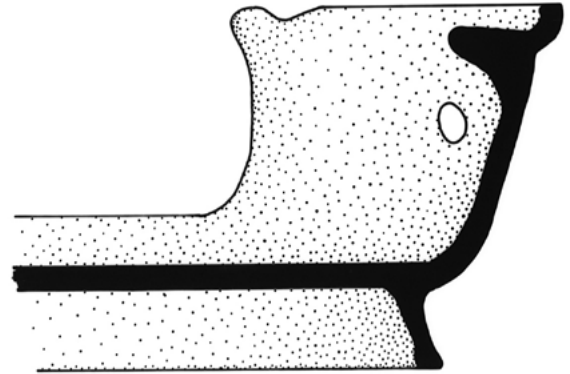
STOVES

Refer: PART 2 (below)

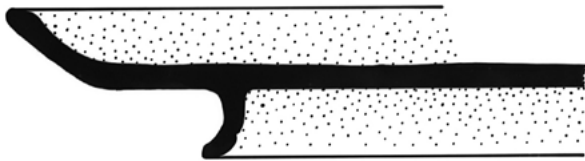
Sherds of at least ten stoves were found on site.



KSC1 103
Grey body.

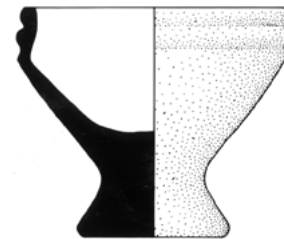


KSC1 401
Stove sherd. Pot support section missing. External ridge.

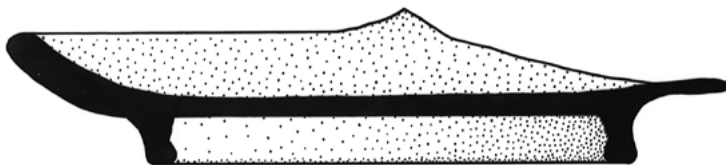


KSC1 255
Pot support section.
Red body. Two holes (air vents) and two of three prongs evident.

Earthenware–Stoneware
MORTAR



KSC1 48
Orange-grey body. Uneven rim.



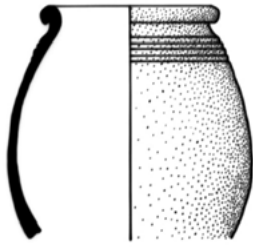
KSC1 213
Reddish-grey body.

KSC1 1195
Orange-grey body with inclusions. Rough base. Ref: Prachuap Khiri Khan site (above).

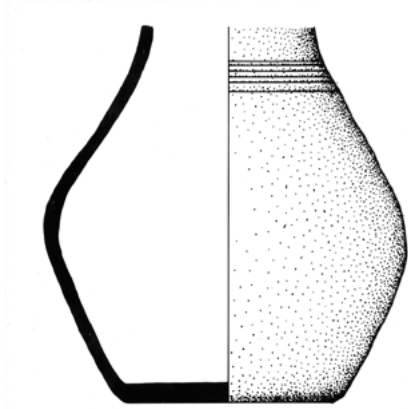
This item is of similar shape to items produced at the Mae Nam Noi kiln site, Harper (1988 ii) however the base of many of those items bore the remains of the clay hump from which they were formed. This was not evident on any of the Ko Si Chang 1 or Prachuap mortars.

Despite a quantity of mortars being recovered from the Ko Si Chang 1 Wreck site no pestles were found. It is possible to assume that the pestles were made locally, perhaps using the heartwood of a tree such as palm.

BOTTLES



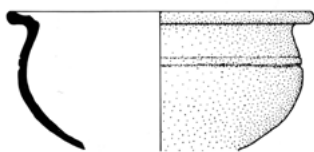
KSC1 923
Medium-grey body, incised.



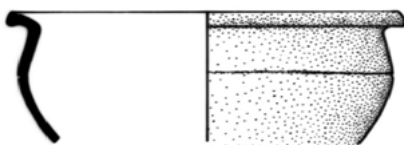
KSC1 3836
Reddish body with blue appearance. Roughly incised as if a thin piece of bamboo was pressed around shoulder. Rough base. Line visible inside footrim. Ref: Prachuap Khiri Khan wreck site PK9 (above).

BOWLS/BASINS EVERTED RIM

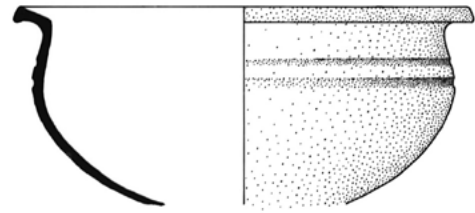
Ref: Green and Harper (1987) Fig 18. This type of bowl has also been recovered from the Ko Rin wreck site, KL189 (above). Similarly shaped items have been recovered at the Ban Tao Hai kiln site, Phitsanulok, Thailand, Hein and Sangkhanukit (1987) Fig. 23, A14475W, A1431EW.



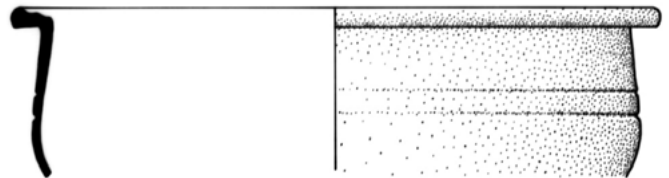
KSC1 308a
Grey-black body.



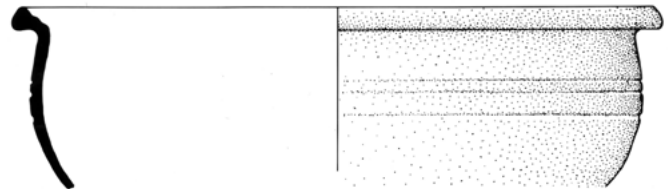
KSC1 308b
Grey-black body.



KSC1 277
Medium grey body.

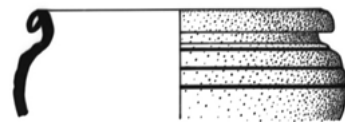


KSC1 279
Smooth grey body.

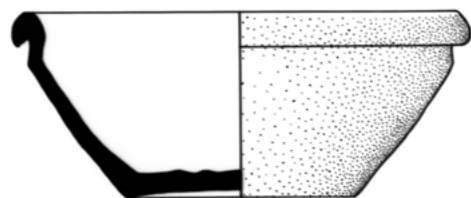


KSC1 308
Grey-black body.

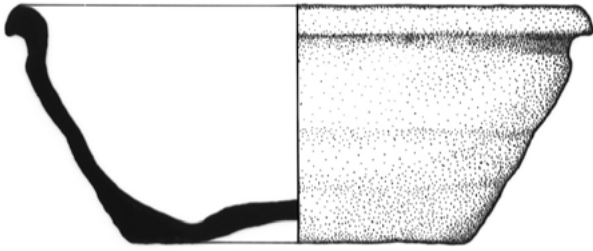
BASINS



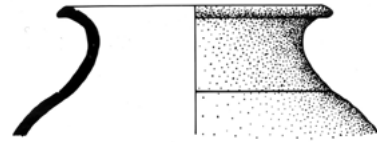
KSC1 3552
Orange body.



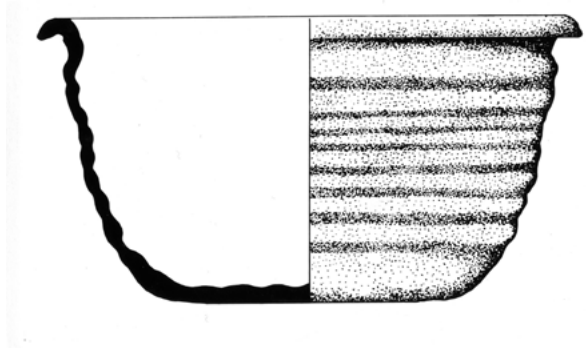
KSC1 3558
Orange body. Ref: Ko Kradat wreck site, Green, Harper and Prischanchittara (1981); the Ko Khram wreck site Plate 47a, Brown (1988); the Ko Rin wreck site KL33 (above) and the Ko Samae San wreck site. The Mae Nam Noi kiln site produced similarly shaped items, Harper (1988 (ii)).



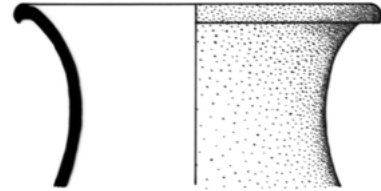
KSC1 187
Grey-beige body between layers of black (not smooth).



KSC1 3518
Orange body.

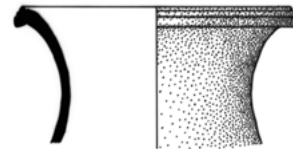
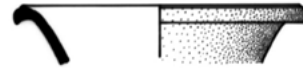


KSC1 2007
Brick red body between layers of blue-grey.



KSC1 2028
An unusual item in that it has a different appearance to the large number of basin sherds recovered from this site. Mark on shoulder where the item probably touched another item during firing. Large incised cross on base.

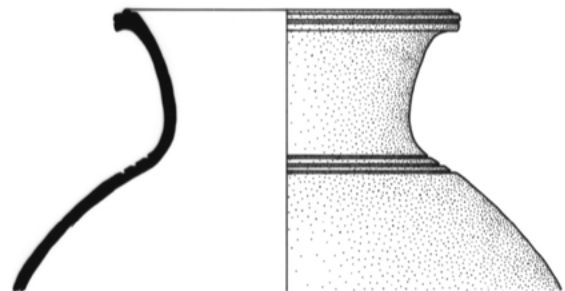
KSC1 3401



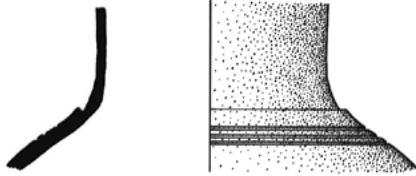
KSC1 564
Pink interior, blue-pink exterior.

KSC1 296* (1:8)
Red to grey body. Design scraped out, about 1 mm deep.. Radius is estimated. Ref: Similar to Mae Nam Noi kiln site find, Harper (1988(ii)) K2Gh18.

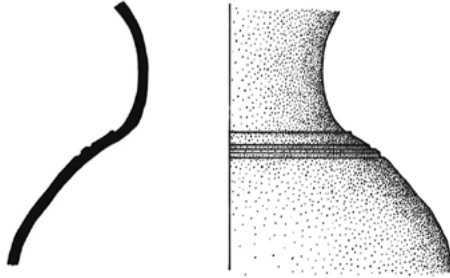
JARS
Refer: PART 3 (below)



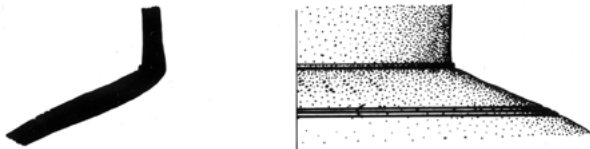
KSC1 160*
Yellow-beige body with smoky grey appearance. Ref: Green and Harper (1983) P129 Pattaya wreck site. Hein and Sangkhanukit (1987) Photo 5 No. A1351EW illustrate what appears to be a similarly shaped item from the Ban Tao Hai kiln site, Phitsanulok.



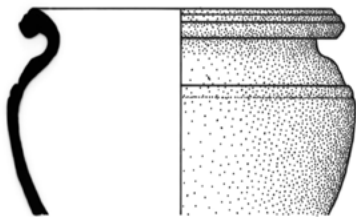
KSC1 55
Red body between layers of medium-grey. Fairly smooth.



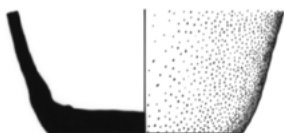
KSC1 412
Thin black layer interior and exterior body.



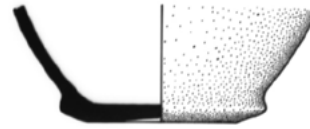
KSC1 124
Pressed decoration. Coarse mauve-grey body with inclusions. Ash glaze. Remains evident of what was probably a vestigial handle over incised lines at shoulder.



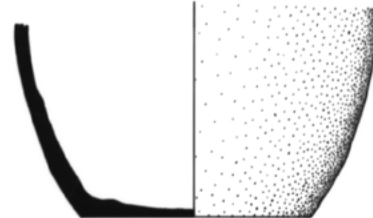
KSC1 80
Mauve-grey body.



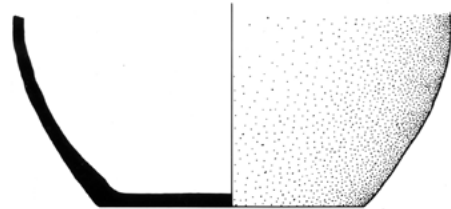
KSC1 2344
Red internal body, blue appearance.



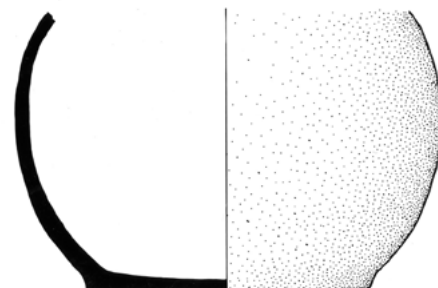
KSC1 828/1498
Carved footrim. Orange-beige body.



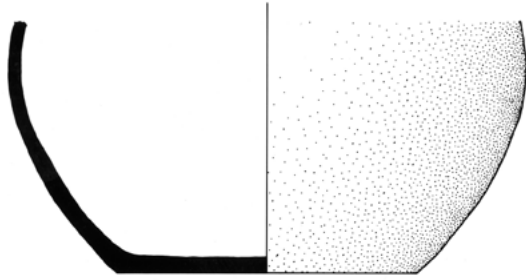
KSC1 987/1004/1497
Mauve-red body between grey layers. Large red inclusions.



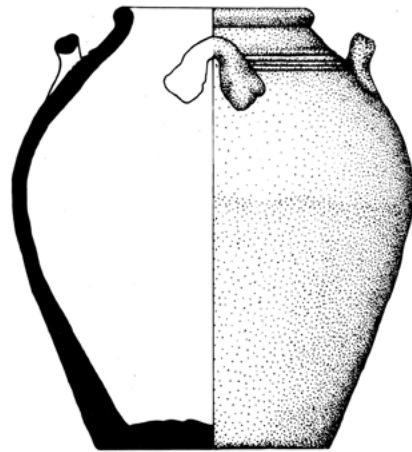
KSC1 252
Blue-pink exterior, pink internal body with large air pockets. External circumference of base scraped to about 10 mm, remainder rough. Item possibly fits with rim KSC1 83 564 (above).



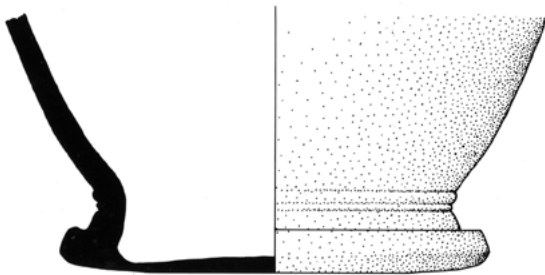
KSC1 221
Orange body.



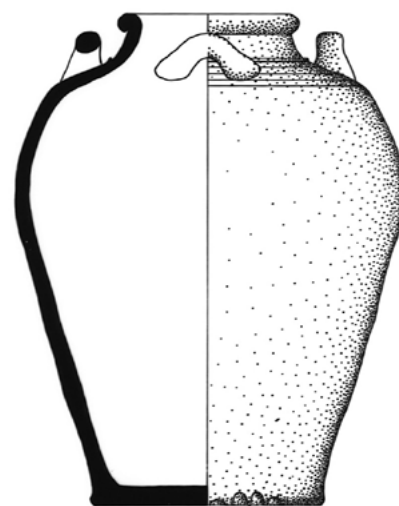
KSC1 220
Light grey body with orange tinge.



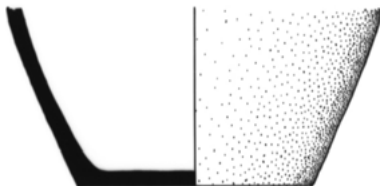
KSC1 3437 (1:8)
Orange exterior with slip. Irregular height. Rough, pitted base.



KSC1 222
Red internal body, grey exterior.



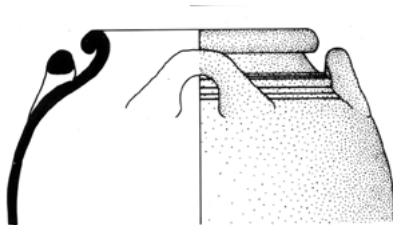
KSC1 723 (1:8)
Dark mauve-grey appearance. Mottled yellow, degraded slip on upper half. Base fairly rough with sherd attached. Evidence of what may be a sealant on top of rim, also possible mark where another item fired above. Probable finger prints around footrim.



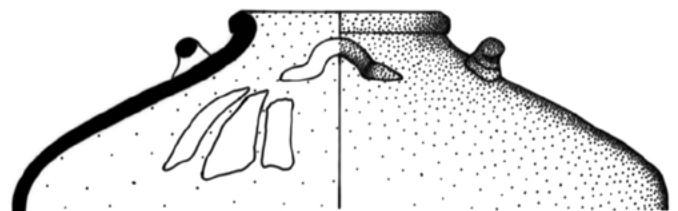
KSC1 3976
Beige body with very large inclusions which, scraped by potter across outside jar, result in scratched, pitted appearance. Remains of a substance, possibly lime, inside jar.

JARS WITH LUG HANDLES
Ref: PART 3 (below)

Stoneware
LARGE JARS—GLAZED



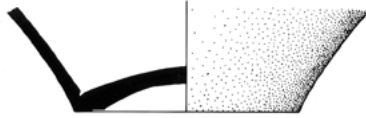
KSC1 83 135
Orange body.



KSC1 194

Sherd section of rim and one handle. Light grey body. Black, deteriorating glaze. Possibly has only three handles. Chinese inscription on shoulder, to right of handle. Ref: A possibly similar sign is shown by Beurdeley (1974: 301) meaning 'complete', a mark of appreciation in the 17th century. Chaffers (1965: 367–8) shows other signs of Ta and Ta chi which translate as 'great' or 'great luck'.

Another possibly similar inscription translates as 'T'ien' 'heaven'. Chaffers notes that this is supposed to be an abbreviation of the reign name T'ien ch'i (1621–27), but says that this is extremely doubtful. See also, the *Witte Leeuw* wreck site, Pijl-Ketel (1982: 223–4).



KSC1 243

Grey body, black glaze inside and outside. Fired ring of glaze inside footrim. Probably fits with KSC1 194 (above).

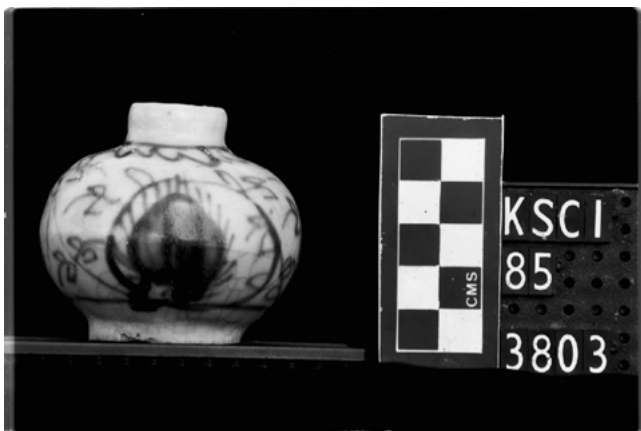
JARLETS

Refer: PART 2 Small Painted Containers (below)



KSC1 193

Deteriorated floral decoration. Light pink-grey body. H 74 mm.



KSC1 3803

RD 22 mm. B35 mm.

Thick glaze, crazed. Pale blue background. Munsell colour 25B 7/0 with dark blue design 10B 3/6, Base has been scraped.

It has been the practice to refer to this type of material as 'Swatow ware'.

The central decoration of KSC1 3803 appears as a flower amongst vegetation, however a closer inspection of similarly decorated items from the Brunei Darussalam shipwreck, Richards (2003 frontispiece, 14 & 26) shows that some appear to have an anti-clockwise swirl within the decoration. Pijl-Ketel (1982: 283) illustrates this but with a clockwise swirl. It could also represent a pearl, see Pijl-Ketel (1982: 278). A similar decoration is also illustrated by Rinaldi (1989: Pl. 298), as one of the Eight Buddhist Symbols but it has a star-like object inside. Crow (1976: 70 top right hand) shows an item, painted under glaze, given as 'used for medicine storage, about 2 1/2 – 3 inches (60–75 mm) high, c. 1300–1500'. The Ko Si Chang 1 item has of course been found in a late sixteenth, early seventeenth century context.

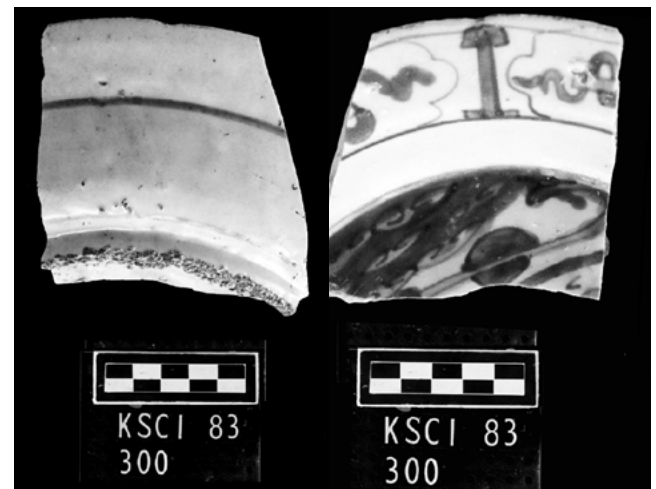
The Binh Thuan ship, said to be probably dated at 1608, on route from China to Johore, Flecker (2004: No. 394), has an item of a similar shape but is slightly more square and the rim slightly everted.



KSC1 3889 (1:2)

Pale blue, somewhat opaque glaze in and out. Paint shows black/brown where not entirely covered with glaze. Base unglazed. RD 32 mm. BD 30 mm. H 54 mm approx.

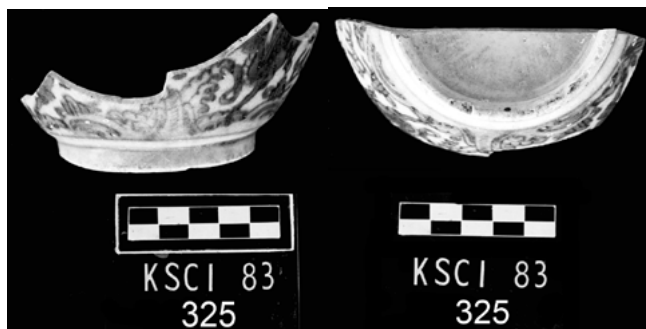
MISCELLANEOUS



KSC1 300

Plate rim and base sherd. Grey-white body which shows red where not covered by glaze. Interior has border with ribbons,

central scene. Sand grains adhering to base. Due to the particular qualities of body and glaze it has been the practice to designate this type of item as 'Swatow ware'. RD140 mm approx., BD75 mm, H51 mm.



KSC1 325

Base sherd (probably a bottle or potiche). White body. Light blue glaze. Exterior decoration: part of dragon, clouds. BD 74 mm.

Porcelain

Ref: PART 2 (below)

MOULDED, RIBBED AND PANELLED CUPS (CROW CUPS) AND SMALL BOWLS

WALLS

These ceramic items are differentiated by the decorative treatments of the narrow panels between the main panels. Due to the nature of sherds, it is not easy to ascertain precisely the system of panelling of the cups and bowls. A sherd determined to fit a particular category may well fit with one from another group within the panelling type.

Where the panelling is unable to be determined (such as KSC1 837 below), the sherd is placed in a category where there are similarities in decoration.

Differentiation between pomegranate, peach and prunus decoration is not always obvious and an estimation is given. Likewise, it is often difficult to ascertain the exact nature of each motif within the narrow panels.

Again, it is difficult to determine exact measurements. Wall thickness varies from between one to three millimetres mainly depending on which section of the complete item the sherd came.

Note: in following, for motives refer to Table 1 on page 84.

TYPE A THE EIGHT PANELS ON BOTH THE INTERIOR AND EXTERIOR ARE OUTLINED WITH A FINE ARCHED LINE ALONG THE JOIN BETWEEN THE LOBES AND THE NARROW PANELS. WITHIN THE NARROW PANELS ARE VARIOUS SYMBOLS. GENERALLY EACH PANEL DIFFERS ONE TO THE OTHER.

Motif A. Simple arched lines over beaded pendants

KSC1 1013 (Figure 5 on page 86) Figure on balcony scene (woman holding scroll). Motifs (ii) RD 130 mm.

KSC1 3434 Woman's figure: Motifs (ii), (iii) (Figure 6 on page 86).



KSC1 837 Figure on balcony. Interior pomegranate.

KSC1 945 (Figure 7 on page 86) Figure on balcony.

KSC1 894 (Figure 8 on page 86) Balcony.

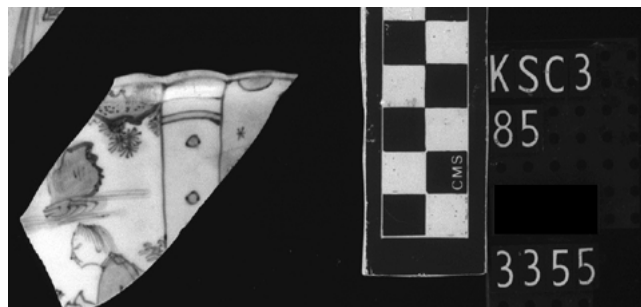
KSC1 741 (Figure 9 on page 86) Balcony. Interior floral.



KSC1 463 Figure. Motifs (ii) (vi).

KSC1 1226 (Figure 10 on page 86) Figure with jar.

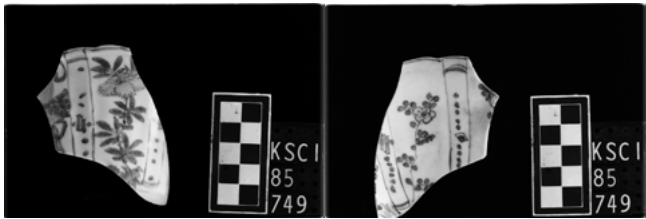
KSC1 1270 (Figure 11 on page 87) Figure and balcony.



KSC1 3355 Figure (No internal view available)



KSC1 772/1712 Bamboo. Figure on balcony. Interior Butterfly, peony. Motifs (iii), (v)



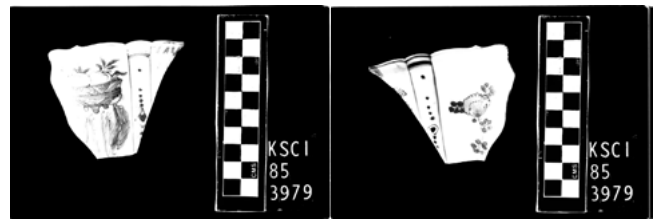
KSC1 749 Tassels and ribbons. Peony. Interior Morning Glory. Motifs (ii), (vi). RD approx. 120 mm



KSC1 746 Possibly peony. Interior peach.
 KSC1 1085 (Figure 12 on page 87) Vase or lantern. Interior Morning Glory. Motifs (iii).
 KSC1 942 (Figure 13 on page 87) Vase. Interior Morning Glory.
 KSC1 1201 (Figure 14 on page 87) Vase. Interior Morning Glory. Motifs (vi) (xix).
 KSC1 1205 (Figure 15 on page 87) Square vase.
 KSC1 755 (Figure 16 on page 87) Square vase.



KSC1 390 Gourd, tassels. Lantern, tassels. Interior Morning Glory or prunus. Floral. Motifs (ii) (vi). RD 150 mm. Likely to fit with KSC1 389 (Motif I below).
 KSC1 1023 (Figure 5 on page 86) Gourd, ribbons and tassels. Interior insect. Motif (vi).
 KSC1 1209 (Figure 17 on page 87) Gourd, tassels, ribbons. Interior floral.
 KSC1 1218 (Figure 10 on page 86) Landscape. Floral.
 KSC1 1094 (Figure 18 on page 87) Vegetation
 KSC1 1210 (Figure 17 on page 87) Landscape. Interior insect or bee.
 KSC1 1020 (Figure 5 on page 86) Bird in landscape.
 KSC1 1033 (Figure 19 on page 87) Landscape. Interior floral.
 KSC1 1668 (Figure 20 on page 87) Deer in landscape. Floral. Interior peach. RD approx. 130 mm.
 KSC1 764 (Figure 21 on page 87) Deer.



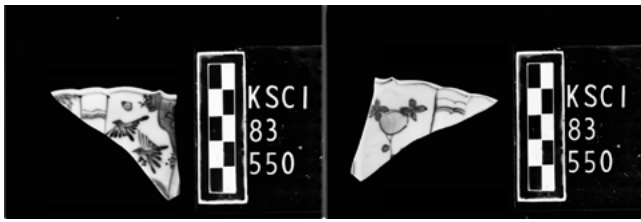
KSC1 3979 Basket in landscape. Interior Morning Glory. Motifs (ii) (iii).
 KSC1 1203 (Figure 22 on page 88) Basket in landscape. Interior butterfly and floral.
 KSC1 1113 (Figure 23 on page 88) Landscape. Motif (ii).



KSC1 382 Basket in landscape. Interior pomegranate.
 Motif A(a). Fluted arched lines, beaded pendants
 KSC1 1198 (Figure 24 on page 88) Floral. Interior peach. RD 120 mm approx.



KSC1 732 Deer. Bamboo. Interior alternates between Morning Glory and peach or pomegranate. Motifs (ii) (iii).
KSC1 1272 (Figure 25 on page 88) Deer in landscape with flying birds. Interior peach. Motifs (iii).



KSC1 550 Flying birds in landscape. Interior peach.
KSC1 1525 (Figure 26 on page 88) Pine trees. Interior Morning Glory. RD 120 mm. Motif (iii).
KSC1 1274 (Figure 27 on page 88) Possibly pine trees. Interior Morning Glory.
KSC1 770 (Figure 28 on page 88) Vegetation.

Motif B. Arched lines, triangulated beads above and below pendants



KSC1 2171 Lantern, ribbons, tassels. Furniture. Interior floral. Motif (i) (iii).
KSC1 3471/2216 (Figure 29 on page 88) Square vase, ornate. Motifs (i), (ii). No internal view available.
KSC1 1199 (Figure 24 on page 88) Vase. Interior Morning Glory.

Motif C. Tight lotus style decoration heads panel

KSC1 1196 (Figure 30 on page 88) Floral and vegetation. Flying bird in landscape. Interior Morning glory. Peach. Motifs (vi) (viii). RD 135 mm.
KSC1 1197 (Figure 30 on page 88) Standing bird in landscape. Peach. RD 125 mm.
KSC1 1263 (Figure 10 on page 86) Floral. Flying bird in landscape. Interior Morning Glory. Peach.
KSC1 1523 (Figure 26 on page 88) Flying bird in landscape. Interior Morning Glory.
KSC1 1008 (Figure 31 on page 88) Landscape. Bamboo. RD 145 mm

Motif D. Bow and short ribbons head panel

KSC1 1265 (Figure 32 on page 88) Figure on balcony. Probably pomegranate. Motif (ii) (iii). R.D. 130 mm.
KSC1 1264 (Figure 32 on page 88) Figure on balcony.

Motif E. Swirl at top of panel

KSC1 1010 (Figure 31 on page 88) Landscape. Motif (v) (xiv). RD 130 mm.
KSC1 892 (Figure 33 on page 89) Possibly figure. Interior foliage. Motif (v) (xv).

Motif F. Swirl and hanging ribbon



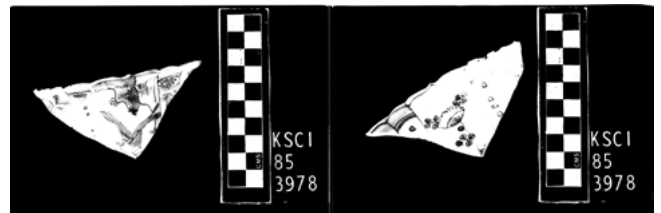
KSC1 383 Possibly a fruit or a bundle, scrolls.



KSC1 1935 Vases.

Motif G. Bow and hanging ribbons

KSC1 846 (Figure 34 on page 89) Ribbons. Vase. Interior probably peach.



KSC1 3978 Bird in landscape. Interior Morning Glory.

Motif H. Hanging ribbons and possible stylized *lingzhi* (sacred fungus)

KSC1 1207 (Figure 15 on page 87) Gourd. Vase. Motif (ii).

Motif I. Hanging ribbons



KSC1 735 Lanterns. Interior Morning Glory. RD150 mm, estimated.



KSC1 2061 Figure on balcony with unusual tree. Interior leaves and insects (No internal view available).



KSC1 389 Vase. Ribbons and probably tassels. Interior possibly insect or stylized bow. RD 150 mm. Motif (iii).



KSC1 385 Furniture. Tassels. Interior foliage.



KSC1 614 Lantern, tassels. Possibly furniture. Interior Morning Glory. Motif (vii).

KSC1 743 (Figure 35 on page 89) Lantern.

KSC1 757 (Figure 16 on page 87) Lantern.

KSC1 953 (Figure 36 on page 89) Lantern. Interior foliage.

KSC1 1325 (Figure 27 on page 88) Square lantern, ribbons, tassels Interior insect.

KSC1 1202 (Figure 22 on page 88) Lantern or gourd, ribbons, tassels. Interior pomegranate.

KSC1 1080 (Figure 37 on page 89) Ribbons. Vase. Interior foliage.

KSC1 1081 (Figure 37 on page 89) Lantern.



KSC1 513 Lantern and tassels. Interior pomegranate.



KSC1 613 Probably tassel.

Motif J. Bow. Straight ribbons joining

KSC1 1073 (Figure 38 on page 89) Furniture and balcony. Interior pomegranate. Motif (iii).

Motif K. Consecutive panels have stylized bow above another bow on hanging ribbon



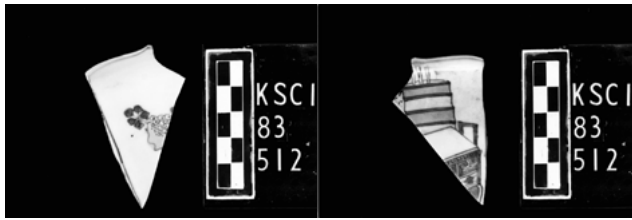
KSC1 3977 Vase. Tassels, ribbon. Interior Morning Glory repeated. Motif (xiv)

Consecutive panels have stylized bow and possible Motif G. Type ribbons.

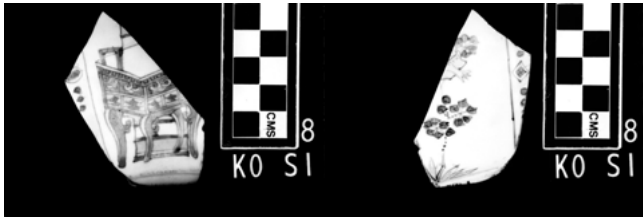
KSC1 1200 (Figure 39 on page 89) Vase. Foliage and fruit. RD 120 mm.

TYPE A MISCELLANEOUS

KSC1 1077 (Figure 40 on page 89) Rock. Vegetation. Interior vegetation.



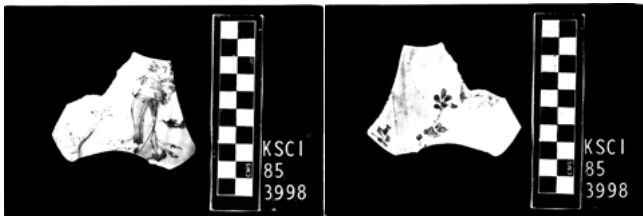
KSC1 512 (Joins with KSC1 8) Altar. Interior—Morning Glory. Motif (ii) and (iii)



KSC1 8 Furniture. Interior Morning Glory.



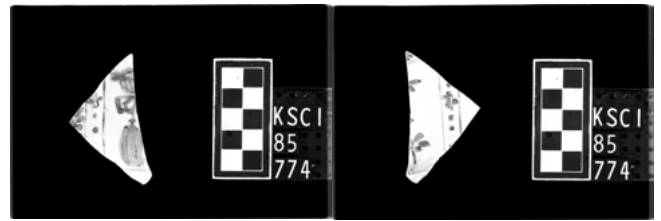
KSC1 2102 and KSC1 1641 (Figure 60 on page 91) Furniture on balcony (possibly altar). Figure. Interior Morning Glory, vegetation. Motif (xv). Possibly similar decoration as KSC1 1265 (above).



KSC1 3998 Figure with dish.



KSC1 589 Unidentified. Motif (ii) (xv).
KSC1 1271 (Figure 11 on page 87) Vase. Interior Morning Glory. Motifs (ii) (x).
KSC1 1275 (Figure 27 on page 88) Gourd, tassel, ribbons. Interior Morning Glory. Motif (v) (xi).
KSC1 1204 (Figure 15 on page 87) Lantern, ribbons. Interior Morning glory. Motif (viii).



KSC1 774 Artemisia leaf, tassels, ribbons. Interior vegetation. Motif (vi).

KSC1 842 (Figure 41 on page 89). Probably furniture. Motif (ii).

KSC1 1088 (Figure 12 on page 87). Tassels and ribbons. Interior peach.

KSC1 742 (Figure 35 on page 89) Vase. Vase. Interior vegetation.

KSC1 765 (Figure 42 on page 89).

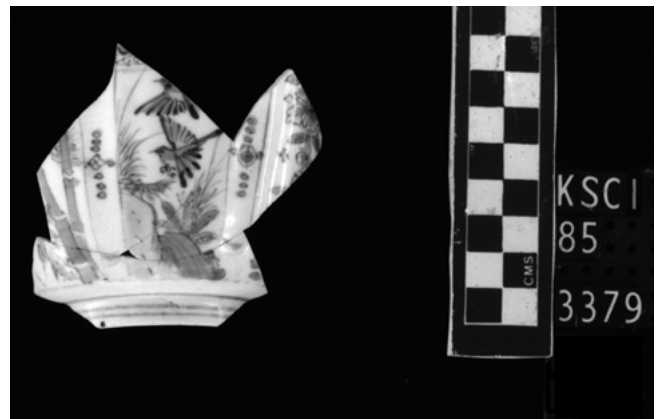
KSC1 766 (Figure 42 on page 89) Possibly balcony. Landscape.

TYPE B THE EXTERIOR NARROW PANEL IS OUTLINED AS IN TYPE A BUT THE INTERIOR MAIN PANEL HAS A SINGLE LINE BETWEEN EACH PANEL. DECORATIONS ARE SIMILAR TO TYPE A.

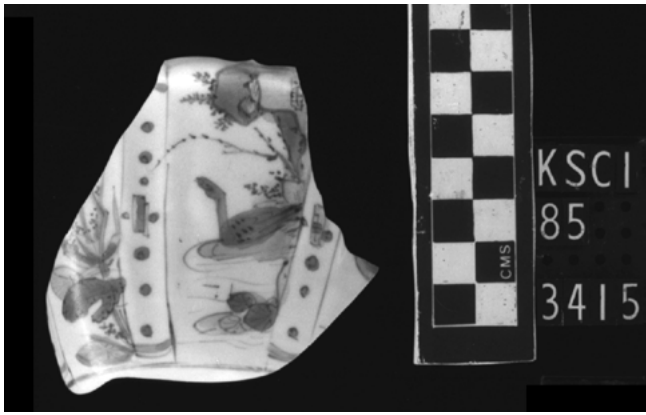
Motif A. Simple arched lines over beaded pendants in consecutive panels



KSC1 2079 Landscape. Bamboo and clouds. Interior peach or pomegranate. This sherd possibly fits with KSC1 2219/1026 and KSC1 3986 (below). Motifs (ii) (viii). RD 150 mm.



KSC1 3379/1736/2244 Bamboo, birds in flight. Motifs (ii), (iii). No internal view available. Believed to fit into this category.



KSC1 3415 Vegetation, waterbird with possible snake's head, on pond (No internal view available).



KSC1 2219/1026 Bamboo. Birds in flight with vegetation including thorny foliage. Interior vegetation and possibly an insect. Motif (ii) (viii). Oriental Ceramic Society of Hong Kong (1981) No.25 shows a cup designated early 17th century. This item, decorated with birds and flowers in eight panels is less sophisticated and not as well executed as the Ko Si Chang 1 item where the narrow panels are more complex.



KSC1 3986 Bird on rock. Bamboo and clouds. Interior insect and peach.

KSC1 1012 (Figure 5 on page 86) Bird (possibly goose). Floral and possibly insect. RD 120 mm. Motif (viii).

KSC1 1336 (Figure 43 on page 89) Bird in flight. Probable lotus leaf. Interior peach or pomegranate. RD 130 mm.



KSC1 738 Bird on Rock. Interior Morning Glory. RD 120 mm.

KSC1 1674 (Figure 44 on page 90) Bird on rock. Interior peach or pomegranate and insect.

KSC1 1327 (Figure 45 on page 90) Bird on rock. Interior peach. RD 120 mm.

KSC1 1703 (Figure 44 on page 90) Flying bird in landscape. Interior peach or pomegranate.

KSC1 1344 (Figure 46 on page 90) Bird landing in landscape. Motif (viii) RD 120 mm.



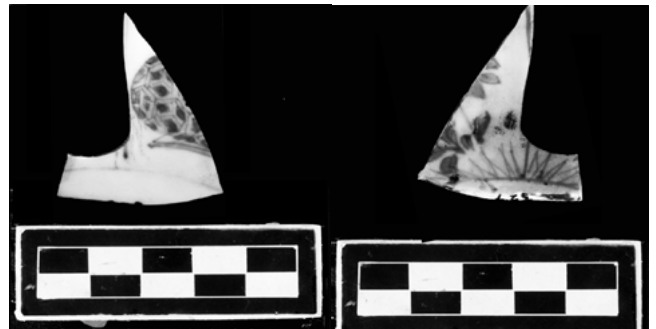
KSC1 591 Flying bird in landscape. Interior Morning Glory.

KSC1 1326 (Figure 45 on page 90) Tree trunk. Interior alternates Morning Glory and peach. RD 120 mm.



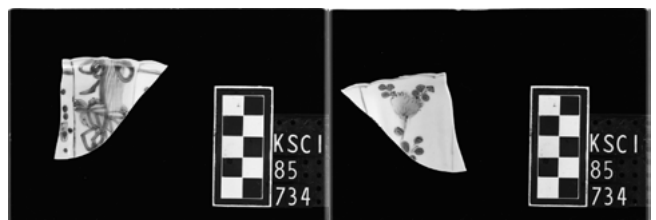
KSC1 747 Lantern. Vase. Motif (ii).

KSC1 1346 (Figure 46 on page 90) Vase. Tassels, ribbons, probably lantern. Interior thorny vegetation and insect. Motif (ii).



KSC1 327 Lantern. Interior vegetation.

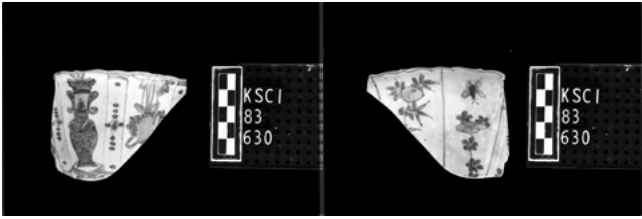
KSC1 1330 (Figure 47 on page 90) Probably lantern and ribbons. Vase on furniture. Interior pomegranate or peach. Motif (vi). RD 140 mm.



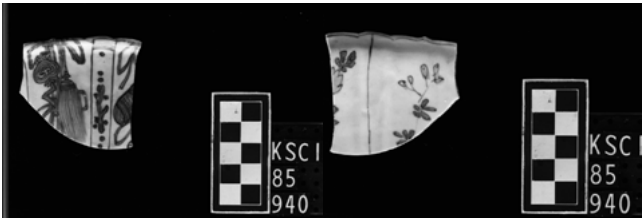
KSC1 734 Artemisia leaf, tassels, ribbons. Interior Morning Glory. Motif (viii) RD 120 mm.



KSC1 736 Ribbons, tassels, Artemisia leaf. Lantern, ribbon, tassels. Ribbons. Interior peach, insect. Motif (ix) (vi).



KSC1 630 Vase. Scroll, ribbons, tassels. Interior alternates between peach and Morning Glory with insect. RD 130 mm approx.



KSC1 940 Tassels, ribbons, possibly lantern. Scroll, ribbons. Interior Morning Glory. Motif (xiii). RD 130 mm.

Possibly Motif A over main central motif

KSC1 1079 (Figure 40 on page 89) Tassels and ribbons. Lantern. Interior Morning Glory and peach or pomegranate. Motif (xiv).

KSC1 1092 (Figure 18 on page 87) Tassels and ribbons. Lantern. Interior vegetation. Motif (xiv).

KSC1 1678 (Figure 44 on page 90) Gourd, tassels, ribbons. Interior peach or pomegranate. RD 120 mm. Motif (xv) and (vi).

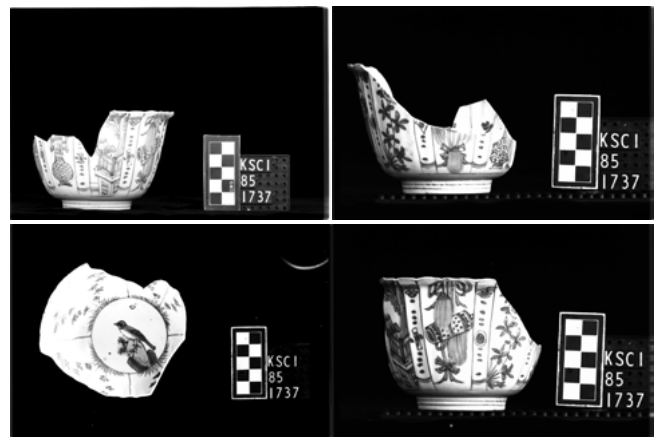
Motif C over beaded pendant possibly alternates with Motif A or Motif A(a)

KSC1 1334 (Figure 48 on page 90) Scrolls, tassels, ribbons. Vase. Alternate peach and insect and Morning Glory. Motif (viii). RD 120 mm.



KSC1 3438 Vegetation. Birds flying. Motifs (viii), (xvii). No internal view available.

Motif C over beaded pendant in consecutive panels



KSC1 1737 Eight panels decorated with: Gourd; Vase; Balcony Scene; Scroll, Tassels, Ribbons; Pomegranate; Tassels; Vase; Unknown. Interior Morning Glory in all panels. Central bird on rock. Motifs (ii) (iii) (viii) (xvi). RD 120–130 mm. H. 80 mm. BD 54 mm. Proportion of 2:3, Height: Diameter define this item as a crow cup according to Rinaldi (1989: Pl. 155). The high bowl 1.4.2 (Pijl-Ketel (1982)) from the *Witte Leeuw* (1612–13), has similar dimensions and though there are similar elements in the decoration, the Ko Si Chang 1 items are more complex and varied. Kilburn (1981) No. 35 under 'Dutch Tableware' shows two 'Wanli/Tiangi 1600–25' items with interior bird on rock scene. One has figures alternating with birds in landscape, the second has champion vases alternating with precious objects tied with tassels and narrow borders between eight sections. Though the exact format of these two cups is not found on the Ko Si Chang 1 items, these are the nearest in terms of form, potting and decoration within the panels and within the narrow panel/borders between the eight panels.

KSC1 1341 (Figure 52 on page 91) Balcony. Gourd, tassels, ribbons. Interior Morning Glory in both panels. Motif (viii). The decoration is similar to KSC1 1737.

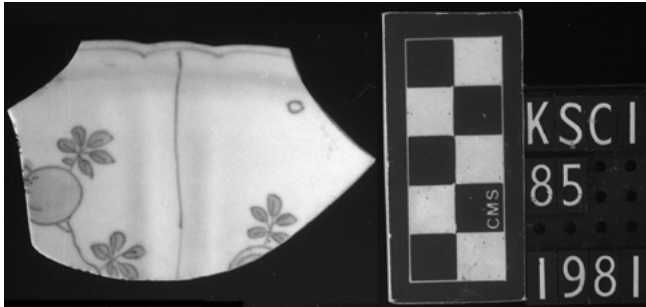
Motif L panel with complex bow and ribbon alternates with Motif A KSC1 1337 (Figure 48 on page 90) Figure. RD 130 mm. A human figure.

Motif M. Stylized bow over two bows on hanging ribbon



KSC1 380 Female figure. Male figure. Interior vegetation and insect.

Motif C. Possibly alternates with Motif M



KSC1 1981/1908 Male figure. Female figure. Interior peach or pomegranate. Motif (xvii). Because KSC1 1981/1908 and KSC1 380 seem so similar in terms of the main decoration it would appear that they could be from the same item. If this is the case then the lotus panel (Motif C) and bow and ribbon (Motif M) alternate which is the case in Rinaldi (1989: Pl.165) though the narrow panels of the latter are not so finely executed as those of the Ko Si Chang 1 item.

Motif N. Consecutive panels of lotus variant with complex beaded pendant



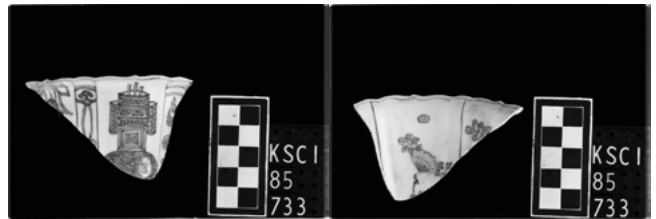
KSC1 297 Vase. Interior unusual leaf. Motif (i) (iv). RD approx. 150 mm.



KSC1 257 Vase. Probably peach, insect. Motif (i) (iv). RD approx. 160 mm.

KSC1 838 (Figure 49 on page 90) Tassels and lantern. Interior peach or pomegranate.

Motif O. Upward lotus or bow, hanging ribbons. Alternates with an unknown motif



KSC1 733 Ribbons. Vase. Morning Glory. RD 125 mm.

KSC1 1075 (Figure 50 on page 90) Vase. Interior Morning Glory.

Motif J. Consecutive panels



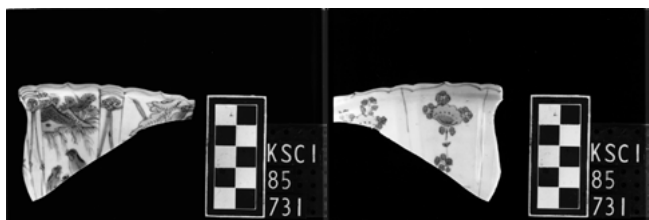
KSC1 2248 Bamboo. Bird on rock within vegetation. Probably floral. Interior Morning Glory in each panel.

KSC1 893 (Figure 8 on page 86) Bird on rock. Interior Morning Glory.

KSC1 1352 (Figure 51 on page 90) Bamboo. Interior vegetation. RD 130 mm.

KSC1 1333 (Figure 47 on page 90) Bamboo. RD 120 mm.

KSC1 1335 (Figure 43 on page 89) Goose in flight. RD 120 mm.



KSC1 731 Bird on rock in landscape. Vegetation or landscape. Interior Morning Glory in each panel. RD 120 mm.

KSC1 1084 (Figure 12 on page 87) Bird on rock. Interior vegetation.

KSC1 1671 (Figure 20 on page 87) Bird on rock and trees. Interior Morning Glory. RD possibly 140 mm.

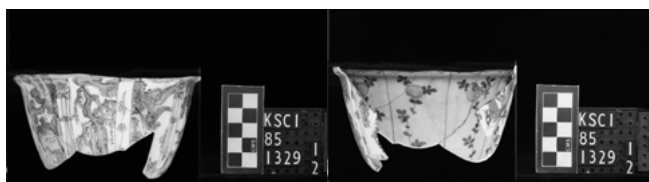
KSC1 1677 (Figure 44 on page 90) Probably vase. RD 130 mm.

KSC1 1702 (Figure 44 on page 90) Bird and vegetation. Interior Morning Glory.

KSC1 1338 (Figure 52 on page 91) Bird in flight. Interior vegetation.

KSC1 1328 (Figure 45 on page 90) Birds. Interior peach or pomegranate. RD 130 mm.

Motif M. Stylized bow above two bows on hanging ribbon. Alternates with Motif P



KSC1 1329/183/461 Probably bird in flight. Pine tree. RD 130 mm. Interior peach or pomegranate. See also (Figure 48 on page 90) for individual sherd.

KSC1 1009 (Figure 31 on page 88) Probably bird in flight in landscape. Pine tree. Bird. Interior peach. RD 130 mm. Forms part of KSC1 1329 above.

KSC1 1076 (Figure 50 on page 90) Bird on rock and floral. Interior cicada or bee and peach.

KSC1 745 (Figure 58 on page 91) Bamboo and bird. Interior peach. KSC1 1075 Vase. Part of balcony or furniture. Interior vegetation.

Motif M. Alternates with beaded pendant

KSC1 1078 (Figure 40 on page 89) Bamboo. Interior Morning Glory. Motif (vi).

Motif P. Central stylized leaf and flower alternates with Motif K. KSC1 1670 (Figure 20 on page 87) Tassels, ribbons. Basket. Interior peach. RD 130 mm.

Type B Miscellaneous

KSC1 839 (Figure 49 on page 90) Landscape.

KSC1 1422 (Figure 54 on page 91)

KSC1 1423 (Figure 53 on page 91) Possibly part of balcony. Vase. Interior peach.

KSC1 1424 (Figure 53 on page 91) Bamboo.

TYPE C THE EXTERIOR HAS 2 FINE LINES CLOSE TOGETHER BETWEEN THE LOBES. THE INTERIOR HAS A SINGLE LINE.

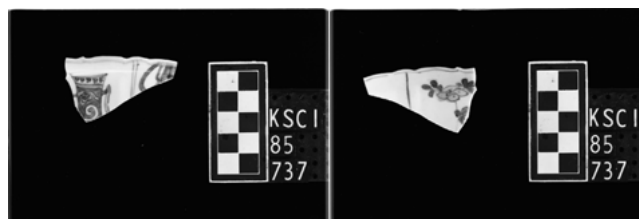
KSC1 941 (Figure 13 on page 87) Ribbons. Vase. Interior thorny branches in each panel.



KSC1 589 Vase. Interior thorny branches.

KSC1 954 (Figure 36 on page 89) Vase.

KSC1 1644 (Figure 55 on page 91) Vase. Ribbons, scroll, tassel. Interior Morning Glory.



KSC1 737 Vase. Ribbons. Interior Morning Glory. RD 120 mm.



KSC1 750 Scroll. Vase. Interior Morning Glory. RD 115 mm approx.

KSC1 1427 (Figure 56 on page 91) Vase with decoration of horse. RD 120 mm.

KSC1 1642 (Figure 60 on page 91) Vase. RD 130 mm.



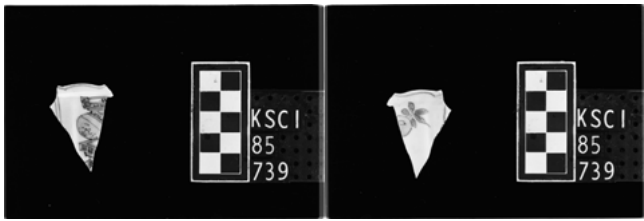
KSC1 462 Scroll, tassels, ribbon. Interior pomegranate.

KSC1 840 (Figure 41 on page 89) Vase. Ribbons. Interior vegetation.

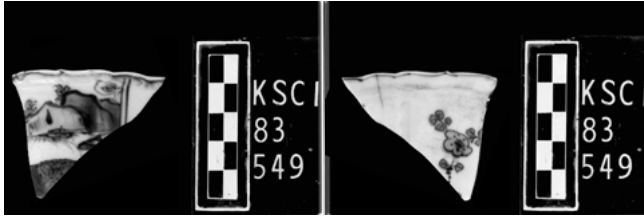
KSC1 771 (Figure 28 on page 88) Ribbons.

KSC1 1426 (Figure 56 on page 91) Scroll, tassels, ribbon. Basket on furniture. Interior peach alternates with Morning Glory. RD 130 mm.

KSC1 1425 (Figure 53 on page 91) Vase. Basket in landscape or on furniture. RD 120 mm.



KSC1 739 Item on furniture. Interior peach.



KSC1 549 Landscape, possibly with a deer.

KSC1 1434 (Figure 56 on page 91) Bird on rock. Vegetation. Bamboo.

KSC1 1645 (Figure 55 on page 91) Birds, mountains. Bamboo.

KSC1 1654 (Figure 55 on page 91) Warbling bird on rock, vegetation.

KSC1 1011 (Figure 31 on page 88) Birds in landscape. RD 120 mm.

KSC1 1034 (Figure 19 on page 87) Insects. Interior peach. RD 120 mm.



KSC1 381 Bamboo. Interior peach. RD 130 mm approx.

KSC1 1643 (Figure 55 on page 91) Bamboo. RD 130 mm.

KSC1 1646 (Figure 55 on page 91) Deer in landscape.

Pine. Interior Morning Glory. RD 120 mm.

TYPE D FEINT LINES DIVIDE BOTH THE EXTERIOR AND INTERIOR LOBES/MAIN PANELS. DECORATION FLOWS BETWEEN THE EXTERIOR LOBES.

KSC1 1331 (Figure 47 on page 90) Lotus pod and clouds. RD 150 mm.

KSC1 1361 (Figure 51 on page 90) Leaf or insect. Interior moon and vegetation.

KSC1 1342 (Figure 52 on page 91) Bird (missing head), clouds, vegetation.

KSC1 1082 (Figure 37 on page 89) Bird in landscape.

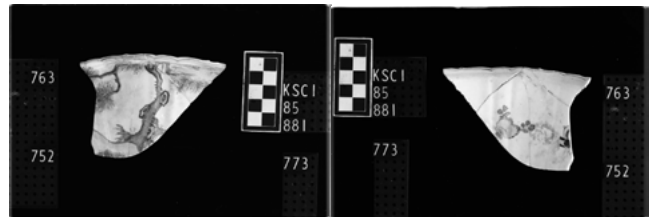
KSC1 1348 (Figure 46 on page 90) Vegetation. RD 140 mm.



KSC1 1421 Furniture in room including cat on stool. Interior insect, peach.

KSC1 1669 (Figure 20 on page 87) Bird in flight, insect or bee, floral and vegetation. Interior peach or pomegranate. RD 130 mm.

TYPE E NO LINES EVIDENT ON EXTERIOR OR INTERIOR OF BOWL.



KSC1 752/763/773/881 Pine tree. Insect (possibly butterfly) and vegetation. KSC1 RD 140 mm.

GENERAL MISCELLANEOUS

KSC1 1214 (Figure 17 on page 87) Basket on furniture. Cartouche. Interior pomegranate.

KSC1 899 (Figure 57 on page 91) Possibly similar decoration as KSC1 2102 and KSC1 1265 above.



KSC1 751 Female figure carrying bundle in landscape.

KSC1 1089 (Figure 18 on page 87) Figure carrying bundle.

KSC1 767 (Figure 42 on page 89) Landscape.

KSC1 1039 (Figure 19 on page 87). Head of person.

KSC1 744 (Figure 58 on page 91) Tassels, probably lantern. Interior foliage.

KSC1 1093 (Figure 18 on page 87) Bird. Interior moon.

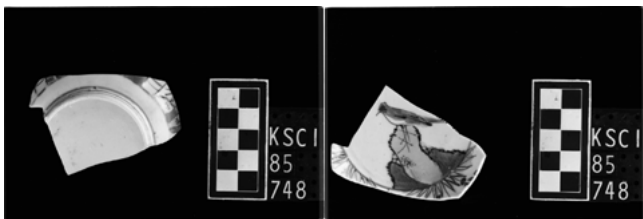
BASES

INTERIOR BIRD ON ROCK DECORATION

- KSC1 1068 (Figure 19 on page 87) BD 50 mm.
- KSC1 1070 (Figure 38 on page 89) BD 51 mm.
- KSC1 1266 (Figure 59 on page 91) BD 52 mm.
- KSC1 1267 (Figure 59 on page 91) BD 51 mm



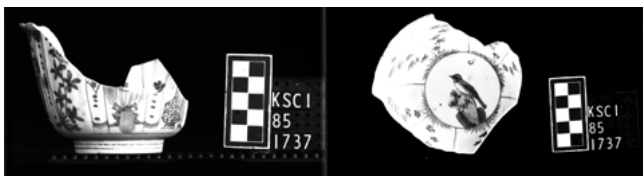
- KSC1 60 BD 53 mm.
- KSC1 1638 (Figure 26 on page 88)
- KSC1 1639 (Figure 60 on page 91)
- KSC1 1640 (Figure 60 on page 91)
- KSC1 1734 (Figure 44 on page 90)



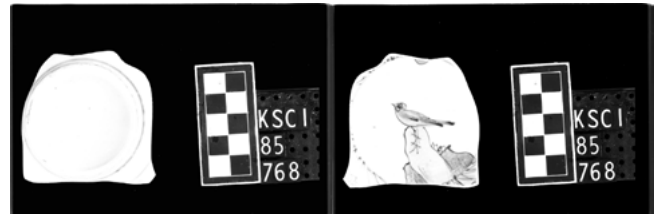
- KSC1 748 BD 53 mm.
- KSC1 1268 (Figure 59 on page 91) BD 50 mm.
- KSC1 1641 (Figure 60 on page 91) BD 54 mm.



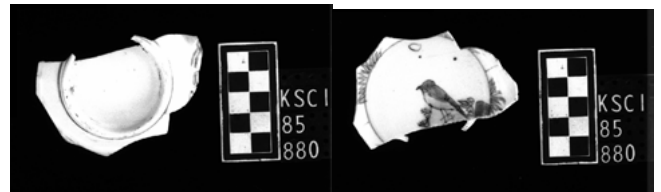
- KSC1 18 BD 68 mm
- KSC1 1419 (Figure 51 on page 90) BD 51 mm.



- KSC1 1737 BD 54 mm. See description under KSC1 1737 above.
- KSC1 1071 (Figure 38 on page 89)



- KSC1 768 BD 51 mm.



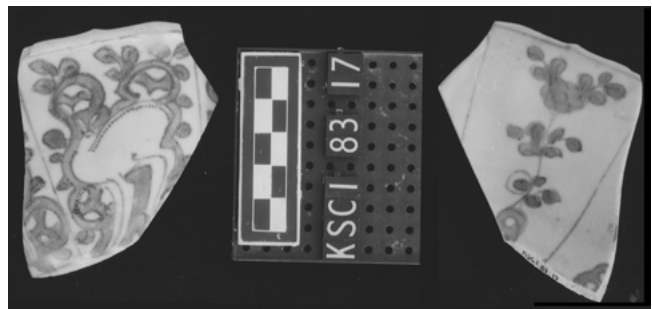
- KSC1 880 BD 49 mm.
- KSC1 1069 (Figure 38 on page 89) BD 53 mm.



- KSC1 759 BD 55 mm.



KSCI 89 BD 50 mm.
 KSCI 1420 (Figure 54 on page 91) BD 50 mm.
 KSCI 1735 (Figure 44 on page 90) BD 55 mm approx.

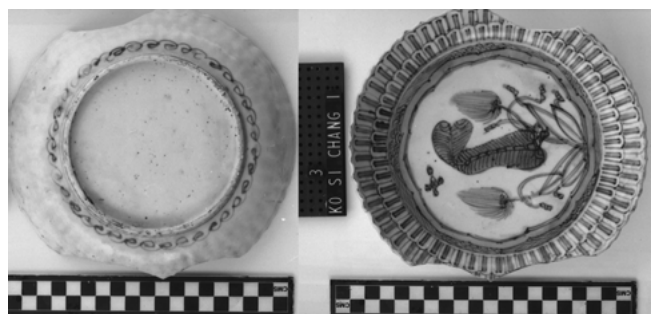
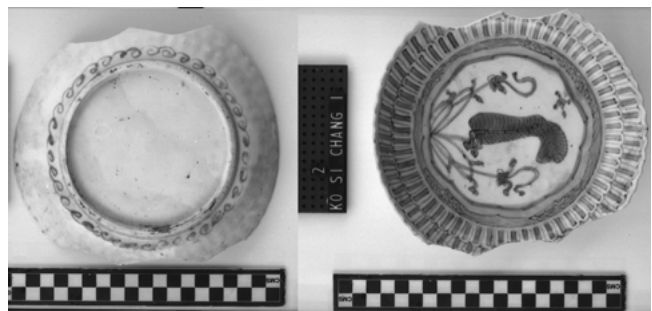


KSCI 17/388 Stylized deer. Central deer with peach and cash type motifs. Interior vegetation and cash type motifs. RD 156 mm, BD 59 mm H 76 mm. Because of its dimensions, height: diameter 1:2, this item falls into the category of bowl.



KSCI 60A

PLATES/DISHES (KLAPMUTSEN STYLE)



MISCELLANEOUS BASES

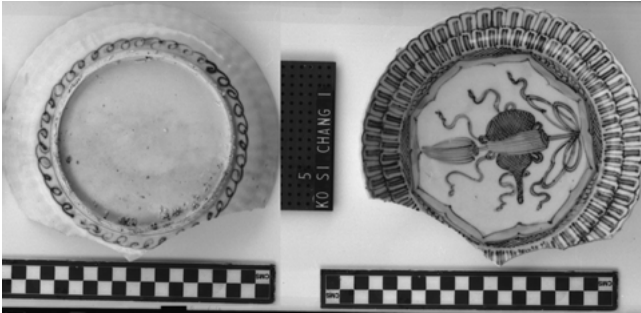
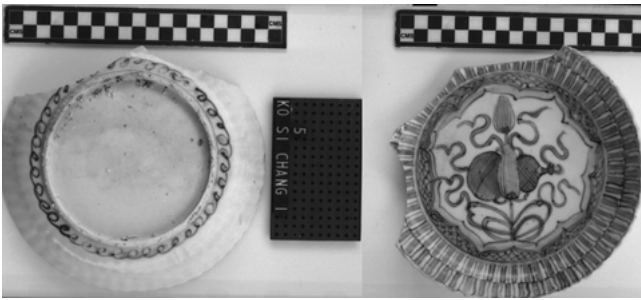


KSCI 7 BD 50 mm. Exterior Vase. Interior floral.
 KSCI 2295 Recorded but not drawn or photographed. Base sherd of possible ribbed bowl. Design undetermined (resembles decorated pole). Chattering inside foot. Unusual with recorded base measurement of 70 mm.

SMALL BOWL MOULDED AND PANELLED

ONE FINE LINE DIVIDES THE EXTERIOR AND INTERIOR LOBES/PANELS.

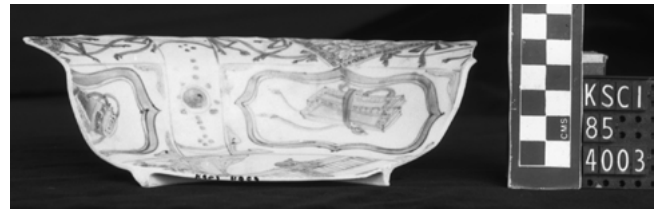
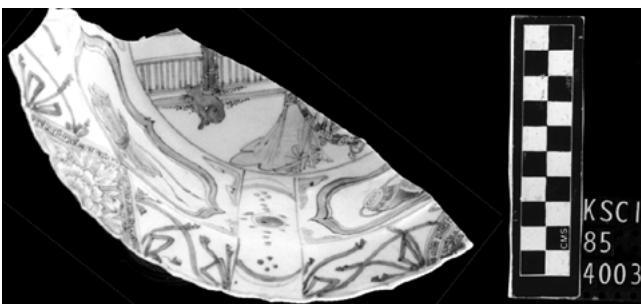
KSCI G2 and G3
 A pair. Body vertically ribbed. Glazed on base. G2: RD 188 mm, H 43 & 40 mm, BD 117 mm. G3: RD 195 mm, H 34 & 39 mm, BD 116–120 mm. Sand adhering to the base and around footrim.



KSC1 G4 and G5

Body and glaze as above. Decorated with a gourd inside an eight-sided scalloped medallion with various diaper and trellis patterns. G4: RD 194 mm, H 37 mm, BD 118 & 123 mm. G5: RD 194 mm, H 38 mm, BD 121 & 25 mm.

Rinaldi (1989: Plate 120) (1615–25) RD 267 mm, H 52 mm has similar items with double tiered brush stroke and ribbed cavetto as G2–5 though Pl. 120 is framed by different motifs with linking diaper rui heads. Rinaldi indicates that dishes with this type of border are rare. Pl. 120 has a bird on rock scene, probably better executed than many of the Ko Si Chang 1 items, certainly more complex than the decoration on G2–5. The exterior underside has a dotted border around the footrim, again more skilfully executed than the Ko Si Chang items. Rinaldi Pl. 121 (1605–15) RD 195 mm, H 38 mm dated from the Santo Palace, Lisbon, does not have the frame around a central medallion and is of high quality. It is however more similar in dimensions to the Ko Si Chang 1 items.



KSC1 4003

Incomplete item. Ribbed body. Foliated rim. Satin white, pale blue glaze. Interior decoration: balcony with woman's costume and a cat visible. Scroll and ribbon pattern on rim. Exterior decoration: fruit/floral. Glazed on base. Sand adhering to footrim which has been scraped. RD 212 mm, H 56 mm, BD 120 mm, T 2 mm (varying). Compare shape to Rinaldi (1989) Pl 123, 125—*Klapmutsen* and Forerunner to *Klapmutsen* (1550–75). The Ko Si Chang shape conforms to Pl. 123 *Klapmutsen* rather than to the traditional Chinese bowl Pl. 122.

Rinaldi (1989: Pl. 80) has a dish with a lady on balcony. This may resemble KSC1 4003. The borders differ but both have what Rinaldi refers to as oval shaped panels. In the case of KSC1 4003 the oval shapes are pointed on four sides, therefore differing in shape somewhat to Pl. 80 which is designated circa 1575–1605.

None of the rim decorations of *Klapmutsen* shown by Rinaldi are the same as on the Ko Si Chang 1 items but similar elements appear. The four sided scalloped cartouche of KSC1 4003 and KSC1 179, which are distinctly pointed at the sides, do not appear common amongst typical Kraak wares. Rinaldi, Group I. Pl. 127 (1595–1610) cartouche form points at the side and top and Rinaldi Pl. 150, a *klapmutsen* of Group VI decoration (1600–15) is pointed. The cartouche on some of the Bing Thuan shipwreck items (possibly 1608, Flecker (2004)) are also pointed. The borders of Rinaldi Group V (1605–50) have similarities to borders of the Ko Si Chang 1 items. The *Witte Leeuw* shallow bowls with flattened rim, (Pijl-Ketel, 1982: 1.3.1) have similar shape and measurements to KSC1 4003. Inv. No. 6414 has a few similar decorative attributes however the Taotie masks present on the *Witte Leeuw* are not represented on the Ko Si Chang 1. Similarly, Kilburn (1981: No. 22/23) shows 'Kraak Ware—Late Ming—*klapmutsen*' with similar format but many differences.

Rinaldi (1989: Pl. 137) shows items (described as typical group IV *klapmutsen*) RD 205 mm, H 60 mm; Pl 138 RD 205 mm, H 62 mm. These heights are quite similar to KSC1 4003 but the group number refers to border classification none of which KSC1 4003 fits exactly.



KSC1 179

Rim sherd. Foliated edge. Interior rim decoration: Rui head, four sided scalloped cartouche and vegetation on cavetto. Exterior decoration: cloud or cartouche and scroll. RD approx. 180 mm. Rinaldi (1989: Pl.143) Dish Borders No. VIII shows the Rui head in border.

KSC1 1773 (Figure 62 on page 91)

Rim sherd. Foliated edge. Decoration: duck in foliage. D 220 mm approx. T 2 mm.

KSC1 1772 (Figure 62 on page 91)

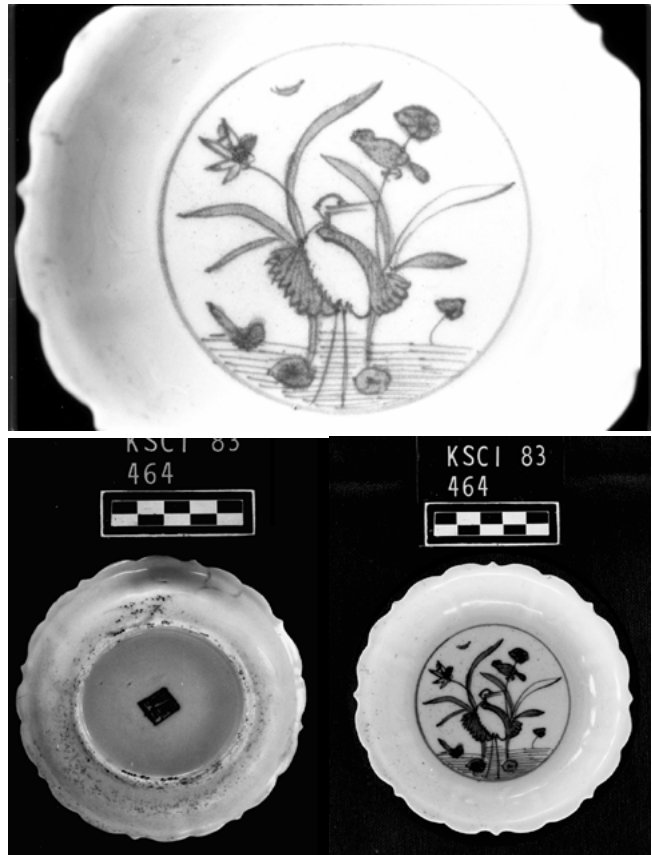
Base rim sherd. D 110 mm approx., T 2 mm. Appears to be similarly decorated to KSC1 4003 above and Rinaldi (1989: Pl. 80). Though little decoration can be seen, there appears to be cultivated landscape, as seen behind the figure on Pl. 80 which is given a date of circa 1575–1605.



KSC1 2288

Section including parts of rim and base. Foliated rim. Central interior—possibly a bird on rock scene. Cavetto—vegetation inside a four sided scalloped cartouche and panelling. Exterior—cartouche and vegetation. BD 110 mm approx. Rim inestimable but probably around 196–210 mm (estimated from associated sherds), H 58 mm, T 2.75 mm approx. Floral decoration under rim exterior resembles Rinaldi (1989: Pl.126)—said to be almost invariably seen under the rim of *klapmutsen*. Rinaldi (1989: Pl.127) Borders of Klapmutsen Group III (1595–1610)—cartouche with flower sprays may be similar to KSC1 2288.

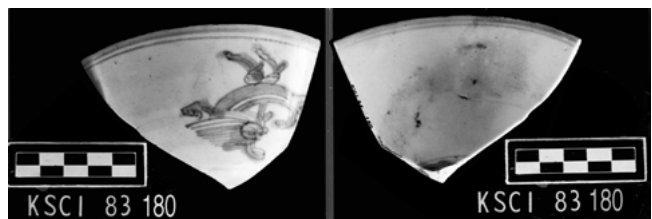
SAUCER



KSC1 464

Small plate or saucer with flattened, foliated rim. Ribbed in eight sections. 'Secret' (*Anhua*) decoration on cavetto representing crane and possibly fungus. This apparently results from fine incisions being made in the body or a light application of underglaze slip, only visible when viewed through the porcelain (Casa-Museu Dr Anástacio Gonçalves, 1996). Central decoration of crane and small bird amongst plants. Very light, green glaze with small bubbles. Rough around foot rim. RD 122 mm approx., H 29 mm approx. The irregular shape means height varies. Unidentified character on base.

NON-RIBBED BOWLS—STRAIGHT RIM



KSC1 180

Rim sherd. Decorated with rampant lion or Dog of Fu symbolizing the power and wisdom of Buddha. Two lines around rim inside and out. D 136 mm approx., T 2.5 mm.



KSCI 299

Rim sherd. D 160 mm approx., T 3–4 mm.



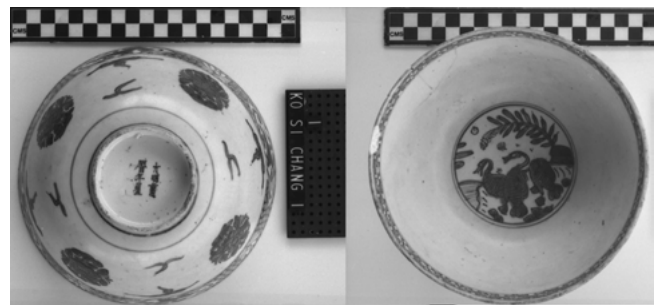
KSCI 31

Section of bowl. Footrim appears to have broken off and the area subsequently scraped. Exterior – floral decoration with swirls. Interior decoration – floral. Diaper pattern inside rim. Base glazed, with two rings of blue under glaze evident. RD 140 mm approx. Footrim OD 50 mm. ID 34 mm approx.



KSCI 326

Rim sherd. RD 150 mm approx.

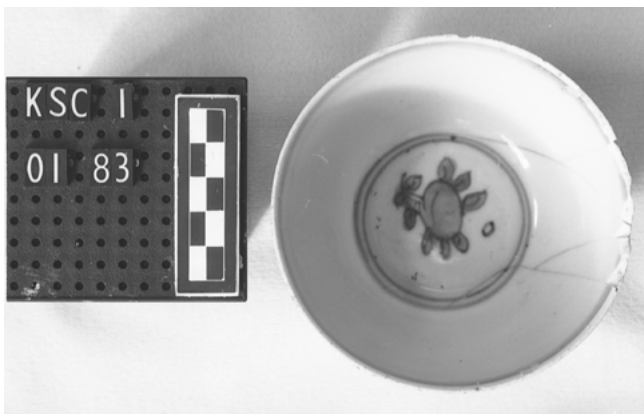
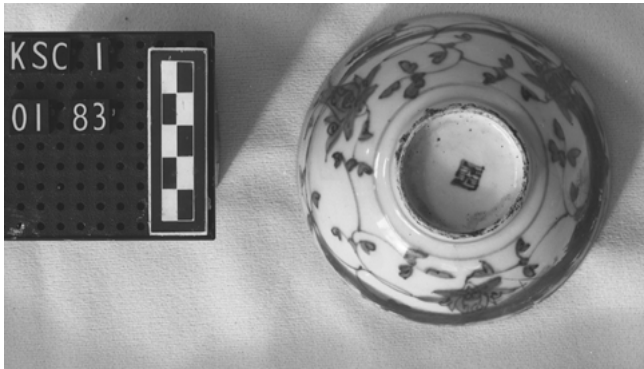
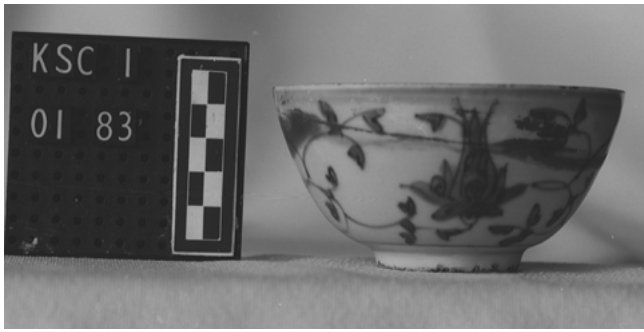


KSCI G1

Complete small bowl with footrim. Central medallion has scene with three geese. Diaper decoration on rim of cavetto. Rim decoration: open lotus, alternating with fish scale and floral diaper. Four cranes in flight and cloud scrolls within a four-sided scalloped cartouche. Below are floral medallions and cloud scrolls. Chinese inscription under base reads *Da Ming Wanli Nian Zhi* (Made in the Great Ming Year Wanli). Wanli reigned from 1573–1619. Rim D 182 mm, H 90 mm, Base OD 68 mm, ID 62 mm, Base H Outside 9 mm, Inside 10.5 mm. Ref: Compare with more complex scene, Rinaldi (1989: Pl. 261b) (1615–25) on dishes with similar shape to G2 etc., above. A less complex decoration is seen on the exterior of *Witte Leeuw*, Pijl-Ketel (1982: 176). Compare KL 60 etc. (above). The central motif of G1 compares with that of Plate 13, Casa-Museu Dr Anastacio Gonçalves, (1996), a dish given a Jia Jing dating, whereas the rim decoration of Plate 13 resembles that of the Ko Rin item KL51 and others.

Harrison (2003: 102) notes 'Overseas clients specially treasured examples bearing a reign mark or some other identifying mark. For barely literate people, Chinese characters neatly brushed under the glaze transmitted an aura of learning, even of personal acquaintance with a wider world'.

KSCI 01



Small bowl with footrim. Non-porcellaneous 'Swatow' type white body. Exterior underglaze blue floral scroll decoration (possibly lotus). Central interior peach and moon. The base has a mark 'lin' meaning forest, or possibly a family name. Sand grains attached to footrim. RD106 mm approx., B 20.5 mm, H 55 mm.

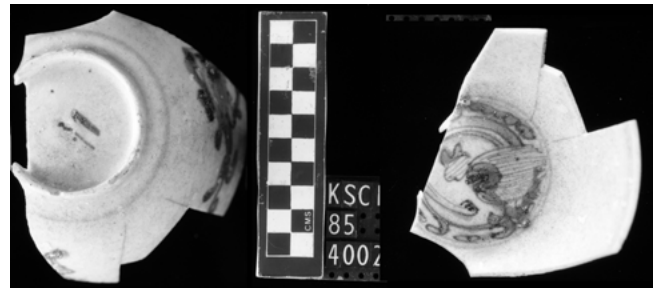
The *Witte Leeuw* item, Pijl-Ketel (1982) No. OKA16389 shape and interior decoration has similarities to this item, however the profile is slightly different at the base. The peach on the Ko Si Chang 1 item itself is represented more clearly and the exterior decoration more complex. von der Porten (1972) shows a bowl (with a more roughly drawn peach blossom and moon than the Ko Si Chang 1 item), recovered from the Drake's Bay area (1579/1595).

KSC1 1774 (Figure 61 on page 91)

Section of bowl. Exterior probably Dog of Fu. Low quality body. Rough, dark, mottled glaze. RD120 mm approx., BD 50 mm approx., H 60 mm approx.

KSC1 1142 (Figure 23 on page 88)

Section of bowl. Exterior decoration, clouds, vegetation and Buddhist Wheel of Law. Inside the wheel is a Chinese symbol possibly representing 'Gu' meaning old. T 3 mm.



KSC1 4002

Section of bowl. Exterior and central interior decoration probably Dog of Fu. Exterior and interior pale blue glaze with fine splatter of dark. Dark blue patterns and lines. Two stroke marks on base. RD120–130 approx. BD50 mm. H60 mm approx.

The *Witte Leeuw* No.11542, p.192 shows a similar decoration. Compare to Pijl-Ketel p.211, No. NG1977–114W and KSC1 761 for different interpretations of the Fu Dog. von der Porten (1972) Fig. 10c and 10d shows sherds recovered from Drake's Bay (1579/1595) with some similarities to KSC1 4002 centre (long bodied nature of Dog of Fu on the KSC1 item).



KSC1 298

Rim sherd. White body. Exterior decoration includes clouds. Unglazed band on interior rim. RD 150 mm, T 3 mm.

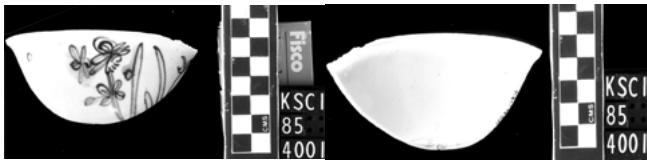
KSC1 683 Not illustrated. Rim sherd. Exterior decoration fish and vegetation. Diaper pattern on rim interior. T4 mm approx.



KSC1 3506

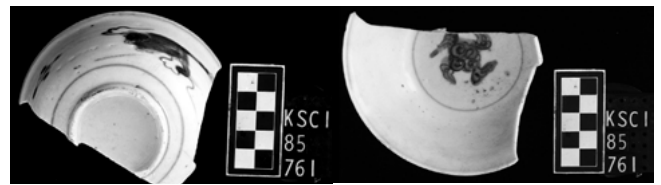
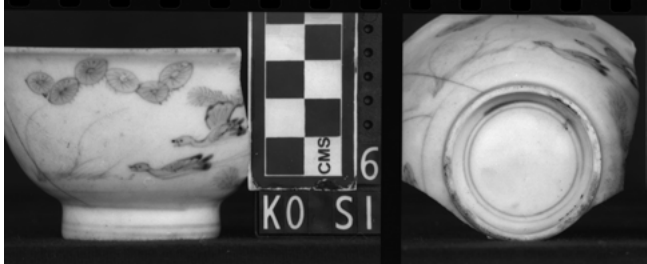
Rim sherd. Exterior Decoration: balcony scene, vegetation. Diaper pattern on rim interior. T3.5 mm.

NON-RIBBED—EVERTED RIM



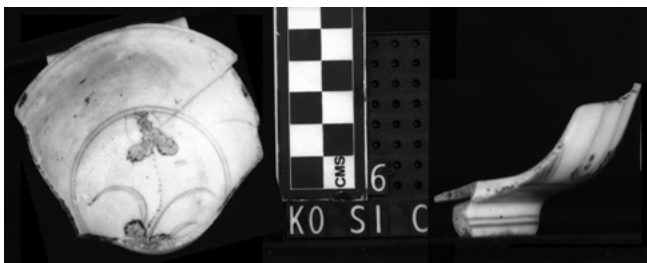
KSC1 4001

Rim sherd. Exterior – dull white glaze, decoration floral and insect. Interior – pale blue glaze with satin finish. RD 120 mm approx.



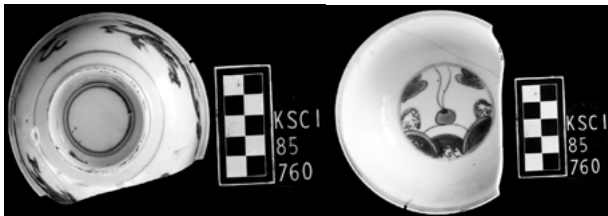
KSC1 761

Incomplete bowl. Roughly applied blue decoration. Exterior Dog of Fu with ribbon. Compare the central interior to *Witte Leeuw*, Pijl-Ketel (1982: inv. no. NG1977114W). The Ko Kradat No.151 (Green *et al.*, 1981) is similarly decorated. Ko Rin KL130 (above) possibly has a similar decoration. KSC1 761 has a rough base with sand adhering. RD 125 mm, BD 46 mm, T 4 mm. The Binh Thuan representations of the Fu Dog, Flecker (2004), are completely different to those on the Ko Si Chang 1 material.



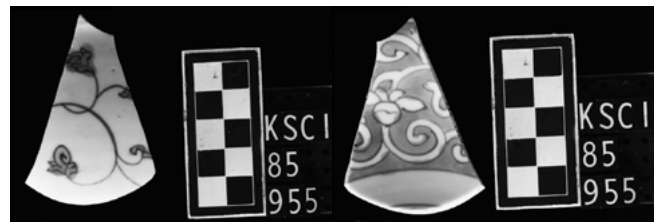
KSC1 G6

Incomplete bowl. Eggshell thin body. Exterior Decoration: geese swimming amongst lotus leaves. Interior—medallion with foliage. Glazed on base. RD 90 mm approx., BD 42 mm, H 50 mm, T 2 mm.



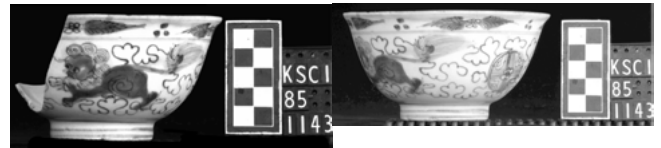
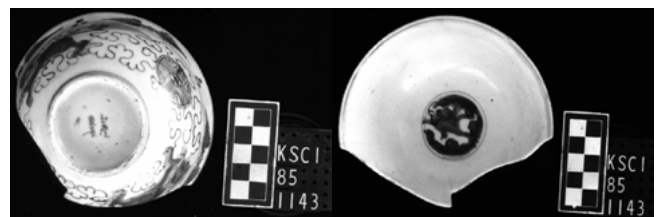
KSC1 760

Section of bowl. Exterior decoration: dragons chasing pearl. Central interior flaming pearl amongst waves. The pearl is the charm against fire. The dragon is one of the Chinese mythological beasts. RD 112 mm approx., BD 48 mm, T 2 mm. The dragon on *Witte Leeuw* No. NG1977-156W, Pijl-Ketel, (1982: 153) is very similar, however, the interior is dissimilar and the Ko Si Chang 1 item has a slightly more accentuated lip. The *Witte Leeuw* item measures D 142 mm, H 69 mm.



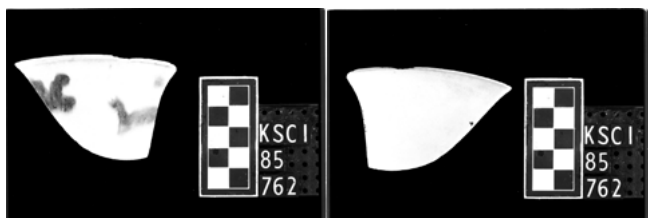
KSC1 955

Body sherd with tiny section of rim. Floral decoration. T 3 mm. Ref. Pijl-Ketel (1982: No. 10853) describes a similar item. The Ko Rin KL 145 (above) has this type of external decoration.



KSC1 1143

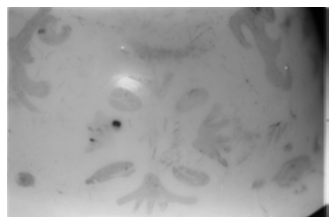
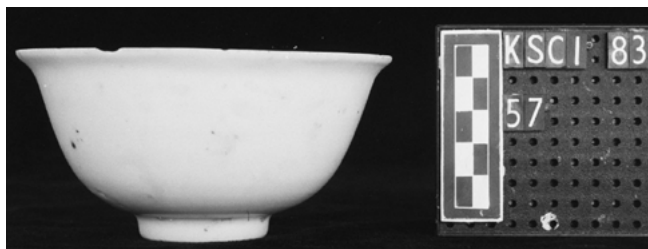
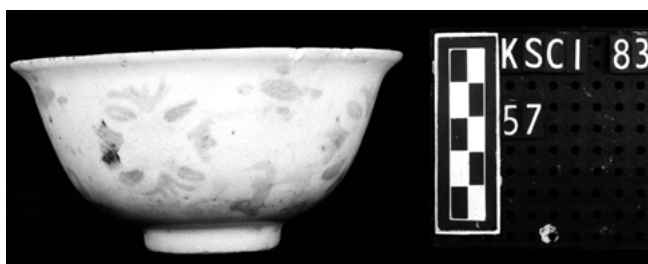
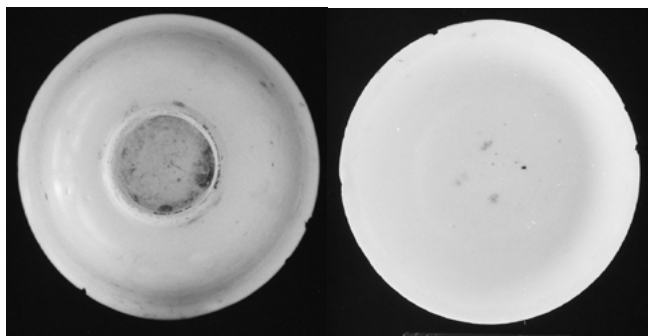
Section of bowl. Exterior Dog of Fu. Interior horse. Inscription on base. RD 124 mm, BD 26 mm, H 63 mm, T 2 mm.



KSC1 762

Rim sherd. Roughly applied blue external decoration. D 130 mm, T 3 mm.

ENAMELLED WARE



KSC1 1983 57

Complete bowl. Fine white body. Traces of enamel on the glaze but no colour visible. Immersion in seawater has dissolved the enamel leaving a discontinuity in the surface of the glaze. Two types of discontinuity can be seen, possibly indicating two different colours. Hobson (1962: 31) says that the enamels used on Ming porcelain were greens of various shades, aubergine, brown or purple, yellow 'usually rather muddy' turquoise blue, black and red. RD 116 mm, BD 41 mm, H 58 mm.

The Binh Thuan shipwreck items BT 320–322 have red-green overglaze of the Zhangzhou type, of Fujian Province, according to Flecker (2004: 6).

Pijl-Ketel (1982: 257, Nos 14051 and 140710) show bowls with deteriorated enamels over glaze. Though given an 18th century dating, comparison cannot be denied with KSC1 57. Brown-black and green remains on one whilst the other has greyish or blackish colour remaining. Interestingly, Pijl-Ketel says 'The underglaze painting was always executed at Jingdezhen or a provincial kiln, while the enamelling was generally done at Canton'. Rinaldi (1989: 48) notes that during the Ming dynasty coloured enamel decoration over glaze became very common. Because it required double firing it was a more expensive process. Hence, they were produced and exported in much smaller numbers than blue and white.

It is not known whether the light mark left by the enamel was the result of chemical reaction or whether the item was scratched lightly before the enamel was applied in an attempt to make it adhere.

MISCELLANEOUS

KSC1 1141 (Figure 23 on page 88)

Rim sherd. Exterior vegetal decoration. Diaper pattern on rim interior. T 1 mm.

KSC1 952 (Figure 36 on page 89)

Rim sherd. Exterior decoration floral and vegetal. T 1.5 mm.



KSC1 348

Rim sherd. Fish. Insect.

DISCS

A total of 59 unglazed porcelain discs were found, in association with the blue and white porcelain bowls. These are thought to be disc supports on which the bowls rested in the saggar during the firing process. There were two sizes, the larger around 60 mm in diameter, the smaller and more common around 30 mm by 5–6 mm thick. Rinaldi (1989: Pl. 185) shows a crow cup of vase and floral decoration, said to be of *c.* 1600–15, with a clay disc attached to the footrim.

CHINESE SYMBOLS ON THE BLUE AND WHITE
DECORATED PORCELAIN AND STONWARE FROM THE
KO SI CHANG 1 AND KO RIN WRECK SITES AND
ASSOCIATED SITES

The following information is from Yeo and Martin (1978), Pijl-Ketel (1982) and Casa-Museu Dr Anastácio Gonçalves (1996) where each has a description together with an illustration.

Aquatic Grass: Part of the water vegetation which commonly appears in the marsh landscapes.

Artemisia Leaf: Symbol of good fortune. Plant of good omen which dispels sickness and evil spirits. Frequently appears on Kraak wares during the late Ming period 1567–1643.

Bamboo: Symbol of longevity because it remains green throughout the winter. It bends in the wind but does not break and is symbolic of the scholar who remains loyal even in poverty. It is one of the Three Friends with Prunus and Pine.

Banana Tree (Plantain): Symbol of self-education.

Basket of Flowers: A symbol of the Chinese love of flowers and the emblem of Lan Cai He, one of the Eight Immortals.

Bee: Emblem of industry and thrift. A bee's nest near a house is said to bring good luck.

Books: Symbol of good augury and warning against evil.

Buffalo: Emblem of spring and agriculture and one of the Twelve Animals in the Chinese cycle of symbols. The buffalo is the mount of Holy Men and sages.

Butterfly: Symbol of joy, summer and married happiness and emblem of longevity.

Camellia: Emblem of beauty and health.

Cat: Gives protection.

Cash: Symbol of wealth.

Castanets: Attribute of Cao Guo Jiu (Ts'ao Kuo-chiu), one of the Daoist Eight Immortals. Used by pedlars and priests.

Ch'i Lin (Qilin): Appears in various forms. Symbol of longevity, grandeur, happiness, illustrious offspring and wise administration. A benevolent animal, with the dragon, phoenix and tortoise is one of the four great mythological beasts of China.

Chrysanthemum: Emblem of autumn and symbol of joviality.

Cicada/Cricket: Emblem of immortality and resurrection, courage and perseverance, symbol of summer, happiness and eternal youth. Signifying the restraint of cupidity and vice.

Citrus—Finger Citron (*Citrus medica*): Also called Fo shou: Buddha's hand. Resembles a classic position of Buddha's hand. Symbol of wealth.

Cloud Collar: Decorative form derived from Rui head, which is derived from fungus—long life and immortality.

Cormorant: One of the water birds seen on a rock in a marsh landscape.

Crab: No Chinese symbolism is attached to the crab. May have had significance in the countries to which the ceramics were exported.

Crane: Symbol of longevity, often found with the pine. Is said to fly with the immortals and carry the souls of departed to heaven.

Cricket: The emblem of courage and the symbol of summer.

Crow: Symbol for filial piety. Symbol of the sun, highly venerated.

Deer: Emblem of longevity. Said to be the only animal able to find the *lingzi*, the holy fungus of immortality. Symbol of official emolument or prosperity.

Diaper/Trellis: Several forms of repeating geometrical pattern.

Dog of Fu/Lion Dog: A Buddhist guardian lion. Often shown playing with an ornate brocade ball and ribbons. Symbolises the power and wisdom of Buddha.

Dragon: An important Chinese mythological beast regarded as lord of heavens and seas and the genius of strength, goodness and life itself. Symbolizes spiritual power, spring, fertility, thunder and storm. Emblem of vigilance and safeguards. Emblem of the emperor. Yang quality with sexual connotation.

Dragonfly: Emblem of summer, symbol of weakness and instability.

Ducks and Geese: Symbols of marital happiness and faithfulness because they mate for life. Symbol of the Yang principle of light and masculinity. Often appear with lotus flowers, the symbols of fruitfulness and offspring.

Eight Buddhist: Emblems: Chakra or wheel, conch shell, umbrella, canopy, lotus, vase, pair of fish and endless knot.

Eight Taoist Emblems: Fan, sword, gourd, castanets, flower basket, bamboo tube and rods, flute and lotus.

Eight Treasures or Precious Things: Jewel, cash, open lozenge with ribbon, solid lozenge with ribbons, the musical stone, pair of books, pair of horns, artemisia leaf.

Eight Trigrams: Form part of an ancient Chinese system of philosophy and divination.

Fan: Attribute of Zhong Li zhuan (Chung-li Chuan), one of the Daoist Eight Immortals, with which he is supposed to revive the dead.

Fish—Carp: Symbol of wealth and abundance, longevity, perseverance and progeny with yin quality.

Fish—Pike or perch: Symbol of domestic happiness and fertility. Emblem of wealth and harmony.

Fish—Two: One of the Eight Buddhist Emblems. Emblem of harmony and married happiness.

Flywhisk (Tassels): Attribute of both Buddhist and Daoist sages.

Frog (see Toad)

Fungus: Plant of long life or immortality.

Gourd: (Pilgrims Bottle) Emblem of longevity.

Grasshopper: Emblem of abundance, male progeny and happiness.

Horse: Emblem of speed and perseverance.

Jui (Rui) Lappet: Symbol of authority and longevity. Head of the scepter Rui, signifying 'as you wish'.

Key Fret: A repeating band of decoration: also called 'Thunder pattern'.

Lantern: Auspicious gift at weddings. Symbol of joy and festivity.

Lingzi (sacred fungus): Plant of immortality, emblem of longevity. Originally it was an emblem of good luck with an implication of power.

Lotus (Bud, Flower, Leaves, Pod): Emblem of summer, symbol of fruitfulness and offspring. Flower is symbol of purity and perfection.


















Lotus Panels: Derived from lotus petal. Generally used as border decoration.

Lozenge: Symbol of victory and success.



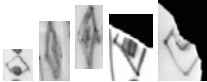



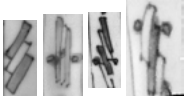

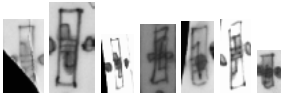








Moon: Represented as the concrete essence of the female or the negative principle in nature.



Morning Glory: Emblem of love and marriage.
Musical Stone: Jade stone, a symbol of good luck and an emblem of harmony.
Peach: Emblem of marriage and a symbol of immortality and springtime.
Pearl: Believed to be the essence of the moon and is supposed to act as a charm against fire, hence the 'flaming pearl'. Associated with feminine beauty and purity. The 'flaming pearl' is frequently used as a decoration together with dragons. Emblem of genius in obscurity.
Peony: Emblem of spring. The Tree Peony is called the King of Flowers regarded as symbol of riches, honour, love, affection and feminine beauty, thus an omen of good fortune.
Pheasant: Symbol of beauty and good fortune.
Picture (Closed Lozenge): Also considered to be a bronze mirror from ancient times. One of Eight Precious Symbols.
Pine: Symbol of strength and longevity. Also symbol of friendship and leadership.
Pomegranate: Symbol of fruitfulness, offspring, posterity and good luck.
Prunus or Plum: Emblem of winter, longevity, beauty and purity.
Rhinoceros–Horns: Emblem of happiness.
Rock: Symbol of longevity, durability and steadfastness
Scroll: The sacred text of the scriptures and the store of truth. Emblem of the literatic class.
Taotie (Monster mask): Supposed to have been the demon of the storm. Might be seen as warning against vices of sensuality and avarice.
Tassels: See Fly whisk.
Toad: Emblem of unattainable. Evoked to obtain wealth. Symbol of spring, of fertilising rain and luck.
Vase: Emblem of perpetual harmony.
Water Pot: Bronze vessel for liquids used on Buddhist altars.
Wheel of Law: Buddhist symbol of Happy Augury and of Sovereign Rule and Authority of Buddhism.

Table 1. Motifs/Symbols (main) of Chinese Blue and White Porcelain Recovered from Ko Si Chang 1

Type	Image
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Motifs/Symbols (central).

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Type	Image		
xviii		xix	

Figures 5–62



Figure 5. KSC I 1012, 1013, 1020, 1023

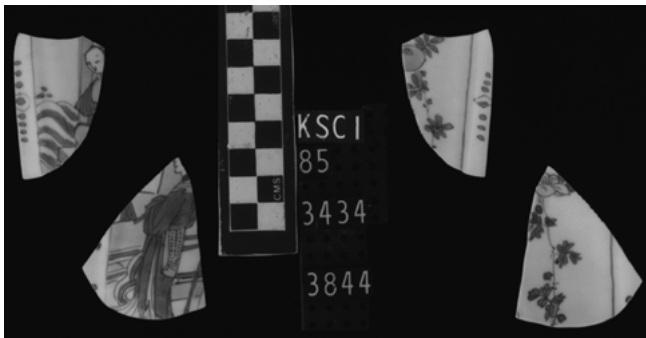


Figure 6. KSC I 3434, 3844

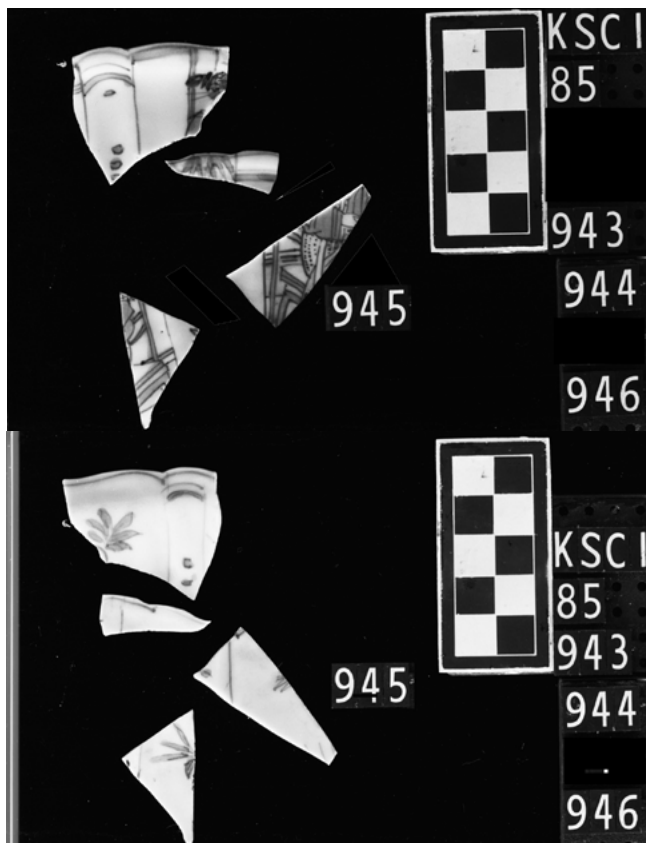


Figure 7. KSC I 942, 944, 945, 946.

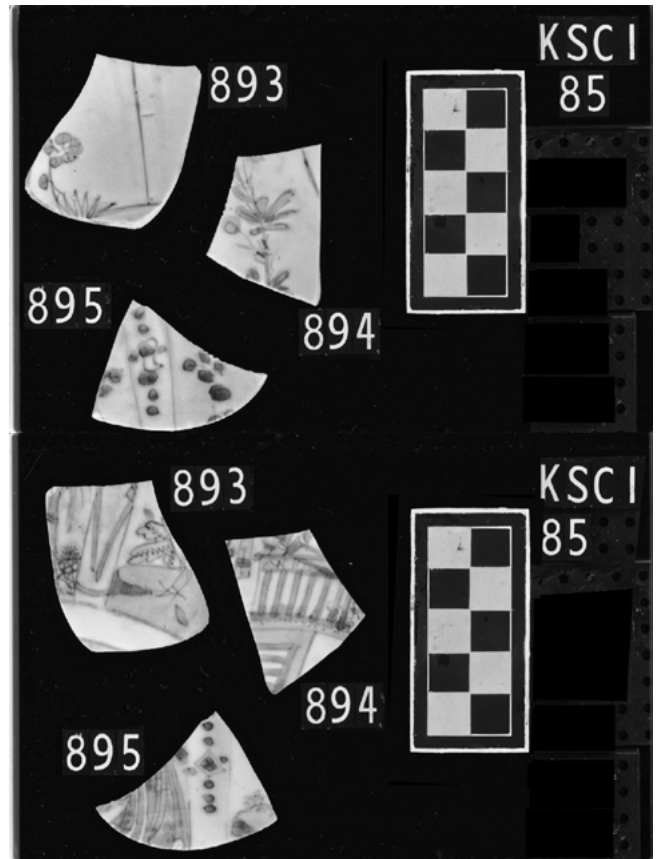


Figure 8. KSC I 893, 894, 895.

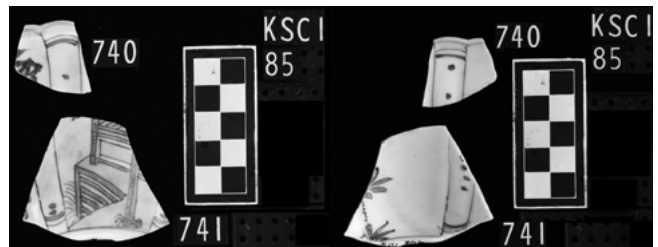


Figure 9. KSC I 740, 741.

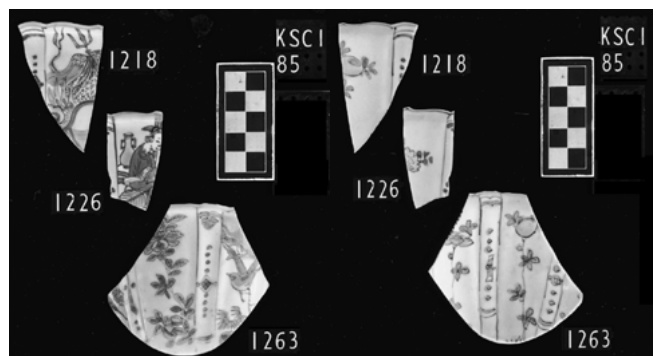


Figure 10. KSC I 1218, 1226, 1263.

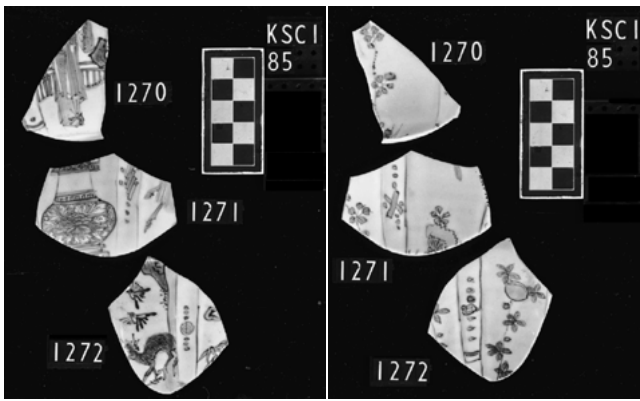


Figure 11. KSCI 1270, 1271, 1272.

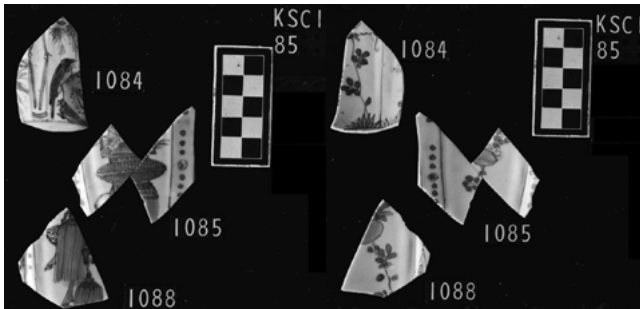


Figure 12. KSCI 1084, 1085, 1088.

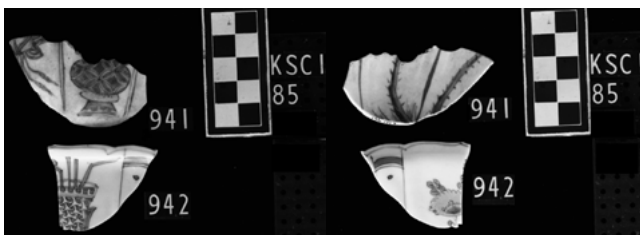


Figure 13. KSCI 941, 942.

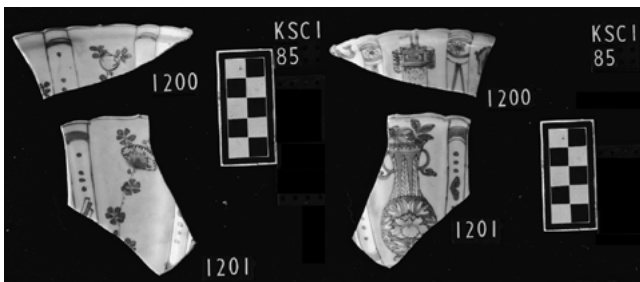


Figure 14. KSCI 1200, 1201.



Figure 15. KSCI 1204, 1205, 1207.

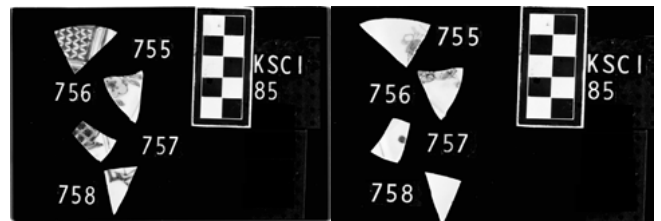


Figure 16. KSCI 755, 756, 757, 758.

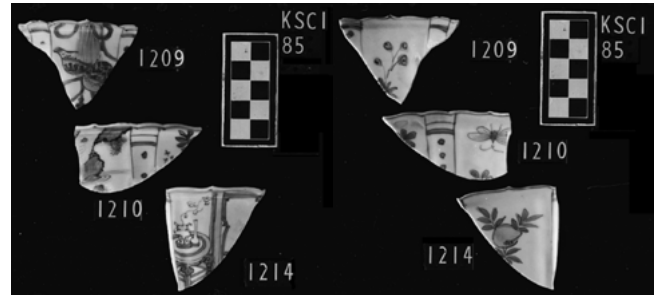


Figure 17. KSCI 1209, 1210, 1214.

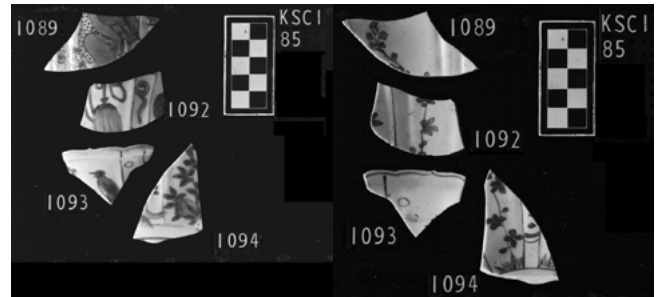


Figure 18. KSCI 1089, 1092, 1093, 1094.

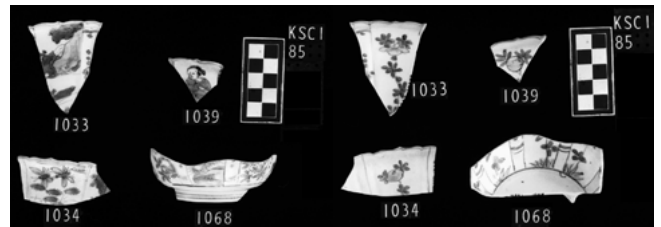


Figure 19. KSCI 1033, 1034, 1039, 1068.

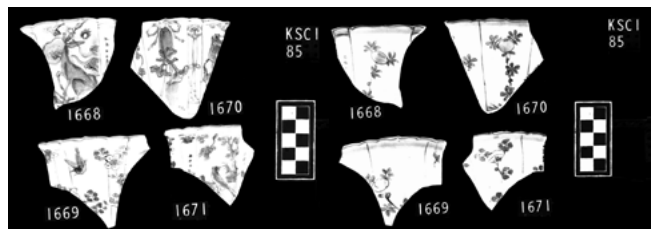


Figure 20. KSCI 1668, 1669, 1670, 1671.

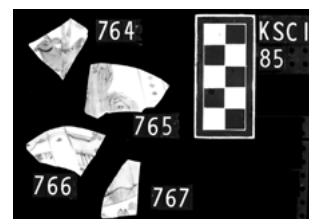


Figure 21. KSCI 764, 765, 766, 767.



Figure 22. KSC1 1202, 1203.

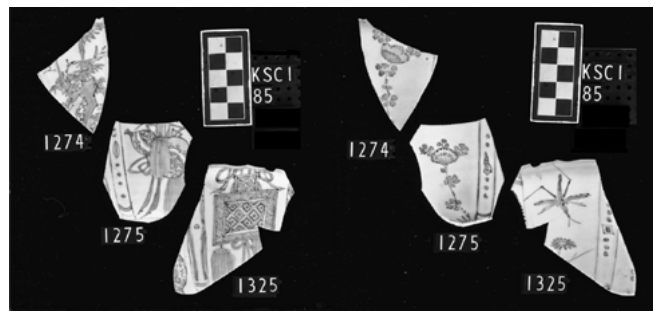


Figure 27. KSC1 1274, 1275, 1325.

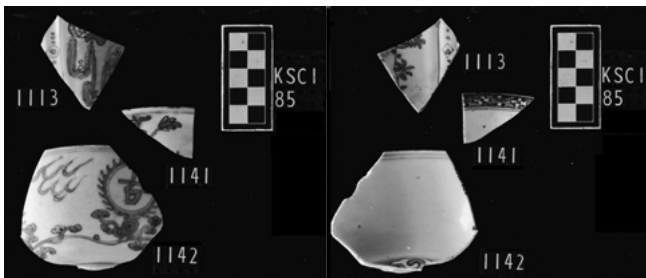


Figure 23. KSC1 1113, 1141, 1142.

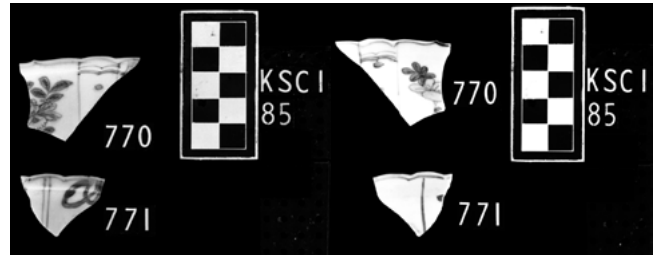


Figure 28. KSC1 770, 771.



Figure 24. KSC1 1198, 1199.



Figure 29. KSC1 3415, 3471/2216.

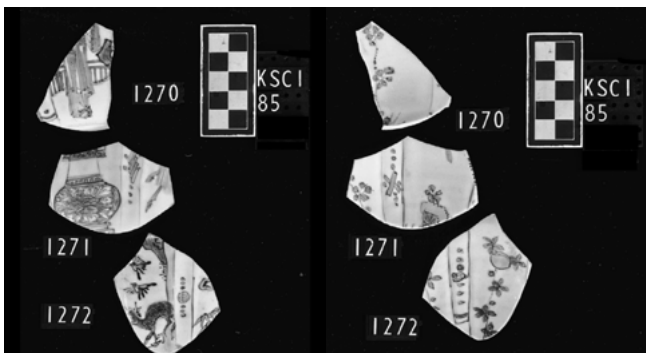


Figure 25. KSC1 1270, 1271, 1272.

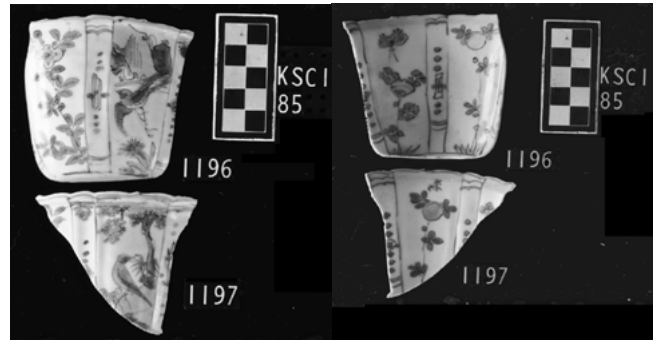


Figure 30. KSC1 1196, 1197.

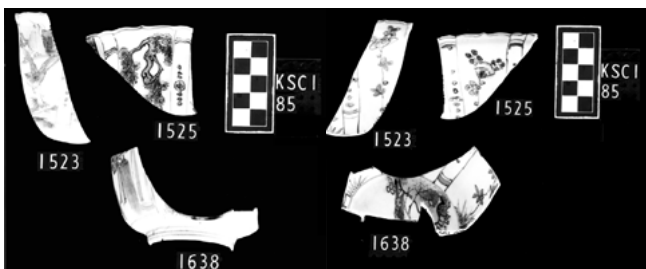


Figure 26. KSC1 1523, 1525, 1638.

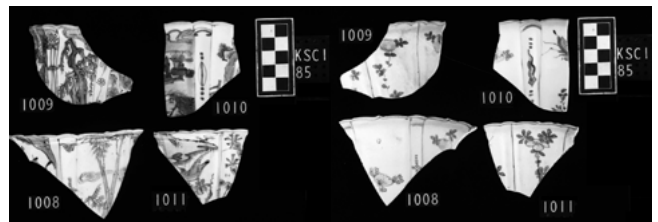


Figure 31. KSC1 1008, 1009, 1010, 1011.



Figure 32. KSC1 1264, 1265.

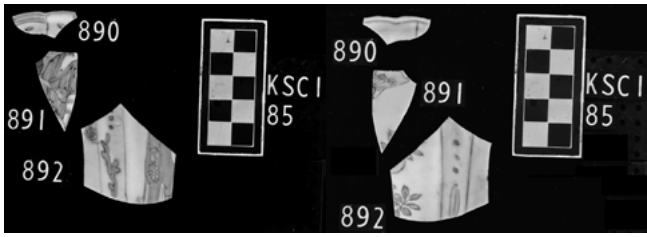


Figure 33. KSC I 890, 891, 892.

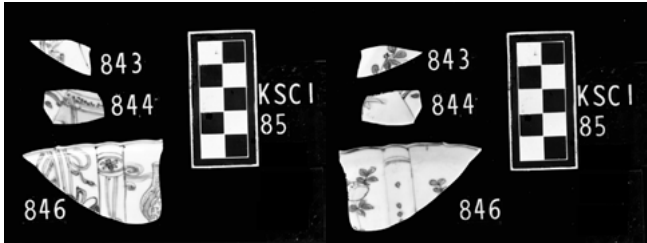


Figure 34. KSC I 843, 844, 845, 846.

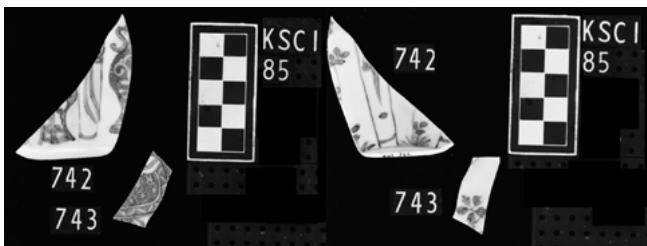


Figure 35. KSC I 742, 743.

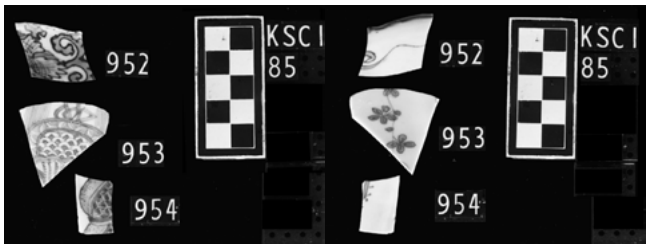


Figure 36. KSC I 952, 953, 954.

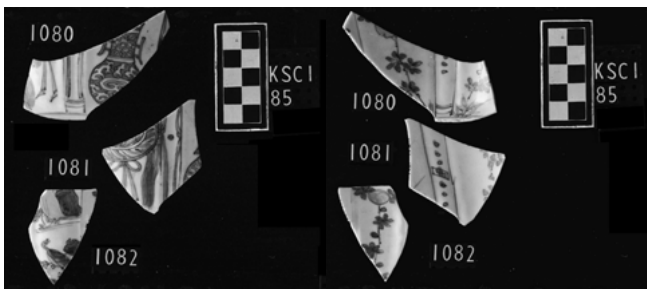


Figure 37. KSC I 1080, 1081, 1082.

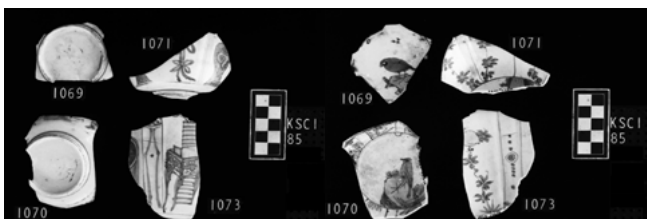


Figure 38. KSC I 1069, 1070, 1071, 1073.

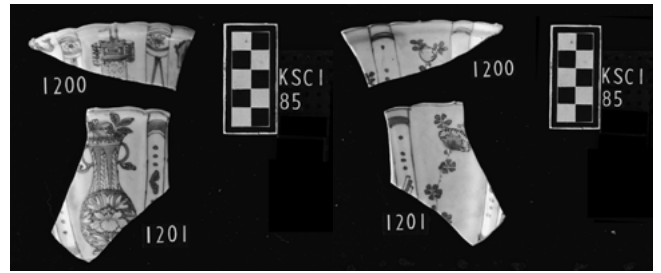


Figure 39. KSC I 1200, 1201.



Figure 40. KSC I 1077, 1078, 1079.



Figure 41. KSC I 840, 841, 842.

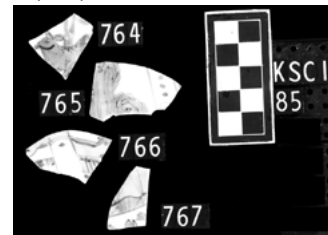


Figure 42. KSC I 764, 765, 766, 767.



Figure 43. KSC I 1330, 1335, 1336.

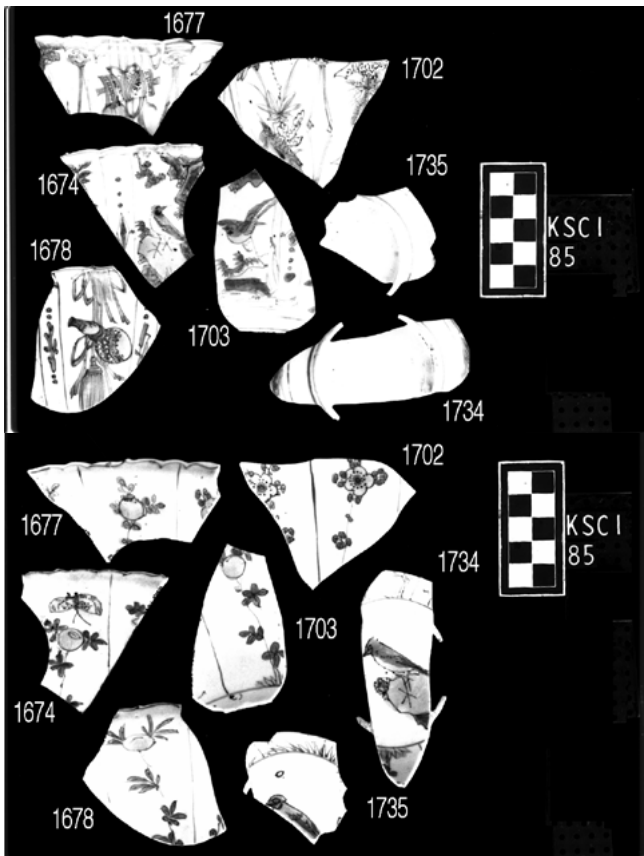


Figure 44. KSC I 1674, 1677, 1678, 1702, 1703, 1734, 1735.

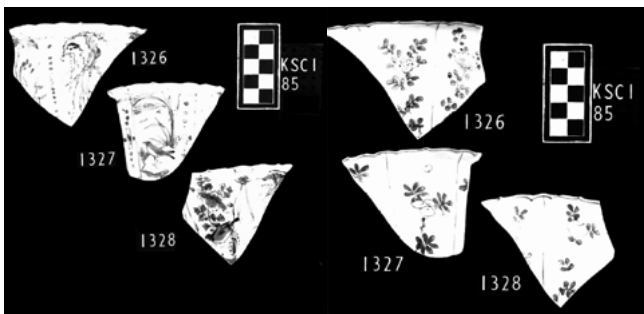


Figure 45. KSC I 1326, 1327, 1328.

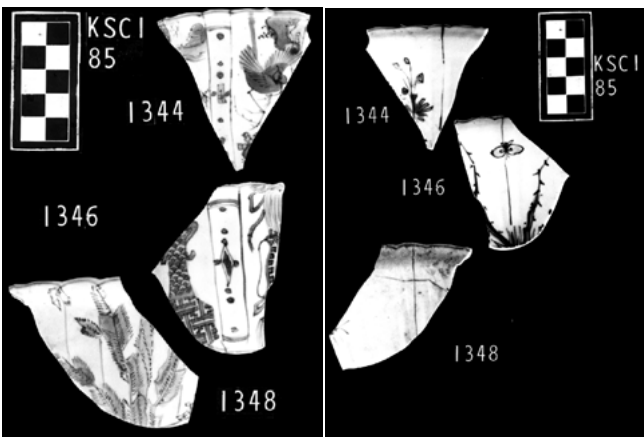


Figure 46. KSC I 1344, 1346, 1348

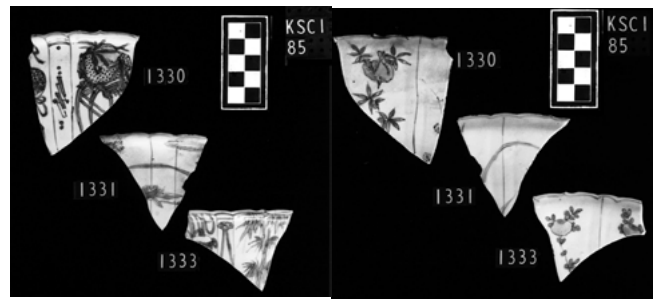


Figure 47. KSC I 1330, 1331, 1333.

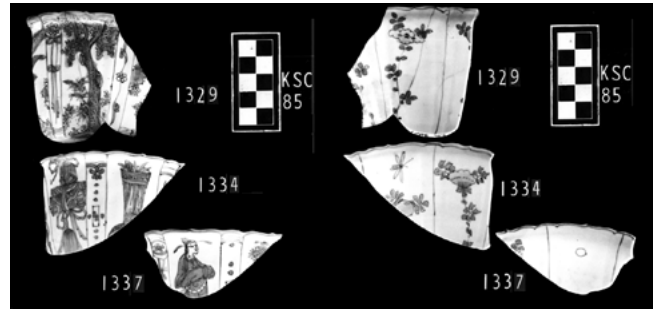


Figure 48. KSC I 1329, 1334, 1337.



Figure 49. KSC I 838, 839.



Figure 50. KSC I 1075, 1076.

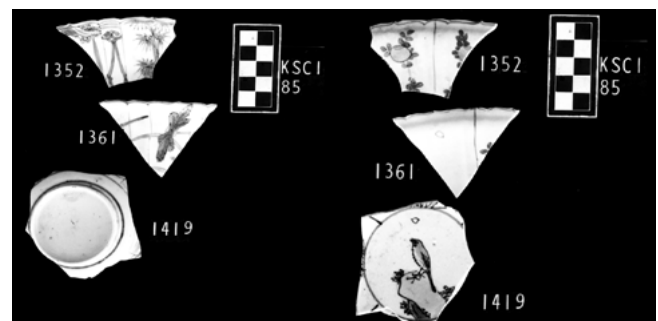


Figure 51. KSC I 1352, 1361, 1419.

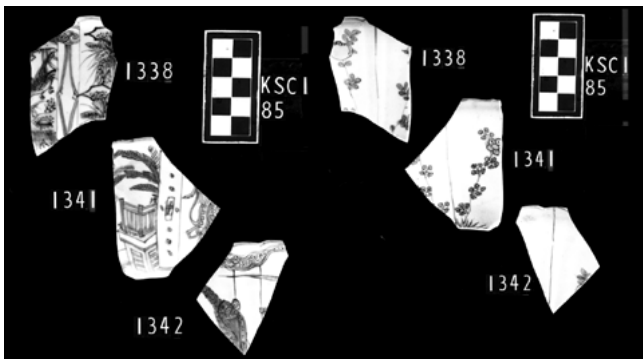


Figure 52. KSC1 1338, 1341, 1342.

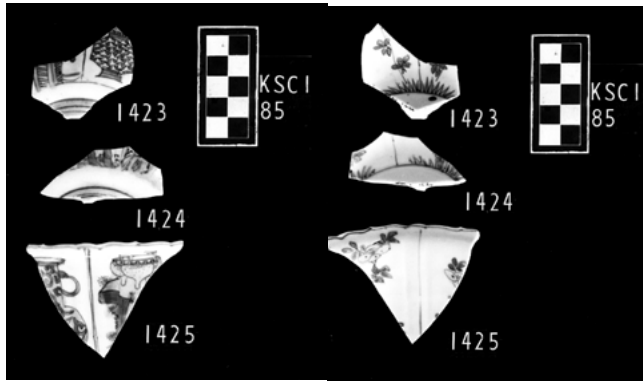


Figure 53. KSC1 1423, 1424, 1425.

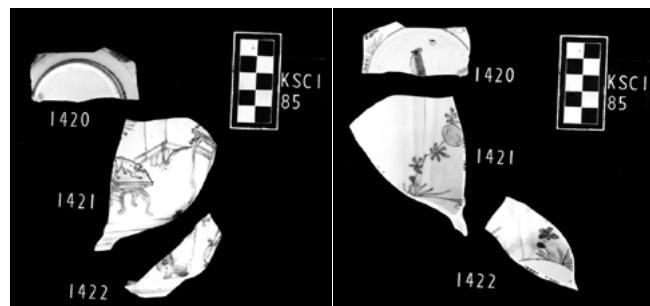


Figure 54. KSC1 1420, 1421, 1422.

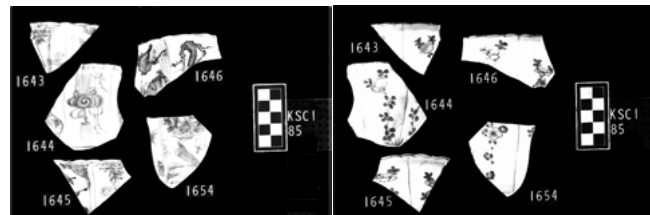


Figure 55. KSC1 1643, 1644, 1645, 1646, 1654.

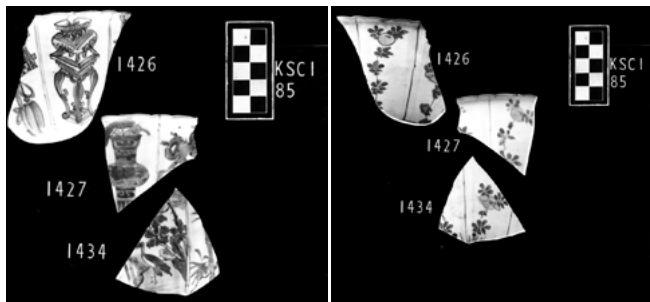


Figure 56. KSC1 1426, 1427, 1434.

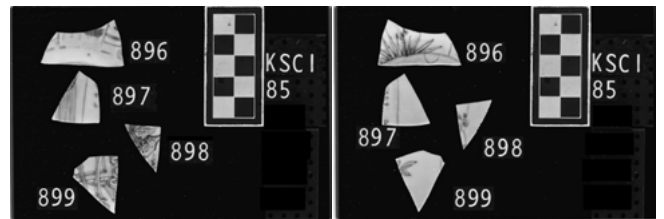


Figure 57. KSC1 896, 897, 898, 899.

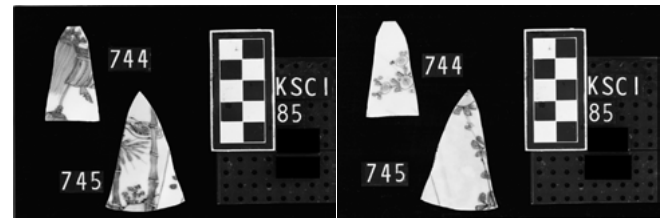


Figure 58. KSC1 744, 745.

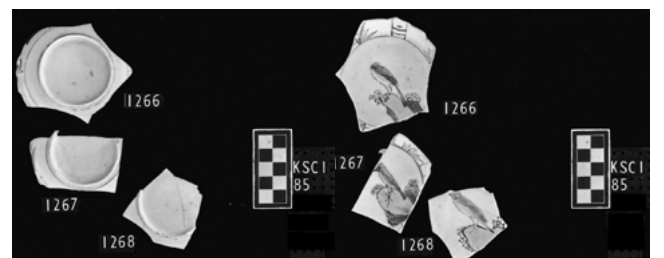


Figure 59. KSC1 1266, 1267, 1268.



Figure 60. KSC1 1639, 1640, 1641, 1642.

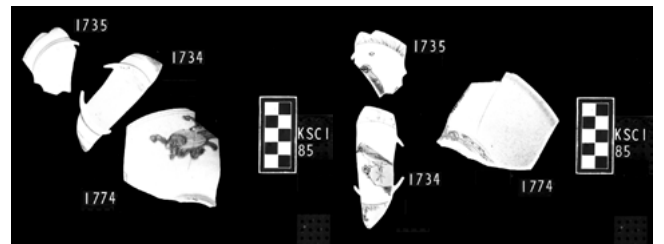


Figure 61. KSC1 1734, 1735, 1774.



Figure 62. KSC1 1767, 1768, 1772, 1773.

Organic Material

LACQUERWARE



KSC1 3545
Lid fragment. Black and orange-red lacquer on soft wood.
Ref: Green and Harper (1983) G48; and Green (1985) KSC1 1983 349.



KSC1 3807
Not to scale
Body fragment from item of black and orange lacquer ware.

ARECA NUT

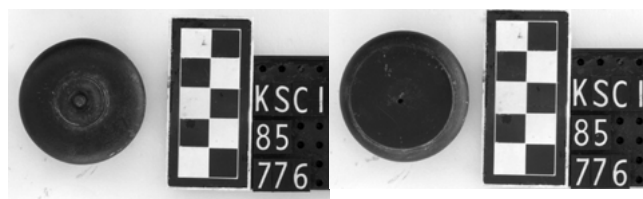
One areca nut (*Areca catechu*) was recovered in 1983. Not illustrated.

EBONY, IVORY OR WOOD

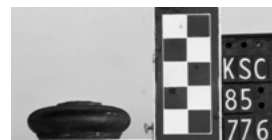
Thai members of the team referred to the following items as 'Thai Chess' pieces. Gervaise observed in Thailand during the second half of the 17th century, Villiers (1998: 89), 'The game they most often play is similar to our chess and the pieces of which it consists have almost the same names'. Shaw (1981: 73) also notes that at Kalong they played Thai chess '...which is a slightly different version from that developed in Europe'.



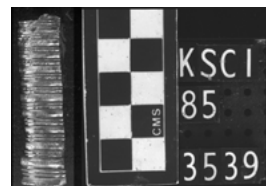
KSC1 3893A
Chess piece, finely turned.



KSC1 776
Chess piece.



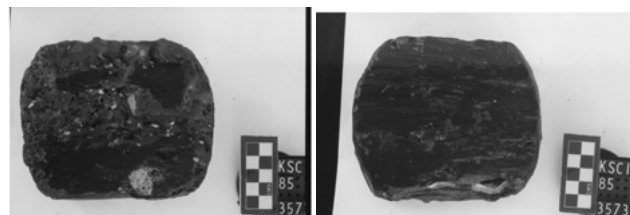
KSC1 3539
Possibly a handle, has a finely drilled centre.



WOOD/TIMBER AND ASSOCIATED ORGANIC MATERIALS



KSC1 3352 (1: 2)
Shaped item. Possibly handle of small tool. Soft, beige coloured.
Hole in broken end.



KSC1 3573
Man-made disc-shaped item, possibly plug/bung. Ref. Green (1983) KSC1 1983 685.



KSC1 633 (1: 2)
Curved piece of wood, probably fitting KSC1 664.



KSC1 664
Wooden item, incomplete. Turned groove.
KSC1 59 & 551
Not illustrated.
Fragments of two musket stocks. Almost identical to a group recovered from the *Batavia* shipwreck (1629). Ref: Green and Harper (1986: 121).

KSC1 654
Not illustrated.
Four lengths of shaped wood, red in colour. D 93 mm.

KSC1 127
Not illustrated.
Lime and resin caulking.

KSC1 690
Not illustrated.
Timber with resin 7 mm thick on one surface, over hole.

KSC1 706
Not illustrated.
Two flat lengths of reed measuring 97 mm x 9.5 mm and 56 mm x 15 mm.

KSC1 689
Not illustrated.
Bamboo recovered from inside Jar 4.

Bamboo has a multitude of uses in Southeast Asia. Holbrook and Suriya (2000) in the 1960s, refer to a type of boat described as a 'Malaysia 2-M' which had two cabins constructed of bamboo and sails made of either canvas or reed matting. Other vessels discussed by these authors also used bamboo in the construction of cabins.

KSC1 3671
Not illustrated.
Bamboo recovered from beneath a plank.

KSC1 588
Not illustrated.
Wood with bolt holes.

A number of treenails were registered including: .
KSC1 1803

Not illustrated.
Length 109 mm, Diameter 8 mm–13.5 mm. Worn at end.
KSC1 3918

Not illustrated.
Length 59 mm x 6.5 mm.

KSC1 4015
Not illustrated.
Two pieces of coal were recovered.

KSC1 687
Not illustrated.

Approximately 4 kg (wet) of vegetable matter was recovered from a large storage jar in 1983. This was identified as gourd seed together with tamarind seed and fibre.

BONE
KSC1 792
Not illustrated.
Rib bone—probably from animal.



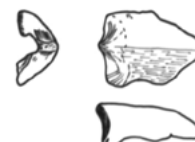
KSC1 570 (1: 2)
Bone, possibly part of a sheep's skull.



KSC1 648 (1: 2)



KSC1 609 (1: 2)
Bone—metatarsus.



KSC1 Fish bones
Not illustrated. 3750g (wet) of fish bones were recovered from inside a large storage jar in 1983.

Metals
Refer: PART 4 (below)

LEAD INGOTS
Large quantities of small conical-shaped lead ingots were found on the site. About 100 ingots equalled 6850 grams. In 1983 a total of approximately 98 kg of lead ingots was raised. Several small strips of lead were recovered in 1985. Lead ingots are commonly found on shipwrecks in the Gulf of Thailand and are thought to be of Thai origin. Scott (1984: 70) indicates that one of the items used in trade or barter in the Philippines was lead fish net sinkers.

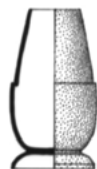
LEAD COVERED STONE SHOT

Ten examples were found, the more complete with diameters 26 mm, 27 mm, 28 mm and 31 mm. This type of shot has been associated with Portuguese armament (Auret & Maggs, 1982; Blake & Green, 1986). Little is known of Southeast Asian armament, so these could be of local manufacture. However, in view of the wooden musket stocks found on this site, which are of European style, it is likely that these shot were of foreign origin. Ref: Green (1983) KSC1 59 and 551 (musket stock); Green *et al.* (1986: Fig. 13).

COPPER ALLOY



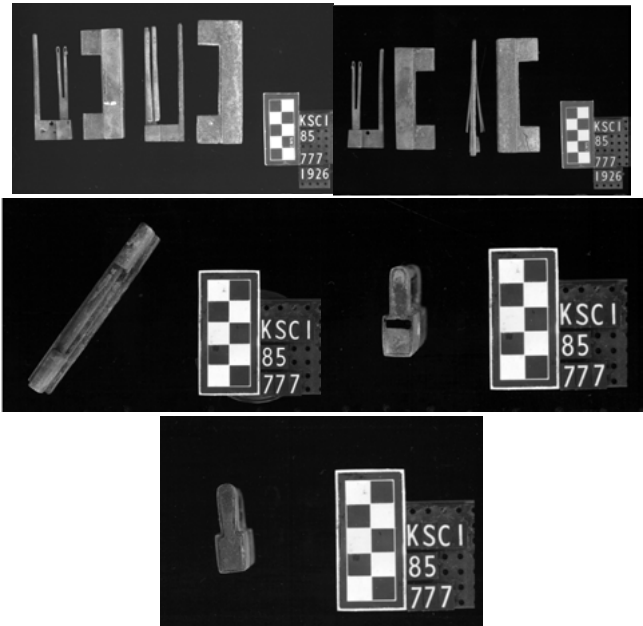
KSC1 769
Possibly handle of small tool.



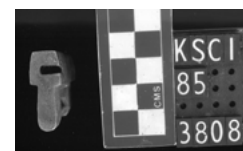
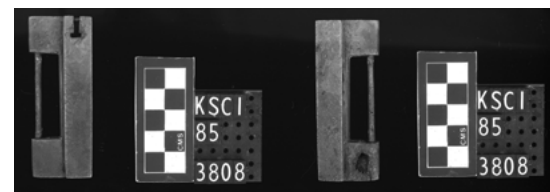
KSC1 3892B
Lower section of lime container. Ref: Green, (1983); Green and Harper (1983) KSC1 03 (lime remains found inside); Ko Si Chang 3 wreck site, Green, *et al.* (1987) KSC3 6A, 486, 486B; KSC2 207 (above). Also Premchit (1971: Plate LIXa) in the de Santos Collection, the Philippines; Rau and Hughes (1985: Plate 7 No. 5), Tak burial site; the Phu Quoc wreck site, Blake and Flecker (1994: Fig. 20).



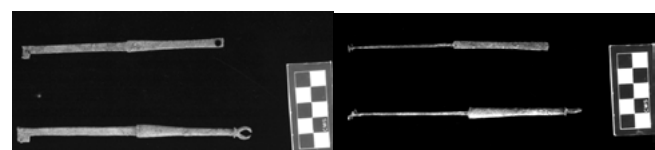
KSC1 629 (1: 2)
Possibly section of lime pot, eroded.



KSC1 777 and 1626
Locks. Chinese style. Possibly cargo as the keys were found in association with the locks. Two Chinese style locks were also recovered from the Binh Thuan shipwreck, Flecker (2004: 10). Flecker indicates that four Chinese locks were found on the Vung Tau shipwreck (1695–1700). Almost identical items are believed to have been recovered from the *Witte Leeuw* wreck site. Pijl-Ketel (1982: 35) bottom right hand side, shows a painting made in 1636, which includes an illustration of a similar lock.



KSC1 3808
Lock.



KSC1 3604
Key

KSC1 3537

Key

IRON

A concretion of nails was identified in 1985.

Glass

Not illustrated.

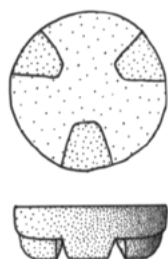
Fragments of glass were recovered from the site.

Stone

Ballast stone

Not illustrated.

16 Kg of ballast stone was recovered from the site in 1983.



KSC1 3893 (1: 2)

Grindstone

Ref: A similar find has been recovered from the Ko Samui wreck site, Thailand.

Table 2. Total Quantity of Artefacts Recovered from the Ko Si Chang 1 Wreck Site

First number with x = complete or almost complete (a substantial part of item remains), second number denotes parts or sherds.

1982/3 Excavation	
Earthenware ceramics	
Lids	17x/4 Pressed earthenware pot lids (lotus bud and knob handles).
Kendi lid	1x/ 37 miscellaneous
Pots with pressed decoration	5x/290
Kendi/Kendi type bowls	21x/1113
Stoves	1x/127 (making up at least 9 stoves)
Small bowls/jars/jarlets	1x/150
Earthenware to stoneware ceramics	
Mortars	13x/6
Bottles (included under Jars)	
Bowls/Basins everted rim	1x/180
Basins	24 x/334
Jars (various types) including some which tend more to earthenware	6x/46
Stoneware ceramics	
Jarlet	1x Jarlet
Large Jars (including Chinese type)	20x/604
Porcelain	
Cup/Bowl/Plate	11x/47
Discs	1x
Organics	
Lacquerware	Fragments
Fish bones	3 kg 750 g
Vegetable fibre	4 kg
Ebony/Ivory/Wood	
Areca nut	1 x
Gun stocks	2
Bung	1x
Dowel (treenail)	1
Flat lengths reed	2
Various small pieces timber	
Caulking associated with timber	
Bone	
Rodent skull	1
Bones	2

Metals	
Lead	98 Kg Ingots
Strips	2
Copper alloy	
Lime container sections	2x
Stone	
Grindstone	1x
Ballast stone	16 kg
1985 excavation	
Earthenware ceramics	
Figurine	1x
Lids	4x/5
Flanged lids	2x/1
Tubular handled	2x/6
Soft bodied tubular handled	1
Other	10
Pots with pressed decoration	223
Kendi/Kendi type bowls	2326
Small bowls, jars, jarlets	4x
Bottles included under Jars	
Stoves	32
Earthenware to stoneware ceramics	
Mortar	1x
Bottles included under Jars	
Bowls/Basins everted rim	9
Basins	3x/73
Jars (various types) including some which tend more to earthenware including KSC1 55 & 88	1x/49
Stoneware ceramics	
Jarlet	1x
Large jars including Chinese type	1x/251
Porcelain	
Cup/Bowl/Plate, etc	6x/1637
Discs	58x
Organics	
Lacquerware	Fragments
Ebony/ivory/wood	
Chess or game piece	3x
Handle	1
Wooden dowels	7
Coal	2 pieces
Metals	
Lead	36 ingots
Lead covered stone shot	10

Lead pieces	2 lengths
Copper alloy	
Locks	3x
Key	3x
Lime container sections	2x
Handle	1
Stone	
Grindstone	1x
Other	
Nail concretion with possible glass & metal	1

PART 2. Ceramics Other than jars

STOVES

Sherds of at least ten ceramic stoves were found on the Ko Si Chang 1 site, indicating that most were cargo items. Other Thai sites from which stoves have been recovered are the Ko Kradat, Ko Samui, Ko Si Chang 2 and 3, Ko Khram, the Pattaya and Rang Kwien wreck sites, Green and Harper (1983 & 1987) and Intakosai (1983 & 1984). Frost *et al.* (1974) also report a find from the Sha Tsui site in Hong Kong. Hein & Sangkhanukit (1987: Fig. 14) illustrate items which are likely to be stoves, recovered from the Ban Tao Hai kilns, Phitsanulok, Thailand.

Warren and Invernizzi Tettoni (1996) indicate that this stove, in Thai known as *cherng kran*, can still be seen, but only in the most remote villages, the fuel used being wood or charcoal. Possibly of relevance, two lumps of what were determined to be coal were recovered from the Ko Si Chang 1 shipwreck site. Holbrook and Suriya (2000) indicate that in the 1960s charcoal stoves were still being used on boats in the Gulf of Thailand. McIntyre (1995: 6) indicates that this variety of stove, traditionally used in Indonesia, is an efficient user of wood and waste such as corn stalks and rice husks. Like the items recovered on the Thai wrecks, the Indonesian stoves or *tungku* are said to be made from sandy clay with ‘...three or more humps built into the stove top, allowing the fire and heated air to pass up around the base of the pot’. McIntyre (1995) indicates that some of these stoves have two or three holes. This can also be seen in the Ko Si Chang 1 and 3 items. Those from the Ko Si Chang 1 all had a raised base to keep them off the floor (such as on boats or wooden floors of a house), but the Ko Si Chang 3 item did not though this may be due to the fact that the item was worn and the skirt may have become detached. At the time of excavation there was no note taken that this may have been the case. The stove believed to be from the Ko Samui site also had a flat base.

The oriental stove, of a different style to the Thai, is a common find in Philippine archaeological sites. Friis (2005) indicates that the stoves from the Thai shipwrecks are not of Javanese style.

SMALL PAINTED CONTAINERS

Crow (1976: 69–71) indicates that celadon and blue and white small pots and jarlets of about 2–3 inches in height were mostly used for herbs and medicine. Crow also includes Sawankhalok small jarlets in this usage. Attention must be drawn to jars shown by Fehervari (2004) who discusses the possibility that floral motifs on 15th century Syrian items represent the plants used to make medicine for which the jars were intended to hold. It would be of interest to ascertain whether this was the case for any of the small containers manufactured at Si Satchanalai. Alternatively, it may be that the Thai artisans were mainly inspired by the scenery around them for use in their decorations. In some cases they appear to be imitating Chinese wares such as shown in Green and Harper (1987: Figs 31a & b) where the artists have based their drawing on a typical Chinese illustration. In fact, they display a diversity of floral and vegetal subjects as well as birds and fish but since there is such a close association between the Thai and Syrian

items the possibility that there was an extra dimension to the Thai items cannot be ignored.

Many of these small items have been recovered from burial sites in the Philippines and elsewhere but it is unknown whether any remains of plant material have been found inside, or in the case of the small jarlets whether any stoppers were found indicating the use or intended use of these jarlets for storage purposes. ‘Covered bowls’ are of their nature, comprised of both base and lid. None of the items recovered from the Ko Rin or Ko Kradat shipwrecks held any material, and in fact, the lid of a small Ko Kradat covered bowl was still joined by a thin layer of glaze.

CHINESE CELADONS

Chinese celadon wares of varying quality were recovered from the Ko Si Chang 2 wreck site. No other shipwreck sites excavated by the Thai–Australian team held Chinese celadons however a good quality piece was recovered by a Thai team from the Ko Samui wreck site. Thai celadon wares were recovered from the Ko Kradat, Pattaya, Ko Khram and the Rayong sites.

Longquan is the name generally given to high quality celadon with designs incised or carved, pressed on moulds or applied in relief. The term has been used rather liberally but should refer to those particular items made in the district of Chekian (Zhejiang) and north of Fukien before the industry there culminated at the end of Song, beginning of Yuan dynasties (1271). As Hobson (1976: 155) explains, the potters moved at the beginning of the Ming dynasty to Ch’u-chou where the quality was not so good. He explained that the Ming celadon had a greyish white porcelain body with a ‘...sea green glaze of unusual thickness which varies considerably in tone’. This is exemplified in the Brunei Darrusalam shipwreck, Richards (2003) where plates and bowls with various shades of celadon glaze were recovered. Burns (2005, pers. comm.) informs that the colour of the glaze depends on the body onto which it is placed, the specific composition of the glaze ingredients, preparation of materials (e.g. grinding of ingredients) and firing conditions. Hobson (1976) indicates that the presence of iron in the clay resulted in a rusty brown colour on the exposed parts, gained during firing.

One group of the celadon wares recovered from the Ko Si Chang 2 appears to be of quite good quality. A second group is much inferior to the first with opaque glaze, heavy body and primitive *sgraffito* decoration. One cause could be, as Medley (1976: 147) explains, due to the nature of inter-connected chambers of the kilns, the ware in the lower chambers was of lesser quality than that in the top ones. ‘This was due to the shorter time taken to raise the temperature at the lower end compared with the upper end where the warming up period was extended and very even. Thus the finest and most expensive material usually came from the upper chambers’. It may therefore, that the Ko Si Chang 2 celadons came from varying chambers. It does not explain the poor *sgraffito* decoration evident on bowls with unglazed centres.

CHINESE PORCELLANEOUS BODIES

Porcelain is made of China stone (*petuntse*), a feldspar found naturally and China clay (kaolin), produced by the natural decay of feldspar. These items, when combined, can be fired up to 1350 degrees centigrade. They were found in large quantities and of good quality near Jingdezhen, China.

Hobson (1962: 13–14) relates that in the early part of the 16th century good quality porcelain clay and stone for the body and glazes was obtained easily from the vicinity of Jingdezhen but were practically exhausted in the reign of Wanli. It is partly due to this that Hobson (1962: 14) determines: ‘There is little doubt that the quite obvious deterioration of the material in some of the Wanli wares is due to these circumstances.’ Hobson goes on to say that ‘There were, of course, fine and coarse wares at all times, and in the larger and heavier vases and bowls it was only natural that stronger and often coarser materials should be used.’ Vainker (1997: 199) suggests that: ‘...the great majority of Wanli wares from Jingdezhen were roughly potted, from poorly prepared paste’. The distinction between the Kraak type items from the Ko Si Chang 1 and those of later shipwreck sites, appears to be that the latter are less finely bodied and of a somewhat more sturdy build. It may be that later Kraak ware was made thicker because of the clay type. It also may be because of mass production: less time and care being taken in the formation of an item or indeed the need to have a less fragile item in order for it to withstand the rigours of long and precarious land and sea voyages. Pijl-Ketel (1982: 43) indicates that it was a thousand mile trip from the kilns over land and water (through the Poyang Lake) to the port. Kraak wares and their forerunners are discussed in greater depth below.

PORCELAIN DISCS

A number of porcellaneous discs were recovered from the Ko Si Chang 1. Li (1996: 209) records: ‘The funnel-shaped saggars and disc-shaped supports made of sagger clay used during the Song–Yuan period were abandoned at Jingdezhen, to be replaced by flat-bottomed saggars and refined supports made of white porcellaneous clay’.

Green (1983) KSC1 1983 387 shows a profile of one of these discs which had been manufactured on a wheel. The diameter is about 60 mm, where one surface is fairly flat whilst the other is bevelled towards the edge. On the central area, diameter about 27 mm, the marks of cloth fibre are set during firing. The area surrounding the fibre pattern has been scraped in a circular direction before firing. It is likely that this may have been done so that in the initial firing of the discs one could be placed upon another with a limited area of contact between each. On one disc (KSC1 906) fingerprints can be seen fired onto the item. Some of the discs have chatter-marks on the cloth side (KSC1 2329 & 2330).

Rinaldi (1989: Pl. 185) shows a cup with a disc still attached. The decoration on this crow cup (given as Jingdezhen 1600–15) has a vase alternating with floral scenes similar to some of the Ko Si Chang 1 items but on a six panelled item with less complex borders than Ko Si Chang 1 pieces. It is of interest that the cup is placed on the flat side of the disc whilst the bevelled side must have sat on the kiln or sagger floor. Rinaldi (1989: 53), explains that the ceramic items were placed in saggars

(cylindrical containers). Sand was sprinkled on the bottom of the saggars to prevent vessels touching the sagger and to absorb any glaze that may run off. The sand could be rubbed off but the use of the disc must have resulted in a cleaner foot.

Rinaldi (1989: 53) indicates that for mass production: ‘... particularly that intended for export the sand was generally left attached’. Though some sand granules were evident on the Ko Si Chang 1 ceramics, in general they were fairly clean. Notable is the fact that products of what has been called Swatow ware, now referred to as items produced at the Zhanghou kilns, very often had quantities of quite coarse sand granules remaining.

Rinaldi also says that the porcelain discs further ‘insulated’ the ceramic item—presumably in terms of absorbing some of the stress during firing at high temperatures.

It is unknown why the discs were present on the Ko Si Chang 1 ship. It is possible that they were used during the packing process in order to separate the cups and bowls from breakage when they were packed one inside the other. One can speculate that grain or straw may have been used in conjunction with the discs. It could be that the discs were still attached to ceramic items and became dislodged upon impact. Possibly they were intended as samples of some kind or perhaps they were to be used in other kilns. Green (1983) indicates that he noted similar discs in Japan at Okawachiyama, Kuyushu, where the kiln of the feudal Lord Nabeshima was located in the late 17th century. It is possible, however, that they were to serve an entirely new function as counters or gaming pieces. Discs made from broken ceramic wares have been found in archaeological sites in the Philippines, Hutterer (1973: 31). Likewise one was recorded by this author in the collection of the National Museum of the Philippines in 1987. They are also reported from excavations in northeastern Thailand, recorded by Soldheim through Hutterer.

BLUE COLOURANT USED ON CHINESE CERAMICS

Blue and white porcelain from Chinese kilns was recovered from almost all the Thai Gulf shipwrecks: Ko Si Chang 1, Ko Si Chang 3, Ko Kradat, Ko Rin, Pattaya, Rang Kwien, Rayong, Samed Ngam, Ko Samui and the Ko Samae San site.

Hobson (1962: 25) describes the periods—Xuande (1426–1435), Zhengde (1506–1521) and Jia jing (1522–1566) where light washes of blue were variegated by touches of a darker line, resulting in a mottled appearance. Another early style was where a design was drawn in carefully pencilled lines, no flat washes of colour being used. Rinaldi (1989: 48) tells that during the Cheng-hua (1465–87), the drawing was outlined in a thin dark line, then filled in with washes of various shades. This technique remained popular and was the most common Ming style. For instance, Kilburn (1981: 17) explains and shows examples (No.5) of ceramics from the Jia Jing period where two shades of wash are used with lines and dots over parts of the wash ‘...to darken or vary certain areas’. A single firing was sufficient for the body, glaze and colourant.

Technological developments have resulted in greater understanding of the particular sources of the blue colourant used in Chinese and Vietnamese ceramics. In an effort to bring a little more precision to the dating of our shipwreck sites a brief summary of what is known about sources of the colours follows.

Cobalt is the source from which the blue is acquired. Great skill was required in its usage. Rinaldi (1989: 52), explains that blue and white porcelain was fired in a reduced atmosphere (a reduction of the amount of oxygen in the kiln). As a result '...cobalt oxide acquires its blue colour by being transformed into cobalt silicate, while the iron present in small quantities in the glaze causes the bluish or greenish tinge in the glaze'. Thus, different qualities of cobalt result in different grades of glaze colours.

Rinaldi (1989: 48) tells that as early as the Tang dynasty cobalt ore from Persia was used in ceramic production. By the beginning of the 15th century this 'Mohammedan blue' was said to be exhausted. There must have been some availability for quite a period. Hobson (1962: 112) comments: '...it is stated in the manuscript T'ao lu that the supply of Mohammedan blue completely ceased in the reign of Wan Li; and, although there is reason to think that this is overstating the case...it is clear that recourse had to be had more and more to the ordinary native blue...', adding 'This is apparent on examples of Imperial Wan Li porcelain which have survived to the present day'. Tests, as described by Garner and Joseph through Brown (1988: 27), showed that on pieces made before the Xuande reign (1426–35) imported cobalt with a low manganese content was used. Rinaldi (1989) describes supplies of a cobalt coming from Sumatra and possibly Zanzibar as tribute, the last being received in 1434. According to Brown (1988), pieces from about 1426 either had native ore with a high manganese content or a mixture of both in different proportions. Hobson (1962: 24) states that this ore came from the neighbourhood of Jingdezhen. The manganese had to be eliminated before the cobalt could be used.

Hobson tells that native blues also came from the Lei-p'ing district of Jaochow but these mines were closed in the reign of Jia Jing and blue from Jui-chou was used in its place. Hobson says that impurities in the native mineral resulted in a dull or greyish colour though there were attempts at refining resulting in '...great variations in quality observable in the blues of all periods...'. Rinaldi (1989: 48), points out that the local ore did not produce 'the dark and brilliant blue of Xuande' but because of its ability to be ground finer it allowed the new painting technique described above. Li (1996: 211) says records show that from the late 15th to the late 16th century cobalt was supplied from different sources. These varied from Shanggao county in Jiangxi, from Yunnan, and possibly from the Central Asian area of Khwarism. The *hui* blue from Yunnan was used from the Jia Jing to the early Wanli period to decorate tribute wares. Li says it was more often blended '...with Chinese ingredients, resulting in a lighter and less purple shade...'. The *hui* cobalt continued to be used in the early years of Wanli until in the late 16th century material mined in Zhejiang began to be used at official kilns. He states that the imported colours ceased to be used among late Ming blue and white wares.

In contrast with the use of the *hui* blue in the Jia Jing and early Wanli, Transitional Wares 1621–mid 17th century are often distinguished by their 'rich purplish' tone of blue which, as described by Vainker (1997: 199) '...contrasted well with the milky white body'. These are well illustrated in Kilburn (1981) Colour Plates. Of Kraak porcelain, Casa-Museu Dr Anastácio Gonçalves (1996: 29) comments

that '...the blues varied from a deep brilliant hue to paler, silver-blue washes'.

Other factors to be taken into consideration when estimating the origin and quality of a porcelain piece is that of those produced at an Imperial Factory, the painting, even to the quantity of blue material used, was exactly calculated, according to Hobson (1962: 17). At the Private Factories, he believes the decoration would probably have been executed by one person, leading to more freedom of design and presumably, use of colour.

In regards to Vietnamese blue colourant, Nguyen-Long (2001: 97) finds that on the Hoi An shipwreck site believed to 15th century '...different qualities of cobalt were used simultaneously'. Thus there are some items with clear blue and others of quite dark blue on this site. Even on the same dish there are clear blue, superior paintings together with mediocre style of painting in dark blue. It also illustrated therefore that the decoration of one item was not the work of one artist alone. Nguyen-Long says that there were no sources of cobalt in Vietnam, and until now its usage was usually related to the Chinese ceramic industry. (Nguyen-Long notes that there was definitely no shortage when the blue and white ceramics from the Hoi An shipwreck were made). Brown (1988: 27) relates that on some Vietnamese ceramics, testing of dark, blackish-blue colour wash revealed that cobalt of the type native to China was used in their manufacture. Items with a clear blue, fine linear brush stroke used Middle Eastern type colour. Under the assumption that if the Chinese sources were used for the dark items Brown says that those examples must be dated no earlier than 1426 since imported cobalt was used in China before then.

BLUE COLOURS ON PORCELAIN AND STONEWARE FROM THE GULF OF THAILAND SHIPS

Only one sherd of what was determined to be porcelain was recovered from the Ko Si Chang 2 wreck site (KSC2 1051). No blue decoration was evident.

A small fragment of blue and white ceramic was recovered from the Pattaya wreck site, Green and Harper (1983: 494). Beurdeley (1974: Fig. 128) attributes the type of rim scroll seen on this sherd to the 15th century.

Some items from the Ko Si Chang 3 wreck site (KSC3 358 & 312) are similar in shape and floral design to items from the Brunei Darrusalam ship, said to be late 15th, early 16th century.

On the Ko Kradat wreck site the blue and white ceramics, some with reign marks, were outlined, then roughly washed. Dots and lines do not appear to have been used.

Ko Rin wreck site items are outlined in thin and thick lines. Some are quite well executed indicating that the artist is fairly well in control of the cobalt application. Lines and dots are used as part of the decoration, for example in leaf veins, bird wing feathering, fish scales, cat body, dots on deer and fungi. Beurdeley (1974: Fig 130) shows a similar type of design as being of the 15th century. Associated designs from the Ko Kradat site indicate a 16th century dating.

The bowl KSC1 G1 from the Ko Si Chang 1 wreck site is outlined then filled mainly in one colour (fairly dark) but some effort appears to have been made to layer colour. The

moulded and panelled wares (crow cups) have relatively light blue glaze compared to some of the Kraak material from later shipwrecks. Decoration on the bowl KSC1 G6 has been outlined then filled with light and dark washes. There may have been one wash then another where darkening was required. There are quite fine outlines and fairly intricate decoration on these crow cups. Lines are used for the tassels, on lanterns, mountains etc. There are dots on vases etc. The Ko Si Chang 1 wares do not have a purple hue.

CHINESE BLUE AND WHITE CERAMICS

In China, Li (1996: 213) says that recent archaeological discoveries have confirmed that Ming export ceramics were produced ‘...in substantial quantities at more than one place in each province’. He includes production sites at Ganxian, in southern Jiangxi, Leping in northern Jiangxi (south of Jingdezhen), Raoping, eastern Guandong (near Shantou or Swatow) Lufeng, in Yunnan, Anxi county in southern Fujian (near Quanzhou), Hunan and probably Sichuan. Many of these wares may have been previously described as Swatow wares. As Li puts it ‘Swatow ware is loosely defined as porcelain wares with underglaze—blue and enamel decoration and characterized by sand adhering to the bottom and the flaking edges of the rim.’ Pijl-Ketel (1982: 195) and Rinaldi (1989: 67) detail further the characteristics of Swatow ware. Some items previously described as Swatow wares have been recovered from wreck sites of the Thai Gulf. Flecker (2004: 6) from Ho (1995) says that kiln excavations in Pinghe County, Zhangzhou region, Fujian Province, determined as late 16th, first quarter 17th century have recovered blue and white and red-green overglaze enamels (as recovered from the Bingham Thuan shipwreck) of what had been termed Swatow type and now referred to as Zhangzhou porcelain. Zhangzhou is near the port of Xiamen, formerly known as Amoy, the next large port north of Shantou, formerly known as Swatow.

Volker (1971: 193–4), in his detailing of the Dutch East India Company (VOC) porcelain trade says that at the end of the 16th century ‘In the near hinterland of Swatow there was a kiln centre at the large town of Ch’ao Chou’. He points out: ‘One of the coarse wares of the period, though at the time, according to de Flines (3), already in its decline, is frequently called Swatow ware. This appellation is misleading and should, I think be abolished’. Volker goes on to say that Swatow is not mentioned and didn’t figure on maps of Sung or Ming China. He says that Swatow was not one of the Chinese ports open to foreign trade during the 16th and 17th century. Likewise, Tan (2004: 94) says it is unclear as to how the group of wares from Zhangzhou became known as Swatow ware because the port of Swatow didn’t become active until the Qing dynasty and it was unlikely that Zhangzhou ware passed through the Swatow port.

CHINESE IMPERIAL AND PRIVATE FACTORIES

Chinese ceramics came under the groupings of Imperial Wares (kilns specialising in the manufacture of items for the ruling class) and Private Factories where wares for the use of the other classes was made. Chinese ‘trade’ was based on the Confucian ideal that merchants were to be despised because as

Rinaldi (1989: 19) puts it: ‘...it was a dishonourable goal as it did not promote social harmony.’ Thus, foreign goods brought to China by envoys were called tribute and commodities to foreign countries were called gifts. This exchange was under the control of the Emperor. Imperial control, according to Kilburn (1981: 13), weakened during the latter part of the 16th century by the ‘...practice of placing palace orders with private kilns’.

Hobson (1962: 18) tells that at the Imperial kilns production was highly specialised, whereas at the private kilns a little more freedom was allowed, leading to as he says: ‘...why in some of the obvious trade wares we meet with refreshing signs of individuality in the painting’. Moreover, Garner (1970: 7) says ‘Nor must it be imagined that high qualities were confined to Imperial wares, made for the use of the court. We often find that pieces made for other uses have a vigour and beauty of design which is absent from some of the Imperial wares’.

At the same time, in reference to particular export wares (in this case a deer plate), Garner (1970: 36, No.58A) says they ‘...were no doubt generally the coarser pieces of a class of porcelain made to meet the needs of the Chinese non-Imperial user.’ He goes on to describe fairly typical elements which can be associated with many of the blue and white ceramics recovered from the shipwrecks excavated by the Thai-Australian team in the Gulf of Thailand including the Kraak wares, such as ‘chatter marks’, radial marks and grit adhering to footrims. However, he notes that ‘...they are skilfully and vigorously decorated...’.

The output of Imperial kilns was much diminished after the death of Wanli (1619) by the apparent ‘...scarcity of marked pieces of imperial style and quality...’, Kilburn (1981: 13).

TRANSITIONAL WARES AND THEIR FORERUNNERS

It is pertinent to look at the group of wares produced in the Forerunners (*c.* 1550–1619) leading into the Transitional Wares (1620–83) (that is, the period of transition between the Ming and Ching Dynasties, after the death of Wanli and before the setting up of reorganized Imperial kilns at Jingdezhen). The group of ceramics produced at this time includes blue and whites which Kilburn (1981: 9) describes as ‘...a new style of painting into ceramic art – spontaneous, naturalistic and a refreshing change from the conventional and formal imperial designs’.

Many of the Ko Si Chang 1 items bear great affinity to those items termed Forerunners to Transitional wares and Kraak ware. These items were in evidence in VOC records and through recent finds on shipwrecks in Southeast Asia and further afield where Kraak ware was widely exported by the Portuguese and Dutch in the 17th century.

The Forerunner of Transitional Wares began in the mid 16th century, when the Imperial wares were deemed not suitable for export markets, Kilburn (1981: 13). Animals, figures in landscape and birds were produced together with the panelling and other decorations seen in Kraak wares. The Ko Si Chang 1 wreck site, (dated from 1573) falls into this period; the blue and white porcelain wares display many of the features of the Kraak wares which Rinaldi (1989:18) says were produced in greatest numbers during the Wanli period. However there are some differences between the Ko Si Chang 1 ceramics and those of some of the other

wreck sites of around this period and later. Ko Si Chang 1 wares are representative of a particular time and clientele, where the new decorations are combined with a large variety of motifs within the narrow panels. What differs between the The Ko Si Chang 1 examples and those from many other wreck sites with what is termed Kraak ware, is that the panel motifs generally vary from one panel (narrow or wide) to the next on the same item. This also occurs on Kilburn (1981: No. 35) which is given as from the Wanli/Tianqi reign (1600–25). The narrow panelled decorations on crow cups are generally of the beaded pendant, ribbon and bow or stylized lotus designs combined with a variety of central motifs related to Buddhist symbols (Table 1, above). In contrast to many other crow cups the Ko Si Chang 1 main panel decorations are fresh, detailed and quite well executed. The motifs are much more varied in design, number and usage than on any of the items noted by this author.

The existence of the Wanli reign material on board the Ko Si Chang 1 ship shows with certainty that this ship operated and met her demise after 1573, the commencement of the Wanli reign, and could have been still operating after the death of Wanli in 1619. Because they still adhere to many of the conventional designs but at the same time have a refreshing freedom about them, they can be described as Forerunners of Transitional Wares.

The fact that Kilburn (1981) in his discussion on Transitional Wares and their Forerunners has categorized the only equally comparable items to those of the Ko Si Chang 1 crow cups under Dutch Tableware, infers that these items differ in some way from the usual Kraak ware. Like the Ko Si Chang 1 crow cups, the thinly potted lobed sections are divided into eight sections, the decorations alternating between panels with a free design. The central interior decoration consists of birds on a rock and floral sprays.

That the Ko Si Chang 1 items are in fact Forerunners (that is leading up to Transitional Wares) may be further illustrated by Jenyns (1971: 18) who states that the typical Transitional ware is described as: ‘a strong build with a clear white body... often left unglazed on a flat base.’ The thick bubbly glaze, bright violet toned blues with ‘figures in landscapes...’ and walls of rock ‘...emerging from swirling clouds. The colour of Ko Si Chang 1 blue is not of a violet tone and the scenes are not as dramatic as those described as Transitional Wares.

DEFINITION AND CHRONOLOGY OF KRAAK WARE

As explained above, Kraak ware is said to have evolved as a result of the change of power to the Wanli dynasty and the subsequent innovations brought about. Speculation is that these wares came soon after the Portuguese opened a permanent trading post in Macao in 1557. Porcelain was produced in massive quantities, catering for the market of the Middle East and Southeast Asia.

As explained by Rinaldi (1986: 1), the word Kraak appears to have several derivations and uses. Thus, the term probably originates from an Arabic word *quarquir* meaning merchant vessels, transcribing into the Spanish *carraca* and then into the Dutch *Kraken* which apparently means to break easily in Dutch. It is also the word for a cupboard or shelf on which

porcelain was kept since the first Kraak ware. Another word, *kraaikoppen* is a Dutch word meaning resembling a crow, as in ‘crow cup’ one of the porcelain items described under ‘Kraak ware’, Rinaldi (1989: 143).

Li (1996: 212) points out that since 1982 much Kraak ware has been recovered from tombs in Guangchang, Jiangxi Province, dated 1573–1645. It has not yet been determined if this material was made in Jingdezhen or elsewhere or whether it resembles the material recovered from the Ko Si Chang 1 site. Li states that: ‘Chinese experts are now convinced that kraak ware, if not up to the standards required for export, was diverted to the domestic market, where it found a ready sale for use as grave goods. The question of whether those Guangchang kraak wares were made at Jingdezhen, Guangchang, or elsewhere, remains unanswered pending the discovery of conclusive archaeological evidence...’.

Several shipwrecks have been recorded as having Kraak ware amongst their cargo including the *Witte Leeuw* (1613), the *Banda* (1615), a ship referred to as the Hatcher Junk (the date given as 1643–6) and the *San Diego* (probably late 16th century). Kraak ware has been uncovered at Drake’s Harbour in California, where two sites are closely associated, one ascribed to Francis Drake’s encampment in 1579 and the other to the 1595 wreck of the *San Agustin*.

Though a few items of porcelain had reached Holland via the Portuguese and Spanish, the first entry of the Dutch ‘into the market’ so to speak, was their capture of two Portuguese ships, the *San Jago* off St. Helena in 1602 and the *Santa Catharina* (1603) near Pattani. The 100,000 pieces of cargo created a frenzy of demand for blue and white wares, as chronicled by Volker (1971).

According to Rinaldi (1981: 62), at the end of the 16th century, beginning of the 17th century some styles ceased and new were produced. The Dutch chose more familiar styles and new shapes developed. There was a reduction in the variety of styles.

Volker (1971) details the porcelains recorded in Batavia and other localities used by the Dutch from 1602–1682. From 1604 blue and white porcelain was leaving Pattani and Bantan with Holland as its destination. In 1614, through Volker (1971: 25–6) there is reference to ‘small, fine cups’. By 1616 there is already discussion of cargoes ‘...bad as to painting...’, perhaps a reflection of mass production due to a huge increase in demand from the West. Soon the Dutch were demanding more cups, as Volker (1971: 29): ‘We want...caudle-cups, half, third and quarter sizes and other kinds, but those cups must be with straight or sheer sides, and not flaring and flat-lipped like common caudle-cups generally are, because the kind with sheer sides are worth a quarter more than those with flaring sides, and even in large lots they will find buyers.’ The caudle cups, which are shown in illustrations accompanying the publication are the crow cups or small lobed bowls similar to those seen on Ko Si Chang 1 and other sites.

Until the mid 17th century, huge cargoes of Kraak wares were sent from China throughout Southeast Asia, Persia, India, Timor and Holland. In terms of items similar to those found on the Ko Si Chang 1 ship, probably the greatest number on any one ship was on the *Amsterdam* (1637) going from Formosa to Batavia, the Bill of Lading noting 25,710 *klapmutsen* and

60,780 ‘caudle cups’ amongst other porcellaneous wares. From around 1643 *klapmutsen* was appearing in more than one size and ‘Concave’ plates are recorded as a new shape, Volker (1971: 49).

According to Kilburn (1981: 14) after 1644 ports of Fujian province from which most porcelain had been exported were unable to be used for that purpose.

KRAAK WARE—DEVELOPMENT OF SHAPES AND DECORATION

In her writings on Kraak Porcelain, Rinaldi (1986 & 1989) attempts to classify dishes and borders in chronological order. This has been questioned by Jean-Paul des Roches, according to Casa-Museu Dr Anastácio Gonçalves, (1996: 30) upon the discovery of the *San Diego* ship recovered in 1993. Ceramics from this ship reveal that all Kraak wares were in evidence around 1595–1600 except for those with a flat rim finishing in a raised lip (Jia Jing period) and those bearing foreign motifs (following Wanli period).

Kilburn (1981: 13) gives an outline of the development of Kraak wares. As indicated above, in the middle of the 16th century a range of designs was made in the Chinese kilns to suit the export market of the Middle East and Southeast Asia and as such animals, birds and figures were brought into the traditional Chinese decorations. Panels, borders and diaper patterns were incorporated.

Kilburn (1981: 17) says, the characteristic egret and lotus borders, the Daoist landscape and many other motifs disappeared early in the Wanli period (1573–1619). Illustrations from nature continued, but became increasingly stereotyped as the demand for export porcelain expanded during the Wanli period, ‘...placing the decorators under more and more pressure to increase their output.’

It is at this stage, the beginning of the 17th century that the bowls with flattened rim (*klapmutsen*) probably first appeared due to the Dutch requirement for a spoon to fit inside. The *klapmutsen* were amongst the first cargoes ordered by the VOC from Pattani in 1608. Dishes of a similar shape to *klapmutsen* appear on the Ko Si Chang 1 wreck.

New decorations came after 1600 as Kilburn (1981: 21) explains. On many dishes and plates, panels were replaced by roundels—usually filled with alternate flower sprays and symbols. Just before the death of Wanli, the range of decoration extended as a reaction to the Japanese desire for individual designs in their tea ceremony.

Kilburn (1981: 23) determines that the best guide for dating Kraak is the treatment of the underside of dishes and plates. Earliest pieces have birds on branches or floral sprays in running style (see the treatment of the underside of the Ko Rin plate rims). The early pieces also have the panelled style which appears early Wanli. It is of note that the Ko Rin items are not panelled. By 1600 the designs underneath are sketched with less and less care ‘even on pieces with the finest drawing on the front’. By the Kangxi/Tiengi 1621 reign the underside decoration was represented by a few lines and blobs.

In reference to ceramics recovered from the *Witte Leeuw* of 1613, Kilburn (1981: 21) determines that the drawing is less detailed than items made prior to then and shows signs

of general deterioration under pressure of huge quantities being ordered. Kilburn says that this is a distinguishing feature of late Ming pieces. Mass production led to progressive deterioration of goods over time. Quality varied due to too few skilled artisans. As Rinaldi (1989: 209) states: ‘At the same time it was necessary to keep prices low and this coupled with the increase in demand, created a period of mass production which was not conducive to patient, skilful painting’. However, Rinaldi believes that unlike other porcelains, the quality of decoration of Kraak wares did not seem to deteriorate. She is of the opinion that the Hatcher Cargo was of better quality than that of the *Witte Leeuw* which was thirty years earlier. Kilburn (1981: 19) comments that there is a tendency to judge Kraak in the more refined the pieces ‘...the earlier it is likely to be, in view of the general deterioration in standards throughout the Wanli period’. He says that this is misleading when applied to Kraak ware.

In relation to the items recovered from the Ko Si Chang 1 which would appear to have their manufacturing time in the late 16th century or the first couple of decades of the 17th century, it may be argued that the small cups (referred to here as crow cups for easy identification) akin to Kraak ware are more intricately and expressively decorated than either those of the *Witte Leeuw* or the Hatcher cargo. The Ko Si Chang 1 crow cups differ from those of the other wreck sites in various ways—variety, colour, fineness and decoration. The colouring is generally lighter than on the 17th century ware destined for European markets (apart from the item described by Kilburn (1981: No. 35). Rinaldi (1989: 233) remarks that the Artemisia leaf is the most common representation on the Kraak wares. This is not a central distinguishing feature of the Ko Si Chang 1 items though it does occur. She also says that human figures are quite rare, whilst they often appear on the Ko Si Chang 1 items in comparison to the quantity of sherds.

Apart from the shape of the items given as *klapmutsen*, the Ko Si Chang 1 ware shows no sign of European influence. Probably the most definitive distinction, pointing towards a different clientele for the Ko Si Chang 1 cargo, (that is, Asian versus European), is the number of panels into which the bowl exterior and cavetto are divided. In contrast to many other crow cups described, most, if not all of the Ko Si Chang 1 panelled items are divided into eight sections. Within each pattern are many illustrations with Chinese symbolism, divided by narrow panels with pertinent motifs related to Buddhism. (On Ko Si Chang 1 wares, these generally vary between each panel such as seen on KSC1 1737 above). Hobson (1962: 106), discusses this in relation to the Emperor of the Jia Jing period (1522–66) where the Eight Precious Things, Eight Sacred Emblems of Buddhism and the Eight Immortals are reflected in the decoration of palace porcelain. Many of these symbols are represented on the Ko Si Chang 1 cups.

Thus, it may be significant in determining the precise dating of the Ko Si Chang 1 wreck, that the pattern of eight rather than six panels was used on crow cups, indicating that it is likely they were produced before European interest became a dominant force in the market. Volker (1971: 22) states that the first time the Dutch saw porcelain was in 1602. After this time it may be argued that the diversity of decorations deteriorated under mass production. Minimization began

and decoration, such as the hastily formed *Artemisia* leaf, was frequently used.

Several other comparisons in decoration can be made between the wares recovered from the Ko Si Chang 1 to those found on other sites: As pointed out by Kilburn (1981: 21) and as can be seen in Pijl-Ketel (1982) the appearance of the monster mask (Taotie) is frequent on *Witte Leeuw* (1613) Kraak wares, as is a cicada on rock as central decoration. The latter was apparently not often seen on 16th century pieces, however, von der Porten (1972: Fig. 18) shows this decoration on what has been a late 16th century ceramic at Drake's Bay. Neither the monster mask nor cicada on a rock feature on Ko Si Chang 1 items.

From the *Banda*, Dumas (1981: 59) shows blue and white ceramics with some elements comparable to Ko Si Chang 1 but these do not have such a fine appearance as the Ko Si Chang 1 items. For example, it is evident that the decoration of the item on Dumas (1981: 63) has been executed with less care than similar representations on the Ko Si Chang 1. Likewise the underside decoration appears hastily painted, an indication of later wares, as explained by Kilburn (above). Ribbons appear between panels, however, there is no evidence of beaded pendants. The *Banda* wares include the cricket/cicada or grasshopper as a dominant decoration and also the *Artemisia* leaf.

Although the opportunity for a tulip-like decoration could presumably have been taken up much earlier by the Chinese, it was not until it became a craze in Europe (1630s) that a tulip-like ornament appeared between Chinese motifs as referred to by Volker (1971: 60). This decoration does not appear on the Ko Si Chang 1 wares.

Of the Hatcher Cargo, designated a time period of 1643–6, Rinaldi (1989: 155) says the variety of decorative motifs was greater than those of the *Witte Leeuw* and the painting of better quality. It has to be pointed out that the items shown by Hatcher and Thorncroft (1987: 78–9) show very tightly pointed panels and ribbons resembling a mere knot in comparison to the Ko Si Chang 1 decorations. Additionally, Hatcher and Thorncroft, (1987: 74), show similar decorations to those of the Ko Si Chang 1 group of crow cups etc., however, the Hatcher material also includes decorations such as a maze-like design, fish scale and sunflower (developed from peach) executed in a restricted manner.

Of the Ko Si Chang 1, *Witte Leeuw* and Hatcher ceramic decorations, the Ko Si Chang 1 are more free flowing and the panel decorations significantly more varied, surely a more likely occurrence before the onset of mass production. But as suggested elsewhere, it is this author's belief that the Ko Si Chang 1 cargo was possibly not destined for the European market, but for a more discerning Southeast Asian customer.

KO SI CHANG 1 WARES OF TRANSITION

Sherds of plates and dishes of *klapmutsen* style were recovered from the Ko Si Chang 1 wreck site and are easily recognisable as such because of the rim shape. However, being fragments only, it was not always easy to differentiate between moulded bowls (Shape I) and cups (Shape IV), Rinaldi (1989: 155). Some items with a rim measurement of around 150 mm diameter may be determined

to be bowls rather than cups. Rinaldi gives the date for production of the bowls as 1570–1610.

Ribbed and panelled crow cups, Shape IV, are said by Rinaldi, to have been manufactured between 1600–45. Different authors refer to similar items as high cups, and caudle cups. The term crow cup is in deference to the central decoration, invariably a bird on a rock. Caudle, defined by the *Concise Oxford Dictionary* (1979) as a 'warm gruel with spice, sugar and wine, for invalids...' supposedly reflects European usage. This term, used by Volker, may, as Rinaldi (1989: 154) points out, have included a greater range of items than those specified under Rinaldi's definition of crow cups. Volker (1971) mentions: '...small fine cups...' going from Bantam to Holland in 1614. These could have been caudle or crow cups.

The crow cup is said by Rinaldi (1989: 138) to be the most typical Kraak bowl shape with a height to rim diameter ratio of 2: 3. Dimensions vary from approximately 60–110 mm in height and 100–150 mm diameter. They have an everted, foliated rim and steep walls which Rinaldi (1989: 138 and 153) says shows a departure from the traditional Chinese shape. They are moulded and lobed, in the case of the Ko Si Chang 1 items like that represented on Rinaldi (1989: 42 g and possibly f). Generally the cups linear painted panelling follows the shape of the moulding. Many of the Ko Si Chang 1 items have panelled exterior and interior however others divide the main panel decoration with one or two fine lines. Some have no divisions at all. Interior decorations on the Ko Si Chang 1 items almost always have a central bird on rock scene with floral, fruit or vegetal design around the cavetto. KSC1 17/388 however has a stylized deer. Due to its measurement it can be defined as a bowl.

Several other ceramic sherds from the Ko Si Chang 1 ship seem to mirror the period in which they were likely to have been produced, during the Forerunner to Transitional Wares. For example item KSC1 1421 illustrating a cat sitting on an item of furniture in a large room or balcony, possibly reflects Vainker's (1997: 199) observation that: 'The use of scenes from poems, plays and novels to decorate the new and improved porcelain had much to do with the greatly increased circulation of printed books during the Wanli period... Landscape painting emerged from its subordinate role to become principal design'. He contributed this to the ability of the cobalt used enabling fine gradations of wash on the work.

Vainker (1997) describes how, in order to link scenes on opposite sides of pieces: 'The two devices of steep cliffs and banks of cloud solved the problem and are often seen on Transitional blue and white'. On the Ko Si Chang 1 wares the cliffs and bank are delineated by the fine separation lines between panelling. This can be seen on KSC1 549, 1082 and others (above).

DESCRIPTION OF KRAAK WARE IN RELATIONSHIP TO BLUE AND WHITE PORCELAIN FROM THE KO SI CHANG 1 SHIPWRECK

It is apparent that the decoration appearing on Kraak ware developed from the preoccupation of the Jia Jing regime with Daoism and longevity. Wanli brought new innovations. Kraak wares differ in technique and decoration as Casa-Museu Dr Anastácio Gonçalves (1996: 29) states: 'New decorative motifs were added to the traditional themes—which included landscapes with deer, insects, birds and flowers'. Rinaldi (1989:

67), explains that most non-Dutch scholars label an item as Kraak ware if it is decorated with ‘typical Kraak motifs’ and if it complies with most of the general characteristics given for Kraak porcelain. Kilburn (1981: 18), explains: ‘The term is still used loosely to cover most types of late Ming export wares. However it is also used in a narrower sense, for the thin-walled plates, dishes, bowls and cups with panelled decorations which were exported from the beginning of the Wanli to the end of the Ming Dynasty. The key words here are “thin-walled”, and “panelled” for these are the features that define the ware.’

Rinaldi (1989) says that although the use of panelling is often the determinant of Kraak ware there are some wares which are panelled but don’t belong to this category.

Rinaldi (1989: 68) describes Kraak ware in the following terms:

- Thinness and lightness: The Ko Si Chang 1 items are quite thin and appear to be more so than items retrieved from other shipwrecks of around the same date or later;
- Impurities produce pitting and small imperfections: There are small imperfections and pittings on the Ko Si Chang 1 items;
- Glaze has bluish tinge. Tendency to flake off on rims: the Ko Si Chang 1 glaze is very slightly bluish but there was not a noticeable tendency to flaking despite the considerable period of immersion in sea water;
- Rims may be flat, everted or straight, foliated rims predominate: The Ko Si Chang 1 items have foliated rims, slightly everted rims in case of bowls and crow cups and flat in case of plates;
- Grit commonly adheres to footrim: Although sand granules were noted on the footrim of some of the Ko Si Chang 1 wares it was not a predominant feature;
- Bases are nearly always glazed and pitted: Often bear chatter marks. The bases of the Ko Si Chang 1 items were glazed and often pitted: Chatter marks were recorded on some of the items;
- Reign or shop marks rare: A bowl (G1) from the Ko Si Chang 1 wreck site bore the Chinese inscription ‘Da Ming Wanli Nian Zhi’—Made in the Great Ming Year Wanli;
- Most pieces probably thrown on a wheel and then pressed into moulds: Others may have been prepared on cloth then pressed into a mould; On dishes the moulded design on the cavetto has round or ogival medallions or simple ridges. Moulding may divide borders on dishes or walls on bowls into lobed panels: Moulded designs and vertical ridges occurred on the crow cups and small bowls and some of the Ko Si Chang 1 dishes.
- Decoration is painted in underglaze cobalt blue varying from dark blue to silver hues. Design outlined in dark tone and filled with light wash. Sometimes dots or lines are used: The Ko Si Chang 1 items have a silver hue and dots and lines were sometimes used in the decorative colouring.

The most succinct description which adequately conveys the qualities of the crow cups, bowls and *klapmutsen* sherds recovered from the Ko Si Chang 1 ship is from Jenyns (1988: 180).

The finest of all the Wan Li blue and white export families are usually in the form of small dishes, bowls or ewers with a thin resonant body as hard as glass and in sharply moulded metal

forms. These have a crisp almost brittle texture and their shapes have often been warped by the great heat in which they were fired. The edges of these pieces are notched and the decoration painted in a pale silvery blue which is clear and luminous with a glassy appearance because of the relative absence of air bubbles in the glaze. The designs, which tend to repeat themselves, include a bird on a stone, geese on a marsh, an eagle on a rock, cicadas and other insects with flowering plants... They are often painted in panels with ju-i head sceptres and false gadroons round the top. The painting is swift, elegant and finished and the bodies have sand adhering to the footrim, pinholes in the glaze and wheel or chatter marks on the base, all signs of summary execution.

Though there may be a very slight degree of warping in the Ko Si Chang 1 items, it is not significant, they do however have slight differences in wall thickness where moulding has been not entirely consistent. None of the Ko Si Chang 1 birds have been identified as an eagle and though cicadas may appear they do not play a prominent part in the decoration. Crickets, bees and butterflies often appear amongst the vegetation.

REPRESENTATION OF DEER ON CHINESE BLUE AND WHITE PORCELAIN FROM THE KO SI CHANG 1, KO RIN AND OTHER SITES.

It is opportune here to examine the treatment of all the deer portrayed on the Ko Si Chang 1 and Ko Rin items.

Willets (1986: 9) in reference to sherds recovered from two settlements on the Johore River, Malaysia, occupied in the 16th and 17th century said: ‘They are parts of eight-sided bowls featuring, in each of the eight panels, a figure of the spotted East Asiatic or Sika Deer (*Cervus nippon*), a favourite decorative motive of traditional Chinese art, since ‘deer’ (*lu*), stands for its homophone, *lu*, meaning ‘official salary’ and was hence an auspicious subject’.

Two varieties of deer motif appear on ceramics from shipwrecks of the Thai Gulf. There is a stylized deer motif appearing a bowl from the Ko Si Chang 1 site, KSC1 17/388, where a deer is poised in a landscape composed of what has been described by different authors as including rocks, wheels, cash sign or branches (henceforth described as cash sign), together with plants and sometimes birds. From this group Rinaldi (1989) suggests dating can be estimated by the way the legs have been treated. A more complex representation of a deer in landscape depicting a scene appears on cups, bowls and plates/dishes such as KSC1 732, 764, 1272, 1668 and KL38 and 169. Comparison with other items with a deer representation will be made here in effort to determine if the way the deer has been drawn, particularly in regard to the shaping of the legs and hooves, has any bearing on dating.

The simple style, which KSC1 17/388 represents has been found on various shipwrecks as well as other areas, offering fairly precise dating. These include: the Binh Thuan shipwreck (estimated at 1608); *Witte Leeuw* (1612) shipwreck; Drake’s Bay, California (1579 or 1595); the Ardebil Shrine, Iran (pre-1611) and the Santos Palace, Lisbon (pre-1613).

Rinaldi (1989) indicates that the deer motif is not uncommon and was therefore popular, though she says that the deer bowl was not often found in Dutch collections and

may have ceased production around 1610. It apparently wasn't found on the *Banda* shipwreck off Mauritius (1615), was limited on the *Witte Leeuw* (1613) and not found on later wreck sites though it was known, through Dutch records, to have been requested in 1646; Volker (1971: 103) details a ship's invoice on a voyage from Formosa to Mocha with 8670 'deer cups'. It is not known by this author whether this refers to a stylized deer decoration.

The Ko Rin wreck site which has no directly datable material has no crow cups or stylized deer cups. Decoration of non-stylized deer do appear on KL169, a bowl sherd and KL38, a plate. The hooves on the KL169 sherd are missing. The deer on KL38 are of good proportion and have quite well formed legs and hooves, depicted by two long, curved lines. They are part of a simple scene and there is some use of linear fill in the decoration. There is no sign of the cash-type decoration which appear on the stylized deer cup/bowls. Pope (1956: Plate 91) shows a dish with very similar interior decoration to KL38 which is said to have a Jia Jing (1522–66) mark on a glazed base.

Rinaldi (1989: Pl. 31 and Pl. 32) dishes, are categorized as forerunners of Kraak. Plate 31 has an undecorated cavetto, with a decorated rim. The deer is not as well drawn or treated as on KL38, the hooves differ in that they are two straight prongs. This item is also described as from the Jia Jing period. Pl. 32, is from the Longqing dynasty 1567–72. The deer have long, curved hooves with a more obvious foot than seen on Ko Rin or Ko Si Chang 1 items.

Kilburn (1981: Pl. 1) shows a deer not dissimilar to KL38, feet with long hooves and an openness of scene, bearing a Jia Jing mark. Casa-Museu Dr Anastácio Gonçalves (1996) Plate 13 shows an item with many of the elements of Ko Rin material in terms of decoration: birds and foliage, though no deer are included. This is also given a Jia Jing dating. Similarly Garner (1970) Plate 56B, shows a plate with similarities to Ko Rin items dated as second half of the 16th century.

Rinaldi (1989: Pl. 57), given as 1575–1605 shows a dish from a private collection in the Netherlands. It features pomegranates in border with two deer in landscape. The deer are rounded, and better formed than some others shown in Rinaldi. One is shaded, the other has light dotting in three lines along the backbone. Long, curved lines added to the end of the main part of leg form hooves. The hooves are not dissimilar to those on KL38 as is the case with the deer itself. The deer are also more like those of the non-stylized deer from the Ko Si Chang 1 wreck site than some others illustrated, as are the representation of the hooves. The underside of the dish does not resemble any from Ko Rin or Ko Si Chang 1.

Casa-Museu Dr Anastácio Gonçalves (1996: Pl. 45) shows a plate with a deer also with some similarities to KL38 with long hooves (though the back hooves are treated differently) and alert ears. There is more shading on the Plate 45 item with dots and lines whilst the dotting on KL169, for example, is more evident. The blue colouring and decoration of Plate 45 differ. It is described as early Wanli (1573–1619). The differences may actually help pinpoint a date for the Ko Rin item.

By association through the above examples, it is therefore likely that the Ko Rin ship was around the late Jia Jing, early Wanli period.

It is known that the items from the Drake's Bay area in California came either with Francis Drake in 1579 or from the *San Agustín* wreck of 1595. Drake plundered material from the Spanish galleon *Espiritu Santos*. Von der Porten (1972: Fig. 11a) shows a sherd from a small bowl similar in style to KSC1 17/388 but the deer is treated differently and unlike the Ko Si Chang 1 items has groups of dots as part of the colour fill. Unfortunately the lower legs are missing.

Rinaldi (1989: Pl. 53) shows a dish with two deer in landscape with rocks/cash estimated to be 1570–1600. One deer has groups of dots—no particular number, the other shaded by striations. The deer have long, well shaped hooves. Light and dark blue paint goes outside the outlined decoration. Rinaldi says that identical sherds, assumed to be from Drake's expedition in 1579, were found at Drake's Bay. Rinaldi probably refers to von der Porten (1972: Pl. 7c) a deer on plate with hooves developed from two slightly curved lines. This depiction may be similar to KSC1 732 however the background is dissimilar.

The Arbedil Shrine in Iran, can serve as a dating tool; Rinaldi (1989) relates nothing was added after 1611. Of the stylized deer type decoration, Rinaldi (1989: 140) says: 'Generally the drawing of the background foliage is rather sketchy but there are examples in which the deer and surrounding motifs are drawn with exquisite carefulness, such as the bowl from the Arbedil Collection (Pl. 156) which is unusual for its superb quality and for a centre medallion which is masterfully painted with a watchful deer, his muscles tense, ready to leap away. The surrounding rocks and plants are drawn with infinite care for the minutest details.' In fact Rinaldi Pl. 156 (1570–1600) shows an item which appears to have eight panels with long hooved deer in cash type motif or foliage, separated by two thin lines. The deer have groups of four or five dots. The item is coloured silver-blue and is well shaded. The decoration is more complex, and the legs are not stylized like the item KSC1 17/388.

The Spanish vessel *Santa Margarita*, reportedly wrecked off the Mariana Islands in 1601 whilst on voyage from Manila to Mexico, carried Kraak ware amongst its cargo. Harbeston (2003: 12) illustrates a dish with deer amongst scenery. Whilst no similar dish was recovered from either the Ko Si Chang 1 or Ko Rin sites, the deer on items from these sites do have similar features to that from the *Santa Margarita* site. The physical shape of the *Santa Margarita* deer seem to be quite like the Ko Si Chang 1 non-stylized deer, however it is difficult to estimate since the Ko Si Chang 1 finds are of sherds only. One *Santa Margarita* deer has groups of dots as part of the body fill whilst the other deer has striations. The long curved toes of the *Santa Margarita* deer resemble those on the Ko Rin plate (KL38), a feature seemingly common to that of the deer on KSC1 732.

Jarlets from the Binh Thuan wreck site are estimated to have been made at the Zhangzhou kiln, Flecker (2004: 6–8). Nos. 168–178, 542–551, 690–701 were apparently hastily and crudely decorated with stylized deer and cash sign. It would appear that they were mass produced, probably for the European trade. They are very different to those from other sites discussed here. The fact that jarlets of such poor quality decoration were being exported must be indicative of

a high demand at that period. Apart from these items, there are, from the Binh Thuan ship, carefully executed items, eg. a chequered basin (*klapmutsen*) No. 13. Flecker says that this item, even though it rivals Jingdezhen is from the Zhangzhou kilns.

The deer also appears on plates from the Binh Thuan ship. No. 702 has a deer with well formed hooves on an item which appears hastily painted. No. 401 has deer with hooves, not so well formed. Scolloped medallion cartouches, like those on the Ko Si Chang 1 dishes form part of the decoration.

There were several items with deer decoration, recovered from the *Witte Leeuw* wreck site. Pijl-Ketel (1982: 1.9.3) 'High bowl without moulded pattern' shows a stylized deer amongst 'cash-like' motif and vegetation. There are dots along the backbone. No attempt has been made to draw hooves, and the legs are badly drawn lines. Of all the items of this type noted by this author, this is most like KSC1 17/388.

Pijl-Ketel (1982: Inv. No. 6450) shows a shallow bowl decorated with a spotted deer with hooves. Inv. No. 4028, shows two dishes with two deer on each. The deer have dots down the backbone. There is the cash-like item as part of the landscape on one plate. The legs are hastily drawn with little attention paid to the treatment of the hooves.

In addition to those mentioned above, the stylized deer is represented in the following: Rinaldi (1989: Pl. 158) (1600–10), D 140 mm, H 76 mm, shows a bowl held in Lisbon at the Casa-Museu. There is a central deer with cash and small amount of foliage. The round bodied deer has dots along backbone and stylized legs. The cavetto is divided into eight sections by a single line decorated with cash-like item and foliage. On the exterior are deer in panels. Rinaldi (1989: 140) indicates that this type is like the *Witte Leeuw* item but with a lesser quality round body, legs close, hooves almost touch, thus perhaps a later date than the Drake's Bay type. This item closely resembles KSC1 17/388.

Other examples of stylized deer cup/bowl are shown and discussed in Pope (1956: 139, Pl. 107): '...a small bowl decorated with eight white deer against foliage backgrounds. These little animals are extremely stylized with their long slender legs, and not only is the type well known on export wares of this period including a large number of small jars found at various places all throughout Southeast Asia...but vessels with the same decoration are also known in Dutch paintings in the 17th century'. Pope gives an example of a still life by Jan Soreau (1615–38) in the Walters Galley, Baltimore (no 37. 1902) which shows a bowl much like the one under discussion).

Volker (1971: Pl. IV, No. 5a) illustrates four items with deer decoration said to be carrack ware. One item (D 150 mm H 90 mm, from South Celebes) shows a deer bowl described as having an early 17th century motif. This item has more dots and is drawn slightly differently to KSC1 17/388, including the treatment of the legs, but on the whole it is not dissimilar. In fact one deer leg may be hooved. Rinaldi (1989: 140) says that this item was made in a second class kiln with unskilled labour.

Lunsingh Scheurleer (1974: 210 and Mono. 29), shows the exterior of a bowl from the Princessehof Museum, Leeuwarden, divided into eight panels. The featured deer is not dissimilar to KSC1 17/388, though the deer heads are not as well formed as that on the Ko Si Chang 1 item. Scheurleer says that a similar cup is depicted in a still life dated 1623, referred to by

S. Hofman writing in Bulletin of the Rijksmuseum Amsterdam, 1967, No. 1, pl 2.

Garner (1970) Plate 58A middle shows a similar type of small bowl with deer (about 140 mm diam.) from the Victoria and Albert Museum. The deer legs are separated, one leg is held on each and they are hooved. Cash features amongst a little vegetation. It is dated as of the second half of the 16th century. Interior and exterior deer and decoration are similar to KSC1 17/388.

In reference to KSC1 732, 764, 1272 and 1668, items with non-stylized deer, Rinaldi (1989: Pl. 165) (1590–1600) D. 140mm, H. 76mm, shows a bowl, from a United Kingdom collection, said to be of exceptional quality. A bird on a rock features in the centre. The interior and exterior are divided into six panels, not eight, the usual Ko Si Chang 1 number. The deer and the decoration within the narrow panels are more similar to the Ko Si Chang non-stylized deer than any other illustrated by Rinaldi. The deer have dots in lines and shading, the hooves are well formed, possibly similar to those from Ko Si Chang. This item is a rich blue (more so than Ko Si Chang items) with a variety of shades. Two panels on Pl. 165 have deer, one recumbent and one standing. Rinaldi indicates that it is rare to see a recumbent deer as a motif on Kraak ware. The deer on KSC1 1668 appear to be seated, but alert. Rinaldi (1989: 139) says the shape of her Type 1.1. bowls with deer motifs generally are divided into eight to ten exterior panels, commonly on the interior there are eight panels.

SUMMARY

- An item of blue and white porcelain with a reign mark signifies that it was likely to have been made for a Chinese market, be it China itself or overseas. Those designed for export were not given a maker's or reign mark. A blue and white porcelain bowl with a reign mark (KSC1 G1) appears on the Ko Si Chang 1 ship. The fact that the Ko Si Chang 1 crow cups were in the company of the marked items, probably signify that they were also intended for a Chinese clientele.
- The particular colouring, thickness, use of design and the number of panels on the Ko Si Chang 1 items sometimes differs from the *Witte Leeuw* and *Banda* material known to have been intended for the European market.
- Illustrated wares closest to the crow cups recovered from the Ko Si Chang 1 ship, are those shown by Kilburn (1981: 35). These must have been significantly different enough to be categorised by Kilburn as 'Dutch Tableware' rather than under general Kraak ware. Described as cups, they have been given as coming from the time period Wanli/Tianqi 1621–27.
- The fact that the crow cups on the Ko Si Chang 1 ship were divided into eight panels, an auspicious number for the Chinese, may be significant. It has to be acknowledged however that although the diversity in decoration is restricted in the *Banda* (1615) ceramics, the use of eight (or more) panels is prevalent.
- Ko Si Chang 1 ceramics had no cicadas on a rock, nor masks, tulips or sunflowers amongst the decoration. They were fairly thin walled, of a light silvery blue colour and

fairly carefully decorated. It is believed that they were intended for a non-European clientele, and that they were made late 16th century or at the beginning of the 17th century, without European influence. Additionally, the thin walls and the fact that the glaze was of good quality, even after four centuries spent in a marine environment, must testify to its high quality, possibly superior to some of the items intended for the European market.

- The representation of deer on ceramics, shown in PART 1 above, indicate a date for the Ko Rin ship of around the period of transfer between the Jia Jing and Wanli dynasties (second half of the 16th century). The Ko Si Chang 1 ship would appear to be around the turn of the 16th to 17th centuries.

PART 3. Jars

An Inventory of Thai and Associated Wares Recovered in the Thai Gulf and Further Afield Including Some Documented in Private Collections. An Attempt to Determine a Particular Time Period, Kiln site or Area an Item or Group of Items May Have Been Manufactured.

In earlier times, jars made of fired clay played a significant part in the daily life of people throughout Southeast Asia and further afield. Ceramic jars were used in ceremonial events, for storage of water and food and the transport of commodities. Smaller jars were carried inside large jars, straw probably used as cushioning. Chonlaworn (2004) refers to despatches of gifts of jars from Ayutthaya to Ryukyu (Japan) in the 1480s carrying wines made of fruit and flowers. Jars from wreck sites in the Gulf of Thailand were found to have carried eggs, fish, vegetal matter, resin and possibly lime. Jars were tied to the deck of ships into the 20th century, Holbrook (2000).

A custom still existing today in rural Thailand is the placement of a large water storage jar next to the roadside near a dwelling. There is an understanding that travellers are welcome to quench their thirst. Spinks (1976: 198) indicates that they were set out '...as an act of merit in the best Buddhist tradition'. The explorer Gervaise, through Villiers (1998: 12) understood that the custom of storage in jars purified river water, preventing dysentery.

Until excavation undertaken at the Mae Nam Noi kiln site, Singburi Province, Thailand began, Harper (1988 ii); Praicharnjit (1981 i and ii), many jars recovered from land and underwater sites throughout the world, were denoted the provenance of Sawankhalok, that is a product of the Si Satchanalai kiln site, Sukhothai Province, Thailand. Since the Mae Nam Noi excavations began, many large jars believed to have their origin in Thailand have been denoted with a provenance of that kiln site. The author noted that although the jars and other items excavated at the Mae Nam Noi kiln site resembled many of the shipwreck finds of the Gulf of Thailand, there were differences. The Mae Nam Noi finds from the particular area excavated in 1988 were more highly fired, the upper rim was often slightly flattened and the body colour often differed to the colours noted on the Ko Si Chang 1 wreck site finds.

It was deemed possible that if jars with particular distinctive qualities were grouped together, information could be gained as to which kiln site the items may have come, even though particular kilns probably no longer exist. Material from datable sites with the same qualities as undated finds could be put into some kind of time frame. This inventory, with its accompanying parts, may assist in the dating process.

Jars are listed by type in the proposed order (open to debate) of manufacture, estimated by associated finds. This could be, for example, dated or datable items from shipwreck sites. It has to be acknowledged that several types of jars were likely to have been manufactured at the same time. Likewise, the same jar type could be in use over a substantial period.

Unless otherwise indicated, jars from the Ko Si Chang 1 and 2, Ko Rin, Ko Khram and Prachuap Khiri Khan sites itemised in this section are included in the catalogue associated with this document. For comparative purposes, some jars

determined as having other than a Thai provenance are also included in this inventory. Jars located in museum collections or other sources have been included if a provenance is given or likely to be accessible. Several unprovenanced jars have been included if information given with their description is pertinent to other jars in this report.

Many museums and private collections throughout Southeast Asia and further afield are known to hold quantities of complete, or almost complete ceramics including jars of the type investigated in this report. For example, the National Museum of the Philippines holds a large number whilst Evangelista (1987, pers. com.) estimated that the de Santos collection in the Philippines is made up of about 60% brown glazed jars, as found on Thai wreck sites.

Some items were tested for chemical composition by Amdel and a basic result given where available (see Table 4 on page 134 to Table 29 on page 140). In some instances, additional information from Amdel is given. This may be an important indicator of kiln site provenance and as such can be investigated further by specialists. Munsell colour testing was also undertaken by the Thai-Australian team in the latter years of excavation.

Measurements are approximate. Many of the Thai shipwreck finds were sherds only, from which drawings of a more complete item were estimated. Some jars were asymmetrical, some had slumped and warped, it was difficult to ascertain a precise measurement. Other measurements in this report have been estimated from published photographs and drawings. Information such as any indentation on the mouthrim, or details of body or glaze is difficult to ascertain from a photo or drawing unless that information is given in text.

Those wares investigated by the author in the Philippines and some of the Thai sites (other than those excavated by a Thai-Australian team) were denoted an identification number by the author. In most cases this number does not correspond to any allocated in Philippine or Thai registers unless otherwise indicated. The lettering BR# followed by a number refers to a specific jar sherd made available for testing from the Mae Nam Noi kilnsite.

Whilst at the Underwater Archaeology facility, Sattahip, Thailand during the 1980s, the author was shown artefacts said to be from the Ko Samae San, Ko Samui and Rang Kwien underwater sites. Those artefacts believed to be from the Ko Samae San (said likely to be a jettison site) were heavily encrusted with a coralline substance. It was difficult to confirm that any particular one of these artefacts was from the Ko Samae San site but was taken to be so.

Much of the analyses are based on the author's previously unpublished reports. Access was also given to sherds from sites other than those of the Thai Gulf and Thai kiln sites including several shipwreck sites off the coast of Africa and from land sites in the Philippines. In some cases visual comparison was able to be made with sherds from the Mae Nam Noi site.

For reasons of economy within this report, Ko Si Chang 1, 2, 3, Prachuap Khiri Khan (PK), Ko Lin (KL) and Ko Khram (KKH) are written without the additional 'wreck site'. Of those jars which underwent material analyses (see Tables 4–29 for results), the word Amdel is followed by the abbreviated kilnsite

names which have been found to have ceramics with the same, or similar profile.

1. Jars Estimated to have been Manufactured in the Vicinity of the Ban Bang Pun Kiln site, Suphanburi, Thailand

Ref: Vilaikaew (1989).

1.1 Comparable Fig. 41 Green and Harper (1987)

Rang Kwien wreck site, Green and Harper (1987) Fig. 41. Jar. B 125 mm (estim.). H 300 mm (estim.).

Turiang wreck site, Brown and Sjostrand, (2000) Fig. 10. Jar (incomplete).

Maranei/Pulau Bakau wreck site, Indonesia, Brown (2004) Plate 28, M1/6. Jar. H 426 mm.

The Philippines, Valdes (1992) Figs 4 A & B. Jars from a private collection. H370 mm, H395 mm.

Penny's Bay, Hong Kong, Valdes (1992). Similar jars to above are said to have been recovered from here.

Puerto Galera, the Philippines, Peralta (1982) Plate 78. Jar. Pressed and incised. Shape comparable Fig. 41 items, decoration comparable Fig. S25 items (below). H 457 mm.

Royal Nanhai wreck site, Brown and Sjostrand, (2000) Fig. 10. Jar (incomplete).

Ko Khram wreck site, KKH 7. Base sherd. Coarse grey body with black inclusions. B 104–112 mm.

Phu Quoc wreck site, Blake and Flecker (1994) Fig. 18 Jar (incomplete) H 270 mm.

1.2 Comparable Figure S25 Green and Harper (1983)

Rang Kwien wreck site, Green and Harper (1983a) Plate 29 and photo MA1481 WA Museum. Shoulder sherd. Figure on horseback, bodhi leaf and lotus bud decoration, stamped and applied.

Sha Tsui wreck site, Hin and Ng (1974) Fig. 8c. Shoulder sherd. Stamped bodhi leaf or trefoil decoration.

Turiang wreck site, Brown and Sjostrand, (2000) Plate 42. Two rim sherds, at least four more jars buried in seabed. Body dark grey and gritty. Pressed decoration. RD 360 mm. Th. 25 mm. Vol. 260 litre approx.

Turiang wreck site, Brown and Sjostrand, (2000) Plate 41a&b. Jar. Stamped decoration. H 460 mm (shorter than S25)

Turiang wreck site, Brown and Sjostrand, (2002) Fig. 13. Jar. Said to be identical to Longquan (below).

Nanyang wreck site, Brown and Sjostrand, (2002) Fig. 13. Jar. Said to be identical to Longquan (below).

Longquan wreck site, Brown and Sjostrand, (2002) CP 46,49, Figs. 13 & 29. Jar. Yellow-beige body. H 800. Vol. 260 litre. Lotus bud or *krachang* decoration stamped and applied.

KSC2 25, Green and Harper (1983) Jar. Dark grey body. RD 312 mm. B 300 mm. H 736 mm. W 644 mm. Vol. 120 litre approx. Lotus bud decoration stamped and applied.

KSC2 1061. Amdel No. 10/AC 1252/88. Body sherd. Dark grey exterior. Stamped lotus bud decoration. Amdel: BR, NT, Almost Nong O. Refer to KSC2 illustrations in Catalogue PART 1 above.

KSC2 1234. Amdel No. 36/AC1252. Body sherd. Dark grey exterior. Stamped bodhi leaf decoration. Amdel: Nong O, NT.

KSC2 1065. Amdel No. 12/AC1252/88. Body sherd. Dark grey exterior. Stamped magical bird decoration. Amdel: BR, NT.

KSC2 63. Rim sherd. Medium grey body. RD 340 mm (to outer flared rim). Th. 10.5 mm.

KSC2 1231. Amdel No. 33/AC1252/88. Rim sherd. Beige-grey body with black inclusions. Black exterior. RD388. Amdel: BR, NT.

KSC2 1237. Amdel No. 38/AC1252/88. Base sherd. Light mauve-grey body. B 160 mm. Amdel BR, NT.

KSC2 1239. Amdel No. 40/AC1252/88. Base sherd. Medium grey body with black inclusions. Black exterior. B 155 mm. Roughly finished inside. Amdel: BR, NT.

Maranai wreck site, Indonesia. Brown (2004) Plate 28, M25/11. Jar. H 700 mm.

1.3 Base Sherds of Suphanburi Type in Terms of Appearance of Body

KSC2 52. May fit KSC2 63 & KSC2 1231 (above). Grey body. Grey-beige exterior. B 230 mm. Th. 10 mm.

KSC2 1238. Beige to dark grey body with black inclusions. Black interior. B 86 mm.

KSC2 1236. Amdel No. 37/AC1252/88. Grey body. Black exterior. B 192 mm. Amdel: BR, NT.

KSC2 1213. Orange-beige-grey body with black inclusions. Black exterior. B 92 mm.

KSC2 1221. Amdel No. 28/AC1252/88. Medium grey body. Black surface. B 144 mm. W 256 mm approx. Amdel: BR, NT.

KSC2 1232. Amdel No. 34/AC1252/88. Light mauve-grey with black inclusions. Black exterior. B 196–208 mm. Amdel: BR, NT.

2. Items Made at Another Kiln Site but which have Characteristics Pertinent to, or in Association with, the Suphanburi Product Including Style of Rim, or Base, or Adaptation of Bodhi Decoration.

Ban Pa Yang kiln site, Si Satchanalai, Harper (1984) PY 1359. Base sherd. Red-grey body. Unglazed. B 184 mm.

Ban Pa Yang kiln site, Si Satchanalai, Harper (1984) PY 1358. Rim sherd. Ridge. No incisions. Mauve-grey body. Unglazed. RD 264 mm. Applied bodhi leaf decoration differs to those of the Suphanburi kilns but is basically the same motif.

Ban Pa Yang kiln site, Si Satchanalai, Harper (1984) PY 1360. Wall sherd. Grey body. Unglazed. Decoration as above.

Ban Pa Yang kiln site, Si Satchanalai, Harper (1984) PY 1265. Rim sherd. Mauve-grey body. Unglazed RD 176 mm. Decoration as above.

Kiln 120, Ban Nong O, Si Satchanalai, Hein (1986) Fig. 14, top right. Rim sherd.

Phitsanulok kiln site, Hein and Sangkhanukit (1987) A1406SW, Fig. 19 and Photo 5. Jar.

Puerto Galero, the Philippines, Peralta (1982) Plate 79. Jar. Applied lotus bud, incised and pressed decoration. H 393 mm.

Mae Nam Noi kiln site, Harper (1988(ii)) KA1, etc. Basin. Rim sherd. Applied bodhi leaf decoration.

Mae Nam Noi kiln site, Harper (1988(ii)) S1. Jar, long neck, flared, indented outer rim. Mottled fly ash and metallic appearance.

3. Jar, Aspects of which Point Towards an Origin Similar to Those Sherds Recovered from the Si Satchanalai and Phitsanulok Kiln Sites. Based on Similar Rim Treatment, Glaze Type, or Other Factors

Si Satchanalai kiln site surface find, Green and Harper (1987) Fig. 28a. Rim sherd. Ridge at neck. No incisions. Red-black body. Black glaze with iron red mottling into rim. RD 136 mm.

Si Satchanalai kiln site surface find, Green and Harper (1987) Fig. 28b. Rim sherd. No ridge or incisions evident. RD 132 mm.

Si Satchanalai kiln site surface find, vicinity Kiln 36. Harper (unpub.) drawing (2), photo 1982/4 (15,16). Rim sherd, one handle existing. Flared rim, indented. Ridge at neck. No incisions evident. Grey body. Black with mottled iron red glaze extending inside rim.

Si Satchanalai kiln site surface find, vicinity Kiln 36. Harper (unpub.) drawing (3), photo 1982/4 (15,16). Rim sherd. Flared rim, indented. Ridge at neck. No incisions evident. Black-red body. Black with mottled iron red glaze extending inside rim.

Phitsanulok kiln site, A 1406SW, Hein and Sangkhanukit (1987) Photo 6 & Fig. 26. Rim sherd. Ridge at neck. Incised under lugs. Mottled glaze.

Sarawak Museum, from Loban Kudih, Bakong (322/120). Moore (1970) Plate 12d. Jar. Probable ridge at neck. Unable to estimate if incised under lugs. Black glaze, appears from photo to extend to just above foot. H 354 mm. W 311 mm. Described as 'Kalong' ware.

Sha Tsui wreck site, Hin and Ng (1974) Fig. 9a. Rim sherd. Dark brown glaze exterior and interior. Said to be similar glaze to 'Sawankhalok wares'.

Turiang wreck site, Brown and Sjostrand (2000) Plate 18. One of three jars. Many sherds recorded on seabed. Ridge at neck. Incised under lugs. Appears pinkish-grey. Yellowish with possibly mottled greeny-brown glaze. H 330 mm, another H 335 mm. Vol. 12 litre, approx. Made by coiling, commencing around a flat disc of clay. Many sherds were recovered from this site.

Brunei Museum, from Kg Kinlap. Harrison (Field Notes) 1973.104. Jar. Possibly fits this section. Found in ground with Annamese and Sukhothai material. Indented rim. Ridge at neck. Incised under lugs. Base flat 'not purple', clear buff body spotted black. Thin black glaze extends inside rim, partly degraded on top 3/4 of item then running. Possibly two applications. RD 175 mm. B 155 mm. H 415 mm. W 320 mm. Wt 5 kg. 'Handles relatively small'.

'Medieval Vessel', Christies (1989) Nos. 2 and 3. Jar. Ridge at neck. Lightly incised under lugs. Appears to be a smooth, medium grey body surface with a dark green-black glaze 3/4 way down body, scooped. H 305 and 335 mm.

KSC2 67. Rim sherd. Ridge at neck. Incised under lugs. Coarse body with black inclusions. Degraded glaze into rim. RD 136–150 mm. Th. 9.5 mm.

KSC2 66. Rim sherd. No ridge or incisions evident. Yellow-grey body with grey exterior. Deteriorated thin yellow-brown

glaze into rim. White-pink wash inside jar. RD 116–120 mm. Th. 5 mm.

KSC2 69. Rim sherd, flared, indented. Ridge at neck. Reddish body, medium grey exterior. Degraded thin green-black glaze into rim where it is mottled red-yellow. RD 180 mm.

KSC2 1069. Amdel 14/AC1252/88. Rim sherd, flared. Purple-red body. Dark grey exterior. Degraded green-brown glaze extending inside rim. RD 252 mm. Amdel: NT, BR, Nong O.

KSC2 1066. Rim sherd, flared. Red-grey body with black inclusions. Fragments of black glaze remain. RD 188 mm.

KSC2 70. Rim sherd, flared. Mauve with tiny red inclusions. Grey surface. Deteriorated light green to yellow-black glaze on rim. RD 200 mm.

KSC2 1230. Rim sherd, flared. Red-grey body. Degraded green brown glaze extending inside rim. RD 220 mm.

KSC2 73. Rim sherd, flared. Ridge at neck. Degraded thin green-black glaze. RD 195 mm.

KSC2 1220. Base sherd. Amdel No. 27/AC1252/88. B 280 mm. Amdel: NT, BR, Nong O.

KSC2 1233. Amdel 35/AC1252/88. Base sherd. Brick red body with blue-grey exterior. Glazed to just above base. Evidence of coiling. B 196 mm. Amdel: Nong O.

KSC2 1062. Amdel 11/AC1252/88. Base sherd. Dark grey-blue body. Orange exterior. Concave base. B 120 mm. Amdel: Almost Thai KN.

KSC2 1060. Rim sherd. Black glaze with brown mottling. RD 280 mm. Amdel: Nong O, MON KN.

KSC2 1301. Sherd with lug. Amdel No. 51/AC1252/88. Black glaze. Amdel: Nong O, almost MON KN.

Punta Sunog, Luzon, the Philippines, Harper (1988(ii)) 108. Shoulder sherd. Ridge at neck. No incisions. Red-purple body with white inclusions. Thick, shiny black glaze. Interior coil marks. Amdel: Thai KN.

4. Jars Mainly from Thai Production Sites, Possibly Including Si Satchanalai (Ban Ko Noi, Ban Pa Yang, Ban Nong O), Sukhothai, Phitsanulok, Nakhon Thai and the Mae Nam Noi Kiln sites. Some items likely to be products of kiln sites outside Thailand but have some similarity to Thai products

4.1 Medium Jar

a) Rounded rim, does not appear to have indented upper rim. Nanyang wreck site, Brown and Sjostrand (2002) CP35. Jar. Ridge at neck. No incised lines under lugs. Appears to have smooth pink-grey body surface. Blackish-brown glaze, scollops 2/3–3/4 down body then running. H 285 mm. Narrow jar. Ko Khram wreck site, Brown (1975) Fig. 8a. Ridge at neck. Black glaze 3/4 way down body ending in scollops. H 340 mm (approx.).

Okinawa, the Ryukyu Islands, Japan (excavated), Chonlaworn (2004) Fig. 2, No. 6. Jar. Ridge at neck. No incisions under lugs. Glazed to upper 1/2–2/3 finishing straight. RD 120 mm. B 100 mm. H 316. W 170 mm. All measurements estimated. Narrow jar.

Royal Nanhai wreck site, Brown and Sjostrand (2000) Plate 91 and (2002) CP35. Jars, 100 items. Coarse grey body, appears pink-grey. Smooth surface. Brown-black glaze 3/4 way down body ending in scollops. Ridge at neck. No incision on illustrated items. H 295 mm. Narrow jar.

Palapat Melian, Luzon, the Philippines, 61–M–15, Harper (1988(i)a), 071. Rim sherd. Ridge at neck. Light purple-beige-grey body with white and orange inclusions. Fairly thick brown glaze. RD 112 mm. Visually resembles BR21#13. Amdel: None. Scar inside rim.

Pattaya wreck site, P16, Green and Harper (1983b). Rim sherd. Ridge at neck. No incisions under lugs. Grey surface, interior brick red. Dark green-black glaze. RD 124 mm. W 184 mm. Narrow jar.

Ko Samui wreck site (believed to be), Harper (unpub.) KS/RH/84/.1/85 Jar. Pink-beige body. Peeled, crazed, olive green-brown glaze to upper half. Ridge at neck. No incisions under lugs. Remains of lime inside. RD 111 mm. B 104 mm. H 310 mm. W 160 mm. Narrow jar.

Ko Samui, Amdel No. AC1253/88 KS1. Base sherd. Amdel: BR, NT.

Iwahiu, Puerto Prinsesa, Palawan, the Philippines, marked 70–N68–NM–1, Harper (1988(i)a) 234. Jar upper section. Ridge at neck. No incisions under lugs. Brick red with white inclusions. Dull yellow surface, possibly underfired glaze. RD 120 mm. W 198 mm. Scar on rim. Amdel: None.

Brunei Museum, from Kg. Pangkalan, Padang, Bukit, Ulu, Tutong, Harrisson (field notes) 1968–163 15E. Jar. Purple body. Ridge at neck. Rough, flat, purple base. Mottled greenish-black glaze to approx upper 2/3. Whitish slip. RD 125 mm. B 112 mm. H 256 mm. W 188 mm.

Brunei Museum, from Kg. Brunei Dalat, Mukah, Sarawak, Harrisson (Field Notes) 71–14 15E. Jar. Ridge at neck. Base burnt red at outer edge. Discoloured greyish glaze, degraded to upper 2/3, finishing straight. RD 118 mm. B 136 mm. H 339 mm. W 229 mm. Harrisson says of unusually large size ‘Possibly of later date than bulk of specimens’.

Brunei Museum, from Niah area, Sarawak, Harrisson (Field Notes) 1965–1295 15E. Jar. Probably ridged at neck. Purple body. Rough, flat, purple base. Discoloured, mottled brownish to olive glaze, bubbly in patches. Appears to be almost to base. Runs in some place. RD 128 mm. B 115 mm. H 306 mm. W 184 mm. Wt. 2.5 kg. Narrow jar.

b) Indented upper rim

Si Satchanalai kiln site, vicinity of kiln 55 (SO2), Hein (1987(3)). Jar. Ridge at neck. No incisions apparent under lugs. Brown-red body surface Munsell approx. 2.5YR3/4. Grog added to clay. Thick glaze probably applied by dipping and pouring, extends inside mouth to upper 3/4 body, very dark greenish-black to mid brown in thin areas. Coil built on flattened clay base. Mouth finished on wheel. RD 115 mm. B 135 mm. H 315 mm. Wt. 2.720 Kg. Palapat Melian, Luzon, the Philippines, Harper (1988(i)a) 011 Rim sherd. Red purple-grey body with inclusions. Good mottled green-brown glaze. Rim unglazed. Fired ash inside mouth. RD 116 mm. Amdel: MON KN.

Sarawak. Jar from a Melanau (322/36). Moore (1970) Plate 12b) left. Black glaze to upper 1/2–2/3 then running. H 313 mm. M 167 mm. Described as ‘Kalong’ ware. Narrow jar.

Shuri Castle (excavated), Okinawa, Ryukyu, Japan, Chonlaworn (2004) Fig. 1 No. 5. Jar. Ridge at neck. Incised under lugs. Dark brown, glazed from below rim to upper 3/4 then runs. RD 170 mm. B 175 mm. H 350 mm. W 250 mm. All measurements estimated.

Shuri Castle (excavated), Okinawa, Ryukyu, Japan. Chonlaworn (2004) Fig. 1 No. 44. Jar. Ridge at neck. Dark brown. Glazed to inside rim to above base. RD 100 mm plus. B 120 mm. H 335 mm. W 225 mm approx. All measurements estimated.

Ko Khram wreck site, KKH5. Rim sherd. Ridge at neck. Brick red body. Grey-blue exterior. Degraded brown black glaze. RD 124 mm. W 208 mm approx.

Ko Khram wreck site, KKH3. Possibly fits this section. Incomplete jar. Rim missing, assumed to be similar to KKH5 but probably slightly longer and more flared (see Brown (1988) Fig. 54). Ridge at neck. No incisions under lugs. Purple-red to dark grey body. Brick red base. Degraded dark brown glaze to upper 3/4 with straight finish. RD 120 mm approx. estimate. B 146 mm. H 340 mm approx. estimate. W 228 mm approx. KSC3 2, Green *et al.* (1987). Jar. Ridge at neck. No incisions under lugs. Grey body Munsell 2.5RP 5/2. Green-brown glaze Munsell 10YR 4/4, 3/4 way down body. RD 108 mm. B 100 mm. H 280 mm. W 168 mm. Wt. 2.5 kg. Compare SF23, Mae Nam Noi Kiln site. Narrow jar.

KSC3 151, Green, *et al.* (1987). Jar. Ridge at neck. No incisions under lugs. Pink-grey body, Munsell 2.5YR 4/4. Thick green-brown glaze extends inside mouth, Munsell 2.5YR 4/4, to upper 3/4 body. RD 116 mm. B 120 mm. H 304 mm. W 204 mm. Wt. 2.8 kg. Circular support mark on base.

KSC3 317, Green *et al.* (1987). Jar. Ridge at neck. One incision under lugs. Grey body 10P 5/4. Thick, runny green-brown-black glaze 2.5YR 4/4, 3/4 way down body extends inside mouth. RD 124 mm. B 104 mm. H 316 mm. W 212 mm. Wt. 2.4 kg.

KSC3 140, Green *et al.* (1987). Jar. Ridge at neck. One incision under lugs. Red body 2.4R 5/4. Thick green-brown glaze with white flecks 2.5Y 4/4, 3/4 way down body. RD 124 mm. B 124 mm. H 332 mm. W 216 mm. Wt. 3.2 kg. Vol. 7.5 litre.

KSC3 439, Green *et al.* (1987). Jar. Cut off rim. Ridge at neck. One incision under lugs. Medium coarse pink-grey body. Thick green-brown-black glaze, 3/4 way down body. RD 124 mm. B 124 mm. H 284 mm. W 212. Wt 2.3 kg. Circular support mark on base.

KSC3 Sherd, Amdel No. 63/M7860/87. Amdel: BR, almost NT.

Mae Nam Noi kiln site, Harper (1988(ii)) BR SF23. Jar. Ridge at neck. No incisions under lugs. Thick slightly green-brown-black glaze mottled blue-white into rim and upper half. Unglazed section appears metallic. RD 116 mm. B 108 mm. H 300 mm. W 176 mm. Scar on rim. Throw marks inside. Narrow jar.

Pattaya wreck site, P15, Green and Harper (1983b). Jar. Ridge at neck. Incised on shoulder. Red surface. Olive green-brown glaze extends inside mouth rim. RD 104 mm. B 124 mm. H 276 mm. W 204 mm.

Pattaya wreck site, P371. Amdel No. 2/M7860/87 Rim sherd with lug. Beige body. Green-black glaze. RD 115 mm. Amdel: NT.

Bahuguhan Cave, the Philippines, Harper (1988(i)a) 175. Rim sherd. Mauve body. Thick, shiny brown-black glaze interior and exterior. RD 128 mm. Amdel: BR, (NT MgO little low). Brunei Darussalam wreck site, Richards (2003: 54) Type 20. Jar. Ridge at neck. No incisions apparent under lugs. Reddish-grey body. One jar with thick, dark brown-black glaze running to approximately 3/4 of the way down the body. Three jars with degraded green-brown glaze ending in a straight finish 1/2-2/3 down the body. H 280–310 mm. Ridged surface—deep throw or coil marks evident. Narrow jar.

c) Rolled rim, no discernible neck

Mae Nam Noi kiln site, Harper (1988(ii)) K2 GE 2. Jar upper section. Ridge at neck. No incised lines under lugs. Dark red body. Underfired glaze into rim. Sand and slag attached. RD 124 mm. W 208 mm. Ridged surface.

Mae Nam Noi kiln site, Harper (1988(ii)) K2 GD 18. Jar upper section. Ridge at neck. No incisions under lugs. Orange-grey body. Mottled yellow-black glaze. Linear mark where item rested during firing. RD 124 mm.

Mae Nam Noi kiln site, Harper (1988(ii)) K2 Ge 1. Jar upper section. Ridge at neck. No incised lines under lugs. Red-grey body. Thick underfired or inferior glaze. RD 120 mm.

Ko Khram wreck site, Brown (1975) Fig. 12b. H275 mm.

Ko Samae San underwater site (believed to be), sherd, Amdel No. 30/M7860/87. Mauve-grey body. Amdel: Thai KN and Brown Glazed KN (except MgO higher).

Ko Samae San underwater site, (believed to be), Harper (unpub.) No No. 1986. Jar upper section. Ridge at neck. Coarse mauve body with red inclusions. RD 103 mm.

Ko Samae San underwater site, (believed to be), Harper (unpub.) SS3. Jar. Ridge at neck. Red body. Yellow slip or degraded glaze. RD 110 mm. Amdel: BR except MgO high.

Ko Kradat wreck site, Green *et al.* (1981) KK26. Jar upper section. Ridge at neck. No incisions under lugs. Light brown body. RD 126 mm.

PK1. Jar. Ridge at neck. No incisions under lugs. Coarse, dark beige-grey body with red exterior. Possibly glazed but degraded. Ridge at neck. RD 124 mm. B 100 mm. H 260 mm (average as distorted). W 192 mm. Scar on rim.

Ko Rin wreck site, KL34. Jar upper section. Ridge at neck. Orange and grey body with quartz inclusions. Pink-grey surface with bluish tinge. Ridge at neck. RD 110–122 mm. W 212 mm. Amdel: BR, NT.

KSC1 83 135. Jar upper section. Orange body. Ridge. Incised under lugs. RD 124 mm. W 204 mm.

d) Miscellaneous

Bo Dili, Banang, La Union, Luzon, the Philippines, marked 77–TT–2, Harper (1988(i)a) 235. Jar upper section. No ridge at neck. No incised lines. High fired beige body, corrugated. Olive green-brown, runny glaze. RD 116 mm. Amdel: None. Sarawak Museum, No. 1132, from cave near Bau. Harrison (1950) Plate X. Jar. No ridge at neck evident. Purple body. Dark olive glaze, ‘...shading irregularly to pale greenish’, to upper 2/3 body. Inside lip—red-brown wash or slip. H 250 mm. Throw lines evident. Flat base, rather rough.

Sarawak Museum, No. 3037, found near Batu Kitang, Kuching. Harrison (1950). Incomplete jar, rim broken.

Possibly ridge at neck. Purple body. Dark olive glaze to pale greenish to upper 2/3–3/4. Red-brown wash or slip inside lip. H 250 mm. Flat base, rather rough. Throw lines evident. Sarawak Museum, No. 3420, from P'Umur, Baram River, Kelabit, Sarawak, Harrison (1950). Possibly fits this section. Said to be fatter and shorter than No. 1132 and 3037 otherwise identical. Glaze as above. Purple body. Throw lines evident. Rough, flat base.

Calatagan, Batangas, Luzon, the Philippines. Fox (1959) Plate 135. Ridge at neck. Fox says body ware would suggest Kalong provenance. 'Unusual' black glaze to upper 3/4 body ending in scollops. H 285 mm. W 175 mm.

Phu Quoc wreck site, Blake and Flecker (1994) Fig. 16. Many jars. Rim surface not visible. Probably ridge at neck. Thick brown glaze to upper 3/4 then scolloped with a few runs. H 280–600 mm (this item H 450 mm). Exact example was not shown.

Ko Samui wreck site, Harper (unpub.). Amdel No. KS1 AC1253/88. Base sherd. Amdel: BR, NT. Believed to be from this type of jar.

Magala, Niah, Sarawak (excavated) 322/109. Moore (1970) Plate 12b right. Jar. Black glaze to upper 1/2 then running. H 195 mm. W 186 mm. Described as 'Kalong' ware.

Bulumanis, Muria, North Central Java. Spinks (1959) Fig. 51. No. 2615. Jar. Ridge at neck. Glazed to upper 1/2, finishing straight. Ridged surface, deep throw or coil marks evident. H 285 mm.

Ko Samae San underwater site (believed to be), Harper (unpub.) SS4. Jar, lower section. Grey and pink-grey body. Degraded glaze upper 1/2. Throw lines visible internally. B 114 mm.

University of Singapore. From Indonesia. Willetts (1971) No. 350. Jar. Ridge at neck. Fine, dense grey biscuit body. Mottled chocolate brown glaze to upper 2/3–3/4 ending in scollops. H 336 mm.

Kay Bungo, Batangas, Luzon (assumed), the Philippines, Harper (1988(i)a) 115. Possibly fits this section. Base section. Orange body with white and orange inclusions. B 112 mm. Amdel: BR.

The following items from the Philippines were determined to fit the Type 4.1 category by the author in 1987. Unfortunately particular rim treatment and other specific details of each jar were not identified:

Batangas, the Philippines. National Museum of the Philippines Special Display Room. BB TRB SQ89–88. Jar. Green-brown glaze. Narrow jar.

Karitunan, Calatagan, Batangas. National Museum of the Philippines. Herran Storage Room. KR356. GR233 61–G–59. Jar. No. 105 marked on side.

Palapat Uy, Batangas, the Philippines. National Museum of the Philippines Special Display Room. 61–H–41 PP(M), 109 GR–82. Jar. Very shiny brown-black glaze.

Puerto Princesa, Palawan, the Philippines. Jars. Many of this type are believed to come from this site. Alba (1987, pers. com.). Puerto Galera, Oriental Mindoro, the Philippines. San Carlos University Museum storage facility, Cebu, the Philippines. Grave pieces retrieved from looters by Father Thiel. No. 64–1–162. Jar. Red body. Mottled green-brown glaze. RD 180 mm. H 298 mm.

Punta Sunog, Batangas, the Philippines. National Museum of the Philippines Special Display Room. PS–177 GR75. Jar. Green-brown-black glaze. Flared rim similar to Brown (1975) Fig. 8 from Koh Khram wreck site.

4.2 Medium Ovoid Jars

'Medieval Vessel', Christies (1989) No.1. Possibly fits this section. Jar. Black glaze until just above base. H 345 mm.

Palapat Melian, Batangas, Luzon, the Philippines. Harper (1988(i)a) 069. Possibly fits this section. Rim sherd. Beige-grey body. Mottled yellow-brown surface. RD 164 mm. Amdel: BR. Mark on rim where item fired.

Mactan Island, Cebu, the Philippines. Collection of Banadas/Ramas 71–9–5. Grey body. Shiny green-black glaze. Ridge. Incised. Possibly little more highly fired than is usual for Thai wreck site jars.

Fernandez Collection, Butuan City, Mindanao, the Philippines. Mark on rim where another item sat during firing.

Hoi An wreck site, No. 3725, Guy (2000), Nguyen-Long (2001) Fig. 1. Thirty jars. Ridge at neck. Does not appear to be incised under lugs. Thick glaze to upper 2/3 with straight finish. H 365 mm.

KSC3 38, Green *et al.* (1987). Jar. Indented upper rim. Ridge at neck. No incisions under lugs. Grey surface, Munsell 10RP5/4. Degraded green-brown glaze to upper 1/2–2/3 with straight finish. Munsell 10YR4/4. RD 136 mm, B 160 mm, H 353–360 mm, W 312 mm, Wt 5.3 kg.

KSC3 1, Green *et al.* (1987). Jar. Ridge at neck. No incisions under lugs. Pink-grey surface. Thick green-black glaze to upper 1/2 with straight finish. Munsell 10YR 4/4. RD 152 mm, B 144 mm, H 396–410 mm, W 348, Wt 8 kg.

KSC3 1076j. Sherd Amdel No. 62/M7860/87. Base-body join. Red-grey body. Green-brown-black glaze with thick dribble. B 150 mm, Th. 6.5. Amdel: BR (Almost NT MgO low).

KSC3 5, Green *et al.* (1987). Incomplete jar, rim missing. Ridge at neck. No incisions under lugs. Grey body, Munsell 2.5R5/2. Thick green-brown glaze to upper 3/4, scolloped, Munsell 10YR4/4. B 148 mm, H 360 approx, W 284 mm.

Verde Island, Luzon, the Philippines, Harper (1988(i)a) 189. Possibly fits this section. Rim sherd, indented. Mauve-grey with white inclusions. Mottled brown on black glaze. RD 150 mm. Amdel: None.

Pattaya wreck site, P13, Green *et al.* (1983b). Rim and shoulder sherd. Indented upper rim. Grooved upper surface. Ridge at neck. No incisions at lug join. Grey-pink surface. Green-black glaze. RD 144 mm.

Pattaya wreck site, P31, Green *et al.* (1983b). Jar. Ridge at neck. Incised under lugs. Concave base. Grey surface. Thick black glaze to upper 2/3 then long streaks. RD 164 mm, B 144 mm, H 404 mm, W 360 mm.

Calatagan, Batangas, the Philippines. Locsin (1967) 186. Jar. Ridge. Coarse grey body, burned reddish brown where exposed. Brown-black glaze to upper 2/3–3/4, scolloped. Mark on base. H 320 mm.

Brunei Museum from Kg. Sumbiling, Brunei. Harrison (field notes) 67–212. Jar. Rolled lip. Ridge at neck. 'Minimal grooves'. Base warped with remains of blackish glaze adhering. Very thick, double-dipped, blackish-brown glaze to upper

2/3 then running. RD 155 mm, B 172 mm, H 407 mm, W 383 mm, Wt 8 kg.

Bahaguhan Cave, Marinduque, the Philippines. Harper (1988(i)a)184. Possibly fits this section. Base sherd. Purple with orange inclusions. Thick brown-black glaze. B 192 mm. Probably join marks inside. Concave base. Amdel: NT.

Bahaguhan Cave, Marinduque, the Philippines. Harper ((1988(i)a) 153. Possibly fits this section. Rim sherd, unsure if upper rim indented. Ridge at neck. No incisions under lugs. Beige-brown body with white inclusions. Thick brown-black glaze. RD 152 mm. Amdel: BR. (NT MgO little low).

Bahaguhan Cave, Marinduque, the Philippines. Harper (unpub.) 176. Possibly fits this section. Rim sherd, light indentation. Ridge at neck. Brown with round beige and orange inclusions. Thick green-brown glaze. RD 152 mm. Amdel: BR. NT MgO little low. Visually resembles BR21#13. Brunei Darussalam wreck site, Exhibition, (2005) WAMaritime Museum, Fremantle. Some of the jars were noted to have runny glazes, some were unglazed inside the mouth. Slight indentation inside mouthrim and an incised line further inside mouth rim:

Brunei Darussalam wreck site No. 6876. Jar. Grey surface with inclusions.

Brunei Darussalam wreck site No. 6868. Jar. Grey surface.

Brunei Darussalam wreck site No. 3274. Jar. Brown-beige surface.

Brunei Darussalam wreck site No. 2/5. Jar. Beige surface with inclusions, texture appears 'sandy'. Ridge. Incised under lugs. Marks inside jar where three items were fired.

Brunei Darussalam wreck site. Richards (2003), Type 2, p.58. Jar. Incised inside rim. Ridge at neck. Incised under lugs. Pinkish body surface. Green-brown glaze over slip to upper 1/2 then running. H 430 mm.

Brunei Museum, from Kg. Brunei, Dalat, Mukah, Sarawak. Harrison (notes) 1971.12. Jar. Glazed to upper 2/3, straight finish. Possibly red slip. Flat base. RD 175 mm, B 182 mm, H 374 mm, W 370 mm, Wt 7.5 kg.

Mae Nam Noi kiln site, Harper (1988(ii)) SF20. Possibly fits this section. Rim sherd, indented upper rim. Ridge at neck. Dark grey with white inclusions. Mottled brown-black glaze. RD 144 mm.

4.3 Large Jars, Tall Ovoid

Bungiao Rock Shelter, Zamboanga, the Philippines. Marked 69-GG-14. Harper (1988(i)a) 202. Possibly fits this section. Base sherd with rough coil mark joins. Light red-grey body. B 284 mm. Amdel: None.

Sarawak Museum, from Gedong, Moore (1970) Plate 10c), (222/806). Ridge at neck. Does not appear to have incisions under lugs. Brown glaze, unable to determine from photo how far it extends. H 642 mm. W 460 mm. Described as Kwantung (Quandong) ware.

Pangil, Laguna, Luzon, the Philippines. Harper (1988(i)a) 146. Marked 75-G. Possibly fits this section. Shoulder sherd. Ridge at neck. incised under lugs. Orange body with large round inclusions. Green-brown glaze extends inside rim. Amdel: None.

Punta Sunog, Batangas, Luzon, the Philippines. Harper (1988(i)a) 119. Possibly fits this section. Base sherd. Red body

with white inclusions. B 300 mm. Amdel: None. Coil marks inside. Marks where three items fired inside.

Punta Sunog, Batangas, Luzon, the Philippines. Harper (1988(i)a)113. Possibly fits this section. Rim sherd, indented upper. Pink-grey with white and orange inclusions. RD 212 mm. Incised inside rim. Visually resembles BR19#6. Amdel: BR. (NT MgO low).

Royal Nanhai wreck site, Brown and Sjostrand (2002) CP69. Large number of jars. Ridge at neck. Incised under lugs. Brown glaze, streaking and running over a wash to 3/4 upper body. H 680 mm. Vol. 80 litre. (Brown & Sjostrand say the jars are from the Mae Nam Noi kilns).

Phu Quoc wreck site, Blake and Flecker (1994) Fig. 16. Many jars. Some possibly fit this section. Unknown if upper rim indented. Ridge at neck. Thick brown glaze to upper 3/4 scolloped with a few runs. Heights of similar jars vary between 280–600 mm, Fig. 16 H 450 mm. Exact example was not shown. Mae Nam Noi kiln site, Harper (1988(ii)) K2 Ge 9. Rim sherd, indented upper. Ridge at neck. Light grey body. Green-brown-black glaze into rim. Ridge. RD 212 mm.

Mae Nam Noi kiln site, Harper (1988(ii)) AC26. From the collection of the Abbot, Wat Phra Prang, adjacent to the Mae Nam Noi kiln site. Jar. Ridge at neck. Incised under lugs. Green brown-black glaze over a wash into rim. RD 216 mm. B 264 mm. H 640 mm. W 480 mm. Scar in three places on rim.

Mae Nam Noi kiln site Kiln 2, Harper (1988(ii)) Jar 2. Recovered from inside kiln 2. Upper section. Ridge at neck. Incised under lugs and also through waist. Dark red body. Dark grey external layer. Body matrix not as tight as usual in Kilns 1–4. Inferior yellowish glaze from just below rim onto main body. RD 208 mm. W 464 mm. Scar on rim.

Shuri Castle (excavated), Okinawa, Ryukyu, Japan. Chonlaworn (2004) Fig. 1 No. 3. Jar. Ridge at neck. Incised under lugs. Dark brown glaze to more than 3/4 upper body. RD 210 mm. B 290 mm. H 650 mm approx. estimate. W 475 mm. All measurements estimated.

KSC3 61. Sherd. Amdel No. 61/M7860/87. Amdel: BR, (NT MgO low).

KSC3 2201C. Sherd. Amdel No. 66/M7860/87. Everted rim, dark grey interior, red surface. Bloating apparent. Degrading green-brown glaze. Ridge. Incised. Th. 11 mm. Amdel: None. KSC3 26, Green *et al.* (1987). Jar. Upper rim indented. Ridge at neck. Incised under lugs. Red-grey body with orange inclusions. Munsell 10RP5/2. Degraded green-brown glaze to upper 2/3, two dips or slip and glaze to upper 1/2. RD 224 mm. B 248 mm. H 604 mm. W 480 mm. Wt 20.4 kg. Vol. 70 litre. Marks inside where three items fired.

KSC3 101, Green *et al.* (1987). Jar. Upper rim indented. Ridge at neck. Incised under lugs. Medium coarse, red body. Munsell 10R 4/6. Degraded, possibly underfired, yellowish to green brown glaze. Ash glaze inside rim. RD 224 mm. B 280 mm. H 600 mm. W 496 mm.

KSC3 69, Green *et al.* (1987). Jar. Upper rim indented. Ridge at neck. Incised under lugs. Red-grey body. Munsell 10RP 5/4. Runny green-brown glaze to upper half. Munsell 2.5Y 4/2. Ridge. Incised. RD 200 mm. B 272 mm. H 600 mm. W 472 mm. Wt 21.600 g. Attachments at neck.

KSC3 29, Green *et al.* (1987). Jar. Upper rim indented. Ridge at neck. Incised under lugs. Exterior body Munsell 2.5RP5/2.

Interior 2.5YR 4/2. Degraded thin green-brown glaze Munsell 10YR 4/4. RD 180 mm. B 288 mm. H 584 mm. W 480 mm. Resinous remains were found inside this jar.

J. Toralba Site, Butuan, Mindanao, the Philippines. Harper (1988(i)a) 135. Possibly fits this section. Shoulder sherd. Light orange to dark grey body with orange and white inclusions. Amdel: BR (NT MgO little low). Resembles BR21#13 internally.

Pattaya wreck site, P9, Green and Harper (1983). Jar. Upper rim indented. Ridge at neck. Incised under lugs. Green-black glaze to upper 3/4. Ridge. Incised under lugs. RD 200 mm. B 244 mm. H 608 mm. W 412 mm.

Pattaya wreck site, P569, Green and Harper (1983). Jar. Pink surface. Degraded green-black. RD 184 mm. B 268 mm. H 588 mm. W 424 mm.

Pattaya wreck site, P166, Green and Harper (1983). Jar. Ridge at neck. Incised under lugs. Green-black body to upper 1/2. RD 180 mm. B 268 mm. H 608 mm. W 456 mm.

Pattaya wreck site, P30, Green and Harper (1983). Jar. Ridge at neck. Grey surface. Red interior. Degraded green-black glaze to upper 2/3. RD 180 mm. B 236 mm. H 572 mm. W 412 mm.

Pattaya wreck site, P1, Green and Harper (1983). Jar, upper section. Upper rim indented. Ridge at neck. Incised under lugs. Grey-green glaze with upward run. RD 204 mm. W 420 mm.

Pattaya wreck site, P3, Green and Harper (1983). Jar, upper section. Upper rim indented. Ridge at neck. Incised under lugs. Pink body. Green-black glaze. RD 184 mm. W 420 mm.

Pattaya wreck site, P12, Green and Harper (1983). Amdel No. 1/M7860/87. Sherd. Ridge at neck. Incised under lugs. RD 202 mm. Amdel: Nong O, BR (NT MgO little low).

Bahuguhan Cave, Marinduque, the Philippines. Harper (1988(i)a) 147. Possibly fits this section. Jar upper section. Upper rim appears to be indented. Ridge at neck. No incisions evident. Light brown body with orange inclusions. Bloating. Thick black-brown glaze extends into rim. Item appeared to have a smoother finish than those from the Thai Gulf wreck sites. RD 176 mm. W 416. Visually resembles BR 21#13, BR19#6. Amdel: BR (NT MgO low).

Bahuguhan Cave, Marinduque, the Philippines, Harper (1988(i)a) 182. Possibly fits this section. Rim sherd, lightly indented upper. Attachment inside rim. Brown body with orange and white inclusions. Brown-black glaze. RD 182 mm. Amdel: BR. Visually resembles BR21#13 interior and glaze. Colour and body type of BR1.

Brunei Darussalam wreck site, Exhibition, WAMuseum (2005). (Harper notes 28/3/05) No. 1890. All large jars have slight indentation on rim. Ridge at neck. Two to four incisions under lugs. Appear to have a slip to top 1/2 then top 1/6 glazed.

Brunei Darussalam wreck site, Richards (2003), Type 181, p. 56 & 58. 435 jars of this type were recorded. Slight indentation on upper rim of example p. 56. Indentation not obvious on jar p. 58. Ridge at neck. Two sets of incised lines. Pinkish body. Green-brown glaze to upper 3/4 over slip, some with drips, some straight. H 620 mm. Wt up to 20 kg. Vol. over 50 litre.

Ko Samui wreck site (believed to be), Harper (unpub.) 17 2/1/85. Jar. Ridge at neck. Incised under lugs. Tapers towards base. Grey body. Degraded olive green-black-brown glaze to

upper 3/4, running. RD 184 mm. H 620 mm. W 430 mm. Compare KSC1 723 below.

Sarawak Museum, from Lobang Imam, Niah (322/40). Moore (1970) Plate 12c). Ridge at neck. Unable to estimate if incised under lugs. Black glaze. Appears to be glazed over slip to upper 3/4 approx. H 595 mm. W 450 mm. Described as 'Kalong ware'.

National Museum, Jakarta No. 379, Adhyatman and Ridho (1984) No. 174. Unsure if rim indented but has circular incised line on rim. Ridge at neck. Incised under lugs. Black-brown glaze from below rim to upper 3/4 then running. Mouth, half of neck and lower body coated with brown slip. Yellow-brown glaze smears at lower body. H 640 mm. W 475 mm. Flat, coarse purplish base. Says many found at Trowulan, East Java. Brunei Museum, from Kg. Saba Ujong, Brunei, Harrison (Field Notes) 1965.786. (Note—the item with this number shown in Harrison (1986) differs to the item recorded here). Jar. Upper rim does not appear to be indented. Ridge at neck. Incised under lugs. Purplish burn to a flat base. Deteriorated brown glaze from neck to above base. Remains of white and purple wash. RD 198 mm. B 263 mm. H 600 mm. W 467 mm. Wt 19.5 kg.

Sabah Museum, Harrison (Field Notes) No. 2857. Jar. Unknown if indented upper rim. Ridge at neck. Probably incised under lugs. Appears to be light red-grey. Possibly two lots of glaze, probably over slip to upper 3/4. Thick brown-black glaze, burnt red around neck. Some running of glaze. W 470 mm (estim.). H 603 mm. Harrison says a 'Sawankhalok' jar. *San Diego* wreck site, 2659. Carre *et al.* (1994). Jar. Possibly fits this section. Ridge at neck. Two sets of incised lines. Brown-black glaze, peeling in places. H 600 mm. Wt. 18 kg. Vol. 51 litre. *Nuestra Señora de la Concepción* wreck site, Pacific Sea Resources (unpub.) A616. Incomplete jar, rim missing. Ridge at neck. Incised under lugs. Unable to determine if indented upper rim. Glazed. H 625 mm approx. This item has a shipper's mark etched on the side.

The following items from the Philippines were determined to fit the Type 4.3 category by the author in 1987. Unfortunately detailed information about each jar was not recorded:

Puerto Galera wreck site, Oriental Mindanao, the Philippines (believed to be). National Museum of the Philippines Special Display Room A17. Jar.

Puerto Galera, Oriental Mindanao, the Philippines. San Carlos University Museum. Grave pieces retrieved from looters by Father Thiel.

Puerto Galera, Oriental Mindanao, the Philippines. Museum Reference Card 64-1-174. Jar of this type said to be from the Puerto Galera. Unseen by this author. H 580 mm.

Fernandez Collection, Butuan City, Mindanao, the Philippines. Jar. Very shiny glaze.

San Carlos University Museum, Cebu, the Philippines. Sherd storage room, No. C A00299. Jar. Glazed to upper 3/4 body. H 520 mm approx.

Karitunan, the Philippines (possibly). National Museum of the Philippines. Herran Storage Room. Marked 216 and 2009. Jar base with five marks inside where items sat during firing.

4.4 Medium—Large Ovoid Jar Elongated Neck—Flared Mouth Rim

a) Support marks inside mouth rim

KSC3 424 Green *et al.* (1987). Jar. Indented upper rim. Ridge at neck. Three sets of incisions—under lugs, on shoulder and on body. Medium coarse red-grey body. Orange and black inclusions. Thick, runny, degraded green-brown-black glaze Munsell 10Y3/0. Orange where lifting, Munsell 2.5YR6/8. RD256 mm. B280 mm. H600 mm. W480 mm. Wt20kg. Six support marks inside rim.

Bahuguhan Cave, Marinduque, the Philippines, Harper (1988(i)a) 182. Possibly fits this section. Rim sherd, lightly indented upper. Attachment inside rim. Brown body with orange and white inclusions. Brown-black glaze. RD182 mm. Amdel: BR. Visually resembles BR21#13 interior and glaze. Colour and body type of BR1.

Brunei Darussalam wreck site, (Exhibition WA Museum January, 2005). BD749 or 747. Jar. No, or only slight, indentation on rim. Ridge at neck. Two sets of incised lines. Green-brown glaze from below rim to upper 3/4 body, ending in scollops. H 600 mm (up to). Tiny mark inside rim, possibly a support mark. Evidence of coiling inside jar. Marks inside base of jar where at least four smaller items were placed during firing.

Ko Samui wreck site, Harper (unpub.) 61. Amdel No. KS2 AC1253/88. Rim sherd, indented upper rim. Ridge at neck. Incised under lugs. RD 253 mm. Support marks inside rim. Amdel: BR.

b) No Support marks visible

Recovered from the Mae Nam (River) Yom (1985), Hein *et al.* (1986) Fig. 9. Possibly fits this section. Glazed to upper 3/4. Punta Sunog, Batangas, Luzon, the Philippines, marked PS-206-GR97. Harper (1988(i)a) 105. Possibly fits this section. Rim sherd. Red-purple body with white inclusions. Yellow, possibly fire ash on rim. RD 292 mm. Coil marks inside. Amdel: None.

Ko Khram wreck site, Brown (1975) Fig 11. Darkened orange-red body. H 450 mm.

Shuri Castle (excavated), Okinawa, Ryukyu, Japan. Chonlaworn (2004) Fig. 1 No. 1. Indented upper rim. Ridge at neck. Incised under lugs. Dark brown. Glazed to upper 3/4 over slip. RD 240 mm. B 250 mm. H 550 mm. W 370 mm. All measurements estimated.

Shuri Castle (excavated), Okinawa, Ryukyu, Japan. Chonlaworn (2004) Fig. 1 No. 2. Ridge at neck. Dark brown. Glaze to upper 3/4 over slip to above base. RD 250 mm. H 600 mm. B 375 mm. W 440 mm. All measurements estimated. KSC3 487, Green *et al.* (1987). Jar. Indented upper rim. Medium coarse dark red-grey body, fired in a reduced atmosphere. Munsell 10 G/RP 3/4. Degraded green-brown glaze. Munsell 10 GY P 4/2. RD168 mm. B184 mm. H 456 mm. W 328 mm.

c) Support marks inside mouth rim—indented outer and inner rim

Mae Nam Noi kiln site, Harper (1988(ii)) SF4. Upper body sherd. Flared rim. Ridge at neck. Incised under lugs. Red-grey body. Underfired or inferior glaze from rim downward. Fly ash on rim. RD 256 mm. Six support marks on rim.

Bahuguhan Cave, Marinduque, the Philippines. Harper (1988(ii))174. Possibly fits this section. Brown body with white, orange and black inclusions. Thick black glaze. RD 186 mm. Amdel: BR. (NT MgO low). Attachment inside rim.

4.5 Miscellaneous Large Jars Exhibiting Features Comparable with Jars Between Type 4.1 & Type 4.9.

a) Attachments on rim

Mae Nam Noi kiln site, Harper (1988(ii)) SF19. Upper body sherd. Ridge at neck. Incised under lugs. Dark beige-grey body with orange and white inclusions. Green-brown-black mottled glaze from below mouth rim. RD 176 mm.

Mae Nam Noi kiln site, Harper (1988(ii)) K2Ge11. Upper body sherd. Ridge at neck. Incised under lugs. Dark beige body with orange inclusions. Green-brown-black glaze. RD 220 mm.

b) Slightly flared rim, extended neck, rounded body

Ko Samui wreck site, Harper (unpub.)15. Jar. Grey body. Ridge at neck. Incised on shoulder. Deteriorated, thin glaze to upper 3/4 of jar and extends inside rim. RD 232 mm. B 168 mm. H 436 mm. W 370 mm.

San Diego wreck site, Carre *et al.* (1994) 1707. Jar. Ridge at neck. Two sets of incised lines. H 385 mm. Wt 7.5 kg. Vol. 21 litre.

c) Two sets of incised lines between neck and lugs

Ko Kradat wreck site, KK34. Green *et al.* (1981). Upper body sherd. Grey body, black-grey interior. Olive green slip/glaze. RD 268 mm.

Ko Kradat wreck site, KK35. Green *et al.* (1981). Upper body sherd. Grey body. RD 268 mm.

4.6 Jars Comparable Between Type 4.2, 4.3, Into Type 4.9. Slightly Longer Neck than Type 4.9 (below)

Brunei Museum from Kg. Sebakit Tg. Maya, Tutong. Harrison notes 1967.815. Ridge at neck. Two sets of incised lines. Glazed from below rim. Streaked olive green-brown glaze streaked over slip to upper 3/4. Purple coloured flat base. RD193 mm. B227 mm. H515 mm. W 440 mm. Wt 16.5 kg. Ko Samae San underwater site (believed to be). Harper (unpub.) No No. (1). Upper section. Ridge at neck. Two sets incised lines. Grey-red body. Degraded glaze. RD 200 mm. PK 25. Jar. Upper rim not indented. Ridge at neck. Incised under lugs. Purple-red-grey body. Thin, degraded olive green-brown glaze (probably 2 dips or wash and glaze) to upper 3/4. RD 200 mm. B 256 mm. H 552 mm. W 456 mm.

4.7 Jars Comparable Between Type 4.1, 4.2 and 4.9. A Squat Type.

Brunei Darussalam wreck site, Richards (2003) Type 2, p.55. Jar. Lightly indented upper rim. Incised under lugs. Beige surface. Degraded glaze to upper 1/2. H400 mm.

Ko Samui wreck site, Harper (unpub.) KS/RH/84/85.3. Jar. Lightly indented upper rim. No ridge or incisions. Pink-grey surface into inside rim. Thin, degraded green-black-brown glaze to upper 2/3. RD 152 mm, B 162 mm, H 408 mm, W 362 mm.

PK 13. Jar. Ridge at neck. Incised under lugs. Coarse grey body with large dark grey inclusions. Degraded green-brown

glaze. RD 160 mm. B 168 mm. H 352 mm. W 344 mm. Marks on rim and base.

San Diego wreck site, Carre, *et al.* (1994) 1473. Jar. Ridge at neck. Incised under lugs. Grey body. Patches of dark red. From the photo it appears that this jar may have a yellow slip/glaze. H 345 mm. Wt 9 kg.

Museum Brunei, Harrison (notes) 1965.1294. Jar, rolled rim. Ridge at neck. Incised under lugs. Mottled, blackish-olive glaze to upper 3/4, some runs. RD 158 mm. B 200 mm. H 340 mm. W 370 mm. Wt. 8.5 kg.

4.8 Large Jar, Rolled Rim, No Discernible Neck. Tapered Towards Base.

KSC1 723, Green (1983). Jar. Ridge at neck. Body probably red—appears dark mauve-grey. Yellow, underfired glaze to upper half. RD 187 mm. B 224 mm. H 525 mm. W 402 mm. Possibly sealant on upper rim. Fairly rough base.

4.9 Large Jars, Rolled Rim, Short or no Discernible Neck.

Palapat Melian, Batangas, Luzon, the Philippines, Harper (1988 (i)a) 088. Possibly fits this section. Sherd with lug handle. Incised under lugs. Thick, Light purple-grey body with black and white inclusions. Glaze appears yellow. Amdel: BR. Visually closely resembles BR1 1985. Resembles BR20#12, BR21#13 interior. Ko Khram wreck site, Green and Harper (1987) Fig. 39. Ridge at neck. Incised under lugs.

Ko Kradat wreck site, Green *et al.* (1981) KK36. Jar. Two sets of incised lines. Grey body. Yellow-brown slip. RD 190 mm.

Ko Kradat wreck site, Green *et al.* (1981) KK38. Jar. Two sets of incised lines. Grey surface with pink patches. RD 190 mm. Singtai wreck site, Malaysia, Brown (2004) Plate 69, S30. Jar. Appears to have ridge at neck. Brown glazed. H 460 mm.

Ko Samae San underwater site (believed to be). Harper (unpub.) No No. (2). Possibly fits this section. Base sherd. Dark brown-grey body. Green-brown glaze to upper 1/2–2/3. B 208 mm. Interior coil marks evident.

Ko Samae San underwater site (believed to be). Harper (unpub.) No No. (3) 1986. Upper section. Ridge at neck. Dark grey surface, coarse red body. Gap in rim fold. Ridge. RD 186 mm.

Ko Samae San underwater site (believed to be). Sherd Amdel No.31/M7860/87. Amdel: NT, (Almost BR, MgO high).

Ko Rin wreck site, KL19. Amdel AC1219/87. Upper section. Ridge at neck. Incised under lugs. Orange body with many quartz inclusions. Blue interior. Appears friable. RD 196 mm. W 428 mm. Amdel: NT, (Almost BR, MgO high).

PK 24. Jar. Ridge at neck. Incised under lugs. Orange-red body. No evidence of glaze. RD 192 mm. B 232 mm. H 464 mm. W 400 mm.

PK 14. Jar. Ridge at neck. Two sets of incised lines. Coarse orange to brick red body with blue surface. No evidence of glaze. RD 192–200. B 192 mm. H 480 mm. W 408 mm. Except for slightly different placement of incised lines this item compares to *San Diego* 5262.

PK 26. Sherd. Amdel No. AC1253/88. Coarse purple-grey body. Degraded medium brown glaze. Amdel BR, NT.

PK 27. Sherd. Amdel No. AC1253/88. Coarse brown-grey body. Degraded, probably green glaze. Amdel: BR. (NT MgO little low).

San Diego wreck site, Carre *et al.* (1994) 2819. Probably fits this section. Jar. Ridge at neck. Two sets of incised lines. Grey body. Patches of dark red. Degraded brown-black glaze. H 560 mm. Wt 17 kg. Vol. 50 litre.

San Diego wreck site, Carre *et al.* (1994) 5262. Jar. Two sets of incised lines. Grey body. Patches of dark red. Degraded brown-black glaze. H 480 mm. Wt 18 kg. Vol. 36 litre.

São João wreck site, 81/22. Sherd. Amdel No. 74/M7860/87. Appears to be from this type of jar. Incised under lugs. Exterior and interior medium-grey layers surrounding a light mauve layer. Quite large orange inclusions. Degraded glaze—remains of green-brown over a yellowish slip. Amdel: BR, NT. Visually the internal body resembles BR#11 but the *São João* item is a lighter colour. The exterior incisions and colour resemble BR#7.

Museum Sultan Abu Bakar, Pahang, Dupoizat (1984) No. 148. Jar. Two sets of incised lines. Dark red body. Black glaze to upper 3/4. RD 208 mm (possibly inside mouth measurement). H 475 mm. Wt. 16kg.

Museum Sultan Abu Bakar, Pahang, Dupoizat (1984) No. 151. Jar. Ridge at neck. Incised under lugs. Dark red body. Mottled whitish glaze to upper 1/2. RD 183 mm. H 460 mm.

Museum Sultan Abu Bakar, Pahang, Dupoizat (1984) No. 153. Jar. Ridge at neck. Two sets of incised lines. Mottled whitish glaze to upper 1/2. H. 423. Wt 14 kg.

São Bento wreck site, Auret and Maggs (1982) Fig 36. Jar. Deteriorated, darkish green-brown glaze. Ridge at neck. Incised under lugs.

São Bento wreck site, SB77/103(2), Sherd. Amdel No. 72/M7860/87. Slightly mauve-grey surface. Quite highly fired. Orange and white inclusions. Interior appears red. Incised. Amdel: BR. This author is unsure whether this sherd is from the previous item. Resembles BR11#2 visually.

São Bento wreck site, SB77/103 (1). Sherd. Amdel No. 71/M7860/87. Refer Auret and Maggs (1982). Ridge at neck. Incised under lugs. Quite high fired body, red with large red inclusions. Grey surface. Yellow-orange, non shiny glaze or slip. Amdel: None. Visually appears to resemble BR#7, however BR thinner.

São Bento wreck site, SB77/103 (3). Sherd. Amdel No. 73/M7860/87. Probably fits this section. Sherd is not from a particular jar (sea worn on all edges). Quite highly fired. Slightly mauve-grey body with quite large maroon inclusions. Deteriorated glaze, fragments of yellow slip remain. Incised. Amdel: None. Visually body appears not dissimilar to BR#1, quite dense, colour differs.

Kuantan, east coast of Malaysia. Dupoizat (1984) No.152. Jar. Grey body. Deteriorated yellowish glaze with small shells attached. RD145 mm (possibly inside mouth measurement). B210 mm. H480 mm. Wt 16kg.

Mae Nam Noi kiln site, Harper (1988(ii)) K2 GE 13. Upper section. Ridge at neck. Incised under lugs. Light red body with inclusions. Green-brown-black glaze. Glaze mark just below exterior rim. RD 212 mm.

Mae Nam Noi kiln site, Harper (1988(ii)) K2 GD 24. Upper section. Ridge at neck. Dark grey body with inclusions. Greenish yellow-brown underfired glaze. Glaze mark just below exterior of rim. RD 208 mm.

Mae Nam Noi kiln site, Harper (1988(ii)) K2 GD 23. Upper section. Two sets of incised lines. Orange body. Inferior greenish-yellow glaze. Metallic inside mouth surface. RD 196 mm.

The following complete or almost complete jars from the Ko Si Chang 1 wreck site were recorded by the Thai-Australian team over several excavation periods:

KSC1 677. No ridge. Two sets of incised lines. Five incisions under lugs. 2 incisions on shoulder. RD 183 mm. Rim finish differs to others from KSC1 in this group.

KSC1 G50. Red body. Ridge at neck. Incised under lugs. Red body. Degraded yellow slip/glaze. RD 188 mm. B 212 mm. H 476 mm. W 392 mm. Remains of fish bones and a bung were recovered from this jar.

KSC1 G52. Ridge at neck. Brown body. Degraded green-yellow glaze to the upper half. RD 186 mm. B 216 mm. H 483 mm.

KSC1 G53. Ridge at neck. Three incisions under lugs. Red surfaces surrounding a grey layer. Degraded glaze. RD 188 mm. B 225 mm. H 485 mm.

KSC1 652. Ridge at neck. Eight incisions under lugs. Red body, grey upper surface. RD 186 mm. H 485 mm. W 400 mm.

KSC1 653. Ridge at neck. Incised under lugs. Red body, grey surface. RD 204 mm. B 250 mm. H 550 mm.

KSC1 655. Ridge at neck. Three incisions under lugs. Red body, grey surface. RD 186 mm. B 213 mm. H 450 mm. W 410 mm.

KSC1 659. Ridge at neck. Four incisions under lugs. Red body, grey surface. RD 185 mm. B 220 mm. H 460–472 mm. W 395 mm.

KSC1 665. Ridge at neck. Six incisions under lugs. Red body, grey surface. B 228 mm. W 392 mm.

KSC1 666. Red body, red and grey surface. Ridge at neck. Seven incisions under lugs. RD 198 mm. B 200 mm. H 480 mm. W 410 mm.

KSC1 669. Ridge at neck. Six incisions under lugs. RD 186 mm. B 210 mm. H 466 mm. W 405 mm.

KSC1 678. Ridge at neck. Six incisions under lugs. Red body. Evidence of glaze to upper 2/3. RD 190 mm. B 225 mm. H 474 mm. W 417 mm.

KSC1 686. Ridge at neck. Four incisions under lugs. RD 175 mm. H 452 mm. W 396 mm. A bung and vegetable fibre were recovered from this jar.

KSC1 694. Ridge at neck. Three incisions under lugs. Red body, green-black and red surface. RD 196 mm. B 215 mm. H 460 mm. W 389 mm.

KSC1 698. Ridge at neck. Five incisions under lugs. Red body, grey-blue surface. RD 185 mm. H 500 mm. W 418 mm.

KSC1 707. Ridge at neck. Five incisions under lugs. Red body, yellow-white-black spray-like glaze to upper 2/3. H 463 mm. W 402 mm.

KSC1 708. Ridge at neck. Five incisions under lugs. Red body. Yellow slip/glaze to upper half. RD 179 mm. H 487 mm. W 393 mm.

KSC1 713. Ridge at neck. Five incisions under lugs. Red body, grey upper section. RD 199 mm. H 498 mm.

KSC1 714. Red body. Yellow slip/glaze to upper 1/2. H 455 mm. Scratch marks indicated trimming had occurred. Fish remains were recovered from this jar.

KSC1 3437. Orange body. Slip to upper 1/2. H 464 mm. W 416 mm.

KSC1 sherd, Amdel No. 13A/M7860/87. Amdel: BR, NT.

KSC1 sherd, Amdel No. 13B/M7860/87. Amdel: BR, NT.

KSC1 sherd, Amdel No. 13C/M7860/87, sherd. Amdel: None.

Seychelles wreck site, Blake and Green (1986) Fig. 15. Jar. Ridge at neck. Two sets of incised lines. Deteriorated glaze probably covering a wash to upper 2/3. H 485 mm.

Santiago wreck site, 81/5 (5). Sherd. Probably fits this section. Amdel No. 75/M7860/87. Medium grey body, fairly highly fired. Appears to have quite high silica content. Surface appears slightly blue. Red layer, some air gaps, then thin light grey layer. Amdel: BR.

Witte Leeuw wreck site, Pijl-Ketel (1982) 12211. Jar. Ridge at neck. Two sets of incised lines. Grey-red body with black inclusions. Sometimes this type has white discolouration according to Pijl-Ketel. Scratched and pitted. Traces of yellow slip or glaze. RD 200 mm. H 500 mm.

Witte Leeuw wreck site, Pijl-Ketel (1982) 12216. Jar. No ridge at neck, but an incision just above lugs. No incisions under lugs. Grey body with black and white impurities. Interior surface has yellow and grey discolouration, possibly slip. RD 190 mm. B 220 mm. H 480 mm.

Witte Leeuw wreck site. Sherd, Amdel No. 70/M7860/87. Orange with quite large yellow inclusions. Grey surface. Black inclusions. Appears white 'powdery' on blue over red. This sherd does not fit the description of previously described *Witte Leeuw* jars. Amdel: BR, NT, almost Nong O.

Batavia wreck site, BAT608A. Sherd. Amdel M/7860/87. Probably fits this section. Layer of grey on upper surface over orange-red layer. Orange and white inclusions. Surface—bluish appearance. No glaze evident. Th. 7 mm. Internal body resembles BR7. Amdel: BR, NT. This jar is not as thick as many of the large jars in this section.

Batavia wreck site, BAT608B. Sherd. Amdel M/7860/87. Probably fits this section. Orange-red body. Surface appears blue. White-blue and orange inclusions. No glaze evident. Amdel: None.

Batavia wreck site, BAT 545. Rim sherd. Amdel M/7860/87. Appears to fit this section. Light red and grey body. Orange, white and black inclusions. Air gap in rim fold. Deteriorated bluish surface. Visually not dissimilar to BR#2 but less mauve. Amdel: NT. (BR MgO little high).

Nuestra Señora de la Concepción wreck site A325, Pacific Sea Resources. Probably fits this section. Incomplete jar. Ridge at neck. Two sets of incised lines. Glazed. This author was shown photographs of complete jars from this site in the 1980s. *Vergulde Draeck* wreck site GT 913. Green and Harper (1987) Fig. 38. Sherd. Many incisions under lug handle. Blue surface layer over red body. Possibly fits Type 4.10.

Fort Jesus, said to be 'from Captain's House', Kirkman (1974), Fig. 39 (1). Upper section. Incised under lugs. Grey body, burning purple. RD 150 mm (possibly inside mouth measurement).

4.10 Large Jars, Rolled Rim, Short or no Discernible Neck, Wide Mouth.

Mae Nam Noi kiln site, Harper (1988(ii)) K2 Gh 4. Upper section. Orange-red body, dark blue outer layers. Surface appears brown. Many incisions. RD 192 mm. W 320 mm approx. Long interior finger marks at join of lug to wall. Mark on rim where item fired.

Mae Nam Noi kiln site, Harper (1988(ii)) Kiln 2 Jar 1. High fired orange body. Ridge at neck. Many incisions under lugs. Unglazed. RD 208 (other similar items RD 176 mm, RD 192 mm) B 192 mm. H 400 mm. W 376 mm. Compare Jakarta 4069 and *Risdam* Fig.9B (below).

Mae Nam Noi kiln site, Harper (1988(ii)). Other of the above type had the following body descriptions:

Orange with inclusions; orange to dark beige; orange-red, dark blue exterior; external and internal surface appears brown; high fired, red surrounded by bluish layer, may have inferior glaze; some have metallic appearance.

Vergulde Draeck wreck site GD1046. Amdel M7860/87. Probably fits this section. Sherd. Blue layer over light red layer. White, orange and black inclusions. Visually similar to BAT 545. Amdel: BR.

Vergulde Draeck wreck site GT 913. Green and Harper (1987) Fig. 38. Sherd. Many incisions under lug handle. Blue surface layer over red body. Possibly fits Type 4.9.

National Museum, Jakarta, from Padi field near Toekau, Salatiga, Central Java, Harrisson (Field Notes), ref. 4069, 26–3–41. ‘Medium jar’ (may be shorter than other jars in this section). Many (eleven) incisions under lugs. Said to be stained red and caked with red earth.

National Museum, Jakarta, No. 2761. Adhyatman and Ridho (1984) No. 178. Many incisions. H 540 mm. W 430 mm. Appears to have slightly wider mouth than is usual. Ash glaze. Flat, hard, purplish base. Say many found at Pasar Ikan, Jakarta.

Risdam wreck site, Green and Gangadharan (1985) Fig. 9B. Two jars. Distorted, one extremely. No ridge at neck. Incisions or scratch marks on shoulder. Fine, low fired stoneware body Munsell 10YR 6/4. Poor quality fine, eroded glaze. Slip. Munsell 2.5 YR 5/4. Brown and Sjostrand (2002) Fig. 48 shows what appears to be a yellow-beige jar from the *Risdam*. B 190 mm. H 373 mm. W 325 mm.

4.11 Jar—Flared Mouth, Sloped Rim

Koh Khram wreck site, KKH 1. Amdel No. AC1253/88. Rim sherd. Indented outer rim. Ridge at neck. Incised under lugs. Purple surface. Red-grey body. Green-brown glaze extends into rim. RD 236 mm. Amdel: None (almost MON, almost Nong O).

Shuri Castle (excavated), Okinawa, Ryukyu, Japan. Chonlaworn (2004) Fig. 1 No. 4. Ridge at neck. Incised under lugs. Dark brown. Glazed to upper 3/4 then running. RD 175. B 175 mm. H 375. W 270 mm. All measurements estimated.

4.12 Jars—Miscellaneous

These jars were tested by Amdel but do not fit any of the Types above:

Bungiao Rock Shelter, Zamboanga, Mindanao, the Philippines, Harper (1988(i)a) 202. Base sherd. Marked 69–GG–14. Light

red body. No glaze evident. B 284 mm. Rough coil mark joins inside. Amdel: None. Low SiO, high Al₂O₃.

Kay Bungo, Batangas, Luzon, the Philippines, Harper (1988(i)a) 116. Rim sherd. Marked BK 60–P–1 (note—two items marked identically). Light purple-grey body with white inclusions. Ash glaze—appears yellow-orange inside rim. RD 240 mm. Amdel: None. Low SiO.

Kay Bungo, Batangas, Luzon, the Philippines, Harper (1988(i)a) 117. Rim sherd. Also marked BK 60–P–1. Dark grey body surrounded by brown-grey. Mottled yellow-brown glaze to upper mouthrim inside and out. RD 222 mm. Amdel: None. Low SiO, high Al₂O₃.

Batavia wreck site, BAT609. Sherd. Amdel No. M/7860/87. Grey body with maroon inclusions. Green-brown degraded glaze. Th. 8 mm. Amdel: None.

Kota Batu, Brunei. Sherd. Amdel No. 76/M7860/87. Incised under lugs. Light pink-mauve body with maroon inclusions. Deteriorated green-brown glaze, possibly over slip. Visually somewhat like *São Bento* (3) but chemical components differ. Quite highly fired with dense body. Amdel: None.

Observation and Discussion of Jar Groups

1. Jars estimated to have been Manufactured in the Vicinity of the Ban Bang Pun Kiln site, Suphanburi

Vilaikaew (1989), in Thai, shows various examples of jars from this kiln site.

Two main styles were recovered from sites recorded in this report: Type 1.1 jars with a flared and incised mouth, incised base rim and incised decoration and Type 1.2, very large jars, body tapering towards a flat base, incised, flared mouth, stamped and incised decoration. Some have an applied decoration which has been pre-stamped. Indrawooth (1985: 6) informs that stamped decoration was practised by potters in the Thai Dvaravati period and that the technique and motifs may have been introduced to these potters by Indian people during the Gupta and post-Gupta period. He reasons that it was a result of local imitation of Roman contact in West India.

It is noted that the Type 1.3 base KSC2 52 has similar features as a Type 1.1 jar though larger. It may join with Type 1.2 items KSC2 63 and KSC2 1231 in which case it is possible that the types of rims and bases of Type 1.1 and 1.2 are interchangeable.

No jar sherds from a particular kiln at Suphanburi were tested by Amdel however, ten sherds collected from the river edge adjacent to one of the kilns at Suphanburi were analysed (Amdel report AC 1219/89 S2–S15). Nine of these sherds were of a material with similar description to those items recovered from the Ko Si Chang 2 shipwreck site (see Type 1.2 (above)) which because of their shape and decoration were deemed to be products of the Suphanburi kilns. They had a friable appearance (though not in actual density, MacLeod (pers. comm. 1980s)), light grey or beige body containing particles of quartz and black inclusions see No. 47 in Table 3 on page 129. Amdel testing showed that the chemical component varied between those of the Mae Nam Noi kilnsite (BR), the Nakhon Thai kilnsite (NT) and the Nong O kilnsite. Thus a specific result was not attained for this group. The sixteen tested items from the Ko Si Chang 2 shipwreck, deemed to have come from the Suphanburi kilns fall into a BR, NT and sometimes Nong O range. It was found however, that levels of K_2O of the nine Suphanburi river bank finds were slightly higher.

It could be that the sample range was limited or that the Ko Si Chang 2 items were made at a slightly different location in the Suphanburi kilnsite area. As is the case with many of the items tested in this survey, a result fitting BR and NT range and with a variation with Nong O is not confirmation for any one site, demonstrating the difficulty in pinpointing a particular area of manufacture. The researcher cannot rely solely on the Amdel results, however they can act as a determinant toward a possible provenance when other factors are taken into account – such as form, decoration, body type.

The tenth item (S15) was glazed, with the appearance of a poor quality item recovered from the Ko Si Chang 2 site (KSC2 105) and not estimated to be manufactured at the Suphanburi site. With an Amdel result fitting the Sukhothai, almost KN, almost PY ranges and its closeness in manufacture and decoration to the KSC2 105 item which fits Almost KN, Almost Suk., indications are that this item is probably of

Si Satchanalai manufacture. It suggests that cargoes were possibly brought from Sukhothai Province, via a complex transport system, through the Suphanburi area eventuating in the Bight of Bangkok. It appears that this item may have been lost during cargo transfer.

The Ko Si Chang 2 shipwreck dated as some time after 1403 offers a dating at early to mid 15th century for the transitional period of operation of the Sukhothai-Si Satchanalai kilns and the concurrent operation of the Suphanburi kilns.

In reference to Type 1.1 Puerto Galera, Plate 78, it may be noted that there is a wreck site in the vicinity of Puerto Galera believed to be carrying both Chinese and Thai jars, but it is not known whether this item was salvaged from that site. Green (pers. comm.) reports that jars with the lotus bud design, believed to have been excavated from local burial sites, could be seen at Father Thiel's Museum at Puerto Galera, Mindoro, the Philippines, in the 1980s. Early Thai ceramic items recorded from the area indicate that this port was associated with the trade of Thai ceramics in the 15th and 16th century.

2. Items made at another Kiln site but which have Characteristics Pertinent to or an Association with the Suphanburi Product Including Style of Rim or Base or Adaptation of the Bodhi Decoration

This section has been included to illustrate the difference in rendering and possible transfer of the bodhi and lotus bud design between kiln sites. Whilst at the Suphanburi kiln site designs were pressed onto the jar or onto a piece of clay and subsequently attached to a jar, at the Si Satchanalai, Phitsanulok and Mae Nam Noi kiln sites, the lotus bud and bodhi decorations were made from a rolled strip of clay applied directly to the jar surface.

The Puerto Galera jar, Plate 79 is interesting in that it has a direct resemblance in form to the Suphanburi product Type 1.1 Puerto Galera Plate 78 (above). However, it has the applied lotus bud decoration together with simple incised and pressed decoration, as is manufactured at the Si Satchanalai kilns, the area from which it is likely to have originated.

3. Jars, Aspects of which Point Towards an Origin in the Vicinity of the Si Satchanalai, Phitsanulok or other Thai Kiln site.

Even though some of the jars in this group have commonalities, represented through both the Mae Nam Noi and Si Satchanalai surface finds, they are more likely to have come from one than the other despite the ambiguous Amdel results. This section is included to show the similarities in form and illustrates possible transfer between the kiln sites.

Jars with many variations are included in this group because of their similarity to items found at the Si Satchanalai kilnsite (Figures 28, Green and Harper (1987) and others seen and photographed at Si Satchanalai by Harper (1982) Sheet No. 4 (15 & 16) and drawings 2 & 3. Determination has been made in terms of rim treatment, handle type, body, glaze, Amdel result or through association of finds. There are also similarities between Phitsanulok jars, Hein and Sanghanukit (1987) Photo 6 & Fig.

26. Initially, caution was undertaken, because the Si Satchanalai jar sherds were surface finds, that is, not recovered in a stratified archaeological context and it could not be confirmed that they were of Si Satchanalai manufacture. In fact, Hein had indicated (Green, *et al.* (1987:70) that jars as Type 4.1 (below) of which Type 3 are likely to be forerunners were not typical of Si Satchanalai jars. Later however, Hein (1987(3)) indicated that a complete jar of this type had been recently recovered in the area of Ban Ko Noi, Si Satchanalai, and there was no doubt that large quantities of the type were made there and probably exported. At that stage Hein indicated that the dating was yet to be determined.

Glazed jars recovered from the Phitsanulok kiln site, Hein and Sangkhanukit (1987) Photo 6, A1406SW, do appear to closely resemble the forementioned Si Satchanalai glazed jars. One should be wary of defining a provenance from a shape or decoration alone. This author noted that patterns recorded on press decorated earthenware sherds recovered at the Phitsanulok kiln site in the 1980s resembled those from the Ko Si Chang 3 site, however the clay body differed.

The items recovered from Si Satchanalai (Figs 28a & b) probably represent an early version of Type 4.2. Fig. 28a has a black glaze, see No. 36 in Table 3 on page 129.

The Sha Tsui item Fig. 9a, Turiang Plate 18, 'Medieval Vessel' Nos 2 & 3 and KSC2 1069 have a rim type appearing to compare to the Si Satchanalai item photos 15, 16, drawings 2 and 3. They may represent an early Type 4.1. The glaze of the 'Medieval Vessel' items ends in scollops, see 42 in Table 3 on page 129.

Within this section the body surface (under the glazed area) of the jar from Turiang, Plate 18 appears yellowish, possibly with a mottled green-brown glaze. A white or yellow appearance is a common trait amongst the large jars Type 4.9 No. 18 in Table 3 on page 129, where it is likely to be the result of an underfired glaze, consistent with one made from a basis of ash. Other items have this appearance when ash falls onto the rim or shoulder and is subsequently fired onto the jar. The rim treatment of this item resembles, somewhat, that of one of the jars drawn and photographed at Si Satchanalai, by this author.

The jar KSC2 66 in this section demonstrates the difficulties in estimating provenance from particular features of a jar. This item is determined as likely to be a product of the Si Satchanalai kiln site (assuming here and throughout that those noted by Harper were manufactured there). The white-pink wash, see No. 17 in Table 3 on page 129, on this item demonstrates that a particular wash was used at this period of production. However, an item under Type 4.3—Ujong 1965.786, with a white-purple wash, exhibits features of a Mae Nam Noi kiln site product (in that it is glazed below the rim).

In this section KSC2 67 is recorded as having black inclusions, a common feature in products of the Si Satchanalai kilns—such as celadon and painted wares, see No. 15 in Table 3 on page 129.

Of the seven glazed jars from the Ko Si Chang 2 site, the Phitsanulok kilns are not considered a place of manufacture as the MgO content of the Ko Si Chang 2 jars is consistently lower than that given for Phitsanulok earthenware and stoneware. The jars from the Ko Si Chang 2 site tested by Amdel all compare to the chemical content of Nong O or almost MON KN, almost Thai KN. Three also fit the NT, BR composition, so that a definite provenance through chemical analysis alone, is difficult. Given the Nong O result one could speculate that these items were from that

area of the Si Satchanalai kiln site or at least somewhere in that vicinity, Nong O being slightly north of the Ban Ko Noi and Ban Pa Yang kilns. There is however, the possibility that this arrangement of chemical components indicates another production area, be it at Mae Nam Noi, Nakhon Thai or another area of Si Satchanalai in use at a particular period. An area of the Mae Nam Noi kiln site could be considered since KSC2 70 has orange or red inclusions, a frequent occurrence in a MNN product, see No. 11 in Table 3 on page 129. However, even though they exhibit some styles seen at the Mae Nam Noi kiln site, it is likely that the place of manufacture was in fact the Si Satchanalai kiln site.

The unusual result of the KSC2 1062 Amdel test of almost Thai KN with a Fe_2O_3 content of 2.04%, the percentage of Fe_2O_3 being much lower than that of the other six Ko Si Chang 2 jars tested and those of the generalized range for Nong O, NT and BR, could be significant. The fact that the percentage of Fe_2O_3 from sherds described as Thai Ko Noi equals 1–2% whereas the percentage given for Nong O (part of the Si Satchanalai kiln site complex) is 5–8%, whilst that of the Mae Nam Noi kiln site is 4–6%, and Nakhon Thai 4–6% illustrates the complexity in trying to estimate specific provenance.

Of note is the Sarawak Museum item from Bakong, Lobong Kudih No.322/120). With glaze to just above the base, see No. 35 in Table 3 on page 129, it appears to have a similar rim shape and black glaze as the Si Satchanalai finds. No complete jars of Type 3 were recovered by Harper at Si Satchanalai and the extent of glaze coverage to the body was not recorded. Moore (1970) records that the clay body of jars Nos 322/40 & 322/120 resembles that of Locsin (1967) Plate 192 though probably from a different kiln (Plate 192 being attributed to 'Kalong'). In reference to Calatagan Plate 186, Type 4.2 below, Moore says despite its great likeness to jars No.322/40 (Type 4.3) and No.322/120, it probably did not come from the same kiln or kilns. A Kalong attribution is significant for No.322/120 since KSC2 1233, with similar features, gives an Amdel result of Nong O. In this case, it would suggest that in fact both Bakong No.322/120 and KSC2 1233 items were Thai items possibly manufactured at the Si Satchanalai kilns. The inference is that the Calatagan item 192 may be from a different kiln. See further discussion under Type 4.3 (below).

4. Jars from Thai Production Sites—Possibly including Si Satchanalai, Sukhothai, Phitsanulok, Nakhon Thai and the Mae Nam Noi Kiln sites, including, for Comparative Purposes, some jars from Kiln sites other than Thai

4.1 Medium Jars

As indicated above, Hein states that an area of Ban Ko Noi, Si Satchanalai was a production site for this type of jar. Early authors such as Moore (1970) refer to 'Kalong' as a provenance for these jars, possibly in order to distinguish them from any known Chinese product. There are none of this type illustrated in Shaw (1981) or Nimmanahaeminda (1983) as coming from the northern Thai kilns.

Harrison (1950) illustrates similar jars in relationship to a T'ang grave. It is likely that this type of jar proved to be of such a practical shape that its form was transferred between

kiln sites. There are small, possibly indicative differences, between the jars of this section. Some are roughly finished on the outer surface, with the construction coils or throw marks quite obvious, other appear relatively smooth. Some rims are shaped whilst others are rolled somewhat like the large jars in Type 4.9. Other jars are slightly rotund whilst some are narrow. In general, narrow jars usually have quite deep ridges visible on the body surface, see No. 44 in Table 3 on page 129. A more precise grouping can be estimated by comparison of ratio height: waist.

This author reasoned that the shaped rim may indicate earlier items whilst the rounded rim may be indicative of a later period since the Type 4.9 with rolled rims were prominent in the 16th, into the 17th century. Unfortunately a rim type was not always able to be ascertained from photographs. Rim types even differ on jars from the same shipwreck. This could indicate that both forms were made at one kiln site or cargoes were taken from warehouses with wares from more than one kiln site. Further research may assist in forming a time line for the production of these jars.

4.1 a) Rounded rim, does not appear to have indented upper rim.

None of the Type 4.1a) appear to have an indented upper rim or incised lines under the lug handles. The main difference between rounded rim Type 4.1a) and rolled rim Type 4.1c) is the length of the neck. In Type 4.1c) the outward gradation commences from the rim towards the widest part of the body, whereas the rounded rim is associated with a longer neck. In general the jars in this group are quite narrow.

The Nanyang item CP35 has a blackish-brown glaze to the upper 3/4 then running, see Nos 34 & 38 in Table 3 on page 129. The Ko Khram item, Fig. 8a has black glaze to the upper 3/4, see Nos 34 & 36 in Table 3 on page 129.

An item from the Palapat Melian land site in the Philippines falls into this section. Ceramics other than jars from this site, indicate that Sukhothai and Si Satchanalai products were found together with a sherd of a large jar estimated to be of Type 4.9, (proposed to be manufactured at the Mae Nam Noi kiln site) and with a similar body type to an item from the *Witte Leeuw* shipwreck of 1612. It is estimated, because of the diversity of kilns from which the ceramics at this site originated, and the proposed dates over which the kilns operated, that this site may have been occupied over a period of time.

The jar Palapat Melian 071 which has white and orange inclusions and a scar inside the mouth rim, visually resembles BR21#13. It displays many attributes of a Mae Nam Noi kiln site product but fails to fall into the prescribed BR chemical range. This may indicate an insufficient test collection from the MNN kiln site or it may be that the item was manufactured at another area of the MNN kiln site. The item has a thick brown glaze, see No. 37 in Table 3 on page 129.

There were several styles of this type of jar noted from the Ko Samui site. One jar tested by Amdel resulted in BR, NT. The particular appearance including glaze leads to speculation that KS/RH/84/.1/85 may be of a provenance other than Thai, possibly Chinese. The item from Okinawa, Fig. 2, No.6 may resemble KS/RH/84/.1/85, in form. Compare Type 4.1d) Bo Dili 235.

An item from the Philippines, Iwahu 234, has white inclusions, a scar on the rim and fits no production area tested by Amdel. See Nos 10 & 22 in Table 3 on page 129, for items with similar traits. A scar on the mouth rim may be the result of placing one jar upon another in the kiln or through the use of a special support. It is not always easy to determine whether a spurred support has been used, as discussed elsewhere in this report.

The Brunei Museum items 1968–163 15E from Tutong and 71–14 14E from Mukah differ from others in this group in that they are rounder. 1965–1295 15E has a rough, flat, purple base, see No. 40 in Table 3 on page 129.

4.1b) Indented upper rim

The indication, through Hein (1987 (3)) that this type of jar was produced in quantity at Ban Ko Noi, Si Satchanalai in the area of Kiln 55, near SO2 (and only that area as far as was known at that time) proves that Si Satchanalai was indeed at least one of the production sites for this form of jar. The fact that the item BR SF23 (Special Find) and others were recovered in the area of the Mae Nam Noi kilnsite indicates that a similarly shaped item was also made at the latter site.

Ko Khram 5 records a grey-blue exterior. This type of colouring is often associated with the jar Type 4.9, see No. 19 in Table 3 on page 129. Since this colouring is achieved as a result of firing in a reduced atmosphere this feature can not be used to define any one site but at the same time the particular method of firing kilns in this way may be more prevalent at one kiln site than another. The Ko Khram items in this section appear to resemble the Ko Si Chang 3 more rounded items. Likewise, the Phu Quoc item of this type appears to have qualities similar to those of the Ko Si Chang 3 jars.

The item Ko Khram 3 has a missing rim section, however Brown (1988) Fig. 54 shows that a similar type of jar with a slightly longer neck was recovered from this site. KKH3 had a dark brown glaze to the upper 3/4, see No. 34 in Table 3 on page 129. Figure 1 No. 5 excavated from Shuri Castle also has this extended neck together with an indented upper rim such as found on KKH5. Shuri Castle Fig. 1 No.44 and KKH5 may also be similar. Since KKH3 and KKH5 were both incomplete jars these are only estimates.

Within this group, there are various indicators that the Si Satchanalai kilnsite is likely to have been the source of at least some of these jars. Palapat Melian 011 had an Amdel result fitting MONKN. In essence, this means a 0.30% higher Fe_2O_3 than tested BR products. The KSC3 151 and 439 items both have circular marks on the base, a feature common to small items at the Si Satchanalai kilns though tubular supports were also recorded at the Mae Nam Noi kiln site, (Harper (1988(ii)) SF7), albeit of a small diameter and unsuitable for stacking jars. Jars could also have been stacked base to base or rim to base, leaving a circular mark. The flat surface of a spurred support, as seen as the Mae Nam Noi kiln site, (Harper (1988(ii)) SF14, SF8) could also leave this mark. Examples of base to base and base inside rim stacking were also recorded at the Mae Nam Noi kiln site, (Harper (1988(ii)) K2GE8 & K2GE12).

The Ko Si Chang 3 items record smooth pink-grey bodies, the colour reached by other items at the Si Satchanalai kilns, see No. 1 in Table 3 on page 129. The KSC3 jars are generally

wider and rounder than SF23 from the Mae Nam Noi kilns except for KSC3 2 which is a narrower version. They resemble Nanyang and Royal Nanhai items of Type 4.1a) in terms of colour and smoothness of body. Conversely, a Ko Si Chang 3 sherd, Amdel 63/M7860/87, believed to be from this type of jar had an Amdel result of BR, almost NT. The jar KSC3 2 compared with the Mae Nam Noi special find MNN SF23 which in turn had a different appearance to many of the usual products of the Mae Nam Noi Kiln 2 area. SF23 has throw marks visible internally, see No. 41 in Table 3 on page 129. From the photograph, this author cannot dismiss a similar origin for the Sarawak jar 322/36. Moore (1970) describes this as 'Kalong' ware.

Three out of four Ko Si Chang 3 items drawn were incised under lugs as was the Shuri Castle jar, Fig. 1 No.5. Pattaya P15 was unusual in that it had a line on the shoulder below lugs. Neither the Mae Nam Noi item MNN SF23 nor the Ko Khram jars had incisions on the body. The Brunei Darussalam items do not appear to have incisions.

There seems, all factors considered, to be an association between the Ko Si Chang 3 finds and the Si Satchanalai kilns. If indeed the Si Satchanalai kilns produced these items the Ko Si Chang 3 ship is likely to have been trading at a time when the Mae Nam Noi and Si Satchanalai kiln sites were producing similar wares.

In general there appears to be a particular commonality between jars recovered from Shuri Castle and the Ko Si Chang 3 jars, and some with Ko Samui and Ko Khram. Since there is datable literature, (Chonlaworn, 2004 Table 1 and 2), to support the entry of wine jars into Ryukyu from Thailand between 1430–80, a more precise time period for the operation of these ships may be able to be estimated.

Notably, Pattaya item P12, Type 4.3 has an Amdel result fitting Nong O, BR (NT MgO low), a fairly unique result. A raised level of 5.7% Fe₂O₃, higher than most other jars of this type puts it into the Nong O range. If, as is likely, it is a product of the same kiln site as P16, Type 4.1a) this result may help to link the group of items falling into that chemical range to a particular kiln site area.

Type 4.1b) items from Brunei Darussalam appear to be narrow and have very deep throw marks which are probably the result of coil building, see No. 41 in Table 3 on page 129. Compare also MNN BR SF23, and the item from Bulamis, Muria, North Central Java, (No. 2615) Type 4.1d). In contrast, this type of jar from the Brunei Darussalam site, Type 20, appear to be of different manufacture to the Ko Si Chang 3 items, and appear to compare to P16 from the Pattaya site. Interestingly, larger jars, Type 4.3 from the Brunei Darussalam site look smoother than these jars and could be from a different production site, or at least the work of a different manufacturer. It is possible that examination of the differences in width: height ratio between jars could aid in the determination of provenance and time of production.

4.1c) Rolled rim, no discernible neck.

This type of rim is also associated with the large jars Type 4.9 and is likely to have been produced around the same period. A comparison can therefore be made between those jars resembling Type 4.1b) such as KKH5 with an indented

upper rim, and those like KL34 with a rolled rim and no discernible neck and an Amdel result of BR, NT.

The item MNN K2 GD18, recovered from the Mae Nam Noi kilnsite, demonstrates that this type of item was made in that area. The orange body is a common feature of items made there, see No. 2 in Table 3 on page 129. A sole item of this type from the Ko Si Chang 1 wreck site, KSC1 83 135 also had an orange body. Being the only one amongst many Type 4.9 jars may indicate that it was other than cargo. It was the only item in this section to be incised under the lugs.

The recovery of ceramics likely to be from the Sukhothai kiln site together with Si Satchanalai covered bowls and whitewares from the Ko Samae San and Palapat sites indicates that these sites were probably from a period when the Sukhothai kilns were operating and the kilns at Si Satchanalai were producing what is termed by Hein (2001) 'Later Stoneware'. Associated finds also indicate production at the Mae Nam Noi kilns.

Although the author is unable to associate the Ko Samae San sherd tested by Amdel No. 30/M7860/87, to any specific jar sherd, it is unlikely to have come from a jar with an indented rim since none of that type were recorded at the Fine Arts Department, Sattahip, by this author. It is unusual, with a low Fe₂O₃ value of 1.99% in the range of KN and Brown Glazed KN except for the MgO content. When compared with jar KL34 from Ko Rin (like Ko Samae San, being a site with a Si Satchanalai covered box), the Fe₂O₃ content varies considerably, KL34 equalling 4.16% Fe₂O₃. The Amdel report states that it appeared to have a different origin from a Type 4.3 jar from the Pattaya site, P12 with a Nong O, BR (NT MgO little low) result.

Another item, from the Ko Samae San site (SS3), fits the compositional range of BR except for a higher MgO content, see No. 30 in Table 3 on page 129. Items other than jars from this site also have a higher than expected MgO result, including whiteware, painted covered bowls and bowls painted with chakra. This phenomena also occurs with a Ko Si Chang 2 painted bowl and a Ko Rin *potiche*. All would otherwise expect to be of a Si Satchanalai origin. This would indicate that immersion in a marine environment may be the cause of this MgO content. See further discussion below.

4.1d) Miscellaneous.

Although Bo Dili 235 seems to exhibit a similar profile to many of the items judged to be products of the Thai kilns, the body, glaze and lug handles differ to jars recorded on the Thai shipwrecks. The item had no ridge at the neck nor incisions on the body. The Amdel result fitted none of the Thai sites. This item was not considered to be of Thai manufacture and is submitted here for comparative purposes, exemplifying the particular difficulties in determining a provenance for individual items with a somewhat similar profile.

Harrison (1950) in reference to Plate X No.1132, 3037 and 3420, items from Sarawak, says that they all have a striking resemblance to an item figured by Ottema (1946) Fig. 146, found by '...Janey expedition in a T'ang grave in north Annam'. Since the T'ang Dynasty spanned 618–906, this dating clearly does not equate with those of the Thai ship wrecks. However, it may indicate that this style of jar did in fact develop very early on and that the jars found on the Thai

wreck sites are copies of earlier Chinese items. Nos 1132 & 3037 are described as having a dark olive glaze to the upper 2/3. In their description of jars, other early authors have denoted a provenance of 'Kalong', (Fox (1959) Plate 135, with a black glaze to the upper 3/4 ending in scollops and Moore (1970) 12b) left and right, Nos 322/36 & 322/109 (Type 4.1b), with a black glaze ending 1/2-2/3 down the wall. These are said by Moore (1970: 58), to be characteristic of Sarawak Phase III sites. As indicated above the 'Kalong' nomenclature may in fact have been in order to make a distinction between an item known to have been produced in China to one exhibiting different features, and estimated to be from another kiln site based in Thailand. The items from Sarawak, as described by Harrison may in fact resemble the surface finds from Si Satchanalai detailed in Type 3. The rim style of jar No.1132, as estimated from the photographic profile, appears to be similar to Types 4.1b) KKH3 or 5 and KSC3 439 and Type 4.1a) KS/RH/84/85.1 jars. External throw lines are evident, as can be seen on the Brunei Darussalam items. In body shape No.322/109 from Magala, Niah is possibly similar to KL34 (Type 4.1c) above), however, Moore's general description of this type of jar indicates that the rim usually has an 'up-turned edge' (described in this report as indented) whereas the item from Niah appears to have more of a rolled rim. The Melanau jar No. 322/36 and the jar from Bau, No. 1132 look like they may have a similar place of manufacture with slightly squarish rim seen from the side.

Willets (1971) No.350 in describing the University of Singapore item from Indonesia says that the treatment of the foot makes attribution '...to Sampampaeng virtually certain' As indicated above, none of this type of jar has been illustrated in Shaw (1981) or Nimmanahaeminda (1983). Items from the Nanyang and Royal Nanhai (Type 4.1a) and Phu Quoc (Fig. 16), Calatagan Plate 135 and the University of Singapore item (from Indonesia) (Type 4.1d) are all glazed to the upper 3/4 ending in scollops. Many of these items are described as have a brown glaze. Rim types are not able to be determined from the photograph but the general shape and treatment appears to be similar to that of the Ko Si Chang 3 jars.

Kay Bungo 115 had orange and white inclusions, qualities associated with jars from the *Batavia* shipwreck (1629) No. 13 in Table 3 on page 129.

Although the rim treatment of the Puerto Galera No.64–1–162 was not recorded, the larger rim diameter of this item (RD 180 mm) makes it comparable to Shuri Castle Fig. 1 No.5 (Type 4.1b), with RD 170 mm as an approximate estimate. Most of the Type 4.1 have a RD 100–125 mm.

The item from Batangas BB TRB SQ 89–88 was of the narrow type possibly similar to those represented by Brunei Darussalam Type 20, (Type 4.1b)). The Ko Si Chang 3 jar KSC32 (Type 4.1b)) being narrower than others from that site, also had throw lines evident but appeared to have a smoother surface than those of the Brunei Darussalam site for example.

It is likely that Punta Sunog PS–177 GR75 is similar to some of the jars from Shuri Castle. It is described as having a flared rim, similar to Brown (1975) Fig. 8, from the Koh Khram site.

4.2 Medium-Ovoid Jars

The main difference between jars of this type is whether incised lines are present under the lug handles, an aspect not easily determined from photographs. It is estimated that most jars from the Pattaya site, Brunei Darussalam, and the item from Sumbiling, Brunei do have the incisions whereas Pattaya P13 and the jars from the Ko Si Chang 3 site do not. It is notable that the Type 4.1, 4.3 and 4.4 jars from the Ko Si Chang 3 do have incisions under the lug handles. Of the Pattaya jar Types 4.1, 4.2 and 4.3, some of each type are incised under the lugs.

The fact that several of the above mentioned with or without incisions have a body with a pink appearance, (a phenomenon recorded at Sisatchanalai, Harper (1987) (see No. 1 in Table 3 on page 129) may be also be indicative of a particular production area.

The item No. 1 from the 'Medieval Vessel' may not be of the type produced in Thai kilns. The black glaze is notable in that it extends almost to the footrim, see Nos 35 & 36 in Table 3 on page 129. The shape, estimated from the photograph may not mirror others in this section. Only two lug handles are visible in the photograph.

The Palapat and Verde Island items were rim sherds only, therefore cannot be confirmed to be of this particular jar type however rim style and measurements are similar. This is also the case with Bahuguhan Cave rim and base sherds.

Of all the sites represented in Type 4.2, the only site with a possible Type 4.9 jar is Palapat where a lug sherd (Palapat 088, Amdel: BR) may belong to these jars, prevalent from the second half of the 16th century. Again, this indicates that Palapat may be a site with a collection extending over a period (estimated by an Amdel result fitting that of MON KN on a Type 4.1 jar). It is almost certain that the Palapat site was operating around the time of the Ko Kradat shipwreck after 1522, estimated by the similarity with associated ceramics, other than jars.

Of the Hoi An item Fig. 1, the rim diameter is estimated to be less than that of the base. The Ko Si Chang 3 item KSC3 38 also records a rim diameter less than the base whereas KSC3 1 has a rim diameter greater than base. Both these ships carried cargoes of Vietnamese wares.

All of the The Ko Si Chang 3 jars recorded a glaze Munsell colour of 10YR 4/4. This has the potential to be a useful tool in comparing jars, however Munsell data was unavailable from most sites. KSC3 5 glaze ends in scollops, see No. 42 in Table 3 on page 129.

Visually, the shape and viscosity of glaze of Pattaya P31 and Calatagan 186 seem to be more alike than when compared with the Ko Si Chang 3 jars. This author is unable to determine if the Calatagan item has incised lines under lugs. Calatagan 186 is scolloped whilst P31 is not. The glaze colours differ also. The item from Sumbiling, Brunei 67–212 visually, and from the given description, is almost identical to P31. Another note of interest is that both P31 and Bahuguhan Cave 184 are described as having a concave base.

Calatagan 186 has a brown-black glaze ending in scollops and a mark on the base, potential significant traits for identification of jars. Moore (1970: 59) says that this item

probably did not come from the same kiln as the items from Niah (322/40) (Type 4.3) and Bakong (322/120) (Type 3).

Items from the Bahuguhan Cave site have orange (BC184 & 176) and white (BC176) inclusions, see Nos 6, 11 & 13 in Table 3 on page 129. Other sites with orange and white inclusions include *Batavia* 608A & B (Type 4.9) wrecked in 1629, suggesting that the Bahuguhan Cave items could have been from a kiln functioning around then. However, celadon produced at the Si Satchanalai kilns was also recovered from the Bahuguhan Cave site. This indicates a production period earlier than the demise of the *Batavia* by which time there is no evidence that Thai kilns were still producing celadon wares. It could be that the Bahuguhan Cave was a habitation site over a period of time.

Enigmas encountered whilst investigating jar finds can be illustrated through the following: Of the Brunei Darussalam items (Richards, 2003: 58) Type 2 has a ridge and is incised under lugs. It has a green-brown glaze similar to the Pattaya item, however P13 has no lines under lugs. Harper records an item BD2/5, which was incised under lugs and had marks where three items were fired inside the jar like that of a Ko Si Chang 3 jar, however it differs to Ko Si Chang 3 items of this type which have no incisions under the lugs. Thus the Brunei Darussalam items have elements of both Pattaya and Ko Si Chang 3 finds, which as discussed under Type 4.3 (below) are not generally considered to be exactly the same.

Notable also is that the jar from the Brunei Darussalam site, Type 2, Richards, (2003: 55), (Type 4.7 below) differs from the Brunei Darussalam item (Richards, 2003: 58) described above, particularly in glaze type. Brunei Darussalam Type 2, (Richards, 2003: 55) may represent a transitional stage between Type 4.2 and 4.9 when the production site, was on the cusp of developing the Type 4.9 jar.

A rim sherd from the Mae Nam Noi kiln site, SF20 had similar measurements to jars of Type 4.2. This item had a dark grey body with white inclusions. Its definition 'Special Find', indicates that this item was unusual in the context of other wares recovered in the area of Kiln 2 in which it was recovered, or it had other notable features. Apart from this item there were no jars recorded at the Mae Nam Noi kiln site by Harper (1988(ii)) with a definite shape corresponding to Type 4.2. It could be that jars of this type were not manufactured at the Mae Nam Noi kiln site or at least at the specific area excavated in 1988. However, other aspects of some jars of Type 4.2 in this report do point towards a provenance of the Mae Nam Noi kiln site in terms of body content. Bahuguhan Cave 176 for example has a brown body with round beige and orange inclusions, factors present in MNN SF19 (Type 4.5a), admittedly another 'Special Find', see No. 6 in Table 3 on page 129.

4.3 Large Jar, Tall Ovoid

Of the Type 4.3 some jars have aspects of the surface finds at Si Satchanalai whilst others have similarities to those illustrated in the Mae Nam Noi report, Harper (1988(ii)).

The Sarawak Museum brown glazed jar from Gedong (222/806) Moore (1970) Plate 10c) is said to be an example of 'Kwantung' ware described as a greyish-buff, fairly coarse body burning pinkish or reddish where exposed. Moore

describes the glazes as usually brown, olive brown or ochre, rarely olive green. This item compares with jars Type 3 and 4.3 in this report. It seems to be narrower than the Thai shipwreck finds. If this jar is a Kwantung (Guangdong) jar (said to be likely produced in the vicinity of Canton (Guangzhou), South China) there seems to be a continuum, with similar products being manufactured at Thai kilns. Harrisson (1986: 41) says of Guangdong wares in reference to the handles '... their attachment being always parallel to the wheel grooves of the interior or vertically across them, never at an oblique angle or applied with a downward pull, like the handles of Sawankhaloke jars'. However, as can be seen by Figs 28, Green and Harper (1987), the surface finds from Si Satchanalai do not appear to have a downward pull whereas the lug handles from the Mae Nam Noi site do have a distinct downward pull. Again, it may be the case that any item determined to be of Thai origin was deemed 'Sawankhaloke' when it could in fact have come from another Thai site. The item from Gedong, No.222/806 has no incisions evident under lugs. It may be that the thin, tapered shape of the Gedong item described by Moore (1970) as Kwantung ware, when compared with the more rotund shape of Niah item No.332/40, also estimated to be of Type 4.3 and described as 'Kalong' ware, may help define the wares. It should be pointed out however that the Bakong jar No.322/120 Type 3 above, described as 'Kalong' ware and estimated by this author to exhibit particular features associated with the surface finds located at Si Satchanalai, has very similar features to Gedong, No.222/806. Again there are no examples of this type of jar, referred to as 'Kalong' ware, illustrated by Shaw (1981) or Nimmanahaeminda (1983).

In this section, Pangil 146 from the Philippines is interesting in that it is the only item recorded with an orange body and round inclusions, see No. 8 in Table 3 on page 129. This author noted at the time of examination that the item was unlikely to be a product of the Thai kilns. The sherd fitted none of the chemical percentages reached at any of the Thai kiln sites as measured by Amdel. Unfortunately the mouthrim was missing.

According to Homan (1987, pers. comm.) the jar from the Puerto Galera wreck site fitting this type was said to be the only item recovered, to be identified as Thai.

Punta Sunog 113 and J. Toralba 135 have some common traits of the Mae Nam Noi product. There are, however, certain dilemmas. PS113 has a pink-grey body (a common Si Satchanalai attribute) together with orange and white inclusions, see No. 13 in Table 3 on page 129. Visually it resembles a MNN product BR19#6 and the Amdel result fits that of BR (NT MgO low) No. 29 in Table 3 on page 129. This item has the potential to be a useful determinant of kiln provenance. The J. Toralba shoulder sherd 135 has no rim remaining but it is thought to possibly fit this section. The Amdel result also fits BR (NT MgO little low). It may be that the MgO differentiate may help pinpoint a provenance for these jars.

There were, according to Brown and Sjostrand (2002) CP69, large numbers of this type of jar recovered from the Royal Nanhai ship dated c. 1460. The Ko Si Chang 3 jars have some similarities with the Royal Nanhai jars however accompanying finds differ. Royal Nanhai CP69 and Ko Si

Chang 3 items appear to be finer bodied than some other jars. The slip is obvious on both, though the glaze cover may differ. The Royal Nanhai jars are brown glazed whilst the Ko Si Chang 3 items are green-brown. The surface wash of jars from both sites is similar to that of AC26 from a private collection near the Mae Nam Noi kiln site, see No. 31 in Table 3 on page 129.

It can only be assumed that all jars from the Phu Quoc wreck site have the same features as the one item illustrated. Of note, it is said by Blake and Flecker (1994) that the structure of the Phu Quoc ship was roughly contemporary with the Pattaya ship.

Finds from the Mae Nam Noi kilns show two different methods of glazing. There is glaze inside the rim of the item from the Abbot's collection at the Mae Nam Noi kiln site, AC26 whilst Kiln 2 Jar 2 is glazed from below the rim. Jars AC26 and Ko Si Chang 3 (KSC3 69) resemble each other in that they have scars inside the mouth rim, probably from spurred supports, see Nos 21 & 22 in Table 3 on page 129.

Jar 2 from MNN Kiln 2 is significant in that the body matrix is not as 'tight' as the usual product of Kilns 1–4. The loose matrix of this item may indicate that this was an extraneous product to Kiln 2. However, an inferior yellowish glaze or slip probably indicates that it was a product of this kiln and that it was underfired, like many of the jars featuring in this report—particularly Type 4.9 jars, see No. 18 in Table 3 on page 129. The jar is glazed externally from below the mouthrim, one of the features of the Mae Nam Noi product, see No. 20 in Table 3 on page 129. Glaze downward of the mouthrim also occurs on the Brunei Museum jar of this type from Kg Saba, Ujong 1965.786.

The item Shuri Castle Fig. 1 No.3 has a similar rim treatment to Ko Si Chang 3 items. The shape is, however, slightly less rounded than the Ko Si Chang 3 jar compared to estimated height, more the shape of Pattaya P9! The impression though is of a finer item than the Pattaya product, more towards that of Ko Si Chang 3 items.

As indicated above, some aspects of the Ko Si Chang 3 and Royal Nanhai jars, such as wall thickness, rim treatment and general appearance point towards a provenance other than the Mae Nam Noi kiln site, whereas other aspects of the Ko Si Chang 3 items point towards it. KSC3 26 has orange inclusions in the body and a surface wash as noted on AC26 for example.

KSC3 26 had marks on the inside base where three small items had been fired, as did Punta Sunog, PS119 and the item from Karitunan (marked 216 and 2009), see No. 24 in Table 3 on page 129.

As discussed under Type 4.1 above, Pattaya P12 fits the BR (NT MgO little low) pattern but also fits the Amdel percentages estimated for Nong O. A Nong O result, together in some cases with MON KN, others with BR or NT also occurs in the Ko Si Chang 2 items (Nong O being an area to the north of the Si Satchanalai kiln site).

Other items which compare to Mae Nam Noi kiln site products in that they have orange inclusions include Bahuguhan Cave 147, the only item recorded with a light brown body and orange inclusions, see No. 7 in Table 3 on page 129. This item resembles BR#13, BR19#6 visually and fits an Amdel

result of BR (NT MgO low). Other sherds from the Bahuguhan Cave site have quite similar bodies, see Nos 5 & 6 in Table 3 on page 129. The fact that there are slight differences in the description of body colours and inclusions between sherds could be due to the recording method or that clay mixes varied within a kiln site. It may be that visual resemblance combined with an indicative Amdel result will ultimately determine a specific area and a particular time period for production of the area. Conversely, the author noted that Type 4.2, BC153 differed in appearance to the usual Thai shipwreck items. It may have resembled the jar surface finds recovered at Si Satchanalai, however it too recorded an Amdel result of BR (NT MgO little low). Points to note are that BC147 measurements and estimated shape fit it between a Type 4.2 and 4.3 jar.

Another rim sherd from the Bahuguhan Cave site, BC182, having a rim diameter similar to the jars in this section and with an attachment on rim, unknown whether to be of a circular or 'prong' support, is also included under Type 4.4.

The Brunei Darussalam Type 181 compare with Pattaya items (P9 and P30) in thickness and appearance, as is the case with Type 4.1 jars (above). The Brunei Museum item from Kg Saba, Ujong resembles the Brunei Darussalam Type 181 and Pattaya items more than items from the Royal Nanhai. There is therefore a difference in style of this type of jar exemplified in the grouping of Ko Si Chang 3 and Royal Nanhai and another group of Pattaya and Brunei Darussalam. Thus, the Ko Si Chang 3 and Royal Nanhai appear to fit into one section whereas jars from the Pattaya, Brunei Darussalam, Saba Ujong, Ko Samui and *Nuestra Señora de la Concepción* sites appear to be closely associated.

The jar from Lobang Imam, Niah, No.322/40, black glaze over slip, described as 'Kalong ware' compares from photographs with BD Type 181 Richards (2003: 56–58) in the treatment of glaze over slip.

The item from Jakarta Museum, No. 379, is said to have a circular incised line on the rim. This may be what this author describes as an indented rim or it may be, as observed on the Brunei Darussalam and other jars, a light line further inside the mouthrim. The glaze description of this jar is also like that of the Brunei Darussalam and Niah items.

The glaze treatment of the Brunei Museum item from Saba Ujong 1965.786 differs in appearance to those jars which have a thick glaze. It is possibly like Ko Samui 17 2/1/85 which is similar to the Pattaya jar, P30 but is slightly tapered at the base, not unlike KSC1 723 (Type 4.8) and may represent fusion of Types 4.3 and 4.9. The Ko Samui item has a longer neck than KSC1 723.

Colours (thick brown-black glaze fired red around the neck) and style of handles of the Sabah Museum jar No. 2857 reflect aspects of Si Satchanalai finds. These jars compare with jars with green-black glaze from the Pattaya site. Harrison described the Sabah item as a 'Sawankhalok' jar.

There is possibly an association between the *San Diego* item SD2659 and Ko Si Chang 3 finds in regards to the incised lines, the type of glazing and general appearance.

An unusual feature of the jars from the *Nuestra Señora de la Concepción* shipwreck of 1637/8 is a shipper's mark etched on the side of Jars A616 and others. These jars may have been retained by the shipper and re used over an extensive period,

as it is unusual for this type of jar to be recorded on a site as late as this. It is notable that the handles of these jars are depicted as a more horizontal feature than some other jars, such as those recorded at the Mae Nam Noi kilnsite, where they are flatter with a downward pull.

4.4 Medium-Large Ovoid Jars, Elonged Neck, Flared Mouth Rim

The jars in this section vary in their rim treatment.

Harper (1988(ii)) Fig. 6b shows a group of flat supports with six spurs and a rim sherd with six marks inside the mouth rim, all recovered in the vicinity of Klong 1, the Mae Nam Noi kiln site, Singburi Province. Various types of firing supports were used at the Si Satchanalai kiln site, tubular supports being the most popular on small items. Hein (1985) shows various types of supports including grooved disc supports and spurred disc supports varying from 3, 4, 5, and 6 spurs, recovered from the excavation at Si Satchanalai, of Kiln 42 and associated kilns. They were more concentrated in the lower levels of the excavation consisting of kiln built upon kiln. Hein and Sangkhanukit(1987) Fig. 29 records an 'unusual' support at the Ban Tao Hai kilns (PK1), Phitsanulok, with 9 spurs similar in style to those of the Mae Nam Noi kilns.

4.4a) Support marks inside mouth rim

Of interest is KSC3 424 which had three sets of incised lines on the body together with six spurred support marks inside the mouthrim. This jar was the only item to record orange and black inclusions, see No. 12 in Table 3 on page 129. It should be taken into account that this is likely to be estimated from external appearance rather than from a broken surface, considering the item was complete.

Despite their differences, as pointed out in Type 4.3 (above), the Type 4.4a) BD749 or 747 and BD2/5 (Type 4.2) and KSC3 26 (Type 4.3) record jars with marks inside the base where smaller items were fired.

In style the Ko Samui item KS61 is more like ware from the Brunei Darussalam site than wares recovered from the Ko Si Chang 3.

4.4b) No support marks visible

The jar recovered from the Mae Nam Yom appears to be lightly incised inside the rim. It is unknown if support marks were present. Shuri Castle Fig.1, No.1 was incised inside the rim as were the Ko Si Chang 3 jars. It is unknown if support marks were visible on the Shuri Castle jar or if there were marks inside where smaller items were fired.

4.4c) Support marks inside mouth rim—indented outer and inner rim

The jar sherd 174 from the Bahuguhan Cave had a brown body with white, orange and black inclusions, the only item to record this combination. There are however, commonalities with other jars through glaze type, see No.36 in Table 3 on page 133, and Amdel results of other Bahuguhan Cave finds, see No. 9 in Table 3 on page 132. This jar had an attachment inside the rim but the author is unable to verify if it was from a spurred item.

4.5 –4.8 Miscellaneous Large Jars

Almost all the jars in Type 4.5, 4.6, 4.7 and 4.8 have features which relate to other jars within this text. The examples in these three groups may represent the transition between one major type to another. It is difficult to categorize into which section some individual jars fit. Some jars have features of several types.

Significant to a product of the Mae Nam Noi kiln site, exemplified in SF19, is that the item is glazed from below the rim. The lugs may be larger than those surface finds recovered at the Si Satchanalai kilns. Many incisions under the lugs are not a trait noted on the Si Satchanalai finds nor are orange inclusions which were recorded from the Mae Nam Noi kiln site finds, as were orange and white inclusions.

Type 4.5 Jars Exhibiting Features Comparable with Jars Between Type 4.1 and Type 4.9

Ko Samui 15 and *San Diego* SD1707 compare with Ko Si Chang 3 424 (4.4 above). KS15 is unusual in that it has no incisions under the lugs but it has a set of incised lines between the shoulder and waist. KS15 also has a longer neck than SD1707.

The Ko Kradat jars KK34 & 35 and SD1707 have two sets of incised lines, see No. 25 in Table 3 on page 129. Ko Kradat KK34 & 35 are recorded as having an unusual placement of lines—above and under lugs (there is a possibility of misinterpretation during the drawing process).

Type 4.6 Jars Comparable Between Type 4.2, 4.3 into Type 4.9. Slightly Longer Neck than Type 4.9

The slope from rim to body is slightly less oblique than Type 4.9 leading to the appearance of there being a longer distance between mouth rim and the ridge at the shoulder join.

The Brunei Museum item from Tutong 1967.815 and the Prachuap Khiri Khan PK 25 are both described as having a purple body and olive green-brown glaze and seem to fit between Types 4.2, 4.3 & 4.9. The Prachuap site has jars which definitely fit into Type 4.9 but PK25 varies in that it has a longer neck which is more fitting of a Type 4.3 jar. Both Type 4.3 and Type 4.9 style jars were produced at the Mae Nam Noi kiln site, Harper ((1988) unpub.). Both Tutong 1967.815 and the Ko Samae San item SS(1) have two sets of incised lines. SS(1) seems to vary slightly to others from the site which fit Type 4.9.

It has been noted that a smaller mouthrim in proportion to waist and height is synonymous with a slightly longer neck.

Type 4.7 Jars Comparable Between Type 4.1, 4.2 and 4.9. A Squat Type.

Comparison should be made between Brunei Darussalam items (Richards, 2003: 55 & 58). Though of a similar shape the p. 55 jar is more towards a Type 4.9.

The fact that the Ko Samui item KS/RH/84/85.3 has neither ridge nor incisions sets it apart from those jars believed to have been manufactured in Thailand. However, the body (pink-grey surface) and glaze (green-black-brown) colours do correspond with Thai examples.

The *San Diego* item, SD1473 has a shorter neck than the others but is included in this group because the height corresponds.

4.8 Large Jar, Rolled Rim, no Discernible Neck. Tapered towards Base.

The Ko Si Chang 1 item is somewhat like the Type 4.3 item from Ko Samui KS17 2/1/85.

4.9 Large Jars, Rolled Rim, Short or no Discernible Neck

This type of jar is found predominately on sites dated from the second part of the 16th century into the first part of the 18th century. It is notable that the Pattaya and Ko Si Chang 3 sites, with Types 4.1, 4.2 and 4.3 do not have any Type 4.9 jars, a fact which probably puts the demise of those ships to the 15th century or early 16th century. Notably, simple cross hatched incised Thai celadons of a type described by Hein (2001) Fig. 42, as Later Stoneware, were recovered from the Pattaya site. No painted wares were recovered from the site. No Thai celadons or painted wares were recovered from the Ko Si Chang 3 ship which was carrying Vietnamese and Chinese ceramics.

It may be significant that the Ko Si Chang 3 ship (without Type 4.9 jars) held a particular bowl with indented rim (KSC3 3). This type of bowl was also recorded from the J. Toralba site, the Philippines, from where a jar Type 4.3 was recovered and also from the Royal Nanhai ship where Type 4.1 and 4.3 jars were retrieved. On the other hand, a similarly shaped bowl but with a rounded rim was recorded from the Ko Samae San site, the rim shape of which is more in accordance with that of the Type 4.9 jars. However, the bowl from the Prachuap Khiri Khan site (PK21) had an indented rim together with Type 4.9 rolled rim jars.

The Brunei Darussalam site did not have any Type 4.9 jars, however Richards (2003: 55 Type 2), Type 4.7 above may illustrate a transitional piece between Brunei Darussalam Richards (Type 2, p. 58 Type 4.2) developing into a Type 4.9 jar. This site also had Si Satchanalai small bottles/jarlets and cross hatched celadon comparable with items classed by Hein (2001) as Later Stoneware.

Green and Harper (1987) Fig. 39 show a photograph of large jars Type 4.9 and medium jars in storage in Thailand in the early 1980s. These items are said to have been recovered from the Ko Khram shipwreck. In 1988 the joint Thai-Australian team recovered from the Ko Khram site Type 4.1 jars and a larger jar with similar attributes to those surface finds recovered at the Si Satchanalai kilnsite. The Si Satchanalai jars were glazed brown-black, green-brown and dark brown. No Type 4.9 jars were recovered in 1987. Those Type 4.9 recovered in the early 1980s are likely to be some of the earliest recorded. It is incongruous that they seem to be more like the Ko Si Chang 1 jars of the late 16th, early 17th century than those of the Ko Kradat jars of 1522 onwards. Brown (1988: 37) says that Vietnamese items on the Ko Khram would have been produced no later than 1471 and her thesis (2004) amends the dating to circa 1450. Since the Ko Khram has items which may have a provenance of Suphanburi together with Sukhothai wares and Si Satchanalai Transitional Wares (as Hein (2001) all sites including the one producing the Type 4.9 jars must have been working concurrently.

A shoulder sherd, with a lug handle from Palapat (088) is significant. Estimated to be from a Type 4.9 jar, it has features represented in the Mae Nam Noi product. The sherd has a light purple-orange-grey body, white and possibly black inclusions with a glaze which appears yellow. The body interior resembles BR20#12. The sherd also fits the Amdel percentages for the Mae

Nam Noi kilnsite. Products of the Si Satchanalai and Sukhothai kilns were also found at this land site. This may demonstrate habitation of the Palapat site over a period of time, or that the large jar, most likely from the vicinity of the Mae Nam Noi kilns, was produced around the same period of operation as the Si Satchanalai and Sukhothai kilns. Both instances may in fact have been the case.

Two sets of incised lines were recorded on jars Nos KK36 & KK38 from the Ko Kradat shipwreck site, and like the Ko Kradat jars represented under jar Type 4.5, the placement of lines differs—in this case above and below handles (if correctly represented in the drawing). This phenomena doesn't seem to be a criteria for narrowing a production period as two sets of lines occur on many of the jars, see No. 25 in Table 3 on page 129. It also occurs on the *Witte Leeuw* items of 1613 and the *Nuestra Señora de la Concepción* of 1637/8, thus a period of mid to late 16th to mid 17th century. Like the Ko Kradat ship, the Ko Samae San site also had a jar with two sets of incised lines together with painted covered bowls, white ware and brown ware. Simple incised celadon and painted bowls with simple shell and chakra decoration fitting Hein (2001) Fig 44 as Si Satchanalai Later Stoneware were also recovered from the Ko Samae San site, Amdel results fitting KN, almost PY. Some of the designs resembled those of Sukhothai products as Hein, 2001 Fig 48. Many Type 4.9 jars resembling the style usual on the Ko Si Chang 1 ship and others, were reportedly recovered from the Ko Samae San site. Importantly, ceramics other than jars, with a likely provenance of Mae Nam Noi were also recovered from this site, see Harper (1988ii). The Ko Kradat and Ko Samae San sites must be considered to be of around the same era. Bearing in mind that the Ko Samae San site is possibly a jettison site and also that all the ceramics said to be from the site located at the Division of Underwater Archaeology base at Sattahip were found to be heavily encrusted with a coralline substance, no definitive conclusion should be based on Amdel results from that site.

The Ko Rin jar of this type (KL19) has an orange body with many quartz-like inclusions and appears friable. The inner surface is blue. The visual appearance and matrix are very similar to that of *Batavia* jar BAT545 and both fall into the Amdel range of NT (BR MgO high) see No. 30 Table 3 on page 129. When viewed through a microscope the matrix of KL19 is unlike item BR#1 tested from the Mae Nam Noi kiln site. Items visually high in quartz, were not noted by the author at the Mae Nam Noi kiln site. If this item should have its provenance at the Mae Nam Noi site it is unlikely to be from the particular area excavated in 1988. Jar KL34, Type 4.1d) has similar physical characteristics with an Amdel result of BR, NT.

The Amdel result of KL19, may be significant in the relationship between the sites represented in No. 30 in Table 3 on page 129, that is Ko Samae San, Ko Rin and *Batavia*. Since the Samae San items are more likely to be around the time of the Ko Kradat shipwreck, after 1522 and the *Batavia* was lost in 1629 it is difficult to estimate what the relationship is unless the *Batavia* jar was an item in use on the ship for some period of time, such as for storage.

An item from the Prachuap Khiri Khan underwater site (PK14) also fits into the group of jars with two sets of incised lines though another (PK24) had only one set. (It has been noted

that two sets of lines seem to be prevalent on the Prachuap Khiri Khan where at least some of the jars have longer necks than is usual). Except for slightly different placement of incised lines PK14 compares with the *San Diego* jar SD5262 though the *San Diego* item may be smaller in body to height ratio than some other jars in this section.

No Chinese or decorated Thai wares were recovered from the Prachuap Khiri Khan site. This may be an indication that the ship serviced a more limited clientele, providing utilitarian wares to a local market. A conglomerate of knives was recovered from one jar. One can only postulate as to whether material from this site was for use on board or the jar itself was used as an effective storage unit whilst in transit.

In reference to the jar *San Diego* SD5262, if the rim is slightly flat, as appears may be the case, it would compare with many of the items with somewhat flattened rims, seen by the author at the Mae Nam kilns in 1988. Jars from *San Diego* SD5262 and Pahang 148 and 153 compare closely through the existence of two sets of incised lines and the treatment of the neck. There is also a strong relationship to the jars Type 4.6—Tutong 1867.815, PK25 and SS No No. (1)

A jar sherd (SJ81/22) from the ship *São João* wrecked in 1552 had orange inclusions, another from the *São Bento* (SB77/103(2)) of 1554, had orange and white inclusions. Both visually resemble sherds from the Mae Nam Noi kiln site. Auret and Maggs (1982) Fig. 36 shows a jar from the *São Bento* with deteriorated darkish greenish-brown glaze whilst the sherd SJ81/22 has the remains of green-brown glaze over a yellow slip. The *São Bento* sherd SB77/103(2) achieved an Amdel result fitting the Mae Nam Noi kiln site and resembled BR11#2 visually. This author is unable to confirm whether the *São Bento* sherd is from the item depicted in Fig. 36 but since an incomplete item is illustrated, it could be. It is notable that these sites, dated so closely, both achieved a fired glaze. Most sites including Ko Si Chang 1, which had a quantity of Type 4.9 jars, rarely recorded a jar fired at a high enough temperature for a quality glaze to be achieved.

Another *São Bento* item SB77/103(3) fitted no Amdel profile. This and a *Batavia* item BAT609 (Type 4.12), both with maroon inclusions, see No. 43 in Table 3 on page 129, have a high Fe_2O_3 % at 9.60 and 9.65% respectively whilst BR and NT readings were 4–6%. Maroon inclusions are also recorded in a sherd from Kota Batu (KB1) (Type 4.12) but the chemical components differ, again falling outside the range of any ceramic sherds tested by Amdel.

It is notable that of all the Type 4.9 jars recovered from the Ko Si Chang 1 wreck site, only one is recorded as having two sets of incised lines.

Of the Ko Si Chang 1 jars many had a degraded yellow slip/glaze. As stated above the nature of this glaze indicates that it was not as highly fired as the items noted at the Mae Nam Noi kiln site in 1988. Together with variance in rim treatment it is likely that the Ko Si Chang 1 items, if produced at the Mae Nam Noi kiln site, were produced in a different area and probably era, than the area investigated by this author. Low firing and subsequent poor glaze quality of many of the Type 4.9 jars may be due to several factors: the inability to achieve a high temperature due to lack of available timber, (that is local resources depleted, indicating perhaps a later period of production at the kiln site); a desire for a quick turn over in the kilns due to high demand;

a need for a lower fired item for a particular reason such as keeping water cool by method of evaporation.

It has to be noted that a bush fire is said to have passed over the area some time before the Mae Nam Noi kiln site excavation in 1988, possibly resulting in changes to surface sherds recovered in the area.

The description of the Seychelles and *Santiago* sherds is consistent with other Type 4.9. The author cannot confirm that the *Santiago* sherd submitted for Amdel analysis is indeed from a Type 4.9 jar. Like KL19, the *Santiago* sherd 81/5(5) appears to have a high quartz-like material. It does indicate that there may be some relationship, however tenuous, between these jars. The Ko Rin vessel carried some similar ceramics, including Si Satchanalai painted wares, to those on the Ko Kradat ship, dated after 1522. The *Santiago* vessel is dated 1585.

Like Palapat 088, the *Witte Leeuw* (1612) jar WL12216 is described as having black and white inclusions. The jar WL12211 has black inclusions. See Nos 15 & 16 in Table 3 on page 131. As the *Witte Leeuw* sherd, Amdel 70/M7860/87 with orange body and large white inclusions (Amdel result of BR, NT, see No. 11 in Table 3 on p. 130), does not fit precisely the description of the Pijl-Ketel jars, this author assumes that a sherd of a somewhat similar type was submitted for analysis. *Witte Leeuw* 12216 is unusual in that it has an incision just above the lug handles but there is no ridge and no incised lines under lugs.

The *Batavia* sherds, BAT545 and BAT608A & B have some particular qualities reflective of a Mae Nam Noi product in regards to surface colour and inclusions in the body, see Nos 13, 14, 19 & 45 in Table 3 on page 129.

Aspects of the Fort Jesus item, as seen through Kirkman (1974), appear to resemble many of those particular items seen by the author at the Mae Nam Noi kiln site, 1988 in terms of rim treatment and the general rough appearance.

4.10 Large Jars with Many Incisions Under Lug Handles

There is a difference between Type 4.9 and Type 4.10 jars as reflected in the Mae Nam Noi kiln site finds. K2GE13, K2GD24 and K2Gd23 are more of the shape of the Ko Si Chang 1 items whilst others such as MNN Kiln 2 Jar1, K2Gh4 and K2GD17 have a more rounded shape from mouthrim to waist. A wide mouth results in a rounded jar. This type of jar has been noted often to have no specific ridge but many incised lines under lug handles. Brown and Sjostrand (2002) Fig. 48 show that indentations on the *Risdam* item are not as purposefully formed as on jars from other sites. More than the usual number of incisions were noted on jars from the *Vergulde Draeck* GT913 (1656) and *Risdam* (1727) and the Mae Nam Noi kiln site K2Gh4 and Kiln 2 Jar 1, see No. 26 in Table 3 on page 129. This style was thus produced at sites spanning at least sixty years. The *Risdam* jars were very distorted. Was this due to disturbance at the production site political, hence social upheaval? Could it have been that they were produced in a period of great demand where there was a lack of experienced, skilled potters? Were fuel sources inadequate or insecure in so much as to prevent the constant firing required to prevent slumping? Ayutthaya to the south of the Mae Nam Noi kiln site, long having been a focus of Burmese military attention, was completely destroyed

by the Burmese in 1767, Bang Rachan near the Mae Nam Noi kiln site was besieged at the same time despite putting up a strong resistance. Many of the jars from the Ko Si Chang 3 wreck site had a degree of distortion but nothing to the extent of the *Risdam* jars.

As the *Vergulde Draeck* jar was represented by a sherd only, it is unknown if it had a wide mouth to height ratio. Whilst the colour of the *Vergulde Draeck* sherd is quite blue, an unusual factor with the *Risdam* items is that the body colour is shown to be beige with grey patches, Brown and Sjostrand (2002) Fig. 48. From the photograph of the *Risdam* jar it also appears that the top of the rim may be slightly flattened, as was noted on the Mae Nam Noi items in 1988. Could the *Risdam* jars represent some of the final products of the Mae Nam Noi kilns?

The ridge and incised lines on the item from Jakarta No. 2761 appear to be closer to the mouthrim than occurs on the items from the Mae Nam Noi kiln site.

4.11 Jar—Flared Mouth, Sloped Rim

KKH1 and Shuri Castle Fig. 1 No. 4 have some commonalities with the Turiang item Plate 18 (Type 3 above) however the rim treatment between KKH1 and Turing differ.

4.12 Miscellaneous

Sherds from the *Batavia* site, BAT 609 and *São Bento* 77/103 (3), (Type 4.9), do look similar but the *Batavia* item is thinner in terms of body and glaze. They fit none of the profiles of sites tested by Amdel. Both are described as having maroon inclusions, see No. 43 in Table 3 on page 129. Both have high Fe₂O₃ at 9.60% and 9.65% respectively whereas the limits for BR and NT are 4–6% (see previous discussion in reference to Ko Si Chang 1 and *Witte Leeuw* items).

A shoulder/neck sherd tested by Amdel from Kota Batu, Brunei No. 76/M7860/87, classed as Type 4.12, may be of Type 4.9 but it is difficult to ascertain. It has an Fe₂O₃ reading of 6.30%, therefore not excessively higher than those given for Mae Nam Noi and Nakhon Thai. Also with maroon inclusions, visually the sherd has a quite dense body and resembles somewhat *São Bento* item SB77/103(3). It would appear to be more highly fired than is often the case of Thai shipwreck jars. The general appearance of the sherd is reminiscent of jar sherds recovered in the vicinity of Si Satchanalai, but this is not decisive, see Harper (1984) Fig 7b No.37. Though a provenance may be able to be traced through the maroon inclusions factor, any specific dating is unlikely since of those items with maroon inclusion the *São Bento* is dated at 1554 whilst the *Witte Leeuw* and *Batavia* are 1612 and 1629 respectively.

Table 3. Jars—Particular Features

The reference numbers are those given in Jars—An Inventory etc. (see above).

1) Pink-grey coloured body

- 3. Turiang 18
- 4.1a) Nanyang CP35
- 4.1a) Royal Nanhai Pl. 91
- 4.1a) KS 1/85
- 4.1b) KSC3 151
- 4.1b) KSC3 439
- 4.1d) SS4
- 4.2 KSC3 1

- 4.2 Pattaya P13
- 4.2 Brunei Darussalam Type 2 p.58
- 4.3 Punta Sunog 113
- 4.3 Pattaya P3
- 4.3 BD Type 181 p.58
- 4.7 KS 85.3
- 4.9 KK38

2) Orange body

- 4.1c) MNN K2GD18
- 4.1c) KL34
- 4.1c) KSC1 83 135
- 4.1d) Kay Bungo 115
- 4.3 Pangil 146
- 4.9 MNN K2GD23
- 4.9 KSC1 3437
- 4.9 WL Amdel 70/M7860/87
- 4.9 BAT 608B
- 4.10 MNN Kiln 2, Jar 1

3) Purple-beige-grey body (any of these) with white and orange inclusions

- 4.1a Palapat 071

4) Red-purple body with white inclusions

- 3 PS108
- 4.4 PS 105

5) Beige-brown body with white inclusions

- 4.2 Bahuguhan Cave 153 (Amdel BR)

6) Brown body with round beige and orange inclusions

- 4.2 Bahuguhan Cave 176
- 4.3 Bahuguhan Cave 182
- 4.5a) MNN SF19

7) Light brown body with orange inclusions and dark beige-orange inclusions

- 4.3 Bahuguhan Cave 147
- 4.5a) K2Ge11

8) Orange body with round inclusions

- 4.3 Pangil 146

9) Brown body with white, orange and black inclusions

- 4.4c) Bahuguhan Cave 174

10) White inclusions

- 4.1a Iwahiu 234
- 4.2 Verde Island 189
- 4.2 MNN SF20
- 4.3 PS 119
- 4.4b) PS 105
- 4.12 Kay Bungo 116

11) Yellow, orange or red inclusions

- 3. KSC2 70
- 4.1c) SS No No. 1986
- 4.2 Bahuguhan Cave 184
- 4.2 Banuguhan Cave 176
- 4.3 KSC3 26
- 4.3 Bahuguhan Cave 147
- 4.5a) MNN K2Ge11
- 4.9 *São João* 81/22
- 4.9 SB77/103(1)
- 4.9 WL Amdel 70/M7860/87

12) Orange and black inclusions

- 4.4a) KSC3 424

13) Orange and white inclusions

- 4.1d) Kay Bungo 115
- 4.3 PS 113
- 4.3 J. Toralba 135
- 4.3 & 4.4a) Bahuguhan Cave 182
- 4.5a) MNN SF19
- 4.9 *São Bento* SB77103(2)

- 4.9 BAT 608A
4.9 BAT 608B
- 14) Orange, white and black inclusions**
4.9 BAT 545
4.10 GD1046
- 15) Black inclusions**
3. KSC2 67
3 KSC2 1066
4.9 WL12211
4.9 WL Amdel 70/M7860/87 (surface)
- 16) Black and white inclusions**
4.9 Palapat 088
4.9 WL 12216
- 17) White-pink or white-purple wash**
3. KSC2 66
4.3 Kg. Saba, Ujong 1965.786
- 18) Yellow or white glaze or ash**
3. Turiang 18
4.1a) Iwahu 234
4.1c) SS 3
4.3 MNN Kiln 2, Jar 2
4.4b) PS 105
4.7 SD 1473
4.8 KSC1 723
4.9 Palapat 088
4.9 KK 36
4.9 *São João* 81/22
4.9 Museum Pahang No. 151
4.9 Museum Pahang No. 153
4.9 KSC1 G50
4.9 KSC1 707
4.9 KSC1 708
4.9 KSC1 714
4.9 WL 12211
4.9 WL 12216
4.9 MNN K2GD23
4.9 SB77/103(1)
4.9 SB77/103(3)
5.9 Kuantan No. 152
4.12 Kay Bungo 116
- 19) Grey-blue exterior**
4.1b KKH5
4.1c) KL34
4.9 PK14
4.9 KL19 (interior)
4.9 *Santiago* 81/5 (5) (slightly blue)
4.9 WL 70/M7860/87
4.9 BAT 608A
4.9 BAT 508B
4.9 BAT 545
4.9 GD1046
4.9 GT913
4.10 Jakarta Museum No.2761
- 20) Glazed from below rim**
4.3 MNN Kiln 2, Jar 2
4.3 Museum Jakarta No. 379
4.3 Brunei Museum Ujong 1965.786
4.4a) BD749 or 747
4.4c) MNN SF4
4.5a) MNN SF19
4.9 MNN K2GE13
4.9 MNN K2GD24
- 21) Attachment on rim**
4.3 KSC3 69
4.3 & 4.4a) Bahuguhan Cave 182
- 4.3 MNN AC26
4.4a) KSC3 424 (6)
4.4a) BD749 or 747 (possibly)
4.4a) KS61
4.4c) MNN SF4
4.4c) Bahaguhan Cave 174
- 22) Scar on rim**
4.1a) Palapat 071
4.1a) Iwahu 234
4.1b) BR SF23
5.1c) PKK1
4.2 Palapat 069
4.2 Fernandez Collection
4.3 MNN Kiln2, Jar 2
4.3 MNN AC26 (3 places)
4.7 PKK13
4.10 MNN K2Gh4
- 23) Support mark on base**
4.2 Calatagan 186
4.1b) KSC3 151
4.1b) KSC3 439
4.2 Calatagan 186
4.7 PKK13 (scar)
- 24) Marks inside where another item fired**
4.2 Brunei Darussalam 2/5 (3)
4.3 PS 119 (3)
4.3 KSC3 26 (3)
4.3 Karitunan. Marked 216 & 2009 (5)
4.4a) Brunei Darassalam 747 or 749 (4)
- 25) Two sets of incised lines**
4.3 BD type 181 p.58
4.3 SD 2659
4.4a) BD 749 or 747
4.4a) KSC3 424 (3 sets)
4.5b) SD 1707
4.5c) KK34
4.5c) KK35
4.6 Museum Brunei. Tutong
4.9 SS No No. (1)
4.9 KK36
4.9 KK38
4.9 PK14
4.9 SD2319
4.9 SD5262
4.9 Museum Pahang 148
4.9 Museum Pahang 153
4.9 MNN K2GD23
4.9 KSC1 677
4.9 Seychelles Fig. 15
4.9 WL 12211
4.9 *Nuestra Señora de la Concepción* A325
- 26) Many incisions under lugs**
4.9 GT913
4.9 Salatiga 4069 26-3-41
4.10 MNN K2Gh4
4.10 MNN Kiln 2, Jar 1
4.10 Museum, Jakarta No. 2761
4.10 *Risdam* Fig. 9B
- 27) Wide mouth to height ratio**
4.10 MNN K2Gh4
4.10 MNN Kiln 2, Jar 1
4.10 *Risdam* Fig. 9B
4.10 Salatiga 4069 26-3-41
4.10 Museum, Jakarta No. 178
- 28) Sherds resembling BR sherds (visually)**

- 4.2 Bahuguhan Cave 153 BR1
 4.2 Bahuguhan Cave 176 BR 21#13
 4.3 Bahuguhan Cave 147 BR21#13, BR19#6
 4.3 & 4.4a) Bahuguhan Cave 182 BR21#13, BR1
 4.9 Palapat 088 BR 20#12, BR21#13 interior
 4.9 *São João* 81/22 BR1, BR7
 4.9 *São Bento* SB77/103(2), BR11#2
 4.9 BAT 608A BR7
- 29) Amdel BR (NT MgO low)**
 4.1b) Bahuguhan Cave 175
 4.2 KSC3 1076j
 4.2 Bahuguhan Cave 153
 4.2 Bahuguhan Cave 176
 4.3 PS 113
 4.3 KSC3 61
 4.3.J. Toralba 135
 4.3 Pattaya P12 (Nong O)
 4.3 Bahuguhan Cave 147
 4.9 PKK27
- 30) Amdel NT Almost BR except MgO high**
 4.1c) SS3. Almost NT, almost BR
 4.9 SS. Amdel 31/M7860/87 NT, almost BR
 4.9 KL19. NT, almost BR MgO tiny bit high
 4.9 BAT545. NT, almost BR
- 31) Recorded glaze over slip**
 3. KSC2 66. Thin yellow-brown glaze. White-pink wash inside jar.
 4.1a) Brunei Museum, Tutong. Mottled green-black glaze to upper. Whitish slip.
 4.2 Sumbiling 67-212. Very thick, double dipped black-brown glaze to upper 2/3.
 4.2 Brunei Darussalam Type 2 p.58. Green-brown glaze to upper 1/2 over slip.
 4.3 Royal Nanhai CP69. Brown glaze, streaking and running over 3/4. Wash.
 4.3 MNN AC26. Green-black glaze over a wash into rim.
 4.3 KSC3 26. Degraded green-brown glaze to 2/3, two dips or slip to 1/2.
 4.3 Brunei Darussalam No. 1890. Appears to have slip to top 1/2 then top 1/6 glazed.
 4.3 Brunei Darussalam No. 181, p.58. Green-brown glaze to upper 3/4 over slip.
 4.3 Sarawak Museum, Niah. Plate 12c). Black over slip.
 4.3 Jakarta No. 379. Black-brown glaze. Brown slip. Lower body—yellow-brown glaze smears.
 4.3 Brunei Museum. Kg Saba Ujong 1965.786. Deteriorated brown glaze from neck to above base. Remains of white and purple wash.
 4.3 Sabah Museum No. 2857. Possibly two lots of thick brown-black glaze, probably over 3/4.
 4.4b) Shuri Castle. Fig. 1, No.s 1&2. Dark brown glaze to upper 3/4 over slip to above base.
 4.6 Museum Brunei, Tutong, 1967.815. Streaked brown-olive green glaze streaked over slip to upper 3/4.
 4.6 PKK25 Thin, degraded olive green-brown glaze (probably two dips or wash and glaze) to upper 3/4.
 4.7 *San Diego* 1473. Probably yellow slip/glaze.
 4.9 Ko Kradat 36. Yellow-brown slip.
 4.9 *São João* 81/22. Remains of green-brown glaze over a yellow slip or the remains of what was a glaze to upper 1/2.
 4.9 Seychelles Fig. 15. Deteriorated glaze probably over wash to upper 2/3.
 4.9 *São Bento* 77/103 (3). Deteriorated glaze, fragments of yellow slip remain.
 4.9 *Witte Leeuw* 12211 and 12216. Yellow slip or glaze traces.
 4.10 *Risdam* 9B. Poor quality, fine, eroded glaze over slip.
- 4.12 Kota Batu Amdel 76/M7860/87 Deteriorated green-brown glaze possibly over slip.
- 32) Reach of glaze 1/3—1/2—2/3 upper body**
 4.1a) Okinawa Fig. 2 No. 6. 1/2—1/3
 4.1b) BD Type 20, three items. 1/2-2/3
 4.1d) SS4. 1/2
 4.1d) Bulamanis No. 2615. 1/2
 4.1d) Niah, Sarawak. Plate 12b). 1/2-2/3
 4.2 KSC3 38. 1/2-2/3
 4.2 KSC3 1
 4.2 BD Type 2, p.58.
 4.3 Pattaya P166
 4.3 BD No. 1890. Slip 1/2, glaze 1/6
 4.7 BD Type 2, p.55
 4.9 Singtai S30. 2/3.
 4.9 SS No. No. (2) 1/2-2/3
 4.9 KSC1 items
- 33) Reach of glaze 2/3 upper body**
 4.1a) Tutong, Brunei 1968–163 15E
 4.1a) Mukah, Brunei 71–14 15E
 4.1d) Kuching, Sarawak No. 3037
 4.1d) Indonesia (Singapore) No. 350 (2/3-3/40
 4.2 Hoi An No. 3725
 4.2 Pattaya P31
 4.2 Sumbiling, Brunei 67-212
 4.2 Mukah, Brunei 1971.12
 4.3 Pattaya P30
 4.7 Ko Samui KKS/RH/84/85.3
- 34) Reach of glaze 3/4 upper body**
 3. 'Medieval Vessel' Nos 2 & 3
 4.1a) Nanyang CP35. 2/3-3/4
 4.1a) Royal Nanhai CP 35. 2/3-3/4
 4.1b) Si Satchanalai, Area kiln 55 opposite SO2
 4.1b) Ko Khram 3
 4.1b) Shuri Castle Fig. 1, No. 5
 4.1b) KSC3 2
 4.1b) KSC3 151
 4.1b) KSC3 317
 4.1b) KSC3 140
 4.1b) KSC3 439
 4.1b) BD Type 20 (1 item)
 4.1d) Phu Quoc Fig. 1b
 4.1d) Sarawak Museum 3037 2/3-3/4
 4.1d) Calatagan Plate 135
 4.2 Calatagan 186
 4.2 KSC3 5
 4.3 Royal Nanhai CP69
 4.3 Phu Quoc Fig. 16
 4.3 Shuri Castle Fig.1 No.3. 3/4
 4.3 Pattaya P9
 4.3 BD Type 181 p.56, 58
 4.3 Ko Samui 17 2/1/85
 4.3 Sarawak Museum, Niah 322/40
 4.3 Museum, Jakarta No. 174
 4.3 Sabah Museum No. 2857
 4.3 Cebu C A00299
 4.4a) BD 749 or 747
 4.4b) KSC3 487
 4.4b) Mae Nam (River) Yom (1985)
 4.4b) Shuri Castle Fig. 1 No.1
 4.4b) Shuri Castle Fig. 1 No. 2
 4.5b) Ko Samui No. 15
 4.6 Tutong, Brunei 1967.815
 4.6 PK25

- 4.7 Museum, Brunei 1965.1294.
- 35) Glazed to just above foot/base**
3. KSC2 1233
3. Loban Kudih Plate 12d)
- 4.1b) Shuri Castle Fig. 1 No. 44
- 4.2 'Medieval Vessel' No. 1
- 4.3 Saba Ujong, Brunei 1965.786
- 36) Glaze described as black**
3. Si Satchanalai kiln site Fig. 28a
3. KSC2 1066
3. KSC2 1060 (with brown mottling)
3. KSC2 1301
3. Kg. Kinlap, Brunei 104
3. Bakong, Sarawak Plate 12d)
3. Punta Sunog 108
- 4.1a) Ko Khram Fig. 8a.
- 4.1d) Calatagan Plate 135
- 4.1d) Niah, Sarawak Plate 12b)
- 4.2 'Medieval Vessel' No.1
- 4.2 Verde Island (mottled brown on black)
- 4.2 Pattaya P31
- 4.3 Niah, Sarawak 322/40 Plate 12c)
- 4.4c) Bahuguhan Cave 174
- 4.9 Museum Pahang No. 148
- 37) Glaze described as brown**
- General: de Santos collection 60% brown glazed
3. Sha Tsui Fig. 9a)
- 4.1a) Palapat 071
- 4.1b) Ko Khram 3
- 4.1b) Shuri Castle Fig. 1 No. 5
- 4.1b) Shuri Castle Fig. 1 No. 44
- 4.1d) Phu Quoc Fig. 16
- 4.1d) Indonesia No. 350
- 4.3 Royal Nanhai CP69
- 4.3 Gedong, Sarawak Plate 10c)
- 4.3 Phu Quoc Fig. 16
- 4.3 Shuri Castle Fig. No. 3
- 4.3 Saba Ujong, Brunei 1965.786
- 4.4b) Shuri Castle Fig. 1 No. 1
- 4.4b) Shuri Castle Fig. 1 No. 2
- 4.9 Singtai Plate 69, S30.
- 4.11 Shuri Castle Fig. 1 No. 4
- 38) Glaze described as brown-black or black-brown**
- 4.1a) Nanyang CP35
- 4.1a) Royal Nanhai
- 4.1b) Ko Khram 5
- 4.1b) Bahuguhan Cave 175
- 4.1b) BD one of Type 20
- 4.1d) Palapat 61-H-41
- 4.2 Calatagan 186
- 4.2 Sumbiling, Brunei 67-212
- 4.2 Bahuguhan Cave 184
- 4.2 Bahuguhan Cave 153
- 4.2 MNN SF20
- 4.3 Bahuguhan Cave 147
- 4.3 Bahuguhan Cave 182
- 4.3 Jakarta Museum No. 379
- 4.3 Sabah Museum No. 2857
- 4.3 *San Diego* 2659
- 4.9 *San Diego* 2819
- 4.9 *San Diego* 5262
- 39) Glaze with green mentioned as part of the description**
3. 'Medieval Vessel' Nos 2&3, dark green-black
3. KSC2 69, degraded thin green-black
3. KSC2 1069, degraded green-brown
3. KSC2 70, degraded light green to yellow-black
3. KSC2 1230, degraded green-brown
3. KSC2 73, degraded thin green-black
- 4.1a) Pattaya P16, dark green-black
- 4.1a) Ko Samui KS/RH/84/.1/85, peeled, crazed olive green-brown
- 4.1a) Tutong, Brunei 1968-163 15E, mottled green-black
- 4.1a) Brunei 1965-1295-15E, discoloured, mottled brown to olive, bubbly in patches
- 4.1b) Palapat 011, good mottled green-brown
- 4.1b) KSC3 2, green-brown, Munsell 10YR 4/4
- 4.1b) KSC3 151, thick green-brown, Munsell 2.5YR 4/4
- 4.1b) KSC3 317, thick, runny green-brown-black
- 4.1b) KSC3 140, thick green-brown with white flecks
- 4.1b) KSC3 439, thick green-brown-black
- 4.1b) MNN BRSF23, thick slightly green-brown mottled blue-white
- 4.1b) Pattaya P15, olive green-brown
- 4.1b) Pattaya P371, green-black
- 4.1b) Brunei Darussalam Type 20, three items degraded green-brown
- 4.1d) Bo Dili 77-TT-2 235, olive green-brown, runny
- 4.1d) Sarawak Museum 1132, dark olive "...shading irregularly to pale green"
- 4.1d) Sarawak Museum 3037, dark olive to pale green
- 4.1d) Sarawak Museum 3420, dark olive to pale green
- 4.1d) Batangas BB TRB SQ89-88, green-brown
- 4.1d) Puerto Galera 64-1-162, mottled green-brown
- 4.1d) Punta Sunog PS-177 GR75, green-brown-black
- 4.2 Mactan Island 71-9-5, shiny green-black
- 4.2 KSC3 38, degraded green-brown
- 4.2 KSC3 1, thick green-black
- 4.2 KSC 3 1076j, green-brown-black with thick dribble
- 4.2 KSC3 5, thick green-brown, Munsell 10YR4/4
- 4.2 Pattaya P13, green-black
- 4.2 Bahuguhan Cave 176, thick green-brown
- 4.2 Brunei Darussalam Type 2, p.58, green-brown glaze over slip
- 4.2 Pangil 146 75-G, green-brown
- 4.3 MNN K2Ge9, green-brown-black
- 4.3 MNN AC26, green-brown-black over wash
- 4.3 KSC3 2201C, degrading green-brown
- 4.3 KSC3 26, degraded green-brown
- 4.3 KSC3 101, yellow to green-brown
- 4.3 KSC3 69, runny green-brown
- 4.3 KSC3 29, degraded thin green-brown
- 4.3 Pattaya P9, green-black
- 4.3 Pattaya P569, degraded green-black
- 4.3 Pattaya P166, green-black
- 4.3 Pattaya P30, degraded green-black
- 4.3 Pattaya P1, grey-green
- 4.3 Pattaya P3, green-black
- 4.3 Brunei Darussalam Type 181, p.56&58, green-brown
- 4.3 Ko Samui KS17 2/1/85, degraded olive green-black-brown
- 4.4a) KSC3 424, thick, runny degraded green-brown-black, Munsell 10Y3/0
- 4.4a) Brunei Darussalam BD749 or 747, green-brown
- 4.4a) KSC3 487, degraded green-brown
- 4.5a) MNN SF19, green-brown-black mottled
- 4.5c) Ko Kradat 34, olive green slip/glaze
- 4.6 Brunei Museum 1967.815, streaked brown-olive glaze streaked over slip
- 4.6 PK25, thin, degraded olive green-brown
- 4.7 KS/RH/.84/85.3, thin, degraded green-black-brown
- 4.7 PK13, degraded green-brown
- 4.9 SS No No.2, green-brown

- 4.9 PK27, degraded, probably green
- 4.9 *San Diego* 2819, degraded brown
- 4.9 *San Diego* 5262, degraded brown-black
- 4.9 *Sao Joao*, degraded green-brown over yellowish slip
- 4.9 *Sao Bento*, deteriorated darkish green-brown
- 4.9 MNN K2 GD 24, greenish yellow-brown, underfired
- 4.9 MNN K2 GD 23, inferior green-yellow
- 4.9 KSC1 G52, degraded green-yellow
- 4.11 Ko Khram KKH1, green-brown
- 4.12 *Batavia* BAT609, green-brown, degraded
- 4.12 Ko Batu 76/M7860/87, deteriorated green-brown
- 40) Purple base, rough, flat**
 - 4.1a) Tutong, Brunei 1968–163 15E
 - 4.1a) Niah, Sarawak 1965–1295
 - 4.1d) Sarawak Museum 1132
 - 4.1d) Sarawak Museum 3037
 - 4.1d) Sarawak Museum 3420
 - 4.3 Jakarta Museum No. 379
 - 4.3 Saba Ujong, Brunei 1965.786
 - 4.6 Tutong, Brunei 1967.815
 - 4.10 Jakarta Museum No. 2761
- 41) Throw lines obvious**
 - 4.1b) MNN BR SF23 (interior)
 - 4.1b) BD Type 20
 - 4.1d) Bo Dili 77-TT-2 (corrugated)
 - 4.1d) Cave near Bau, Sarawak 1132
 - 4.1d) Batu Kitang, Sarawak 3037
 - 4.1d) Kelabit, Sarawak 3420
 - 4.1d) Bulamanis, Java No. 2615
 - 4.1d) SS4 (interior)
 - 4.2 Sumbiling, Brunei 67-212 (minimal)
- 42) Glaze ending in scoops**
 - 3. 'Medieval Vessel' Nos 2 & 3
 - 4.1a) Nanyang CP35
 - 4.1a) Ko Khram Fig. 8
 - 4.1a) Royal Nanhai Plate 1 & CP35
 - 4.1d) Calatagan Plate 135
 - 4.1d) Phu Quoc Fig. 16
 - 4.1d) Indonesia (Singapore)
 - 4.2 KSC3 5
 - 4.2 Calatagan Plate 186
 - 4.3 Phu Quoc Fig. 16
 - 4.4a) BD749 or 747
- 43) Maroon inclusions (generally quite large)**
 - 4.9 *Witte Leeuw*
 - 4.12 BAT 609
 - 4.12 *São Bento* 77/103 (3)
 - 4.12 Kota Batu 76/M7860/87
- 44) Narrow form of Type 4 Jars**
 - 4.1 Nanyang CP35 (blackish-brown glaze)
 - 4.1a) Royal Nanhai CP35 (brown-black glaze)
 - 4.1a) Pattaya P16 (dark green-black glaze)
 - 4.1a) Ko Samui KS/RH/84/.1/85 (olive green-brown glaze)
 - 4.1a) Okinawa Fig. 2, No.6 (glaze not stipulated—possibly dark brown)
 - 4.1a) Niah, Brunei 1965–1295 (mottled brownish to olive green glaze)
 - 4.1b) Melanau jar, Sarawak (322/36) (black glaze)
 - 4.1b) KSC3 2 (green-brown glaze)
 - 4.1b) MNN BR SF23 (thick green-brown-black glaze)
 - 4.1b) BD Type 20, page 54 (thick dark brown-black glaze)
 - 4.1d) Batangas BB TRB SQ89-88 (green-brown glaze)
- 45) Items recovered at the Mae Nam Noi Kiln site, Singburi Province**
 - a) MORTARS:

Red body with inclusions. Dark grey exterior. Metallic appearance. Fly ash; Dark red body. Dark grey exterior and interior; Orange-grey body. Grey exterior and interior; Many orange inclusions; Many orange bodies; Orange to grey body. Appears blue-grey in patches.

b) LARGE JARS

Bodies:

High fired, orange with inclusions. Smooth; Orange to dark beige; Orange-red. Dark blue exterior. Surface appears brown; Orange; Metallic; High fired red surrounded by bluish layer. Yellow metallic appearance interior; dark maroon to blue-grey. Maroon internally; Orange between mauve-grey. Dark grey exterior; dark beige-grey with orange and white inclusions; light grey; beige-light orange; beige-grey with white inclusions.

Glaze:

Green-brown-black from below rim; Greenish-yellow-brown; Inferior; Metallic appearance; Yellowish inferior glaze or slip; Glaze extends inside rim; Mottled brown-black; Underfired or inferior; Mottled yellow-black; Fly ash or inferior glaze.

46) Jars recovered at Si Satchanalai, Sukhothai Province

Si Satchanalai, vicinity Kiln 55 (SO₂), brown-red body surface, Munsell approximately 2.5YR 3/4. Grog added to clay. Thick glaze probably applied by dipping and pouring, extends inside mouth to upper 3/4 body. Very dark greenish black to mid brown in thin areas. Coil built on flattened clay base. Mouth finished on wheel.

Results from two jar sherds or large objects recovered from the river Yom at Ban Ko Noi, Si Satchanalai:

a) Mae Nam Yom 57/M7860/87: Dark to medium grey then reddish with many white and some black inclusions. Amdel: almost Phitsanulok (MgO bit low), almost MON KN (K₂O bit low), almost Nong O (SiO₂ bit low (by 0.8%).

b) Mae Nam Yom 58/M7860/87: Similar colour with white inclusions. Amdel: almost MON KN. Almost Nong O Al₂O₃ high by 0.60%. BR SiO₂ bit low, Al₂O₃ bit high, Fe₂O₃ 1.40% too high. Amdel result not specific to any provenance but probably leans towards Mon KN or Nong O particularly taking into account the location where the sherds were recovered.

Jars drawn by Harper (Green & Harper, 1987, Figs 28a and b). Red-black body. Black glaze with iron red mottling extending inside rim.

Stoneware items from Ceramic Survey Sisatchanalai, Harper (1984) give the body colours of:

a) Painted wares and celadons:

Grey; Grey with black inclusions; Pink-grey; Red-grey

b) Unglazed higher fired items:

Mauve-grey; Red-grey with mauve exterior; Grey body with pink exterior; Grey body with red exterior; Grey, slightly mauve with small black inclusions; Orange (fairly high fired earthenware); Red body, olive green-brown glaze.

47) Sherds from the Ban Bang Pun Kiln site, river bank finds, Suphanburi Province

Miscellaneous bodies: Beige-grey with dark grey inclusions up to approximately 1 mm; grey body with medium-grey and black inclusions; friable light grey body with light pink and black inclusions; friable dark grey, slightly purple body with black inclusions.

Large bowl or jar: Body has very distinct layers:

a) Dark grey thin layer with pressed design, b) red-beige layer (9 mm thick) with inclusions, c) light grey body (5–5.5 mm thick) with fine specks and brown inclusions, d) same as b) 2 mm thick. Jar base: Friable looking dark grey, slightly purple body with black inclusions.

Table 4. Amdel Material Analysis Generalised Composition Ranges

	Thai Ware* Ko Noi	MON Ware Ko Noi	Brown Glazed Ko Noi	Nong O
SiO ₂	70–76	67–72	73–76	69–76
Al ₂ O ₃	16–20	16–21	17–19	14–19
Fe ₂ O ₃	1.0–2.0	6.0–8.5	1.5–2.3	5.0–8.0
Na ₂ O	0.3–1.9	0.09–0.3	0.3–0.6	0.18–0.42
K ₂ O	1.8–3.6	1.4–1.9	3.0–3.5	1.4–2.2
MgO	<0.7	<0.7	<0.5	0.5–0.9
	Pa Yang Earthenware	Pa Yang Stoneware	Sukhothai Ware	Bang Rachan (Mae Nam Noi)
SiO ₂	68.5–69	68–75	72–76	68–75
Al ₂ O ₃	15–17	17–23	15.5–19.5	16–19
Fe ₂ O ₃	6.5	1.0–3.0	2.5–4.5	4.0–6.0
Na ₂ O	0.3–0.7	0.3–0.45	0.3–0.6	0.15–0.6
K ₂ O	1.8–2.3	2.6–2.8	1.5–3.0	0.8–2.6
MgO	0.90 & 1.25	<0.5	<0.5	0.4–1.1
	Phitsanulock Earthenware	Phitsanulock Stoneware	Nakorn Thai	Kalong
SiO ₂	66–69	68–75	68–76	72–82
Al ₂ O ₃	16–19	14–19	13–20	13–21
Fe ₂ O ₃	5.0–6.0	5.0–7.0	4.0–6.0	1.0–1.4
Na ₂ O	0.27–0.36	0.25–0.4	0.1–0.5	0.05–0.3
K ₂ O	2.1–2.5	1.8–2.6	1.2–2.2	1.1–2.0
MgO	1.2–1.5	1.2–1.5	0.7–1.4	<0.5
	Ko Noi Support Body	Sukhothai Support Body		
SiO ₂	68–74	71–74		
Fe ₂ O ₃	4.4–5.6 (Thai)	4		
Fe ₂ O ₃	7–9.4 (MON)	4		
Na ₂ O	0.1–0.3	0.3–0.45		
K ₂ O	1.1–1.5	1.7–2.1		
	Suphanburi River Finds (Without S15)			
Si	70.3–73.8			
Ti	0.75–0.86			
Al	15.2–18.2			
Fe	4.52–5.60			
Mn	0.03–0.11			
Mg	0.84–1.04			
Ca	0.63–0.82			
Na	0.43–0.61			
K ₂ O	1.85–2.04			
P ₂	0.03–0.26			

* LASW and MASW

Table 5. Amdel Material Analysis Basins—High Fired

	KSC1	KSC1	KSC1	KSC1 '83 296	SS 46	SS 10	KR 33
	10/M 7860/87	11M7860/87	12/M7860/87	18/M7860/87	AC 1251/88	33/M7860/87	AC 1219/89
SiO ₂	72.00	70.30	68.30	66.50	63.80	71.80	69.10
TiO ₂	0.91	0.77	0.94	0.88	0.82	0.86	0.94
Al ₂ O ₃	18.90	17.20	18.70	20.20	18.70	17.70	18.00
Fe ₂ O ₃	4.86	5.70	5.30	7.10	6.35	4.38	4.74
MnO	0.10	0.04	0.02	0.05	0.05	0.09	0.08
MgO	0.62	0.76	0.68	0.87	3.16	1.49	2.10
CaO	0.58	0.27	0.24	0.45	0.21	0.88	0.77
Na ₂ O	0.26	0.63	0.54	0.44	0.47	0.38	0.30
K ₂ O	1.52	2.14	1.48	2.14	1.61	1.39	1.21
P ₂ O ₅	0.04	0.02	0.08	0.12	0.09	0.04	0.03
LOI	0.82	1.23	3.34	1.08	2.98	1.43	2.72
Total	100.60	99.10	99.60	99.80	98.20	100.40	100.0

Table 6. Amdel Material Analysis Black Surfaced Items

	KSC2 1061 1065	KSC2 1067 1065	KSC2 1079 1213	KSC2 1079 1213	KSC2 1221 1221	KSC2 1226 1226	KSC2 1229 1229	KSC2 1231 1231	KSC2 1232 1232	KSC2 1234 1236	KSC2 1236 1236	KSC2 1237 1237	KSC2 1238 1238	KSC2 1239 1239	KSC2 1240 1240	
	10/ AC 1252/88	12/ AC 1252/88	13/ AC 1252/88	15/ AC 1252/88	25/ AC 1252/88	28/ AC 1252/88	30/ AC 1252/88	32/ AC 1252/88	33/ AC 1252/88	34/ AC 1252/88	36/ AC 1252/88	37/ AC 1252/88	38/ AC 1252/88	39 /AC 1252/88	40/ AC 1252/88	41/ AC 1252/88
SiO ₂	72.7	73.5	73.8	74.6	71.9	73.4	73.3	72.4	72.5	74.2	76.3	73.5	74.2	72.4	74.3	73.3
TiO ₂	0.90	0.94	0.92	0.94	0.92	0.86	0.89	0.89	0.90	0.91	0.82	0.89	0.91	0.86	0.87	0.92
Al ₂ O ₃	17.1	17.5	16.7	17.1	17.3	16.5	17.0	16.9	17.1	17.4	14.9	17.2	16.8	16.3	16.8	17.4
Fe ₂ O ₃	5.55	4.52	4.40	4.36	5.25	5.05	4.76	4.82	5.35	4.40	5.15	4.48	4.26	5.15	4.60	4.46
MnO	0.03	0.04	0.05	0.04	0.03	0.02	0.05	0.08	0.06	0.03	0.02	0.04	0.03	0.05	0.04	0.03
MgO	0.84	0.81	0.83	0.80	1.03	0.72	0.96	1.20	1.07	0.78	0.69	0.88	0.95	0.74	0.81	0.90
CaO	0.37	0.56	0.57	0.50	0.37	0.37	0.55	0.63	0.44	0.53	0.42	0.63	0.37	0.31	0.60	0.60
Na ₂ O	0.46	0.38	0.39	0.47	0.39	0.40	0.46	0.46	0.38	0.36	0.40	0.37	0.41	0.34	0.40	0.49
K ₂ O	1.70	1.57	1.55	1.46	1.23	1.30	1.64	1.56	1.64	1.50	1.60	1.58	1.60	1.31	1.56	1.43
P ₂ O ₅	0.10	0.08	0.04	0.05	0.14	0.10	0.13	0.12	0.11	0.08	0.08	0.14	0.13	0.09	0.10	0.16
LOI	0.94	0.52	0.69	0.57	2.14	2.04	1.09	1.71	0.89	0.64	0.34	1.00	1.17	1.38	0.74	0.94
Total	100.7	100.4	99.9	100.9	100.7	100.8	100.8	100.8	100.4	100.8	100.7	100.7	100.8	98.9	100.8	100.6

Table 7. Amdel Material Analysis Bottles (various shapes)

	SS 43 AC 1251/88	SS 8 AC 1251/88	SS 5 AC 1251/88	KR 17 AC 1219/89	KR 20 AC 1219/89	PKK 4 AC 1253/88	PKK 9 AC 1253/89	KR 18 AC 1219/89	PKK 19 AC 1253/89
SiO ₂	64.6	64.4	66.2	70.2	68.5	74.1	71.3	67.7	73.0
TiO ₂	0.82	0.82	0.78	1.00	0.87	0.76	0.73	0.95	0.77
Al ₂ O ₃	19.7	19.7	19.8	18.2	18.0	18.0	18.3	19.3	19.2
Fe ₂ O ₃	6.10	6.50	4.76	4.66	4.82	3.80	4.06	4.74	4.24
MnO	0.05	0.06	0.10	0.06	0.14	0.08	0.22	0.05	0.07
MgO	2.46	2.64	1.60	1.85	1.35	0.56	1.22	1.64	0.64
CaO	0.76	0.58	1.47	0.61	0.55	0.25	0.40	1.27	0.28
Na ₂ O	0.42	0.42	0.23	0.31	0.39	0.22	0.25	0.25	0.24
K ₂ O	1.67	1.76	1.33	1.17	1.33	1.21	1.32	1.34	1.48
P ₂ O ₅	0.07	0.10	0.08	<0.02	<0.02	0.04	0.13	<0.02	0.07
LOI	2.46	2.96	2.32	2.32	2.24	0.74	2.08	2.34	0.62
Total	99.1	99.9	98.7	100.4	98.2	99.8	100.0	99.6	100.6

Table 8. Amdel Material Analysis Bowls (KSC3 3 Type)

	SS 18 AC 1251/88	SS 40 AC 1251/88
SiO ₂	72.6	71.0
TiO ₂	0.73	0.77
Al ₂ O ₃	19.2	20.4
Fe ₂ O ₃	4.46	4.34
MnO	0.09	0.09
MgO	0.83	0.62
CaO	0.45	0.29
Na ₂ O	0.22	0.21
K ₂ O	1.34	1.48
P ₂ O ₅	0.03	0.04
LOI	0.78	0.43
Total	100.7	99.7

Table 9. Amdel Material Analysis Brown Glazed Items (Potiche and Bowls)

	KR 26 AC 1219/89	SS 17 AC 1251/88	SS 36 AC 1251/88	SS 41 AC 1251/88
SiO ₂	70.6	73.1	72.7	71.4
TiO ₂	0.88	0.76	0.78	0.51
Al ₂ O ₃	19.0	18.5	18.7	17.8
Fe ₂ O ₃	2.24	2.24	2.46	1.93
MnO	0.02	0.01	<0.01	0.02
MgO	0.89	0.50	0.33	0.31
CaO	0.76	<0.01	<0.01	<0.01
Na ₂ O	0.80	0.54	0.47	1.34
K ₂ O	2.62	3.18	3.06	3.46
P ₂ O ₅	0.12	0.09	0.08	0.07
LOI	1.89	0.99	0.59	1.28
Total	99.8	99.9	99.1	98.1

PART 3

Table 10. Amdel Material Analysis Celadon Glazed

	KSC2 1170	KSC2 1249	KSC2 1302	KSC2 1307	KSC2 1377	KSC2 1048	KSC2 1051	KSC2 1053	KSC2 1101	KSC2 1120	KS 4	KS 5	KS 6	KS 7	KS 8	KS 9	KS 10	SS 4	SS 14	SS 11	SS 12	SS 28	SS 29	SS33	SS 35	P 383	KKH 21	KKH 31
	24/ AC 1252/ 88	44/ AC 1252/ 88	52/ AC 1252/ 88	39/ M 7860/ 87	40/ M 7860/ 87	6/ AC 1252/ 88	7/ AC 1252/ 88	8/ AC 1252/ 88	21/ AC 1252/ 88	23/ AC 1252/ 88	AC 1253/ 88	AC 1253/ 88	AC 1253/ 88	AC 1253/ 88	AC 1253/ 88	AC 1253/ 88	AC 1253/ 88	27/ M 7860/ 87	AC 1251/ 88	AC 1251/ 88	AC 1251/ 88	AC 1251/ 88	AC 1251/ 88	AC 1251/ 88	AC 1251/ 88	3/ M 7860/ 87	AC 1253/ 88	AC 1253/ 88
SiO ₂	72.3	71.3	74.0	72.9	71.5	75.3	72.1	75.0	73.1	73.5	74.8	74.8	75.3	73.4	75.7	75.0	71.1	73.1	70.9	74.4	73.7	71.7	71.7	73.0	73.4	73.3	71.1	72.9
TiO ₂	0.21	0.09	0.32	0.30	0.11	0.26	0.15	0.28	0.60	0.32	0.46	0.43	0.45	0.43	0.45	0.38	0.10	0.81	0.75	0.80	0.79	0.77	0.74	0.78	0.52	0.44	0.39	0.51
Al ₂ O ₃	15.8	20.6	18.4	16.8	21.1	16.0	18.6	17.2	18.4	17.3	17.8	17.9	17.4	18.3	17.3	18.3	20.3	18.9	18.0	19.2	18.3	18.8	18.4	19.3	18.0	17.8	19.1	19.9
Fe ₂ O ₃	2.12	1.56	2.48	2.36	1.73	2.18	0.99	2.34	2.22	2.28	1.23	1.34	1.27	1.77	1.44	2.86	1.56	3.30	3.06	1.61	1.84	1.94	2.80	1.96	1.98	2.06	1.34	1.30
MnO	0.08	0.06	0.02	0.04	0.07	0.03	0.05	0.04	<0.01	0.02	0.01	0.01	<0.01	0.01	<0.01	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.03	0.01	0.02
MgO	0.34	0.21	0.29	0.35	0.20	0.32	0.36	0.34	0.56	0.33	0.62	0.37	0.40	0.50	0.27	0.35	0.17	0.44	0.41	0.36	0.53	0.67	0.46	0.35	0.28	0.30	0.54	0.27
CaO	0.06	0.02	0.05	0.12	0.10	0.08	0.16	0.06	0.58	0.09	<0.01	0.05	<0.01	0.08	<0.01	<0.01	<0.01	0.16	<0.01	<0.01	<0.01	0.15	<0.01	<0.01	0.01	0.11	0.03	<0.01
Na ₂ O	0.56	0.36	0.31	0.46	0.51	0.52	0.28	0.54	0.95	0.20	1.14	1.29	1.24	1.11	1.21	0.13	0.52	0.61	0.62	0.58	0.40	0.61	0.61	0.60	1.39	1.48	1.91	1.71
K ₂ O	4.86	5.53	3.08	5.45	5.50	4.68	3.44	3.22	2.40	3.64	2.60	2.88	2.66	2.82	2.62	2.56	5.55	2.96	2.74	2.78	3.08	2.74	3.00	3.00	3.12	2.94	2.38	2.54
P ₂ O ₅	<0.01	0.07	0.04	0.02	<0.10	0.02	0.03	0.02	0.01	<0.01	0.03	0.03	0.04	0.04	0.03	0.04	<0.01	0.06	0.09	0.13	0.12	0.11	0.08	0.11	0.04	<0.01	0.08	0.08
LOI	1.76	1.19	1.67	1.31	0.17	1.42	0.10	1.66	0.79	0.87	1.43	0.95	1.34	0.83	1.35	1.12	0.92	0.23	1.85	0.56	1.02	2.04	0.45	1.11	0.18	1.05	1.29	0.35
Total	98.1	100.8	100.7	100.1	101.0	100.8	96.3	100.7	99.6	98.5	100.1	100.1	100.1	99.3	100.3	100.8	100.2	100.6	98.4	100.4	99.8	99.5	98.2	100.2	98.9	99.5	98.2	99.6

Table 11. Amdel Material Analysis Covered Bowls—Lids and Bases

	SS 1	SS 2	SS 3	SS 4A	SS 9	SS 23	SS 26	SS 38	SS 39	SS 44	SS 45
	24/M7860/87	25/M7860/87	26/M7860/87	AC 1251/88	AC 1251/88	AC1251/88	AC 1251/88	AC 1251/88	AC1251/88	AC1251/88	AC1251/88
SiO ₂	73.6	72.5	73.3	66.7	72.0	73.0	70.7	72.0	71.2	72.0	69.2
TiO ₂	0.88	0.84	0.86	0.78	0.74	0.68	0.77	0.75	0.78	0.80	0.74
Al ₂ O ₃	19.1	19.2	18.7	22.2	18.1	16.4	20.6	18.1	18.7	18.9	18.2
Fe ₂ O ₃	2.02	2.08	2.42	1.76	1.83	1.99	1.55	2.12	2.32	2.40	1.63
MnO	0.02	0.01	0.02	0.07	0.02	0.01	0.01	<0.01	0.02	<0.01	<0.01
MgO	0.57	0.84	0.62	0.56	0.83	0.75	0.75	0.50	0.59	0.37	1.08
CaO	0.09	0.23	0.12	0.19	0.50	<0.01	0.24	<0.01	<0.01	<0.01	0.62
Na ₂ O	0.46	0.41	0.45	0.64	0.56	0.37	0.53	0.55	0.40	0.39	0.40
K ₂ O	3.18	3.28	3.02	3.18	2.92	2.96	3.14	3.02	3.08	3.22	3.10
P ₂ O ₅	0.09	0.05	0.04	0.11	0.11	0.05	0.07	0.08	0.09	0.10	0.05
LOI	0.98	1.12	1.48	1.99	1.35	1.92	1.35	1.19	1.06	0.51	3.14
Total	101.0	100.6	101.0	98.2	99.0	98.1	99.7	98.3	98.2	98.7	98.2

Table 12. Amdel Material Analysis Earthenware Lids

	KSC1	P274	KSC2 33	KS 3	SS 7
	23/M7860/87	6/M7860/87	65/M7860/87	AC1253/88	AC1251/88
SiO ₂	74.5	70.5	65.0	68.7	73.0
TiO ₂	0.83	0.88	0.94	0.55	0.84
Al ₂ O ₃	16.0	17.5	17.6	14.8	15.4
Fe ₂ O ₃	3.86	5.40	5.85	4.46	4.90
MnO	0.05	0.03	0.05	0.05	0.07
MgO	0.85	0.93	0.97	1.17	1.22
CaO	0.28	0.28	0.18	0.07	0.71
Na ₂ O	0.55	0.55	0.73	0.30	0.44
K ₂ O	1.96	1.49	1.78	2.86	1.57
P ₂ O ₅	0.09	0.05	0.09	0.10	0.11
LOI	1.41	1.97	7.35	6.60	2.04
Total	100.4	99.6	100.5	99.7	100.3

Table 13. Amdel Material Analysis Jarlets—Painted (SS 31) Brown Glazed (KKH 8-PKK 15)

	SS 31	KKH 8	KR 104	SS 11	SS 12	SS 19	PKK 15
	AC1251/88	AC1253/88	AC1219/89	34/M7860/87	35/M7860/87	AC1251/88	AC1253/88
SiO ₂	71.3	71.4	71.8	69.9	70.3	72.7	73.6
TiO ₂	0.78	0.81	0.86	0.86	0.82	0.69	0.72
Al ₂ O ₃	17.8	17.2	18.7	18.0	18.0	18.2	17.7
Fe ₂ O ₃	1.90	5.70	2.84	1.72	2.24	2.54	2.30
MnO	0.01	0.07	<0.01	0.02	0.01	0.02	<0.01
MgO	0.81	0.83	0.59	2.80	1.16	0.63	0.38
CaO	0.17	0.20	0.35	0.45	0.63	<0.01	<0.01
Na ₂ O	0.42	0.22	0.76	0.44	0.56	0.80	0.58
K ₂ O	3.04	1.27	2.66	2.50	3.16	3.04	2.52
P ₂ O ₅	0.10	0.09	0.05	0.07	0.05	0.08	0.08
LOI	1.73	1.08	0.89	4.24	2.20	1.08	1.22
Total	98.1	98.9	99.5	101.0	99.1	99.8	99.1

Table 14. Amdel Material Analysis Jars—Includes Medium to Miscellaneous

	RR 34	SS 7	SS 3	SS 4	KS 1	P 371	KSC 3	PKK 26	PKK 27	KSC 1	KSC 1	KSC 1	RR 19	SS 8	P 12	KSC3 107g	KSC3	KSC3 2201c	MNY 1	MNY 2	KSC 2 1062	KSC 2 1301	KSC 2 1060	KSC 2 1233	KSC 2 1220	KSC 2 1069	KSC 2 1241
	AC 1219/89	30/M 7860/87	AC 1251/88	AC 1251/88	AC 1253/88	2/M 7860/87	63/M 7860/87	AC 1253/88	AC 1253/88	13A/M 7860/87	13B/M 7860/87	13C/M 7860/87	AC 1219/89	31/M 7860/87	1/M 7860/87	62/M 7860/87	61/M 7860/87	66/M 7860/87	57/M 7860/87	58/M 7860/82	11/ AC 1252/88	51/ AC 1252/88	9/ AC 1252/88	35/ AC 1252	27/ AC 1252/88	14/ AC 1252/88	42 AC 1252/88
SiO ₂	70.6	73.8	67.3	71.3	73.5	75.6	73.3	72.4	72.9	71.7	70.0	66.5	70.6	72.3	73.2	73.9	71.7	66.6	68.2	67.5	75.3	69.7	71.8	71.9	74.0	73.7	72.1
TiO ₂	1.03	0.83	0.82	0.82	0.80	0.82	0.87	0.80	0.80	0.91	0.86	0.87	0.86	0.81	0.78	0.83	0.98	0.84	0.64	0.63	1.04	0.64	0.63	0.61	0.89	0.60	0.60
Al ₂ O ₃	19.2	18.3	18.2	18.5	18.6	16.1	16.1	18.7	18.8	19.0	18.6	19.7	17.6	17.5	17.4	17.0	18.4	19.0	18.2	19.6	18.6	18.3	17.8	17.5	16.9	17.2	17.1
Fe ₂ O ₃	4.16	1.99	4.46	3.80	3.94	4.38	4.32	4.82	4.84	4.42	4.56	6.90	4.58	4.92	5.70	4.38	4.24	6.35	6.75	7.40	2.04	7.35	6.80	6.60	4.58	5.95	6.15
MnO	0.03	0.01	0.13	0.06	0.09	0.09	0.09	0.07	0.07	0.08	0.12	0.05	0.05	0.06	0.13	0.08	0.05	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02
MgO	0.87	0.94	1.93	1.13	0.70	0.92	0.93	0.68	0.62	0.73	0.88	0.81	1.26	1.46	0.57	0.64	0.61	1.02	0.78	0.83	0.59	0.65	0.69	0.86	0.79	0.70	0.81
CaO	0.43	0.18	0.66	0.64	0.24	0.26	0.71	0.24	0.27	0.66	0.50	0.26	0.48	0.61	0.59	0.55	0.47	0.40	0.19	0.36	0.15	0.19	0.42	0.34	0.47	0.26	0.55
Na ₂ O	0.32	0.35	0.18	0.17	0.22	0.17	0.32	0.26	0.22	0.28	0.33	0.50	0.42	0.21	0.18	0.16	0.22	0.64	0.26	0.40	0.14	0.31	0.32	0.45	0.44	0.26	0.24
K ₂ O	1.19	2.94	1.16	1.30	1.32	1.36	1.17	1.36	1.33	1.50	1.41	1.86	1.17	1.20	1.45	1.36	1.25	2.40	2.10	1.99	1.77	2.08	1.71	1.43	1.45	1.35	1.57
P ₂ O ₅	<0.02	0.10	0.07	0.03	0.04	0.02	0.02	0.03	0.03	0.04	0.04	0.02	<0.02	0.05	0.03	0.02	0.02	0.05	<0.10	0.03	0.03	0.08	<0.01	0.07	0.10	0.03	0.03
LOI	0.92	0.93	3.30	1.04	0.85	1.28	1.37	0.91	0.97	0.50	1.27	0.55	1.60	1.57	1.05	0.66	0.26	0.77	0.83	1.22	1.01	0.87	0.61	1.00	1.15	0.62	0.82
Total	98.7	100.4	98.2	98.8	100.3	101.0	99.2	100.3	100.9	99.8	98.6	98.0	98.6	100.7	101.0	99.6	98.2	98.1	98.0	100.0	100.7	100.2	100.8	100.8	100.8	100.7	100.0

Table 15. Amdel Material Analysis Jars—Large

	GD 1046	S B 77/ 103 (2)	WT	SJ (4)	ST 81/5 (5)	KB 1	BAT 545	BAT 608A	KKH 1	KS2	KKH 4	S B 77/ 103 (3)	BAT 608B	BAT 609	S B 77/ 103 (1)
	M/ 7860/87	72/ M7860/87	70/ M7860/87	74/ M7860/87	75/ M7860/87	76/ M7860/87	M 7860/87	M 7860/87	AC 1253/88	AC 1253/88	AC 1253/88	73/ M7860/87	M/ 7860/87	M/ 7860/87	71/ M7860/87
SiO ₂	68.6	73.5	69.6	70.4	71.9	73.3	72.2	72.9	69.4	74.3	65.6	62.5	73.7	57.5	66.6
TiO ₂	0.98	0.86	0.85	0.91	0.83	0.82	0.90	0.95	0.86	0.77	0.53	1.21	0.93	1.44	0.93
Al ₂ O ₃	19.2	17.5	18.0	18.7	17.6	15.1	17.0	17.9	19.5	17.3	19.1	22.5	17.9	27.5	18.3
Fe ₂ O ₃	5.55	4.46	4.72	4.44	4.56	6.30	4.50	4.64	6.70	4.58	9.15	9.60	4.68	9.65	6.55
MnO	0.08	0.05	0.06	0.07	0.06	0.15	0.09	0.08	0.10	0.09	0.02	<0.01	0.08	0.01	0.12
MgO	1.13	0.59	0.74	0.81	0.81	0.98	1.29	0.90	0.93	0.60	0.58	0.73	0.96	0.66	1.34
CaO	0.61	0.48	0.69	0.59	0.48	0.21	0.78	0.64	<0.01	0.40	<0.01	0.30	0.70	0.26	0.61
Na ₂ O	0.49	0.24	0.46	0.46	0.15	0.18	0.42	0.36	0.35	0.25	0.28	0.14	0.31	0.35	0.66
K ₂ O	0.92	1.08	1.64	1.24	1.12	1.37	1.36	1.17	1.91	1.61	2.12	1.34	0.54	1.15	2.22
P ₂ O ₅	0.08	0.01	<0.01	0.03	<0.01	0.11	0.12	0.07	0.07	0.03	<0.01	<0.01	0.08	0.07	0.08
LOI	0.94	0.68	1.45	0.86	0.70	0.84	1.14	0.98	0.94	0.51	0.94	1.23	0.87	0.68	1.40
Total	98.6	99.5	98.2	98.5	98.2	99.4	99.8	100.6	100.8	100.4	98.3	99.5	100.8	99.3	98.8

Table 16. Amdel Material Analysis Kendi—Including Fluted Types and Lids with Kendi Type Bodies

	SS 1	SS 6	KSC1 1985	KSC1 1985	KR 21	KR 113	KR 115	KSC3 128	SS 15
	AC 1251/88	AC 1251/88	9A/M7860/87	9B/M7860/87	AC1219/89	AC1219/89	AC1219/89	59/M7860/87	AC1251/88
SiO ₂	65.2	70.5	62.1	71.7	64.0	59.5	66.3	65.8	67.6
TiO ₂	0.83	0.88	0.85	0.96	0.92	0.99	0.95	0.95	0.82
Al ₂ O ₃	13.0	14.5	14.7	17.0	14.3	15.3	14.8	16.2	14.4
Fe ₂ O ₃	4.42	4.76	5.30	5.55	5.60	6.20	5.70	5.10	4.76
MnO	0.11	0.08	0.09	0.06	0.05	0.07	0.09	0.04	0.04
MgO	4.28	2.40	0.97	0.87	3.46	5.45	2.84	1.18	2.80
CaO	1.47	0.74	0.56	0.63	0.47	0.59	0.57	1.14	0.29
Na ₂ O	0.60	0.55	0.62	0.59	0.73	0.67	0.77	0.90	0.86
K ₂ O	1.34	1.54	1.60	1.67	1.29	1.32	1.33	1.51	1.78
P ₂ O ₅	0.18	0.18	0.12	0.10	0.29	0.24	0.27	0.39	0.12
LOI	7.20	4.52	11.3	1.38	7.60	9.80	7.25	6.40	6.15
Total	98.6	100.7	98.2	100.5	98.7	100.1	100.9	99.6	99.6

Table 17. Amdel Material Analysis High K₂O(Celadons)

	KSC2 5	KSC2 177	KSC2 1048	KSC2 1170	KSC2 1249	KSC2 1302	KS 10
	39/M7860/87	40/M7860/87	6/ AC 1252/88	24/ AC 1252/88	44/ AC 1252/88	52/ AC 1252/88	AC 1253/88
SiO ₂	72.9	71.5	75.3	72.3	71.3	74.0	71.1
TiO ₂	0.30	0.11	0.26	0.21	0.09	0.32	0.10
Al ₂ O ₃	16.8	21.1	16.0	15.8	20.6	18.4	20.3
Fe ₂ O ₃	2.36	1.73	2.18	2.12	1.56	2.48	1.56
MnO	0.04	0.07	0.03	0.08	0.06	0.02	0.05
MgO	0.35	0.20	0.32	0.34	0.21	0.29	0.17
CaO	0.12	0.10	0.08	0.06	0.02	0.05	<0.01
Na ₂ O	0.46	0.51	0.52	0.56	0.36	0.31	0.52
K ₂ O	5.45	5.50	4.68	4.86	5.35	3.08	5.55
P ₂ O ₅	0.02	<0.10	0.02	<0.01	0.07	0.04	<0.01
LOI	1.31	0.17	1.42	1.76	1.19	1.67	0.92
Total	100.1	101.0	100.8	98.1	100.8	100.7	100.2

Table 18. Amdel Material Analysis Low Al₂O₃ High MgO—Includes Kendi, Stove & Basin

	KL 115	KL 21	KSC3 104	SS 1	SS 9	KR 113	KSS 6	SS 15
	AC 1219/89	AC 1219/89	60/M7860/87	AC 1251/88	32/M7860/8	AC 1219/89	AC 1251/88	AC 1251/88
SiO ₂	66.3	64.0	66.1	65.2	69.3	59.5	70.5	67.6
TiO ₂	0.95	0.92	0.67	0.83	0.79	0.99	0.88	0.82
Al ₂ O ₃	14.8	14.3	15.5	13.0	13.7	15.3	14.5	14.4
Fe ₂ O ₃	5.70	5.60	5.35	4.42	4.36	6.20	4.76	4.76
MnO	0.09	0.05	0.14	0.11	0.04	0.07	0.08	0.04
MgO	2.84	3.46	2.80	4.28	3.86	5.45	2.40	2.80
CaO	0.57	0.47	0.26	1.47	0.74	0.59	0.74	0.29
Na ₂ O	0.77	0.73	0.45	0.60	0.58	0.67	0.55	0.86
K ₂ O	1.33	1.29	1.28	1.34	1.63	1.32	1.54	1.78
P ₂ O ₅	0.27	0.29	0.11	0.18	0.07	0.24	0.18	0.12
LOI	7.25	7.60	6.00	7.20	5.10	9.80	4.52	6.15
Total	100.9	98.70	98.7	98.6	100.2	100.1	100.7	99.6

Table 19. Amdel Material Analysis Low SiO₂ High MgO—Includes 'Rice' Pots & Miscellaneous

	KS 13	KS 14	KS 11	SS 8	SS 43	SS 46
	AC 1253/88	AC 1253/88	AC 1253/88	AC 1251/88	AC 1251/88	AC 1251/88
SiO ₂	62.7	62.9	62.8	64.4	64.6	63.8
TiO ₂	0.70	0.76	0.67	0.82	0.82	0.82
Al ₂ O ₃	20.4	20.4	21.5	19.7	19.7	18.7
Fe ₂ O ₃	3.74	4.24	3.90	6.50	6.10	6.35
MnO	0.02	0.03	0.02	0.06	0.05	0.05
MgO	2.00	2.12	2.56	2.64	2.46	3.16
CaO	0.44	0.06	<0.01	0.58	0.76	0.21
Na ₂ O	0.58	0.44	0.43	0.42	0.42	0.47
K ₂ O	2.40	2.82	2.24	1.76	1.67	1.61
P ₂ O ₅	0.12	0.12	0.10	0.10	0.07	0.09
LOI	6.95	6.00	4.88	2.96	2.46	2.98
Total	100.0	99.9	99.1	99.9	99.1	98.2

Table 20. Amdel Material Analysis Generally High MgO—Includes Whiteware, Jars, Painted Under Glaze Jarlets & Covered Bowls

	SS 13	SS 7	KSC2 1306	KSC2 1315	SS 31	K L/ KR 26	SS 11	SS 12	SS 45	SS 2	SS 9	SS 23	SS 26	SS 5	SS 6
	36/ M7860/ 87	30/ M7860/ 87	53/ AC 1252/88	58/ AC 1252/88	AC 1251/88	AC 1219/89	34/ M7860/ 87	35/ M7860/ 87	AC 1251/88	25/ M7860/ 87	AC 1251/88	AC 1251/88	AC 1251/88	28/ M7860/ 87	29/ M7860/ 87
SiO ₂	71.1	73.8	73.9	73.8	71.3	70.6	69.9	70.3	69.2	72.5	72.0	73.0	70.7	70.1	73.7
TiO ₂	0.73	0.83	0.50	0.36	0.78	0.88	0.86	0.82	0.74	0.84	0.74	0.68	0.77	0.96	0.84
Al ₂ O ₃	17.8	18.3	19.1	17.4	17.8	19.0	18.0	18.0	18.2	19.2	18.1	16.4	20.6	20.8	18.5
Fe ₂ O ₃	1.91	1.99	1.98	1.49	1.90	2.24	1.72	2.24	1.63	2.08	1.83	1.99	1.55	3.14	2.16
MnO	0.01	0.01	<0.01	<0.01	0.01	0.02	0.02	0.01	<0.01	0.01	0.02	0.01	0.01	0.02	0.01
MgO	0.90	0.94	0.81	0.79	0.81	0.89	2.80	1.16	1.08	0.84	0.83	0.75	0.75	0.58	0.94
CaO	0.71	0.18	0.61	0.99	0.17	0.76	0.45	0.63	0.62	0.23	0.50	<0.01	0.24	0.24	0.18
Na ₂ O	0.91	0.35	1.07	1.88	0.42	0.80	0.44	0.56	0.40	0.41	0.56	0.37	0.53	0.40	0.37
K ₂ O	3.44	2.94	2.14	1.90	3.04	2.62	2.50	3.16	3.10	3.28	2.92	2.96	3.14	2.76	3.24
P ₂ O ₅	0.10	0.10	0.10	0.08	0.10	0.12	0.07	0.05	0.05	0.05	0.11	0.05	0.07	0.03	0.08
LOI	1.54	0.93	0.43	0.75	1.73	1.89	4.24	2.20	3.14	1.12	1.35	1.92	1.35	1.67	1.08
Total	99.2	100.4	100.6	99.4	98.1	99.8	101.0	99.1	98.2	100.6	99.0	98.1	99.7	100.7	101.0

Table 21. Amdel Material Analysis Miscellaneous 1—Fits NT or BR (except Above 1.4% MgO). Includes Jars, Basins, Some Celadon Glazed Items & Others

	SS 3	KL 18	KSC2 1223	KL 33	SS 10	KL 17	PKK 9
	AC1251/88	AC1219/89	29/AC1252/88	AC1219/89	33/M7860/87	AC1219/89	AC1253/89
SiO ₂	67.3	67.7	70.2	69.1	71.8	70.2	71.3
TiO ₂	0.82	0.95	0.85	0.94	0.86	1.00	0.73
Al ₂ O ₃	18.2	19.3	19.0	18.0	17.7	18.2	18.3
Fe ₂ O ₃	4.46	4.74	4.18	4.74	4.48	4.66	4.06
MnO	0.13	0.05	0.06	0.08	0.09	0.06	0.22
MgO	1.93	1.64	1.44	2.10	1.49	1.85	1.22
CaO	0.66	1.27	0.41	0.77	0.88	0.61	0.40
Na ₂ O	0.18	0.25	0.37	0.30	0.38	0.31	0.25
K ₂ O	1.16	1.34	1.33	1.21	1.39	1.17	1.32
P ₂ O ₅	0.07	<0.02	0.19	0.03	0.04	<0.02	0.13
LOI	3.30	2.34	2.78	2.72	1.43	2.32	2.08
Total	98.2	99.6	100.8	100.0	100.4	100.4	100.0

Table 22. Amdel Material Analysis Miscellaneous 2

	KKH 7	KKH 50	KSC2 1312	KSC2 1313	KSC2 1002	KSC2 1042	KSC2 1228	SS 13 (2)	SS 32	SS 34	SS 37	P 129	KSC1'83 160
	AC 1253/88	AC 1253/88	55/ AC 1252/88	56/ AC 1252/88	1/ AC 1252/88	5/ AC 1252/88	31/ AC1252/88	AC 1251/88	AC 1251/88	AC 1251/88	AC 1251/88	7/ M 7860/87	17/ M 7860/87
SiO ₂	73.6	68.3	76.5	75.8	70.7	70.8	69.9	65.6	65.9	72.1	68.5	65.3	66.5
TiO ₂	0.80	1.02	0.55	0.71	0.98	0.62	0.98	0.87	0.77	0.80	0.77	0.84	1.00
Al ₂ O ₃	16.4	23.6	16.8	18.0	21.6	22.7	22.2	19.5	19.7	18.6	19.8	20.7	20.3
Fe ₂ O ₃	4.58	2.48	1.41	1.07	3.50	1.99	3.56	7.20	5.80	4.14	6.45	6.65	7.10
MnO	0.04	0.03	0.01	<0.01	0.01	0.03	0.02	0.06	0.05	0.07	0.06	0.06	0.02
MgO	0.82	0.34	0.63	0.47	0.70	0.37	0.73	1.62	1.66	1.00	1.05	0.88	0.84
CaO	0.10	<0.01	0.81	0.51	0.12	0.14	0.11	0.15	0.48	0.35	0.15	0.27	0.19
Na ₂ O	0.56	0.26	1.16	0.98	0.15	0.23	0.14	0.46	0.47	0.22	0.36	0.38	0.61
K ₂ O	1.68	2.72	1.80	2.12	2.24	2.14	2.30	1.86	2.12	1.38	1.73	1.91	1.61
P ₂ O ₅	0.08	0.03	0.09	0.10	0.07	0.08	0.08	0.09	0.08	0.03	0.09	0.06	0.06
LOI	1.50	0.83	0.55	0.71	0.69	1.71	0.80	1.57	1.59	0.89	1.02	3.98	2.38
Total	100.2	99.6	100.3	100.5	100.8	100.8	100.8	99.0	98.6	99.6	100.0	101.0	100.6

Table 23. Amdel Material Analysis Mortars

	KKH 10	KSC1 '83 307
	AC1253/88	15/M7860/87
SiO ₂	68.0	71.9
TiO ₂	0.59	0.83
Al ₂ O ₃	17.9	17.1
Fe ₂ O ₃	8.50	5.60
MnO	0.04	0.03
MgO	0.86	0.72
CaO	<0.01	0.50
Na ₂ O	0.43	0.50
K ₂ O	1.91	1.83
P ₂ O ₅	0.04	0.04
LOI	1.34	1.18
Total	99.6	100.2

Table 24. Amdel Material Analysis Painted Under Glaze—Plates & Bowls—Includes Fish, Shell & Chakra Decorations

	KKH 38	KSC2 1081	KSC2 1265	KSC2 1292	SS 10	SS 27	SS 30	SS 5	SS 6	KSC2 1308
	AC 1253/88	16/AC 1252/88	47/AC 1252/88	49/AC 1252/88	AC 1251/88	AC 1251/88	AC 1251/88	28/M7860/87	29/M7860/87	54/ AC 1252/88
SiO ₂	74.1	73.9	75.5	73.5	70.9	72.6	72.1	70.1	73.7	75.5
TiO ₂	0.84	0.55	0.92	0.89	0.77	0.79	0.68	0.96	0.84	0.91
Al ₂ O ₃	17.4	18.8	18.5	17.8	18.8	19.2	18.1	20.8	18.5	18.3
Fe ₂ O ₃	2.96	1.73	1.83	1.86	2.18	2.16	1.67	3.14	2.16	1.94
MnO	0.03	<0.01	0.02	0.02	0.02	<0.01	0.01	0.02	0.01	0.02
MgO	0.32	0.48	0.28	0.30	0.66	0.47	0.44	0.58	0.94	0.30
CaO	<0.01	0.24	0.18	0.27	0.21	<0.01	<0.01	0.24	0.18	0.32
Na ₂ O	0.47	1.55	0.45	0.44	0.49	0.53	0.78	0.40	0.37	0.43
K ₂ O	1.93	2.40	2.60	2.48	3.08	3.10	3.40	2.76	3.24	2.38
P ₂ O ₅	0.03	0.04	0.08	0.03	0.08	0.04	0.05	0.03	0.08	0.10
LOI	0.95	0.58	0.68	0.61	0.96	0.53	0.95	1.67	1.08	0.54
Total	99.00	100.3	101.0	98.2	98.2	99.4	98.2	100.7	101.0	100.7

Table 25. Amdel Material Analysis Painted Under Glaze—Plates & Bowls—Floral Decoration

	KSC2 1264	KSC2 1315	KSC2 S3	KSC2 105	KSC2 1011	KSC21012	KSC21089	KSC2 1110	SuphS15	KSC2 1084	KSC2 1097	KSC2 1254	KSC2 1306
	46/ AC 1252/88	58/ AC 1252/88	37/ M7860/87	38/ M7860/87	3/AC1252/88	4/AC1252/88	19/ AC 1252/88	22/ AC 1252/88	AC 1219/89	17/ AC 1252	20/ AC 1252/88	45/ AC 1252/88	53/ AC 1252/88
SiO ₂	74.4	73.8	74.2	75.3	77.1	77.2	76.0	77.6	73.2	74.2	73.7	77.4	73.9
TiO ₂	0.87	0.36	0.92	0.95	0.92	0.88	0.90	0.88	0.90	0.83	0.84	0.52	0.50
Al ₂ O ₃	17.8	17.4	17.1	17.6	16.6	16.5	17.9	16.5	18.9	16.8	17.2	16.5	19.1
Fe ₂ O ₃	2.02	1.49	2.36	2.16	1.99	2.52	1.89	1.69	2.48	2.06	2.06	1.12	1.98
MnO	0.03	<0.01	0.04	0.04	0.05	0.06	0.03	0.05	0.02	0.03	0.03	0.01	<0.01
MgO	0.28	0.79	0.38	0.35	0.32	0.34	0.29	0.29	0.36	0.34	0.33	0.58	0.81
CaO	0.20	0.99	0.26	0.37	0.20	0.26	0.14	0.13	0.24	0.16	0.15	0.77	0.61
Na ₂ O	0.41	1.88	0.62	0.60	0.51	0.51	0.51	0.42	0.49	0.55	0.62	1.20	1.07
K ₂ O	2.46	1.90	2.62	2.66	2.12	2.12	2.54	2.36	2.34	2.50	2.52	1.93	2.14
P ₂ O ₅	0.04	0.08	0.02	0.09	0.07	0.07	0.01	0.01	<0.02	<0.01	<0.01	0.08	0.10
LOI	1.35	0.75	1.60	0.99	0.95	0.52	0.54	0.72	0.41	0.72	1.61	0.56	0.43
Total	99.9	99.4	100.1	101.0	100.8	101.00	100.8	100.7	99.3	98.2	99.0	100.7	100.6

Table 26. Amdel Material Analysis Pots—Described as ‘Rice’ Pots

	KSC1 1983 64/M 7860/87	KSC 1983 603 19/M7860	KSC2 1983 50 20/M7860	KS 11 AC 1253/88	KS12 AC 1253/88	KS13 AC 1253/88	KS14 AC 1253/88	KSC2 1217 26/AC 1252/88	KSC2 1223 29/AC 1252/88	KSC2 1247 43/AC 1252/88	KSC2 1297 50/AC 1252/88	P17 5/ M7860/87
SiO ₂	68.3	69.6	72.2	62.8	48.7	62.7	62.9	70.5	70.2	67.3	69.4	70.5
TiO ₂	0.83	0.81	0.88	0.67	0.63	0.70	0.76	0.82	0.85	0.84	0.84	0.77
Al ₂ O ₃	16.6	18.9	17.7	21.5	17.5	20.4	20.4	19.5	19.0	19.7	17.7	16.6
Fe ₂ O ₃	7.3	4.96	4.38	3.90	3.94	3.74	4.24	4.52	4.18	6.30	4.68	4.94
MnO	0.02	0.03	0.02	0.02	0.04	0.02	0.03	0.03	0.06	0.03	0.03	0.03
MgO	0.64	0.80	0.68	2.56	10.5	2.00	2.12	1.02	1.44	0.79	0.61	0.69
CaO	0.19	0.22	0.21	<0.01	<0.01	0.44	0.06	0.26	0.41	0.42	0.25	0.12
Na ₂ O	0.39	0.55	0.50	0.43	0.21	0.58	0.44	0.39	0.37	0.61	0.47	0.38
K ₂ O	1.26	1.82	1.81	2.24	2.06	2.40	2.82	1.48	1.33	1.51	1.59	1.60
P ₂ O ₅	0.01	0.07	0.05	0.10	0.13	0.12	0.12	0.16	0.19	0.11	0.10	0.05
LOI	2.52	2.74	2.26	4.88	17.2	6.95	6.00	1.72	2.78	3.22	3.40	4.14
Total	98.1	100.5	100.7	99.1	100.9	100.0	99.9	100.4	100.8	100.8	99.1	99.8

Table 27. Amdel Material Analysis Round Bottomed Basins

	KSC1 '83 279 16/M7860/87	P 543 4/M7860/87	SS 9 32/M7860/87
SiO ₂	67.9	62.9	69.3
TiO ₂	0.82	0.88	0.79
Al ₂ O ₃	18.9	20.5	13.7
Fe ₂ O ₃	5.75	5.30	4.36
MnO	0.10	0.04	0.04
MgO	1.17	3.16	3.86
CaO	0.96	0.25	0.74
Na ₂ O	0.59	0.25	0.58
K ₂ O	1.59	1.37	1.63
P ₂ O ₅	0.34	0.10	0.07
LOI	2.12	6.25	5.10
Total	100.2	101.0	100.2

Table 28. Amdel Material Analysis Stoves

	KSC1 '83 320 14/M7860/87	KSC3 104 60/M7860/87
SiO ₂	70.2	66.1
TiO ₂	0.75	0.67
Al ₂ O ₃	16.2	15.5
Fe ₂ O ₃	5.50	5.35
MnO	0.02	0.14
MgO	0.71	2.80
CaO	0.18	0.26
Na ₂ O	0.65	0.45
K ₂ O	1.72	1.28
P ₂ O ₅	0.01	0.11
LOI	2.20	6.00
Total	98.1	98.7

Table 29. Amdel Material Analysis Whiteware—Lids & Bowls

	SS 13 36/M7860/87	SS 42 AC 1251/88	SS 56 AC 1251/88	SS 57 AC 1251/88
SiO ₂	71.1	71.5	70.8	74.1
TiO ₂	0.73	0.71	0.09	0.08
Al ₂ O ₃	17.8	18.2	20.2	19.5
Fe ₂ O ₃	1.91	1.60	1.66	1.39
MnO	0.01	<0.01	0.07	0.04
MgO	0.90	0.65	0.22	0.38
CaO	0.71	<0.01	0.41	0.38
Na ₂ O	0.91	0.66	0.90	0.88
K ₂ O	3.44	3.18	3.54	3.00
P ₂ O ₅	0.10	0.09	0.09	0.07
LOI	1.54	1.66	0.23	1.03
Total	99.2	98.2	98.2	100.8

Table 30. Estimated Rough Timeline of Sites Holding Jars of the Type Recovered from Shipwrecks of the Thai Gulf.

Note: Although a particular item other than a jar may have been described by researchers as coming from a site, this author did not necessarily record such an item during investigation.

SITE /REF No.	ESTIMATED OR KNOWN DATE	JAR TYPE	OTHER FINDS
Bo Dili 235, the Philippines		Type 4.1d	
Sarawak, Plate X		Type 4.1d.	
Sarawak, 3037		Type 4.1d	
Sarawak, 3420		Type 4.1d	
Gedong 222/806, Sarawak Museum		Type 4.3	Kwantung ware
Bungiao 202, the Philippines		Type 4.3	Sukhothai, ? Kalong
Pangil 146, the Philippines		Type 4.3	
Ban Bang Pun kilnsite, Suphanburi Province, Thailand		Type 4.1.1, Type 4.1.2	Refer to publications
Si Satchanalai kilnsite, Sukhothai Province, Thailand		Type 2, Type 3.	Refer to publications
Phitsanulok kilnsite, Sukhothai Province, Thailand		Type 2, Type 3.	Refer to publications
Rang Kwien shipwreck site	C14 1270±60	Type 1.1, Type 1.2.	MON Thai, Vietnamese, Chinese
Bakong 322/120, Sarawak Museum		Type 3 .	
Sha Tsui shipwreck site, High Island, Hong Kong	1290±80	Type 1.2, Type 3	Simple pin prick decoration as Si Satchanalai ware. Simple Thai celadon. Ref: pressed earthenware KSC3, Pattaya, Ko Khram
Turiang shipwreck site	Estimated c. 1370, C14 1305–1440	Type 1.1, Type 1.2, Type 3	Suphanburi jar. Sukhothai painted under glaze fish and floral. Si Satchanalai green glazed and brown glazed items, Chinese celadon wares and brown glazed wares. Vietnamese wares
Ko Si Chang 2 shipwreck site	+1403	Type 1.2, Type 1.3, Type 3	Thai painted floral and fish designs. Some items have fish designs on cavetto. Fish designs more controlled than those of Ko Khram shipwreck site. Chinese celadons and probable Vietnamese wares. Datable coins
Nanyang shipwreck site, CP35	±1370	Type 1.2, Type 4.1a	Thai incised celadon. Chinese storage jars
Longquan shipwreck site	±1400	Type 1.2.	Sukhothai fish plates, more simple than Ko Khram. Simple floral. Thai incised celadon. Chinese wares
The Philippines		Type 2.	
Marane or Pulau Bakau shipwreck site	1368–1424/30–50 (Brown 2004)	Type 1.1, Type 1.2.	Sukhothai and Si Satchanalai simple floral painted under glaze. Sukhothai fish with plain cavetto, Si Satchanalai early celadon. Si Satchanalai brown glazed jarlets. Vietnamese wares
Batangas BB TRB SQ8988, the Philippines		Type 4.1d	
Karitunan KR356, the Philippines		Type 4.1d .	
Palapat Uy GR75 61 .H.41, the Philippines		Type 4.1d	
Puerto Princesa, the Philippines		Type 4.1d	
Pangil 146, the Philippines		Type 4.3	
Bungiao 202, the Philippines		Type 4.3 .	Sukhothai, ? Kalong
Penny's Bay, Hong Kong		Type 1.1.	
Puerto Galera, the Philippines 64-1-162, 64-1-174		Type 1.1, Type 2, Type 4.1d, Type 4.3.	
Puerto Galera shipwreck site A17		Type 4.3	
Puerto Galera, Father Thiel		Type 4.3.	
Fernandez collection, the Philippines		Type 4.2, Type 4.3.	
San Carlos Museum CA 00299		Type 4.3.	
Mae Nam Noi kilnsite, Singburi Province		Type 2.	Refer to publications
Kg Kinlap 1973.104, Brunei Museum		Type 3	Sukhothai and Vietnamese wares
Medieval shipwreck site (C5–15th) Nos 2, 3, 1		Type 3 Type 4.2.	Sukhothai fish. Fairly simple Thai celadons.

Punta Sunog PS-177 GR75, 113, 119,105, the Philippines		Type 3, Type 4.1d, Type 4.3, Type 4.4b	Thai celadons, incised
Palapat Melian 011, 069, 088 the Philippines		Type 4.1b, Type 4.2, Type 4.9	Thai painted under glaze covered bowls. Simple incised celadon. Thai whiteware – covered jar. Probable Sukhothai painted items. Chinese Longquan
Mactan Island 71-9-5, the Philippines		Type 4.2	
Mae Nam Noi kilnsite, Singburi Province		Type 4.1c.	Refer to publications
Hoi An shipwreck site Fig.1.	Latest coin 1408. 1449±50	Type 4.2	Vietnamese blue and white similar to Ko Si Chang 3, Si Satchanalai black painted under glaze (according to WA Art Auctions, 2006)
Okinawa Fig.2 No.6, Fig.1 No.5, Fig.1 No. 44	(proposed 1430–80)	Type 4.1a., Type 4.1b	
Ko Khram shipwreck site Fig.8, KKH5, KKH3, Fig.12b, Fig.39, KKH1	estimated to be circa 1450-1487, Brown (2004)	Type 1.1, Type 4.1a, Type 4.1b, Type 4.1c, Type 4.9, Type 4.11	Thai celadon, incised simple floral. Painted Sukhothai fish and floral. Vietnamese wares. Earthenware pots with pressed decoration.
Royal Nanhai shipwreck site CP35 Plate 91, CP69 (given as from the Mae Nam Noi kilnsite)	±1460	Type 4.1a Type 4.3	Thai celadon. Bowl as KSC3 3 (Green and Harper (1987) Fig.23. Chinese brown glazed jarlets. Chinese ceramics dated 1450-64
Palapat Melian 071, the Philippines		Type 4.1a	
From Melanau, Sarawak 322/36		Type 4.1.	
Phu Quoc shipwreck site Fig.16		Type 1.1, Type 4.1d, Type 4.3.	Thai celadon bowl – complex lotus decoration. Jarlets - white to near black glaze
Mae Nam Noi kilnsite, Singburi Province K2Ge9 etc.		Type 4.3	Refer to publications
Shuri Castle Nos 5 &44, Fig.1 No.3, Fig.1 Nos 1 & 2, Fig.1 No.44, Okinawa, Japan		Type 4.1b, Type 4.3, Type 4.4b Type 4.11	
Ko Si Chang 3 shipwreck site KSC3 2, 151, 317 etc, KSC3 38 etc., KSC3 2201C 26 etc. (3 internal marks), KSC3 424, KSC3 487	Brown(2004) dates at circa 1470. (Similar blue wares on Pandanan). Some similar wares to Brunei Darussalam (late 15th, early 16th century)	Type 4.1b, Type 4.2, Type 4.3, Type 4.4a, Type 4.4b	Vietnamese and Chinese blue and white decorated ceramics. Earthenware pots with pressed decoration. Ref: Royal Nanhai bowl as Brown and Sjostrand (2002) Colour Plate 66. Some shapes and designs of blue and white decorated items similar to items from the Brunei Darussalam ship
J. Toralba 135, the Philippines		Type 4.3	Similarities to bowls Royal Nanhai CP 66 and KSC3 3, Green and Harper (1987) Fig. 23
Verde Island 189, the Philippines		Type 4.2	Thai celadon cross hatch incised. Bottle ring handles
Karitunan 216/2009, the Philippines		Type 4.3 (5 internal marks).	
Mae Nam Noi kilnsite BRSF23, SF4,SF19K2Ge11		Type 4.1b, Type 4.4c, Type 4.5	Refer to publications
Pattaya shipwreck site P16, P15, P371, P13, P31, P9 etc.		Type 4.1a, Type 4.1b, Type 4.2 Type 4.3	Thai celadon—incised simple cross hatch. Chinese blue and white (one sherd). Refer Sha Tsui earthenware, Turiang, KSC 1 & KSC3 earthenware pots with pressed decoration
Sumbiling 67-212, Brunei Museum		Type 4.2	
Calatagan 185, 186, the Philippines		Type 4.1d, Type 4.2	Timeline of Thai wares falling between Pattaya and Ko Kradat shipwreck sites. Chinese items. Many Si Satchanalai items – whiteware, painted wares, covered bowls, brown jarlets, celadon incised – linear and cross hatched
Bahuguhan Cave 175, 184, 153, 176, 147 etc., 182, 174, the Philippines		Type 4.1b Type 4.2, Type 4.3, Type 4.4a, Type 4.4c	Thai celadon and jars.
Ko Samui shipwreck site 84/.1/85, KS1,17 2/1/85, 61, 15, KS/RH/84/85.3, KSC1 723	(c. 1500–1510, Brown (2004))	Type 4.1a, Type 4.1d, Type 4.3, Type 4.4a, Type 4.5b, Type 4.7, Type 4.8	Mortar. Thai celadon—perpendicular linear cross hatching. Chinese celadon and blue and white ceramics. Note: Ko Samui numbering is of this author only
Lobang Imam 322/40, Niah, Sarawak Museum		Type 4.3	Kalong
Jakarta National Museum 379/174		Type 4.3	
Saba Ujong 1965.786, Brunei		Type 4.3	
Sabah Museum 2857		Type 4.3	

Brunei Darussalam shipwreck 20, 6876, 1890/181, BD749 or 747, Type 2 page 55	Late 15th early 16th century	Type 4.1b, Type 4.2 (3 internal marks), Type 4.3, Type 4.4, Type 4.7	Thai celadon incised cross hatch. Chinese celadon and blue and white ceramics
Iwahu 234, the Philippines		Type 4.1a	None recorded by this author
Tutong 1968-163 15E, 1967.815, Brunei		Type 4.1a, Type 4.6	
Mukah 71-14 15E, 1971.12, Brunei		Type 4.1a, Type 4.2	
Niah 1965-1295 15E, Brunei		Type 4.1a	
Bulumanis 2615, Java		Type 4.1d	
Magala, Niah Plate 126, Sarawak		Type 4.1d	
Indonesia, No. 350		Type 4.1d	
Kay Bungo 115, the Philippines		Type 4.1d	None recorded by this author
Singtai shipwreck site, Plate 69. 530		Type 4.9	Si Satchanalai covered bowls, brown glazed jarlets, white glazed potiche. Sukhothai painted under glaze bowls – sunburst, chakra decoration
Mae Nam Noi kilnsite K2GE2		Type 4.1c, Type 4.9	Refer to publications
Ko Samae San underwater site No No.1986 etc., SS4, No No.1, No No.1&2, 31/M7860/87		Type 4.1c, Type 4.1d, Type 4.6, Type 4.9	Thai – simple incised celadon. Painted under glaze shell and chakra motifs; covered bowls; whiteware; brown jarlets. Items resembling Mae Nam Noi kilnsite wares. Chinese blue and white ceramics. Note: Ko Samae San numbering is of this author only
Ko Kradat shipwreck site 26, 34, 35, 36, 38	Jia Jing 1522–66, possibly Wanli	Type 4.1c, Type 4.5c, Type 4.9	Painted under glaze jarlets, one painted bowl sherd. Painted covered bowls. Whiteware. Brown ware. Chinese blue and white. No celadons
Tutong 1967.815, Brunei		Type 4.6	
Prachuap Khiri Khan shipwreck site PK1, PK25, PK13, PK14, PK24, PK26, PK27		Type 4.1c, Type 4.6, Type 4.7, Type 4.9	Thai wares resembling Mae Nam Noi kilnsite products.
Museum Brunei 1965.1294		Type 4.7	
<i>Sao Joao</i> shipwreck site 81/22	1552	Type 4.9.	
Museum Sultan Abu Bakar 148,151,153, Pahang, Malaysia	Type 4.9		
<i>Sao Bento</i> shipwreck site 36 etc	1554	Type 4.9	Simple celadon, probably Thai, possibly resemble Pattaya shipwreck finds. Chinese blue and white (probably produced around similar period as Ko Rin shipwreck wares)
Kuantan 152, Malaysia		Type 4.9	
Mae Nam Noi kilnsite K2GE13 etc.		Type 4.9	Refer to publications
Ko Rin shipwreck site KL34, KL19		Type 4.1c, Type 4.9	Thai bottles. Brown glazed jarlet and potiche. Painted jarlets and covered bowls. Chinese blue and white ceramics. Refer to Ko Samae San finds. No celadon wares, No painted Thai plates or bowls
Ko Si Chang1 shipwreck site KSC1'83 135/, 723,677 etc. 1573-1619	1573–1619 Wanli	Type 4.1c, Type 4.8, Type 4.9	No celadon. No painted Thai etc. Chinese blue and white porcelain and brown-black glazed jar with incised character
Seychelles shipwreck site Fig, 15	Late 16 th century	Type 4.9	Beardman jugs
<i>Santiago</i> shipwreck site 81/5(5)	1585	Type 4.9	
<i>San Diego</i> shipwreck site 2659,1707,1473,2819,5262	1600	Type 4.3, Type 4.5b, Type 4.7, Type 4.9	Chinese blue and white ceramics (Kraak ware), Tan (2006)
<i>Witte Leeuw</i> shipwreck site 12211 etc	1613	Type 4.9	Chinese blue and white ceramics (Kraak ware). Chinese jars
<i>Batavia</i> shipwreck site BAT608A etc.	1629	Type 4.9.	Beardman jugs
<i>Nuestra Señora de la Concepción</i> shipwreck site A616 (marked), A325	1637/8.	Type 4.3 Type 4.9	Chinese blue and white ceramics (Kraak ware). Chinese jars
Mae Nam Noi kilnsite K2Gh4 etc.		Type 4.10	Refer to publication
<i>Vergulde Draeck</i> shipwreck site 1046, 913	1656	Type 4.9, Type 4.10	Asian smoking pipe. Beardman jugs. Chinese blue and white ceramics
Fort Jesus, Mombasa Fig 39(1)	late 17th century	Type 4.9	
Salatiga 4069, Java		Type 4.10	
Jakarta Museum 2761		Type 4.10	
<i>Risdam</i> shipwreck site Fig 9B	1727	Type 4.10	No Asian ceramics. Tin ingots

SUMMARY OF CERAMIC FINDS FROM THE SHIPWRECKS DISCUSSED IN REPORT

The positioning of sites on the Sites Table 30 on page 141, has been dictated by the known dates of ship wrecks, datable coins or ceramics, Carbon 14 dating and the similarity to items recovered from one site to another, including jar types. In many cases an estimation only has been allowable. Many sites for example are represented by one jar and are placed where that group of jars is most highly represented on the Table. Even though some sites are some distance apart on the Table the time span may in fact be quite short. To make an exact placement of the sites on the time line is difficult. A site may have a ceramic similar to one from what is thought to be an earlier site, together with another estimated to be of a slightly later period.

It is likely that the particular style of glazed jars recovered from the wreck sites of the Thai Gulf had their prototype in China. Those jars described as Kwantung Ware by Moore (1970), with a thick glaze almost to the foot, appear to be the precursor to the surface finds recovered at the Si Satchanalai kilnsite. As indicated, Hein records that jars similar to Type 4.1 were manufactured at Si Satchanalai. These were thickly glazed to the upper three quarters of the body. A jar base sherd from the Ko Si Chang 2 site (KSC2 1233), glazed almost to the base, had an Amdel result of Nong O. Such a result indicates that it is likely that this item was manufactured at the Si Satchanalai kilnsite.

Because of close visual resemblance to Phitsanulok items, it may be that those kilns were the place of manufacture of some of the jar finds in this report. However, Amdel testing shows a wide variation in chemical composition between Phitsanulok and Thai KN in terms of Fe_2O_3 , Na_2O and MgO . The Phitsanulok result is perhaps closer to MON KN, the biggest variation in content being the percentage of MgO .

A timber from the Rang Kwien ship was carbon dated at 1270 ± 60 . Brown (2004) dates this ship as around 1368–1424/30 up to 1450. Ship structure and ornamentation indicated that it had its nascence in China. The vessel carried Chinese and Vietnamese items together with a product of the Si Satchanalai kilns, a bowl of the type designated as MON (Most Original Node), having an early type light olive green celadon glazed interior. See Harper (1984) KNSF662 & 628 for similar finds from the Si Satchanalai kiln site. Other earthenware finds such as lids and pots with pressed decoration correspond with common finds from other Thai wreck sites. Also amongst the recovered items was a jar estimated to have been manufactured in the vicinity of the Ban Bang Pun kiln site, Suphanburi (Green & Harper, 1987, Fig. 41). Apart from the Suphanburi jar no other jars from this site were described as being from the Thai kilns.

The Turiang site, through a combination of factors, was dated by Brown and Sjostrand (2002: 45) at *c.* 1370. In part, the dating was made by the determination that ‘Si satchanalai fish plates were made for a short period (of) decades, about the middle of the 14th century’. The Turiang load in fact was quite similar to that of the Ko Si Chang 2 ship dated by coinage 1403–1424/5. The Ko Si Chang 2 ship carried Si Satchanalai fish and floral decorated plates of which the clay body in some cases was like that of the Turiang wares

described by Brown and Sjostrand as being grainy, grey with black-speckling.

One distinguishing feature which may ultimately assist in establishing a more precise relationship between sites is the fact that the Ko Si Chang 2 had both scroll and dash motifs (classed by Hein, 2001: Fig. 39e), as Transitional Ware), on the rims of the painted under glaze items. It is unknown by this author, whether the Si Satchanalai fish plate from the Turiang site had these dashes. The Sukhothai items from the Turiang site (Brown & Sjostrand CP7–12) show linear or simple scrolling. On the other hand, Sukhothai finds from the Ko Khram ship had linear decorations, together with a simple, hastily executed scroll decoration that is almost a dash.

The Maranei site, which also carried Suphanburi jars, Brown (2004) Plate 28, together with probable Thai storage jars, had a plate with a *doc mae* centre but plain cavetto, Brown (2004) Plate 24, M13/9. The fish plates recovered from the Maranei ship are of the Sukhothai style with a plain cavetto and linear decorated mouth rim. Artefacts from the Maranei site have an affinity to both the Ko Si Chang 2 and the Ko Khram sites.

Another item of interest is Brown and Sjostrand Fig. 25a), a Si Satchanalai fish motif, painted under glaze item from the Turiang site, which has three spur marks. The only Ko Si Chang 2 item with possible spur marks was KSC2 1308 with a grey body and black and white inclusions.

Similar finds from the two sites, Ko Si Chang 2 and Turiang, include Chinese celadons, Suphanburi jars, Thai wares and pressed earthenware pots with elongated necks. The Turiang ship was constructed with iron nails, Brown and Sjostrand (2002), as was the Ko Si Chang 2 vessel.

The shape, decoration and body type of the painted under glaze plates and bowls from the Ko Si Chang 2 ship are closely aligned between the Si Satchanalai and Sukhothai product illustrating that the sites were likely to have been operating concurrently at the time of the Ko Si Chang 2 wreck. Ko Si Chang 2 finds can be compared to Hein, 2001: Fig. 39b & c (Transitional Wares) floral (*doc mae*) centre and fish cavetto and Fig. 48 (Sukhothai ceramics). Fig 48a, c & d closely resemble items from the Ko Si Chang 2 which Amdel results confirm to be of Si Satchanalai provenance.

Celadon plates from the Nanyang and Longquan wrecks apparently had an entirely different clay body to the painted under glaze items from the Turiang wreck in that they were of better quality, compact, whitish and more highly fired, Brown and Sjostrand (2002). There were no painted wares on the Nanyang ship and no painted fish plates or bowls of a Si Satchanalai origin on the Longquan ship. The Nanyang and Longquan sites had Suphanburi jars whilst the Nanyang had a Type 4.1a) jar.

Some of the Si Satchanalai celadon plates from the Nanyang, shown by Brown and Sjostrand had central spur marks, as CP28 (three marks). It may be significant that CP32, a celadon bowl from the Nanyang has a different shape to the Ko Khram celadon bowls but has the same shape as a painted under glaze bowl from the Ko Khram (KKH34), dedicated a Sukhothai provenance.

The Longquan ship (*c.* 1400), according to Brown and Sjostrand, had Sukhothai fish and floral items more simply

decorated than items from the Ko Khram. Some of the Ko Khram items were decorated with brush strokes on the cavetto, but even when this was not the case, the Ko Khram item was more detailed. The Longquan celadon items are said to have a plain exterior whilst the Ko Khram items are linear incised.

Brown (2004) estimates the Ko Khram site as 1450–1487. This site had an item which is likely to be from Suphanburi (KKH7 above) together with Sukhothai items with fish decoration and brush stroke on cavetto. Si Satchanalai incised celadon items from this site (with no spur marks) appear to fit Hein (2001: Fig. 40 Transitional ware) as opposed to the more simply decorated items recovered from the Pattaya site, classed as Later Stoneware. A mortar of the type made at Si Satchanalai was amongst the wares, as were ceramics estimated to be from Vietnam. Though none were recovered during the Thai-Australian expeditions, it is said that Type 4.9 jars were recovered from this site and if these jars were manufactured at the Mae Nam Noi kilns, it is the earliest known date of manufacture (by this author) for this type of jar. It is estimated that the Ko Khram and Shuri Castle jars are probably about the same era, having similarities in Types 4.1b), 4.4b) & 4.11 jars. The proposed dating of this vessel concurs with the records of jars going into Ryukyu between 1430 and 1470.

Apart from glazed jars, the ‘Medieval vessel’, Christies (1989) had Sukhothai plates, Si Satchanalai incised celadon plates with no apparent spur marks, ring handled bottles and Chinese celadon amongst other wares. The small ‘palm sugar’ pots and earthenware pots with pressed decoration and earthenware lids with lotus bud and knob handles appear similar to those from the Ko Si Chang 3 site, Green *et al.* (1987) including the colour and body type.

The Hoi An ship, dated through coinage (the latest being 1408), and C14 at 1459±50, held Sukhothai style painted under glaze wares (fish and floral) with five spur marks, according to WA Art Auctions Catalogue (2006). Incised celadon plates No.34–44, with central lotus flower and stylized lotus (resembling onion skin) on the cavetto had nil to four spur marks. In comparison to the celadon items of the Nanyang and Longquan (as described above), the Hoi An celadons seen at the auction by this author, appeared to have a deteriorated glaze with a beige, some with a dark grey, tubular support mark. Very few spur marks were recorded on the many painted under glaze and celadon incised surface finds drawn and photographed by Harper (1984 & 1987) at the Si Satchanalai kilns. Hein (1985) records, however, that spurred disc supports were recovered in the excavation of Kiln 42, more particularly at the lower levels. Unfortunately, much of this was back fill, and no specific dating was able to be determined at the time.

Vietnamese ceramics reportedly recovered from the Hoi An site were similar in shape and design to some from the Ko Si Chang 3 site, such as Green *et al.* (1987) KSC3 350. The jar Type 4.2 was also common to both sites. Additionally, Ko Si Chang 3 bowls, estimated to be Chinese or Vietnamese (KSC3 481 and KSC3 13) are very similar to those from the Pandanan site, the Philippines, as shown by Brown (2004) Plate 52, denoted a date of circa 1470. Interestingly, a bowl sherd with similar decoration was recorded at Si Satchanalai, Harper (1984: 29) KNSF 661.

The Royal Nanhai ship (c. 1460) carried well executed celadon plates, bowls and jars with no spur marks, which this author ascertained as likely to be towards Hein’s (2001) Later Stoneware. A bowl similar to one from Ko Si Chang 3 (KSC3 3) was also recovered. This supports a similar dating for these two sites, though the Ko Si Chang 3 had no Thai painted under glaze or celadon wares. The J. Toralba Philippine site also had a bowl similarly shaped to KSC3 3. The KSC3 3 bowl with an indented rim contrasts with similarly shaped bowls (but with a rolled rim) from the Ko Samae San site, possibly roughly delineating a time period of pre- and post-production of Type 4.9 jars, part of their identity being a rolled rim. The bowl with incised rim, recovered together with rolled rimmed jars from the Prachuap Khiri Khan site makes this theory questionable.

Though the jar find from the Mae Nam Yom, Type 4.4b) may resemble finds from the Ko Si Chang 3 ship, it is again significant that no painted under glaze wares or celadon wares produced at Si Satchanalai were recovered from the Ko Si Chang 3 site.

Glazed jars from the Royal Nanhai ship included Types 4.1a) and 4.3 whilst the Ko Si Chang 3 ship carried Types 4.1 and 4.3. There is also a relationship between Ko Si Chang 3 and Shuri Castle because of the similarity of jar Type 4.1b) and Type 4.3.

The types of jars (though not necessarily with the same rim treatments), the placement of smaller jars inside larger ones during firing and the use of spurred supports at the neck during firing connect the Ko Si Chang 3 and Brunei Darussalam sites.

Apart from the similarities in Type 4.3 jars, there is also a connection between the Pattaya and Brunei Darussalam site in that their celadons have the simple linear and cross hatched patterns described by Hein (2001) Fig. 42 as Later Stoneware. This material is similar to an item from Si Satchanalai, Harper (1984) PYSF1304. The *São Bento* site (1554) also has simple celadon sherds, possibly similar to the items from the Pattaya site. Rim sherds of Chinese blue and white Ming dynasty material with borders of diamond diaper patterns were recovered from both the Pattaya and *São Bento* sites however there were no corresponding jars between the two sites.

Like the Pattaya site, the Ko Samui wreck had Si Satchanalai incised celadon material including Later Stoneware cross hatch designed plates, a glazed jarlet and a ring handled bottle probably like the incomplete item from Pattaya, Green and Harper (1983) P14. A mortar, shaped like those of the Mae Nam Noi product but with a pink-grey body and inclusions, was recorded from this site. Many of the Ko Samui jars differ somewhat in style to other jars of similar type. Ko Samui jars Types 4.1a), 4.4a) and 4.8 were most like those recovered from other Thai wreck sites investigated by our team. Other finds included Chinese blue and white ceramics and Longquan celadon. Brown (2004) dates the Ko Samui site as circa 1500–1510.

Incised, cross hatched celadon of a similar ilk to that found on the Pattaya ceramics were also recovered from the Santa Cruz site, the Philippines, Brown (2004 Plate 62, SC475. An incised bottle, Plate 62, SC1590 from the Santa Cruz (dated circa 1488–1505) is also like the Pattaya item, Green and Harper (1983) P14.

The Ko Kradat site (after 1522) had no celadon wares. There were many painted under glaze covered bowls with lotus and mangosteen handles, such as are recovered at Ban Pa Yang, Si Satchanalai. There was one bowl rim sherd only, of a painted under glaze decorated item which was denoted to be of Si Satchanalai origin at the time of recovery. White and brown glazed jarlets and other items were also recovered. A group of bottles was determined to be of Si Satchanalai origin. There is a distinct familiarity reflected between these items and products from the Kalong kilns, northern Thailand, Shaw (1981). The dating of the Ko Kradat vessel was estimated by an inscribed plate fragment translated as having been made in the Jia Jing reign (1522–66). There has been some discussion around the possibility that some of the blue and white wares recovered from the Ko Kradat site may in fact be of the Wanli Period (1573–1619) or later. This furthers the estimated period of operation of the Si Satchanalai kilns. Interestingly, Pijl-Ketel (1982: 195) relates that two Swatow bowls recovered from the *Witte Leeuw* site (1613) are identical to items recovered from the Ko Kradat site.

The Española site, Brooks Point, Palawan, has finds contiguous with the Ko Kradat site, with covered bowls, Brown (2004) Plate 66, ES0134 and 287 comparing to the Ko Kradat Nos. 60–63 and 95–99, Green, Harper & Prishanchittara (1981). The covered bowl is also recovered from the Singtai, Brown (2004) Plate 68 S93, though the decoration appears to differ to that of the Ko Kradat and Española. A *potiche* lid, Brown, Plate 67 ES0516 compares to the Ko Kradat item KK148 whilst the shape of the *potiche* is similar to the Ko Rin item KL26. Brown handled bottles/jarlets of the type recovered from the Ko Kradat and Ko Rin were recovered from the Española site and also from the Singtai, Brown, Plate 68B.

The Ko Rin and Ko Samae San sites had covered bowls from Si Satchanalai. Perhaps of significance in the dating process is the observation that the decoration of the Ko Kradat and Ko Samae San covered bowls varies slightly. Bowls from the Ko Samae San were decorated with the quite simple chakra design. Underpainted wares of the chakra and conch are designated as Later Stoneware, Hein (2001: 135) Fig. 44.

Significantly, neither the Ko Kradat or Ko Rin sites had Sukhothai wares. Nor did the Pattaya site apart from a sherd of a celadon type glazed bowl with a tubular support mark which reached a Sukhothai result through material analyses. The Ko Samui site had no covered bowls or Sukhothai wares but it did have glazed jarlets which could be of Later Stoneware as Hein (2001: 134) Fig.43. The Pattaya ship had simple incised celadons of the Later Stoneware type Hein (2001: 133) Fig. 32.

There is therefore, much support for the theory that Sukhothai production had finished, or was in the throes of doing so, whilst the kilns at Si Satchanalai were still functioning, particularly those producing covered bowls.

It is likely that the Type 4.1c jars developed around the time when an increase in production of Type 4.9 jars commenced, around the period of the Ko Kradat ship (not withstanding those reportedly recovered from the earlier Ko Khram ship). It is notable however that the Type 4.9 jars from the Ko Kradat site may differ for example from those from the Ko Si Chang 1 wreck site.

Finds believed to be from the Ko Samae San site, as recorded in the 1980s at the Fine Arts Department by this author, included celadon bowls with simple, horizontal linear decoration. Though fitting a Thai KN compositional range, some of the celadon items recorded as to have come from the Ko Samae San site have a dark grey body with black inclusions. Could it be that they were manufactured at a time when the Si Satchanalai kilns were using alluvial soil, as was the case of the MON product according to Hein (2001: 199)? There were no central spur marks. Some items had tubular support marks on the base. Apart from the body description, these items resembled many recorded by Harper (1984) at the Si Satchanalai kilns (such as KNSF552).

Also recovered from the Ko Samae San site were the Si Satchanalai equivalent (with tubular support marks on the base) of Sukhothai painted under glaze bowls as shown in Hein (2001) Fig. 48e (Chakra and Mongkut). Amdel results fit KN and PY with slight variations in Fe_2O_3 . Other items believed to have come from the Ko Samae San site include those resembling Si Satchanalai Later Stoneware, (Hein Fig. 44m and 44o conch shell with hatching or with vegetal decoration) and aspects of others illustrated by Hein. To this author's knowledge, this shell decoration has not been recorded from any other underwater site.

The Ko Samae San site had both brown and white glazed wares including lids fitting *potiche*. White glazed wares were not recorded on the Ko Rin or the Xuande sites (Brown and Sjostrand, 2002: 57). The Singtai, unlike the Xuande, according to Brown and Sjostrand (2002: 56–7), did carry white glazed material.

Other finds from the Ko Samae San included covered bowls (mangosteen and lotus bud handles), the painted decoration varying slightly from that of the Ko Kradat finds, more like that of Harper (1987) No.24 from the area of Kiln 5, Ban Pa Yang, Si Satchanalai. There were also items likely to have been manufactured at the Mae Nam Noi kilns, the shapes comparable to many described in Harper (1988). It is significant that the jars Type 4.1 & 4.9 recovered from the Ko Samae San site are both of the rolled rim type. Due to the similarity of some of the artefacts it is assumed that this site and the Ko Kradat are of approximately the same period.

Brown and Sjostrand (2002) and Brown (2004) show that two ships, recovered in Malaysian waters, are of approximately the same period as many of the vessels examined in the Gulf of Thailand. The Xuande (c. 1540) had no glazed jars such as those tabled in this report. Both the Xuande and the Singtai (c. 1550) carried Si Satchanalai painted under glaze covered bowls. It was pointed out that no ship in Malaysian waters of an earlier date was recorded to be carrying these items. Brown (2004), Plate 71.6, middle and right, show small glazed jarlets with brown spots from the Xuande site, reflecting those recovered from the Ko Kradat wreck site, Green *et al.* (1981). Interestingly these were not recorded by this author in the artefacts believed to be from the Ko Samae San site. Like the Ko Kradat, no celadon material was recovered from these Malaysian sites.

There appears to be slight differences between the painted under glaze wares of the Ko Kradat, Ko Samae San, Singtai and Xuande sites. The chakra design did not appear on

the Ko Kradat site. As pointed out above, the Ko Samae San chakra painted bowls reached an Amdel result of a Si Satchanalai product. The chakra design has been recorded at Si Satchanalai, Harper (1987) No.78. The items with chakra designs recorded by Brown (2004) Plate 72 X018 from the Xuande site and Plate 69, S59 from the Singtai are recorded as Sukhothai products. The sunburst or *picul* design was not recorded by this author on items believed to be from the Ko Samae San site. It was recorded on items recovered from the Singtai site, Brown and Sjostrand (2002) CP78. The sunburst design was recorded at Si Satchanalai by Harper (1984) Nos. 67, 68, 79 and also PYSF 921.

Other differences occur between the scrolling on the Si Satchanalai produced covered bowls of the Ko Samae San and Xuande sites and the Ko Kradat and Espanola sites. The Ko Samae San and Xuande have a cross hatched leaf decoration which does not appear on the Ko Kradat items.

The Singtai carried Type 4.9 jars, Brown (2004) Plate 69, estimated to be the main cargo. They are described as having a dark brown glaze to the upper two-thirds of body.

It is evident that close interchange existed between Si Satchanalai and Sukhothai during the time of the Ko Si Chang 2 in early to mid 15th century and continued up to the second half of the 16th century, supporting Hein's view (2001: 153) that the Sukhothai kilns were likely to have been in production for at least one hundred years.

The Ko Rin site was probably amongst one of the latest sites in this report to have wares made at Si Satchanalai. These included painted covered bowls and brown glazed jarlets, together with Type 4.1 and 4.9 jars, however no white glazed ware was recovered. Hein (2001: 183) says that covered bowls, whiteware and brown glazed wares were only made in the final production phase of Si Satchanalai. The fact that sherds from many covered bowls (manufactured in particular from the Ban Pa Yang area of the Si Satchanalai kilnsite) were recovered from the underwater sites of the second half of the 16th century and possibly the early 17th Century, supports Hein's belief that this was a later production area.

Chinese blue and white bowls with crane decoration from the Ko Rin site are identical to those believed to have been recovered from the Ko Samae San site. Some of the decorations on the Chinese blue and white ceramics from the Ko Rin site have attributes of those from the *São Bento* (1554) (KL51 bird and foliage) and the *Witte Leeuw* (1612) (KL145 etc). Casa-Museu Dr Anastácio Gonçalves (1996) relates the bird and foliage design to the Jia Jing period (1522–1566). Dates given by Rinaldi for ceramics which have some relationship to those from the Ko Rin span from the latter part of the 16th century to the first decade of the 17th century. The dishes from the *Witte Leeuw* had developed into the traditional Kraak moulded ware, the conclusion being that the Ko Rin ship was operating at a time of transition leading to the true Kraak ware. Further, the Ko Rin site also had earthenware–stoneware items comparable with the Ko Samae San, Ko Si Chang 1 and Prachuap Khiri Khan sites, all with shapes associated with the Mae Nam Noi kiln site product.

The Prachuap Khiri Khan site had Types 4.1c) and 4.9 jars with rolled rims. No decorated ceramic wares were recovered from this site. One item from this site is a bowl (PK21) of similar shape to KSC3 3 and others discussed above.

However, contrary to expectations that this item would have a rolled rim like that of the Type 4.9 of this period, the rim is actually everted and incised, leading to the conclusion that perhaps this site is slightly earlier than perhaps would otherwise be expected in relationship to the jar finds. Supporting this opinion is the fact that the jarlet PK5 had many qualities reflective of a Si Satchanalai product. Then again, mortars from the Ko Si Chang 1 and Prachuap Khiri Khan sites are of a similar profile to those from the Mae Nam Noi kilns, as described by Harper (1988) but there was no hump (lump of fired clay) attached to the base as was the case for the Mae Nam Noi product seen by this author at the particular area excavated in 1988. It could be that they were made at these kilns but in a different area.

Neither the Ko Si Chang 1 ship of the late 16th or early 17th century, nor the European vessels around the same period or later, carried any Si Satchanalai or Sukhothai wares. The Type 4.9 jar became ubiquitous on these sites whilst Chinese Kraak wares and other blue and white ceramics replaced the painted wares of the Thai kilns.

FURTHER NOTES REGARDING CERAMIC FINDS

Whilst formatting this report, the author had access to only a limited number of sherds, and no access to complete items from the Thai shipwrecks or any other sites. This is apart from items from the Brunei Darussalam shipwreck site which were on display at the Maritime Museum, Fremantle, Western Australia for a short period. Most of this research has been compiled through the use of registers, notes, photographs and drawings completed in the 1980s, and published works. First hand visual comparison, where differences are often immediately obvious, would be more opportune. Additionally, it should be acknowledged that many of the items discussed in this report have been in a marine environment for hundreds of years. Some alteration to their appearance must be considered.

When first viewing the material from the small area of the Mae Nam Noi kiln site still in existence, this author's general impression was that there were many commonalities in terms of the shape of a number sherds. However, the surface and appearance of bodies differed to those recorded on the wreck sites of the Thai Gulf by the joint Thai–Australian team. For example, large jars at the Mae Nam Noi kiln site often had a flattened mouthrim, not apparent on the Gulf finds. Mortars from the Mae Nam Noi kilns had a blob of fired clay attached to the base. Ship wreck finds appeared to be less highly fired, without the metallic appearance of items recovered from that particular area of the Mae Nam Noi kiln site.

Many underwater and land finds were incomplete. An estimation of the actual type of jar which they formed was made by measurements, generally of the mouthrim and base and proposed shape. Such things as colours of glaze and body and the type of inclusions are subjective unless recorded through a Munsell kit or other scientific methods. Some reference points may not always have been recorded from an individual jar. Often the shape of a jar did not fit easily into one section or another. Only a limited amount of testing of jars for material composition has been undertaken, those tests often giving no definite results. There were no tests performed on any particular type of item recorded by this author, including jars, from the Phitsanulok and Nakhon Thai sites. The test sherds from the Mae Nam Noi kiln site came from the small area remaining of what was likely to have been a more expansive production area. Further testing of sherds is necessary to get more specific results. For example, an Amdel result fitting the percentages attained at the BR, NT, (Almost Nong O) sites is too wide for pinpointing specific kiln sites or areas within kiln sites. Even with further tests the variation in composition may be found to be too close, one site to another.

It has been seen that the testing can determine, to a degree, a timeline when the kiln site has been used over a very long period and different clays were used, such as the differences between MON KN and brown glazed KN at the Si Satchanalai kiln site. At a large production site, there are likely to be variations between the clays used at different periods of production and for particular types of product. The longer the production period the greater the chance of different clay sources being used. For chemical testing and analyses, a number of test sherds from sites, particularly kiln sites, is required in order to estimate the range of minerals.

Although until now the ambiguity of the Amdel analyses does not allow the promotion of a definite provenance for any of the sherds tested, it has offered some insight into the range of minerals and allowed for comparison to occur. This, together with other information, has aided in denoting a likely provenance to many jars.

Composition of a jar sherd fitting that of, for example, the Mae Nam Noi kiln site (BR) does not necessarily signify production at the Mae Nam Noi site however it does help to define the possibilities, that is, it gives the range of materials fitting a particular area, and probably more revealing, those which do not. Further investigation with a wider test range from production sites will doubtless refine the results.

For a number of the jars coming from other than Thai underwater sites and tested by Amdel, there are no kiln sites recording similar mineral percentages. These jars (almost all from Philippine sites), were included in this report because of similarities in shape or measurements to Thai jars. Most were in fact rim or base sherds. Many were recorded as differing in some way, in the type or treatment of the clay body, to the usual items recovered from Thai shipwrecks. It is likely that these items have their origin in Chinese kilns.

Caution should be undertaken in the collection of sherds for analysis. For example, sherds from the Ko Si Chang 2 wreck site, with obvious physical resemblances to Suphanburi product, did not correspond to the mineral percentages of sherds collected from the river bank adjacent to an existing kiln site at Suphanburi. The latter may have come from a collapsed kiln or were transported from kilns in the area where clay bodies differed to the Ko Si Chang 2 product.

The perils of contamination can be illustrated by the painted under glaze sherd retrieved from the river bank adjacent to the Suphanburi kiln site (Suphanburi 15 Harper (unpublished)) which, upon examination, was found likely to be a product of the Si Satchanalai kilns. The fact that easily identifiable Chinese blue and white porcelain sherds are recovered at most sites throughout Thailand, as are those from Si Satchanalai and Sukhothai, including from the environs of the Mae Nam Noi kiln site, Harper (1988) illustrates how widespread items from different production sites can be.

It is notable that some items had a higher than expected percentage of MgO when tested by Amdel, see Nos 29 & 30, in Table 3 on page 129. A Ko Samae San jarlet (SS11), almost certainly manufactured at the Si Satchanalai kilns, achieved an Amdel result of almost Thai KN (except high MgO) and almost PY (except high MgO), with an MgO content of 2.80%. Most of the Ko Samae San items attributed by form and design to a Si Satchanalai origin, such as whiteware, painted cover bodes, painted bowls with chakra, and jarlets had a range of about 0.58% to 1.16%, generally in the range of 0.75–1.00%. The upper measurements for MgO content recorded for the kiln sites was KN 0.7%, PY 0.5%, BR 0.4–1.1%, NT 0.7–1.4%. Other items, apart from jars, recording a higher MgO content but otherwise fitting the standard for either BR or NT or both, include Ko Rin bottles and a high fired basin, a KSC2 rice pot and jar and basin from the Ko Samae San site. Burns (2005, pers. comm.) informs that a high level in the ceramic body of the common compounds MgO or CaO content could be a result of high water temperature in the marine environment

assisting the penetration of MgO and CaO. Intakosai (1984) informed that the Ko Samae San site was heavily encrusted with marine growth. A white crust was in evidence on many of the ceramics said to be from the Ko Samae San ceramics seen at the Fine Arts Department, near Sattahip in the 1980s. It is in fact the less highly fired items from the Ko Samae San site which realize high MgO levels. However, it may be that an incomplete test range from the kiln sites did not accurately represent MgO levels and that a high MgO content may, with further material testing, signify, in some cases, a particular provenance.

One line of investigation which may be worth pursuing on the trail of the areas and times where particular jars were made would be to compare percentages of Fe_2O_3 content. Burns informs that clay formed from basalt rock is likely to have a higher CaO, MgO or Fe_2O_3 content whereas granite rock results in higher SiO_2 and K_2O content. Significantly, a high Fe_2O_3 content occurs in the Amdel tests of MON KN 6–8.5% and Nong O, 5–8%. A high K_2O content was also recorded in some of the test items. High levels occurred in earthenware items from the Ko Samui site and in poor quality celadon wares (probably Chinese) from the Ko Si Chang 2 wreck site.

Though not recorded on the items tested by Amdel it is likely that lead is one of the components in the glaze of some of the jars described in this report. Burns, for example, indicates that the fluid, green-black glaze seen on the large storage jars from the Brunei Darussalam wreck site most likely had a component of lead, appreciated in glazing for its viscous properties. Determination of a specific provenance for the large jars may be made by testing the lead in the glaze. Burns informs that the composition of lead is very specific to a particular area and a link between mine site and glazed item may assist in determining provenance. Burns indicates that contamination from lead ingots commonly found together with the ceramics on Southeast Asian wreck sites should not affect the result.

Another thing to take into consideration when assaying jars is Burns indication that the visual appearance of a glaze is affected by the surface tension of a particular item, sometimes patchy on the Brunei Darussalam items for example. Wood ash, high in calcium and readily available in wood and rice husk fired kilns, would have been added to make it very fluid.

Colour differentiation is important. It has been recorded from the Royal Nanhai site, a jar described as having a brown glaze. Similarly shaped jars from Pattaya have a black or green-black glaze. Items from the Brunei-Darussalam wreck have more of a green-black glaze. Jars from the Mae Nam Noi kilns are described as having a green-brown-black glaze. Of jars Type 4.1 (No. 44 in Table 3 on page 129) identified as a narrow form, items from Nanyang, Royal Nanhai and Brunei Darussalam had brown-black or black-brown glaze. Those described as green-black came from the Pattaya site, green-brown from Batangas, Niah, Ko Si Chang Three and Ko Samui whilst those from a Melanau were black. Accurate Munsell Colour Testing could aid in the determination of provenance.

Another aspect regarding glaze is the difference in coverage. It is noticeable that some jars have a glaze or slip to the upper

1/2 whilst others are covered to the upper 2/3–3/4, see Nos 32 to 35 in Table 3 on page 129. It is possible that this denotes a practice at a particular period of time or by a particular manufacturer. The Brunei Darussalam site has jars exhibiting both features. Many of the Type 4.9 jars are only covered to the upper half suggesting that only a certain amount of glaze was actually required to suit the purpose for which the jar was intended. It could also mean that it was a result of economy of time and effort when jars were large and demand was high.

The enigma of many of the Amdel results may be epitomised by No. 36 in Table 3 on page 129, jars described as black glazed. Type 3 KSC2 1301 has an Amdel result of Nong O, almost MON KN. Type 4.2 Verde Island item described as mottled brown on black does not fit any group tested by Amdel. A Type 4.3 item No. 322/40 from Niah, Sarawak is denoted a 'Kalong' ware by Moore (1970). It was due to the complexities of jar types that the author sought to examine individual features of jars in an endeavour to determine if there was any pattern or constancy in the production and treatment of jars.

Further and closer analyses of sherd bodies through scientific method is necessary for unbiased, unambiguous comparison. The author believes that information within this section goes part way toward pinpointing provenance, linking jars with similar features, and ultimately assisting in estimating time of production for particular types of jars at kiln sites and possible time periods of deposition at sea or land.

Recent research at the University of Western Australia (Mendez, 2006: 40), may be of great significance in the quest to determine exactly which kiln sites and kilns produced particular ceramic items. Through the use of laser technology, and without damage to any particular ceramic item being tested, the actual identity of the Chinese Ming dynasty kiln from which it came can be assessed. If this technique can be developed so as to test kiln sites further afield, much of the speculation throughout this report can be tested.

PART 4. Metals

LEAD

Lead ingots were recovered from many of the wreck sites in the Gulf of Thailand. Tonnes of lead were reportedly recovered from the Pattaya wreck site prior to the excavation by the Thai–Australian team in 1982. Large quantities were recovered from the Ko Si Chang 1 site, together with some lead covered stone shot and short lengths of lead. The Ko Si Chang 2 site had lead sheeting and an item which may be a sounding lead. Another ingot was not chemically analysed but may also have had a lead/tin content. The Ko Si Chang 3 carried lead ingots as well as a lotus bud shaped item, possibly a sounding lead. Granite stones were recovered from the Ko Kradat wreck site, but no lead, significant perhaps in terms of the use of lead as ballast.

Lead occurs naturally, mainly as sulphide in the mineral galena. Intakosai (1980s, pers. comm.) illustrated that lead ingots were traditionally made in Thailand by pouring molten lead into small recesses in sand, indicating that he had witnessed this process in Thailand that decade.

Bronson (1992: 87) Fig. 4, shows that Southeast Asian lead producers between 1500–1800 included Thailand, Burma, Vietnam and China. Though not included in the records of metal sources and production 1500–1800 listed by Bronson (1992), indications are that there are many deposits in Sumatra and some in several other Southeast Asian regions including a low average grade from the Philippines.

In Thailand lead appears to have come from, or was exported from, the Peninsula including Langkawi and Pattani, Wheatley (1961: 228). Pires, (Cortêsão, 1967: 108), in the 16th century, mentions lead going from Thailand to Malacca. In the 17th century it was produced in Tavoy, between Pegu and Tenasserim, Hutchinson (1940: 239), then under Thailand's control. It passed from Tenasserim to the East (Japan), according to Anderson (1890: 67–8) being an esteemed cargo, more so than sapanwood.

Bronson (1992, Fig. 3) shows two lead deposits in the north of Thailand, one in the west and one just at the border with Malaysia. Crawford, (1828: 419) tells that in the 19th century lead was to be found in the mountains belonging to the Lawa, (a hill tribe group found in the Mae Hong Son and Chiangrai Provinces). Since these are in the west and north west of Thailand the export of the lead could have come by the peninsular routes and/or down river through the Mae Khlong and/or Mae Nam Chao Phraya river systems.

Lead was a constituent of Chinese cash. It was also used in particular ceramic glazes. Smithies (1997: 69), writing of the travels of Mendes Pinto in the 16th century, mentions that Passiloco (Phitsanulok) was the destination of products from mines around Lake Chiang Mai. It is possible that some of this lead was destined for use in ceramic glazing at kilnsites.

Evidence of lead covered stone shot from Ko Si Chang 1 illustrates its demand in the making of armaments. An even more sinister use could be similar to that in the 18th as described by Phayre (1883) through Levy and Scott Clark (2001: 20) whereby lead was poured by the Burmese onto the heads of advancing Chinese.

According to Burns (2005), the composition of lead is very specific to its particular source. Thus, the provenance of

the lead ingots and any lead used in glazes on jars from the shipwrecks of the Gulf of Thailand and elsewhere could be ascertained through mineral analysis.

IRON

It is believed that nails recovered from the Ko Si Chang 2 wreck site were of iron. A concretion within a large ceramic storage jar including knife blades, also presumed to be iron, were recovered from the Prachuap Khiri Khan site.

According to Reid (1984: 258), Burma, Thailand, Cambodia, northern Vietnam and the central part of Sumatra all appeared to have been roughly self-sufficient in iron production. Bronson (1992: 87–8) Fig. 4, details the recorded areas of Southeast Asian iron production between 1500–1800 as Thailand, Sumatra, North Vietnam and China. At the same time, Fig. 5 records Southeast Asian iron importers between 1500–1800 as Thailand, the southern Peninsula, the Philippines and Java. Fig. 6 shows Thailand and China as the principal sources of iron used in Southeast Asia between 1500–1800. Indeed in 1825 Crawford, (1828: 418) says that it was the metal occurring in the most abundance, being mined around Phitsanulok, Nakhon Sawan and Tak.

Armament

The iron and wood musket stock, together with lead covered stone shot on the Ko Si Chang 1 wreck site represent the only artefacts from the wreck sites of the Gulf of Thailand which may have been directly influenced by Europeans. As Green, *et al.*, (1986), the fragments of the musket stock were almost identical with some found on the *Batavia*, the Dutch East Indiaman wrecked off the Western Australian coast in 1629. The lead covered stone shot has been associated with Portuguese armament Auret and Maggs, (1982) and Blake and Green (1986) but it is not known whether the shot from Ko Si Chang 1 was of local or foreign origin. In reference to Cochin China, Pires, Cortêsão (1967: 115), at the beginning of the 16th century comments 'This king is much given to war and he has countless musketry and small bombards'. Wyatt (1984: 96) relates from the Ayutthya Chronicles that during the attack by the Burmese on Ayutthya in 1569 both sides used guns.

Saltpetre is used as a constituent of gunpowder, in preserving meat and medicinally. Simkin (1968: 216) includes saltpetre (potassium nitrate) amongst the exports of the East India Companies from Ayutthaya and Pattani at the beginning of the 17th century.

It would appear that although iron-casting had spread from China to Pegu and Thailand, and that '...3000 small pieces of artillery...' were captured by the Portuguese when they took Malacca, Simkin (1968: 261), the Portuguese were the real suppliers of guns and ammunition. According to Wyatt (1984: 88) the process of development had already begun 'owing to imports through the Arab and Chinese trade'. Simkin tells that Jesuits helped the Ming and Ching to develop gun foundries in China whilst at the same time purchasing fire-arms from the Portuguese. Crawford (1828: 323) in 1825, recorded that 'The fabrication of fire-arms has scarcely, I believe, been attempted; and for these the Siamese appear always to have trusted to the

casual supply derived directly or indirectly from Europeans'. Reid, (1984: 252) is bold enough to say that the Europeans had no '...produce of interest to Southeast Asians except arms'.

TIN

At the time of excavation two truncated pyramid shaped items from the Ko Si Chang 2 ship were tentatively denoted as lead/tin. The only other item from the Thai wreck sites which may have had a tin content was a mirror from the Rang Kwien ship, tin being known to have been used in the construction of mirrors. Tin is used in the manufacture of lead (20 parts) and pewter (80 parts) and also bronze.

Southeast Asia has long been a net exporter of tin since at least the 10th century. The areas of greatest production on the Peninsula being around Tavoy, Nahkon Si Thammarat, Phuket, Selangor and Perah and also from Laos, (Reid, 1984: 158). Phuket (Junk Ceylon) has been known as one of the richest mines in Thailand.

Thorne and Raymond (1989: 158–9) say that though initially tin comes from veins in rocks, four thousand years ago at the famous bronze age site of Ban Chiang in north east Thailand, tin might have been panned from streams in the area. They say that the fact that bronze needs about 10% tin and that since the source of tin has not yet been found in the Mediterranean and Middle East means that Southeast Asia may have been the source of this essential element for the development of a Bronze Age in those areas. Needless to say this has important implications in the history of mankind.

Wheatley (1961: 77) reveals the significance of tin to the people of Tan-ma-ling at the northern eastern Peninsula during the 14th century where it was used as part of their marriage arrangements. Pires, in the early 16th century (Cortês, 1967: 108) indicates that tin was one of the products traded from Siam to Malacca and that tin was taken from Malacca to Bengal.

Once the East India Companies opened their factories at Pattani and Ayutthaya in the early 17th century, tin was prominent amongst the exports. It was still a staple product when Crawfurd visited in 1825, where it is recorded as freight to China. Crawfurd adds (1828: 323) that in Thailand the resident Chinese were the only manufacturers of tin in Thailand despite it being a product of the country.

COPPER AND COPPER ALLOYS

Copper ores appear in nature principally as copper pyrites, copper glance and cuprite. Metals are combined with copper in order to form copper alloy. In the case of Chinese cash, the mixture can include proportions of lead, tin, zinc and also silver. Copper, together with approximately 10% tin, is used in the manufacture of bronze together with zinc and usually lead.

Within Asia, the participation of copper in trade was in the form of an ingot or a manufactured item, including copper cash. Intakosai (1984: 135) mentions a large number of copper ingots being recovered from the Rang Kwien wreck site. Poorly cast plano-convex shaped copper ingots were recovered from the Ko Si Chang 3 wreck site, Green *et al.* (1987). These ingots have not been analysed in order to ascertain a provenance. Similar items have been recorded from an underwater site

along the coast of Cadiz, Spain by Gomes (1986) and also from a wreck site in the Seychelles thought to be a 16th or early 17th century Portuguese ship, Green and Blake (1986). Like the Ko Si Chang 3 site, the Spanish site also held lead ingots. The copper, lead, tin and other metal ingots doubtless served the dual purpose of a fairly stable ballast.

Lime containers made of copper alloy were recovered from the Ko Si Chang 1, 2 and 3, Rang Kwien and Ko Samui sites. Copper bowls and Chinese style locks and keys were recovered from the Ko Si Chang 1 and Ko Rin sites. Small pieces of copper were also found on the Ko Si Chang 1 site. Other bronze, copper or copper-alloy items recovered from the shipwrecks of the Thai Gulf include vast quantities of Chinese cash (200 kg), a mirror, gong and bell, harpoon, fish hooks, hairpin and tweezers from the Rang Kwien wreck site and bronze cymbals from the Ko Samui site according to Intakosai (1984). Several pieces of Chinese cash were recovered from the Ko Si Chang 2 enabling a dating of the wreck site.

Neither silver nor zinc was found on any wreck site to our knowledge though these items do appear on many cargo lists of ships trading in Asia, the latter being termed *tutenag*, (described as a zinc from China and the East Indies). Zinc and antimony occurred in the district of Rap-ri, east of the Mae Nam, according to Crawfurd, (1828: 419).

Determining the source of the copper found on the Thai wrecks may be elusive. Those countries from which the Thai ingots could have originated include Thailand, Japan, Borneo and Sulawesi, Vietnam, the Philippines or Java., Many of the manufactured items are likely to have had their origin in China or Thailand but it is possible that they came from other sources.

Thailand has an extremely long history in the use of copper as demonstrated by the Ban Chiang ancient burial site in north east Thailand and Non Nok Tha, (Charoenwongsa and Diskul (1978)), reputed to be amongst the earliest bronze age sites in the world. Thorne and Raymond (1989: 158) reveal that outcrops of copper and signs of very ancient mining on the banks of the Mekong River, at Phu Lon were examined in 1984. This was an ancient copper mine – the oldest yet discovered in Southeast Asia, with signs of ore preparation and smelting dating from at least 3000 years ago. Higham (2001: 17) details that the copper ore was extracted from seams in the mountain side and was then smelted in small bowl furnaces near the mines. He says 'Much of the copper was cast into circular ingots, destined for trade...'. He indicates that ceramic casting moulds were used.

In the 19th century, Crawfurd (1828: 419) refers to copper being found in a low range of primitive mountains near Louvo (Lopburi) or Nuk-bu-ri, in about the 15th degree of North latitude'.

Reid (1984: 260–1) explains that 'The richest sources of copper in Southeast Asia were probably those in the northern hills of Vietnam, where much of the famous 'Dongson' bronzework had its origins'. Reid mentions places in Java and Sumatra which '...did have famous centres of bronze manufacture which exported gongs, lamps, betel-sets, kettles and small cannon to Malaya, Borneo and the Moluccas.' He refers to van Bemmelen (1949) however, in that '...modern geology has not revealed workable deposits of copper in these

two islands'. He gives evidence of early copper mining by the Acehenese and some copper working centres far inland in Java.

Japan became the greatest supplier of copper, exporting an average of more than 3,000 tonnes a year in the late 17th and early 18th century according to Innes, through Reid, (1984: 257). Reid says that raw copper was imported into China in the 16th century where it was used in the manufacture of goods including copper cash. Likewise raw copper was imported into places such as Java or Sumatra where it was melted down, manufactured, and some re exported. Hall (1985: 244) indicates that the Chinese prohibited trade to Java due to the flow of copper cash out.

Thailand's place as an entrepot for copper is well documented. Copper was primarily used as a unit of exchange for natural products such as pepper, other spices and forest and animal products. Those involved in the European trade used items such as textiles and tea as collateral. Copper has also been a constituent of the printing and dyeing processes. It is evident through Anderson (1890: 170) and Hutchinson (1940: 82), that large quantities of copper, tin and tutenag were being handled in Thailand in the 17th century. Copper came to both Ayutthaya and Pattani. From there it was sold on to European merchants through Bantam and Surat. Hutchinson discusses a cargo of copper amounting to 1,000 chests and talks of the 'copper fleet' arriving from Japan. Trade through Pattani was dead by 1616, according to Hutchinson (1940: 33), owing to civil troubles there, but continued at Ayutthaya.

Coinage—Chinese Copper Cash

Several coins were retrieved from the Ko Si Chang 2 ship—one bearing the markings of Emperor Ch'eng Tsu whose reign lasted from 1403–1424/5, thus dating the site to this period. Huge quantities of coinage were recovered from the Rang Kwien wreck site (dated from the 7th–15th century), according to Intakosai (1984). These were possibly carried as Pires describes, Cortesão (1967: 170), pierced through the middle so that they could be threaded in hundreds.

Sjostrand (1997) says that Chinese coins were recovered from the Royal Nanhai ship (c. 1460) as were tin coins used by Chinese emigrants into Malacca after 1405.

According to Reid (1984: 257), iron exports from China in the Ming Period were supplemented with enormous quantities of copper/lead cash, which '...came to form the lowgrade coinage of Vietnam, Java, Melaka and elsewhere'. It appears to have been used extensively as 'small money', as in Champa, described by Pires (Cortesão, 1967: 114–15), whilst in trade, gold and silver were used. However as Hall (1985: 244) says, the flow in to Java of copper in the 13th and 14th centuries involved as much copper as silver and gold. Copper cash however was used as a trade item itself, the copper alloy used in manufacture.

In Thailand 'bullet' coins were, according to Le May, through Hein (1987(2): 15), apparently used very early on and by the 13th century '...the coins had reached an advanced form of development and a high degree of standardisation by weight and metal content.' Hutchinson (1940: 217) states that by 1350, if not earlier, the unit of currency had been the silver tical (baht). As Dansilp and Freeman (2002: 24) describe, they were in the form of 'strange rounded lumps', usually silver,

sometimes gold—varying in weights and described as baht. Bullet coins were used until the 1860s when flat currency was introduced.

Lime Containers

Warren and Invernizzi Tettoni (1996: 70) indicate that all Thai households in former times had a set of containers and accessories for the custom of betel-nut chewing (see further discussion below under areca nut). In royal and other high circles, the accompanying spittoons were fashioned from precious metals, brass, porcelain or gilded lacquer. Surviving village equivalents are, according to Warren and Invernizzi Tettoni, much simpler, usually of wood, baked clay, or lacquered woven bamboo, but often decorated and gracefully shaped.

The shape of the copper-alloy lime containers recovered by the Thai-Australian team from the Ko Si Chang 1, 2 and 3 and Ko Rin wreck sites are consistent with a Thai style. Other metal containers are reported from the Rang Kwien, (Intakosai, 1983) and Ko Samui sites, (Intakosai, 1984).

Valdes (2004: 104) acknowledges that in northern Philippines for instance, lime containers are usually made from wood and bamboo. However, Valdes (2004: 106), from the writings of Antonio de Morga, around 1600 indicates that *Buyo* sets were made of brass and other materials and included separate containers. These were made in a part of Manila where Chinese inhabitants were confined to live and work.

Valdes (1992: 109/10) says of Indonesian betel sets 'The most common material are brass...'. The method of casting brass was similar throughout. Called the 'lost wax process' a model is made in beeswax which is then surrounded by a clay mould. When heated, the wax melts and runs off and is replaced by molten brass or copper. The clay mould is then broken away.

Amulet

A small metal item, possibly an amulet, seemingly phallic shaped, was retrieved from the Ko Si Chang 3 wreck site. Used somewhat like a 'good luck charm', Guelden (1995: 139) in her discussion of the spirit world of Thailand explains that 'Some Western scholars believe the phallic design originally came from the Khmer Kingdom and was represented by a stone *linga*. According to legend, Brahmin priests shrunk the large *Shiva linga* to create the smaller *palad khik*, so it could be carried. But other researchers say the design is clearly indigenous'.

PART 5. Organic Material

TIMBERS

This section relies heavily on the works of Bodkin (1990), Corner (1988), Cubitt and Stewart-Cox (1995), Macoboy (1979), Hemphill (2000), Usher (1974), Dastur (1977), Valder (1999), Greenburg and Ortiz (1984), Lemmens *et al.* (1991 & 1995), Brown (1978), van Steenis (1954), Cortesão (1967), Fundter (1982), Food and Agricultural Organization of United Nations (1960), Keating and Bolza (1982), Soerianegara and Lemmens (1993), Chudnoff (1980), Walker (1989), Schery (1972) and Barwick (2004).

Many of the artefacts recovered from the shipwreck sites in the Gulf of Thailand by joint Thai–Australian teams are estimated to have their origin in what is present day Thailand. There are indications, however, that the ships had their place in the wider trading patterns of their times. Obvious examples are the blue and white porcelains and celadons of Chinese origin, carried on many of the ships. Other items, such as the timbers used in the ships' structure have various possibilities of origin. The wide-spread and diverse growing regions from which the timbers could have come make a point of manufacture of any particular ship difficult to pinpoint. Almost all of the timber samples recovered from our shipwreck sites, with a couple of exceptions, indicate a tropical wood. There is the possibility that the ships wrecked in the Thai Gulf could have been built from as far as India to parts of China. Admittedly, the most likely source of timber is local.

Under normal practice, an early shipbuilder would have looked for the most suitable timber growing in a stand near his workplace, being of its nature, bordering a coastline or river. There are however, historic references to timbers being transported great distances in order to fulfil a particular purpose. As is the case with attractive or food producing plants, timbers with particularly useful characteristics have been cultivated far beyond the area of natural distribution. For example, much of the fruit, vegetables and flowers grown all over the world had their origin in South America and central Asia. According to Simkin (1968: 5), already during the dynasty of Achaemenian (559–330 BC) in the Persian Empire, fruit trees were brought from Lebanon and timbers were brought to the Arab world from as far as India (teak or ebony) and Crete.

The fact that some of our shipwreck timbers could have an origin as far away as the Himalayas or China lead this author to enquire if it were possible that these timbers were transported some distance for the deliberate purpose of shipbuilding. It is possible that a repair could have been made at a port of call. If from a distant origin what was the possible route through which the timber travelled to the Gulf of Thailand?

This part of the report examines the patterns of distribution of the timbers recovered from the wreck sites either as part of the ship structure or part of the load. PART 6 (below) also looks at possible land passages and river routes which may have been used over the centuries. It cannot be ignored however, that the lack of a local timber source (as may have been the case in Persia and the Arab Gulf countries) was not likely to have been a problem for shipbuilders of the Gulf of Thailand.

Table 31. Radiocarbon Determinations from Thai Sites, Uncalibrated Years AD

Site	material	lab no.	determination (AD)
Ko Si Chang 1	dyewood log	SUA-2298	1570±90
Ko Si Chang 2	wood fragment	SUA-2697	1290 ±60
Ko Si Chang 3	dyewood log	SUA-2594	1440±60
Ko Si Chang 3	resin	SUA-2703	1540±120
Ko Khram	?	OAEP	1520 ±140
Ko Khram	?	OAEP	1680 ±270
Ko Khram	timber sample	SUA-2701	1380±50
Pattaya	timber sample	SUA-2698	1370±50
Rang Kwien	timber sample	SUA-2699	1270±60
Rang Kwien	ivory	SUA-2700	1800±140
Samed Ngam	timber sample	SUA-2702	1800±150

In all cases attempts were made to select material that would give reliable radiocarbon dates. The outside of a tree, just under the bark, is best used for dating purposes, being the youngest part of the tree. Likewise, samples from treenails made from a relatively fast growing plant with a shorter life span compared to that of a large tree, would be expected to give a more accurate estimated date. For example, *Cassia fistula* used as treenails (dowel) on the Ko Si Chang 1 ship, should give a good estimation of the date the ship was built. In some cases, dyewood logs were selected from the Thai Gulf shipwrecks for testing. Their small diameter (*c.* 200 mm) indicates that they were either thin branches or from young trees and as such, more likely to act as a closer determinant of age than, for example, a timber from the ship structure. Resin and elephant's tusks were selected for dating purposes, unfortunately the latter material proved unsuitable.

Table 32. Wood Samples from Thai Shipwrecks

A number of wood samples were taken from the Thai shipwreck sites. These were processed at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Division of Forestry and Forest Products, Clayton, Victoria and the following attributions given:

Ko Si Chang 1	
Total of 11 samples:	
KSC1 frame 18.0 (1B)	Shorea sp.
KSC1 dye wood (2B)	Acacia sp. (Sappan wood)
KSC 1 dye wood (3B)	Acacia sp. (Sappan wood)
KSC1 frame 18.0 (4B)	Dipterocarpus sp.
KSC1 plank (5B)	Shorea sp.
KSC1 bulkhead (6B)	Shorea sp.
KSC1 dowel from 6B	<i>Cassia fistula</i>
KSC1 floor (7B)	Dipterocarpus sp.
KSC1 plate (8B)	Shorea sp.
KSC1 dowel (9B)	<i>Cassia fistula</i>
KSC1 plate (10B)	Shorea sp.
Ko Si Chang 2	
Total of 3 samples:	

KSC2 87 (1005)	<i>Podocarpus nerifolius</i>
KSC2 87 (1290)	Acacia sp. (Sappan wood)
KSC2 1988 plank	<i>Podocarpus nerifolius</i>
Ko Si Chang 3	
Total of 7 samples:	
KSC3 bulkhead (No.1)	Hopea sp.
KSC3 (No.1B)	Acacia sp.
KSC3 outer plank (No. 2B)	Acacia sp.
KSC3 bulkhead frame (No.3)	Hopea sp.
KSC3 outer plank (No.4)	Tarrietia sp = Heritiera sp.
KSC3 inner plank (No. 5)	Vatica sp.
Ko Khram	
Total of 3 samples:	
KKH 87 (54)	Hopea sp.
KKH 87 (54A)	Shorea sp. (very much decayed)
KKH 87 (54C)	Shorea sp.
Pattaya	
Total of 2 samples:	
Pat 1987 (599)	Shorea sp.
Pat 1987 (600A)	Dipterocarpus sp.
Rang Kwien	
One sample only:	
RW 1987 (4)	Planchonella sp. (Fam. Sapotacene)
Samed Ngam	
Total of 4 samples:	
SN1977 (SN4)	<i>Pinus kesiya</i>
SN87 (1)	<i>Balanocarpus heimii</i> (Chengal)
SN1987 (3)	<i>Pinus kesiya</i>

Thai names for:

shorea sp.	<i>Chan</i>
Dipterocarpus	<i>Ene, Yang Keruing</i>
<i>Cassia fistula</i>	<i>Khun</i>
Podocarpus	<i>Phaya Mai</i>
Tarrietia	<i>Chum Phaelo</i>
Hopea	<i>Ta Khian Thong</i>
Vatica	<i>Resak</i>
Balanocarpus	<i>Chengal</i>
<i>Pinus kesiya</i>	Benguet pine

The timbers recovered from the wreck sites fall into the following categories:

Family: Species:

DIPTEROCARPACEAE

Balanocarpus (a genus sometimes included under Hopea)

Dipterocarpus

Hopea

Shorea

Vatica

FABACEAE

Cassia fistula

MALVACEAE (formerly STERCULIACEAE) Tarrietia

MIMOSACEAE Acacia

PINACEAE Pinus

PODOCARPACEAE Podocarpus

SAPOTACEAE Planchonella

STERCULIACEAE Tarrietia

Research was directed towards possible origins of the timbers found on the wreck sites. Were the ships made locally, that is, in the area of what is present day Thailand, in areas which were in past times under Siamese control; at further points in Southeast Asia, possibly India, Burma, southern China, the Philippines or beyond?

According to Brown (1978) 42% of Asia is of coniferous forests occurring in the Himalayas and northwards and in the mountains of Asia Minor, China and Japan. There are 28% temperate hardwoods or mixed forests occurring in the same area and 30% tropical hardwoods occurring south of the Himalayas.

DIPTEROCARPACEAE FAMILY

The DIPTEROCARPACEAE family into which the majority of our shipwreck timbers fall, is one of the most representative families of tall timbers in tropical Southeast Asia. Balanocarpus, Dipterocarpus, Hopea, Shorea and Vatica are represented on the Thai shipwrecks. DIPTEROCARPACEAE is a large family of 515 species, 16 genera. The resinous tropical trees range from small to very large. They grow in well-drained rainforest and require much soil moisture and high humidity except for a few species. They cannot thrive in swampy soil or waterlogged conditions and are rather restricted in altitude.

The largest and most considerable subfamily, DIPTEROCARPOIDEAE consist of about 495 species in 13 genera, almost confined to tropical Asia but represented in the Seychelles, Sri Lanka, India, Southeast Asia as far as New Guinea. They are best represented in rainforests of Sumatra, the Malaysian Peninsula, Borneo and the Philippines.

Cubitt and Stewart Cox (1995: 23–4) describe the different patterns of growth of dipterocarps in Thailand as:

- Dry Deciduous Dipterocarp Forest
This is present in continental Thailand (north of the Isthmus of Kra) in most lowland areas of less than 1200ml of annual rainfall. It is the predominant forest type of the northeast. It is interspersed with mixed deciduous forest in the north and west. The forest is dominated by *Dipterocarpus obtusifolius*, *D. tuberculatus*, *Shorea obtusa* and *S. siamensis*.

- Seasonal Evergreen and Rainforests
These are all predominantly of the DIPTEROCARPACEAE family but species vary between seasonal evergreen and southern rainforests. They occur on areas with high rainfall and few dry months on the Peninsula and parts of the southeast in upland and lowland areas. They grow in continental Thailand where there is good soil, 1000–2000 ml of rain and areas of increased elevation, thus they are more abundant in high land of the north and west and hilly areas of the northeast. They also grow in some lowland areas and must have been more extensive, but have disappeared over time.

On the Peninsula there are two types which fall into this category—the Thai type evergreen rainforest from Satun to the Isthmus of Kra and the Malay type which is aseasonal and found between the Malaysian border and the Satun—Pattani line.

• Tropical Mixed Deciduous Forest

This area, which is not dominated by dipterocarps has an annual rainfall less than 2000 ml on richer more absorbent soils. Though dipterocarps do not dominate, *Dipterocarpus alatus* is found in this area. It is of interest that a *Cassia* and a *Dipterocarp* grow together in this area since both are represented on the Ko Si Chang 1 ship.

Balanocarpus heimii (Thai: *Chengal*) appeared on the Samed Ngam shipwreck site. *Chengal* is the product of a single species of the genus *Balanocarpus*. It occurs in Thailand south of Pattani and the Malaysian Peninsular where it is widely distributed. Small stands occur under quite varied conditions—swampy flats to hills up to 1000 m high but *Chengal* seems to prefer undulating land with sandy soil. Other species of *Balanocarpus* are reported in India and the Philippines. A large tree (40–50 m), the trunks are mostly well shaped and clear for 30 m or more with a diameter of over one metre. The timber is said to be very durable and strong and used in boat building, flooring and decking.

Timbers designated to be of the *Dipterocarpus* (Thai-*Ene*, *Yang Keruing*) species were from the Ko Si Chang 1 shipwreck frame and floor and from the Pattaya shipwreck. About seventy species of *Dipterocarps* occur in Southeast Asia. This group is widely distributed from Sri Lanka and India, Southern China, eastwards to Indochina, Malaysia, Borneo, the Philippines and Indonesia. In Thailand there are comparatively few species.

The medium to large trees grow from 30–60 m with a straight cylindrical trunk 0.9–1.8 m in diameter. In green condition they can be sawn and machined without great difficulty but due to a high silica content and resin exudation they are hard to work. After treatment they are used nowadays for both hard and light constructional work including ships, boats and flooring.

The author has been unable to identify the Thai vernacular *Ene* in relationship to any member of the *Dipterocarpus* species. It is possible that misinterpretation of the Thai language has occurred and that the vernacular is *Eng*. Brown describes *Eng* as *Dipterocarpus tuberculatus* whilst Fundter includes *D. tuberculatus*, *D. obtusifolius* and *D. gracilis*, under the name of *Eng* in Burma.

In reference to the other names denoted by the CSIRO it appears that many timbers of this genus are nowadays marketed collectively under a group name which varies according to the country of origin. *Keruing*, for example, covers many of the *Dipterocarpus* species throughout Southeast Asia. On the Malaysian Peninsula *Dipterocarpus alatus* is included amongst these. *D. alatus* present as large to very large trees growing in the tropical mixed forests of India, Bangladesh, Thailand, Cambodia, Vietnam and the Malaysian Peninsula.

According to Fundter (1982), *Yang* is the Thai vernacular for timbers which include *Dipterocarpus alatus* (principally), *D. costatus*, *D. grandiflorus*, *D. tuberculatus* and *D. turbinatus*.

Cubitt and Stewart-Cox (1995) give the vernacular for *D. alatus* growing in the tropical mixed deciduous forest as *Ton Yang*. This can be directly translated as Tree Rubber so it may be that the term *Yang* refers to the latex qualities of the tree.

The distribution of *Dipterocarpus tuberculatus* is northern India, Burma, Cambodia, Indo-China, northern Thailand and the Jie-Yang valley of China. In Thailand *D. tuberculatus* occur in the dry deciduous dipterocarp forests—according to Fundter (1982: 164) ‘...usually gregariously on porous sandy, gravelly or lateritic soils on flat or undulating land, sometimes on open ridges (800–1000 m). Abundant on plains and hills, valleys or hill tracts’.

According to Soerianegara and Lemmens (1993) *Dipterocarpus turbinatus* in Thailand is *Yang-na* (general name), *Yang Khon* (Chantaburi), *Yang-pai* (northern).

Thus, the commonality between *Eng* and *Yang* is *Dipterocarpus tuberculatus*. *Dipterocarpus alatus* must also be considered as a possible timber used on the Gulf shipwrecks especially taking into account the fact that more than one unspecified dipterocarp timber was recovered from the sites.

Timbers from the *Hopea* species (Thai: *Ta Khian thong*) were recovered from the Ko Si Chang 3 shipwreck (bulkheads) and the Koh Khram. According to Sjostrand (1997), the Royal Nanhai ship (c. 1460) also had timbers of *Hopea*. Sjostrand believes the ship to be new, due to the fact that no extra layers had been added to the ship.

There are about 100 members of the *Hopea* species of which there are some 10 or more which grow throughout the Indo-Malay region: Malaysia, Burma, Thailand, Sabah, Indonesia, Borneo, New Guinea, the Philippines and China (the northern most limit is Assam and China). The tree can grow to about 50 m with a straight, cylindrical trunk clear to 18 m and a diameter of more than 1 m. The timber is very hard, heavy and strong. Because of its durability in water it is used extensively for framing and decking in ship-building. The *Hopea* nomenclature given to commercial timbers sometimes embraces timbers of other species like *Shorea*.

Ta Khian thong seems to refer specifically to *Hopea odorata* which occurs in Bangladesh, Burma, Laos, south Vietnam, Cambodia, Thailand, the Andaman Islands and northern peninsular Malaysia.

A tantalizing reference, taking into account the relationship between ceramics and sunken ships, is given to a Takhian stream in a forested area close to the Thai-Cambodia border around 14° 15' 10" latitude and 107° 56' 45" longitude in Buriram Province, eastern Thailand. Around eighty ancient kilns were situated in this area producing green and brown glazed ceramics of a ‘Khmer’ style, according to Khwanyuen (1985).

Holbrook and Suriya (2000: 61) relate that in the 1960s, *Takien*, (*Hopea odorata*) was used in Thailand for all components of a boat, being elastic, thus resistant to woodworm.

Analyses reveal that members of the *Shorea* species (Thai: *Chan*) are represented on the Ko Si Chang 1 shipwreck as a frame, plank, bulkhead and plate. They also occur on the Pattaya and Ko Khram shipwrecks. A large number of the species of the genus *Shorea* occur in south east Asia. It is widely distributed from Sri Lanka, southern and eastern India, Burma, Laos, Thailand, Hainan, Yunnan, Indochina and Malaysia eastward to Buru (West Moluccas). The greatest concentration is in the Malaysian Peninsula, Borneo and Sumatra. This genus of about 191 species can grow up to 60–70 metres and can have a diameter of about 1.5 m.

Included nowadays under the trade name of Meranti, Shorea species are suitable for heavy structural work, bridge and wharf construction, flooring and boat framing.

The vernacular name *Chan*, as denoted by the CSIRO, is confusing because it is also associated with a *Vatica* species—*Vatica odorata* in eastern Thailand. Thai Shorea bearing the prefix *Chan* include *Chan dam* and *Chan khao* which are both *Shorea guiso*, (in Thai *dam* is black and *khao* is white), *Chan ditaek* which is *Shorea guiso* in south east Thailand and *Chan hoi* which is *Shorea macroptera*. Other Shorea found in Thailand are *Shorea obtusa*, *S. siamensis* and *S. thorelii*. There are other timbers with the vernacular prefix *Chan* but they are not of the Dipterocarpus, Hopea or Shorea species.

Shorea guiso appears to be one of the most well recorded of the Thai Shorea. It is up to 30–45 m in height, 1–1.8 m in diameter and has straight, cylindrical trunks for 15–25 m. It is widely distributed but is said to be rare on low country (up to 600 m.) and absent from peat swamp sites. It is common in parts of the Malaysian Peninsula and widely distributed in the Philippines. It is also found near the coast of Sabah but not in abundance, and in Brunei, Sarawak and Kalimantan it grows on well drained soils on the lowland forests of most districts. *S. guiso* has a reputation for being fairly resistant to marine borers and is used for shipbuilding.

Shorea macroptera occurs on flat land and low hills. *Shorea obtusa* and *Shorea siamensis* occur in the dry deciduous dipterocarp forests.

A species of *Vatica* (Thai: *Resak*) appears as an inner plank on the Ko Si Chang 3 shipwreck site.

The *Vatica* with the vernacular name *Resak* is *Vatica harmandiana*, found in southern Burma, Thailand, Cambodia, Vietnam and northern peninsular Malaysia.

A number of *Vatica* are common throughout Southeast Asia. It is a large genus of about 68 species. A resinous tree, it is usually small to medium sized, but can be fairly large. The species is widely distributed from southern India, Sri Lanka, Assam, Burma, Southern China, Indochina, southern Thailand, the Malaysian Peninsula, Sumatra, Java, Borneo, Philippines, Moluccas, New Guinea and the Entrecasteaux Islands. There is a marked concentration of species in Borneo and Malaysia. It is generally considered a heavy constructional timber and suitable for marine use. It is nowadays used for the keels and ribs of boats.

FABACEAE OR LEGUMINOSAE FAMILY, SUB FAMILY CAESALPINOIDEAE

Cassia fistula (Thai: *Khun*) is represented on the Ko Si Chang 1 wreck site as dowels joining the ship's timbers.

There are about 600 species of *Cassia* throughout the tropics. *Cassia fistula* is believed to have come from tropical Africa and cultivated in the Old and New World tropics. It has been present long enough in India, Sri Lanka, Thailand, Sumatra and Java to be considered wild.

Bodkin, (1990: 221) says that *Cassia fistula* grows to a height of nine metres whilst Barwick (2004: xviii), says up to twenty metres. This tree is a fast grower and easily grown from seed. Known as Golden Shower (because of the colour of its flowers) or Indian Laburnum, it is a common garden plant throughout Australia.

The wood of *Cassia fistula* is said to be durable and used for a great variety of purposes including boat building. The pods are harvested, the pulp used as a laxative. The bark is used for tanning leather.

Pires, in Cortesão (1967), lists *Cassia fistula* (sic) as one of the products going from Siam to Malacca at the beginning of the 16th Century. He also records that it grew in southern India, (seemingly on or near mountains) and in Sumatra and Java though according to him it was not used there. He does not disclose whether it was the pods or the timber for which it was sought. (There may be confusion in historic texts between *Cassia fistula* and *Cinnamomum cassia* of the Lauraceae family, the bark of which is the source of a spice similar to, but arguably inferior to, what we know as cinnamon).

Gervaise's description in Hutchinson (1940: 10) of a view in Siam at the end of the 17th century is 'Even during the torrid heat of March and April, when the leaves have fallen and the atmosphere is dense with the smoke of forest fires, there are splashes of colour—yellow, and pink, and scarlet—from the cassia trees, to delight the eye'. Notwithstanding the fact that many of the cassia species have yellow flowers, it could be that Gervaise is viewing *Cassia fistula*. Cubitt and Stewart-Cox (1995: 24) mention 'Cassias—draped in clusters of startling yellow' occurring in tropical mixed deciduous forest.

There is no mention of *Cassia* in the discussion of Chinese gardens by Valder (1999). If it was grown there it surely would have been mentioned due to its spectacular floral display.

MALVACEAE, FORMERLY STERCULIACEAE FAMILY

Tarrietia sp. (syn *Heritiera* sp.) (Thai: *Chum phaelo*) was found on the Ko Si Chang 3 shipwreck site (an outer plank).

Various species of *Tarrietia* occur throughout Southeast Asia (North Borneo, Indonesia, the Malaysian Peninsula, Sarawak, Thailand, Cambodia, Vietnam and the Philippines), six species occur in Malaysia. The trunk is generally straight and cylindrical up to 1 metre in diameter. It is a moderately hard, heavy and durable timber, used for general construction, joinery, sleepers etc. It is also suitable for domestic flooring.

The only species the author has been able to find with anything like a similar vernacular name is one which grows around Trat, namely *Chumpreak*—*Heritiera javanica*. The latter has differing vernacular names in central Thailand, Surat Thani and Trang. *H. javanica* is also found in Indonesia, Laos, Indo-China, Peninsular Malaysia, Sumatra, Java, Borneo, Northern Sulawesi and the Philippines. van Steenis (1954: 513) mentions *Heritiera* in reference to tidal swamp species as does Barwick in reference to *H. littoralis*, which she describes as 'Valued in its native region for its dark brown, exceedingly tough wood possibly the toughest of Malaysian timbers—and is used for building boats and for making masts for dhows, poles and wheel hubs'.

It is of interest to note that *Heritiera littoralis* was used in the building of at least one of the four boats recovered at Butuan in the Philippines (C14 dates 320–1250 and Chinese ceramics associated with the boats are believed to be 10th century to 13th century), Cembrano (1998: 4). This timber was also used, together with *Tectona grandis* (teak), in the construction of coffins found at an associated settlement site together with Chinese blue and white ceramics, probably falling into the 14th–15th century Yuan and Ming periods, Cembrano (1998: 18–19).

Also recovered from the settlement associated with the boats was *Areca catechu*, Cembrano (1998: 13). If not indigenous to the Philippines *Areca catechu* has apparently been growing there for centuries.

MIMOSACEAE FAMILY

Acacia (dyewoods and others with possible relevance to the Thai Gulf Shipwrecks) are examined in this section.

Of the timbers examined by the CSIRO, two samples from the Ko Si Chang 1 wreck site—being short lengths of unidentified timber not forming part of the ship structure and denoted dye wood by the excavation team—were noted by CSIRO as Acacia species (Sapanwood). One sample from the Ko Si Chang 2 ship was given as Acacia species (Sapanwood). Two samples from the Ko Si Chang 3, one definitely from an outer plank were determined as of the Acacia species. They were not given the status of Sapanwood by the CSIRO

These designations provoke many questions relating to:

- nomenclature of timbers
- the intended use of the dyewoods from Ko Si Chang 1 and Ko Si Chang 2 ships
- the type of Acacia used in the construction of the Ko Si Chang 3 ship
- the source of the timbers
- the port of manufacture of each ship

Sapanwood/Sappanwood

There is a dilemma in the identification given by the CSIRO 'Acacia species (Sappanwood)'. Acacia belong to the family MIMOSACEAE. Sapanwood is actually *Caesalpinia sappan*, of the CAESALPINIACEAE family. As such, this author understands that the term sapanwood is used by the CSIRO as a general reference to the timber quality with its possible use as a dyewood. Thus, this author herewith refers to the timbers recovered from the Ko Si Chang 1 and Two wreck site, specified as Acacia species (Sapanwood), possessing dye wood qualities, as Acacia dyewoods.

Whilst respecting that *Caesalpinia sappan* is the true sapanwood, it must be acknowledged that the term sapanwood may have been used indiscriminately for dye producing timbers produced and traded throughout Asia for centuries. Some names used in the context of sapanwood include Brazilwood, *Sepang*, *Sapang*, Baquawood and Japanwood. Barwick (2004) also describes *Caesalpinia sappan* as *Bakam* or *Patangi*, a small, prickly, straggling Indo-Malaysian tree up to seven metres. Corner and Watanabe (1969: 240) say that it grows wild on sandy river banks. Lemmens and Wulijarni-Soetjipto (1991: 60–2) further extend its habitat saying that the origin is uncertain—thought to be the region from central and southern India, through Burma, Thailand, Indo-China and southern China to peninsular Malaysia. They indicate that it is cultivated and naturalized in many parts of Malesia and also in India, Sri Lanka, Taiwan, Solomon Islands and Hawaii'

Caesalpinia sappan, as a dye, produces a huge range of reds, pinks and purple dyes. Dastur (1977) explains that this dye is fast on silk but not cotton.

Lemmens and Wulijarni-Soetjipto (1991) say that apart from its use as a dyewood, sapanwood was also used as a medicine in India, Indonesia and the Philippines. In the Philippines it is

a primary source of firewood and small handicrafts. It is used for inlays, fancy work, cabinets, walking sticks etc.

The Oxford Dictionary differentiates between Sapanwood and Brazilwood. It describes Sapanwood as 'a red dyewood obtained from an East India tree (*Caesalpinia sappan*)' whereas Brazilwood is described as 'a hard red wood from tropical tree of genus *Caesalpinia*, yielding dyes.'

Cannon (1994: 36) says the use of sapanwood is of great antiquity. It was exported from India to China as early as 900BC and the Arabs were using it and re-exporting it to Europe by early Medieval times. Its name was altered to 'brazil' and it was imported into Provence under that name in the 13th Century. The Portuguese found large numbers of similar trees growing in South America about 1500. Schery (1972) indicates that it was much sought after following the discovery of Brazil and was responsible for giving that country its present name.

The name 'brazil', according to Cannon (1994) means colour of red hot coals which Dastur (1977: 43) explains derives from the rich dye—brazilin—coming from the heartwood. Another interpretation is given by McRae (1993: 87) where the scientific names for Brazilwood are given as *Caesalpinia echinata* or *Haematoxylum brasiletto*. McRae further explains that the name brazilin comes from the Arabic word *braza* meaning bright red. She says that it was once used as an additive to madder baths to deepen the colour.

In fact, most authors do not differentiate between *Caesalpinia sappan* and *Caesalpinia braziliensis* in the discussion of sapanwood and brazilwood. Dalby (1985: 23) is an exception. He is specific in reference to *Caesalpinia braziliensis* when speaking of Brazilwood. 'The heartwood of this tree is used as a dye stuff. He adds 'It can be used to produce colours that are very similar to the cochineal colours, but they are not as fast'. 'Even so, Brazilwood can be a useful dyestuff if combined with chrome'.

Other Acacias

There are over 500 species of Acacia throughout the world, mostly indigenous to Australia, but also to many of the warmer regions. It is of interest in trying to determine the origin of the Thai shipwreck timbers that there are only two species of Acacia which are native to Malaysia and they are woody climbers, Corner (1988: 447).

At the same time, throughout Southeast Asia there are several Acacia which have characteristics including that of dye wood. This allows for the possibility that one or more of these could be amongst those recovered from the wreck sites:

Acacia arabica (syn *A. nicotica*) This tree grows from 15–18 m with a clear trunk to 7 m and a diameter to 0.75 m.

From the evidence put forward in the literature, it would appear that the provenance of *A. arabica* was tropical Africa where it has been in use since the times of ancient Egyptians for presses, implement handles, houses, furniture and wheels. It has been long enough in the central provinces of the northern Deccan of India to be termed indigenous and is also planted in the drier parts of India and Burma. Sometimes the tree forms pure forests in India, particularly in Mumbai and Madras. It is said to have been introduced to Sri Lanka and Burma, and Indonesia (Java) in 1850.

Acacia arabica is said to closely compare in general strength properties to *Keruing* from the DIPTEROCARPACEAE. The

wood is very hard, durable, resistant to termites and water. It is used for knees in ship building, agricultural implements, handles and cart wheels. The wood is also said to be valuable as fuel and charcoal. The pods and bark have been used for tanning and dyeing fabrics yellow whilst the wood extract is used for sizing cotton and silks.

Acacia catechu (Cutch, Cutch Tree or Catechu tree) is a relatively small tree that has a moderately straight and cylindrical trunk 2.5–3.0 m with a diameter equalling 0.3 m approximately. It is found in India and Nepal, Bangladesh, Sri Lanka, the Southern Himalayas of Pakistan and east to Burma and Thailand and is cultivated in many tropical regions. It is reportedly an extremely strong and hard wood, very durable, takes a fine polish and is resistant to white ants and teredo worms.

This timber was first used in Europe in the 19th century but it was frequently used in India long before for dyeing cotton. Cannon (1994: 42) indicates it was being exported to China and Japan in the early 16th century according to Barbosa, a Portuguese explorer, and was 'sometimes referred to as 'terra japonica' because it was thought to be an earth found in Japan'. It was sometimes known as 'bengal catechu'. The cutch was supplied in the form of a coarse powder prepared from heartwood. Activated with hot water, this was used for dyeing. Cannon details that on wool a light tan can be produced without a mordant and a strong tan, deep reddish-tan and chestnut brown with alum, chrome and copper respectively. Accordingly, he indicates it is an excellent dye for wool, silk and cotton. Usher gives it as the dye source of the original khaki cloth.

Balfour-Paul (1998) states that *Acacia catechu*, was included amongst substances added to the indigo dyepot arriving at an additional colour in their own right and to '...enrich or darken the indigo blue in Central and Southern America'.

Lemmens and Wulijarni-Soetjijto (1991: 37) indicate that: 'The crystalline portion of a concentrated decoction of the wood was called *Katha* or *Kath*'. Further, it was 'much used in betel chewing together with leaf of piper betel'. This is pertinent in the discussion of the areca nuts found on board some of the shipwrecks. They also indicate that a decoction of the wood *khersal*—is used for medicinal purposes in India. It is said to be used as an astringent and also to treat diarrhoea and throat infections.

Many other uses for *Acacia catechu* are put forward—house posts, shipbuilding, cart construction, wells, agricultural implements, handles, hookah stems, flutes, small tools etc. It is also said to be prized as firewood by goldsmiths as it is one of the best woods for making charcoal.

The Ko Si Chang 3 *Acacia* samples, having come from the ship's structure, do not necessarily bear dyewood qualities. Other *Acacia* from the area with the qualities of a dyewood and other properties pertinent to the shipwreck timber samples, are:

Acacia farnesiana found in India and Pakistan, and '...wild in New World tropics...' Schery (1972: 271) it is also said to be a native of America. The timber is used for cabinet works, shipbuilding and agricultural implements. The bark is used for tanning. *Acacia farnesiana* is cultivated in Malayasia, according to Corner and Watanobe (1969: 222) where it is called *Bunga Siam*. Of interest in the discussion of ceramics in relation to

ships and trade, Fox (1959: 337) says of the Pulung Bakaw archaeological excavation on the west coast of the Philippines, from where Thai ceramics have been recovered, the site was covered with a stand of *Acacia farnesiana* which he stated was '...common along the shores of Calatagan'.

Acacia leucophloea is a native to large parts of south and Southeast Asia—India, Nepal, Pakistan, Sri Lanka, Burma, Thailand, Vietnam, Java, Timor and Sumbawa. It is used for posts, agricultural implements, indoor construction and furniture, etc. It is an excellent fuel and very suitable for charcoal. The bark fibre is used for fishing nets and ropes, flavour for spirits, dyeing and tanning.

Acacia pennata is found in the sub-Himalayan tract, Bihar, Bengal, India. The bark is used for tanning, fishing nets and fish poison. The stem yields a long strong fibre suitable for cordage, fishing gear etc.

Acacia senegal is found in India in the Sind and south east Punjab. It yields the true gum arabic of commerce; it is used in the manufacture of pharmaceutical preparations, blacking, ink and confectionary, calico printing and dyeing of silk and crepe and for thickening colours and mordants. It is also mixed with pigments used for colouring pottery.

PINACEAE FAMILY

Pinus insularis (syns. *P. Kesiya* and *P. Khasya*) Benquet Pine, was used on the Samed Ngam ship.

Also known as Luzon Pine in the Philippines, this tree comes from the high mountain areas of south east Asia including Assam, Burma, southern Vietnam and Thailand. It attains its best growth in Burma at altitudes 610–2700 m. There is an account through Valder (1999: 83) by Ji Han in 304 of trees in the south producing seeds of a very large size. Valder says it is recorded by Li In in a Chinese report in 1979, that the only southern pine with large seeds is *P. insularis*. It grows from about 30–40 m with a clear straight cylindrical trunk clear to about 12 m and a diameter of 1–1.4 m.

According to Cubitt and Stewart-Cox (1995: 24) pine forest '...still occurs naturally in small tracts in some upland areas of Thailand between 800–1800 m where soils are sandy and ridges exposed'. One of two native pines *P. kesiya* sometimes occurs as '...pure stands but are more often mixed with dry dipterocarps at lower elevations and hill evergreen oaks at higher elevations'.

Pinus insularis is used in shipbuilding and is the source of turpentine.

PODOCARPACEAE FAMILY

There are about 100 species of Podocarpus, 30 species of which are present in Malesia. *Podocarpus nerifolius*, (Thai: *Phaya mai*) a conifer, appears to be able to grow to 50 m height, 0.5–0.9 m diam. Most species of Podocarpus occur in mixed mountain forests but individual species can grow in swamp forests to limestone hills.

P. nerifolius is a native to New Guinea and the Himalayas. It grows in tropical (often in high lands) to temperate climes, extending from the Himalayas (Nepal, India) to east-central China, Japan, Indo-China and the rest of Southeast Asia and Melanesia. Barwick (2004) says it occurs on coastal and lowland swamp forests, on volcanic soils. According to Valder

(1999: 87), it is still occasionally cultivated in China today ‘... appreciated for its longevity and evergreen habit’.

P. neriifolius is one of the main sources of Podocarpus timbers, one of its recorded uses being in boat construction. It is a light to medium weight softwood. Barwick indicates that it is easily worked and is particularly prized for cabinet work and furniture.

Podocarpus neriifolius is classified as non-durable when used in contact with ground or exposed to weather it is said to be susceptible to marine borers. This timber has definitely lived beyond expectation on the Ko Si Chang 2 wreck site where it was present as a plank.

SAPOTACEAE FAMILY

One member of the *Planchonella* species was found on the Rang Kwien shipwreck site. There are a hundred species of this tree extending throughout Southeast Asia to Australia, Polynesia and beyond. Five species are indigenous to Malaysia. One of these is *Planchonella obovata*, an evergreen seashore tree up to 36 m.

It is significant that none of the timber samples recovered from the shipwrecks of the Gulf of Thailand were determined to be of the *Tectona* genus—teak. Crawford (1828: 427), in 1825, recorded that of the considerable forests of Siam, the most valued was from the hills of Raheng and Chiang Mai, whilst an inferior product was from around Phitsanulok. None was produced south of about latitude 16 degrees north. At the time very little was exported but ‘...much used by the Siamese themselves in the construction of junks, and above all, in that of their numerous temples’.

In conclusion, of the ships investigated by the joint Thai-Australian team, the use of timber other than teak points toward smaller vessels rather than ocean-going junks, most likely coastal runners built of timbers available in the area in which they were constructed.

OVERVIEW OF HISTORIC REFERENCES TO DYEWOODS IN TRADE IN THAILAND

The earliest located reference to sapanwood, brazilwood or any other dyewood in reference to the Malaysian Peninsula or Thailand is through Wheatley (1961) who indicates that around the 7th century Tan-Tan, a settlement on the Peninsula produced sapanwood and betel nut (areca). Wheatley (1961: 296) mentions jungle products, including sapanwood and betel nut going from the Peninsula to China before 1000. Also through Wheatley (1961: 217), an Arab text relates that up to 1000, Kelah (on the east of the Peninsula), was the centre of commerce for woods such as aloeswood, camphor, sandalwood, ebony and baquawood (identified as ‘brazil-wood’ by Hobson-Jobson according to Wheatley).

Around the 13th Century, the peninsular states were, to the Chinese, sources of jungle products, notably aromatic woods. As detailed in Promboon (1984: 113) the earliest listed Chinese envoys in Siam were in 1370. In 1372 and 1374 Siamese tribute articles included sapanwood.

Simkin (1968: 158) adds that in 1386 a Ming envoy came to Ayutthaya to acknowledge a tribute of 100 picul (6 tons) of pepper and 100 piculs of sapanwood. The following year Ayutthaya sent 30 elephants and in 1389, 1700 piculs of

sapanwood. By 1387, 10,000 catties of sapanwood were being sent to China and in 1390, 170,000 catties of sapanwood—100 catties equalling one picul (about 60kg).

Promboon (1984: 111–113) explains that ‘From the early Ming period pepper, sapanwood and other aromatics were monopolized by the Chinese government. No Chinese was allowed to trade in this rarity (though the practice apparently thrived). There is evidence that, in 1379, Hung-wu gave his officials, pepper and sapanwood as reward for their services. This practice continued in later periods, in which the salary of officials was paid partly in pepper and sapanwood. Apparently, these commodities were used interchangeably as currency, and as substitutes for silver, paper currency and cloth.’ Promboon notes that in the latter half of the 14th century ‘The clearest evidence demonstrating the Chinese defiance of the restrictions was the fact that in 1393 the Cham King informed the emperor he had captured twenty private Chinese ships loaded with great quantities of sapanwood.’

Trade in sapanwood continued and according to Promboon, (1984: 115) ‘It was recorded in the mid 15th century that Japanese missions to China brought with them some merchandises, like deerskins, rhinoceros horns, elephants, tusks, and sapanwood, all of which were local products from either Siam or other states of the Archipelago’. He details that sapanwood was in abundance in Siam. In 1453 Japan re-exported to China 106,000 catties of sapanwood.

In the late 15th century up to thirty vessels arrived annually in Malacca from Siam with cargoes including lac, benzoin and ‘brazilwood’. Pires, through Cortesão (1967: 123–4), refers to ‘brazil’ which came from Siam to Malacca and that China was buying a great deal of ‘brazil wood’ from Malacca. The Chinese then put levies on cargoes coming from Malacca—fifty percent on ‘brazil’.

Pires (Cortesão, 1967: 203) speaking of the south east islands of what is now Indonesia ‘...it has a great deal of brazil, which they take to Malacca to sell, and they go there from Malacca for it because it sells well in China, and the Bima brazil is very thin. It is worth less in China than that from Siam because that from Siam is thicker and better’.

Simkin (1968: 158 & 167) also indicates that trade from Pegu included ‘brazil wood’ and that the Chinese were buying ‘brazil’ in Malacca. Simkin (1968: 216) notes that Dutch East India Company (VOC) exports from Ayutthaya at the beginning of the 17th century included sapanwood. VOC exports from Patani after 1602 also included sapanwood together with areca.

This dyewood was one of the principal exports of the area at the beginning of the 17th century. Peter Floris, a Dutchman aboard an English vessel, describes a cargo of sapanwood from Siam to Japan in 1613 and another cargo left, bound for Mecca, in 1614, Mooreland (2002: 74 & 116). However, in 1616 the agents for a vessel trading between Bangkok and Japan were forced to bribe heavily to procure a small quantity of sapanwood, only to be told lead and skin were a better commodity, Anderson, (1890: 67–8).

Hutchinson (1940: 11), tells how in the second half of the 17th century Kaempfer describes the Dutch trading post known as New Amsterdam, above Paknam, as a large bamboo building, the roof of which was used as a storage place for hides awaiting shipment. Outside the building in the open

were piles of sapan wood ‘...which was valuable as an export for the violet dye it contained’.

Crawfurd (1828) writes of sapanwood being amongst the produce brought down the Mae Nam from northern Thailand in flat boats or bamboo rafts. Sapanwood is included in his list of Siamese exports. Crawfurd (1828: 426) records that ‘The *Caesalpinia Sappan*, or sapan tree, called *Fang* by the Siamese, valuable for the red dye of its wood, is a very abundant production of the Siamese forests, where it grows to the height of fifty or sixty feet, and often to the diameter of two feet. The places remarkable for its production, are the mountains of the Peninsula lying between the 10th and 13th of north latitude. Sapanwood, in point of quantity, if not of value, is the most considerable of all the exports of Siam’. He mentions that on the east coast of the Peninsula around Pran ‘The forests in the neighbourhood abound in sapan wood’.

Perhaps relevant to the shipwrecks excavated in the Gulf of the Thailand, Crawfurd (1828) stated the object of coasting trade was to collect produce for the Chinese market including eagle-wood, dyewoods and barks. Another point to consider in relationship to the Gulf ships is that in 1835, Anderson (1890) recounts that there was considerable trade in sapanwood via native boats between Mergui and Dacca but on official company documentation between 1883–4 no trade was mentioned. This suggests illicit trading was rife. Could this have occurred on the ships excavated by our team? Perhaps the comment by Crawfurd (1828: 412) had a deeper meaning, in reference to cargoes going to China from Thailand ‘All gruff commodities such as dye-woods, barks, etc, are constantly taken on speculation by the owners of the junk’.

DYESTUFF IN THE HISTORY OF TRADE

The recovery from the shipwrecks of the Gulf of Thailand of timbers with the ability to produce dye, has an association to the spice trade which had been central to the European endeavours into Southeast Asia in the sixteenth century. European merchants, representing the East India companies, competed throughout the Asian market for dyestuff, included under the mantle of spices. According to Balfour-Paul (1998: 108) the Chinese have been processing indigo for about 2000 years, and for centuries imported extra indigo from India, Java and the Philippines. There was therefore knowledge regarding the use of dyestuffs in the area for a considerable time.

Indigo gives a general name to a variety of plants from which a dye of the same name is extracted, the most widespread plant being *Indigofera tinctoria*. Indigo was valued because of its strong, stable violet colour. It was increasingly sought over the centuries in order to replace woad, the traditional European dyestuff. Indigo was processed, formed into cakes and dried for transport.

Indigo was particularly important in the sixteenth and seventeenth centuries. Even though in the Portuguese trade there was a royal monopoly on spices, according to Balfour-Paul (1998: 44) ‘...from the 1550s royal control weakened and much private cargo found a place in the king’s ships. She says ‘Despite high royal customs duties imposed upon it, indigo was still easily the most valuable of the drogas...’ (drogas being spices including dyes). Apparently between 1580–1640 an average of 22% of Portuguese ships’ cargo was drogas

Balfour-Paul (1998: 44) acknowledges that ‘...seven Dutch ships in 1631 carried between them a total of 333,545 pounds of indigo worth at least five tons of gold’.

Pertinent to finds from the Gulf shipwrecks, Balfour-Paul indicates that powdered areca nut and tamarind juice were added to the indigo vats to aid fermentation and cutch (*Acacia catechu*) and areca nuts could be added to enrich or darken the indigo blue.

A point of interest, are the indigo dye pots of the Toba Batak dyers of northern Sumatra as shown in Balfour-Paul (1998: 127). These pots bear a marked similarity to the earthenware pots with pressed decoration recovered from many of the Thai shipwreck sites. They appear to be of a similar size and shape though the necks are not as extended as on the majority of the Thai shipwreck pots. It is possible that some of these pots were intended for use in the dyeing process.

Another interesting point is that at the beginning of the 19th century Crawfurd (1828:441) refers to ‘Ko-kram’ as Indigo Island. Whether this is a reference to the water colour surrounding the island or Ko Khram was in fact a source of indigo is not known by this author however it stands to reason that dye sources would be recorded in such a manner.

In short, the Acacias from the Ko Si Chang shipwrecks have the capacity to fit into the large dye pool of Southeast Asia. It is possible that the traders on the Ko Si Chang 1 and Two ships could have been participating in the dye trade, albeit in a limited way. Were the dyewoods destined to supply local dyers? Is it significant that large numbers of earthenware pots appear on the ships together with dyewoods?

Resins

Resin was attached to the outside of a wooden plug from the Ko Si Chang 1 ship. The plug may have come from a large jar containing fish remains. Resin was also on a piece of deteriorated wood with a man made hole. This is likely to have been a piece of ship’s timber where the resin covered a treenail. Like the Malay *perahus* discussed below, caulking was used on the Ko Si Chang 1 vessel, some remains of which were recovered. (Caulking being unbleached cotton or hemp fibres pounded into a seam and sealed with a compound of pitch, aloe resin and lime (Holbrook and Suriya, 2000: 66)).

A quantity of resin was carried on the Ko Si Chang 3 ship inside a large jar (KSC3 29). It was thought to be an aromatic, possibly traded as incense (Green, *et al.*, 1987).

Resin was also found attached to the underside of a ceramic lid from the Ko Si Chang 3 ship (Green, *et al.* 1986, KSC3 286), indicating that the lid had been placed in an upside down position, probably onto a large jar.

Another piece of resin with the impression made by wood on one side was recovered from the Ko Si Chang 3 wreck site (KSC3 2094). It is not certain whether the resin was in fact attached to a piece of timber forming the ship’s structure.

The resin recovered from the shipwrecks could have been one of several substances used in trade depending upon their individual purpose or intention.

LAC

Lac, one of the items appearing on Southeast Asian trade inventories is defined by the *Oxford Dictionary* as a 'Resinous substance secreted on trees by lac insect of Southeast Asia as protective covering, used as varnish etc.' The parasitic lac insect is given as *Coccus lacca* by Floris (Mooreland, 2002). Lac is also associated with the dyeing industry, the richest in dyestuff coming from India and countries to her east according to Sandberg, (1994: 68) who says 'The lac scale insect has various trees as host plants, most of which belong to the *Ficus* family (*Ficus indica* and *Ficus religiosa*).

'KAM-NYAN' AND BENJAMIN OR BENZOIN

Crawford, (1828: 425) refers to 'Agum resembling benzoin, and hitherto confounded with it, is a native product of the Siamese territories. The Siamese call it *kam-nyan*, which is nearly the Malayan term, and represent it as the spontaneous product of a forest tree growing in Lao, in the districts of Raheng, Chiang-mai, and La-kon, as far north as the twentieth degree of latitude'. A Malaysian tree with a similar common name is *kemenyan*, a member of the STYRACACEAE family, Forest Department Malaysia (1978: 262–5). Benzoin or benjamin is included as export items such as from Pattani in 1613, by Floris, Mooreland (2002: 79).

DAMAR/DAMMAR/DARMER/DARMAR

Another important resin-producing tree is the dipterocarp *Shorea javanica* and other related species which grow in southern Sumatra and one use is to make high-quality varnishes. This was used in the recreation of the Borobudur Ship where the 'damar wood' was referred to as 'a natural resin and adhesive, to keep the ship together', *The Jakarta Post* (2003: 5). In fact there are many references to *damar* in Fundter (1982: 30–36 & 192). Most are under the Dipterocarpus, Shorea, Hopea and Vatica species, therefore of the DIPTEROCARPACEAE family. It may be that the word *damar* or *darmer* is used in reference to a tree with resin producing qualities. Severin (1997: 19 & 180) estimates that a single tree may produce 100 kg of resin (through tapping) whereas the natural excretion coming out of its own accord, may be over a period of years, is much harder, more pure and of a far higher quality.

The builders of the traditional Malay *perahus* also used *darmar*. *The Straits Times* (1987: 6) refer to it as dipterocarp oleo-resin. They say *darmar* is '...tapped, dried and pounded to a powder and then mixed with kerosene...'. Before application the *darmar* is mixed with the floss from the kapuk tree (*Ceiba pantandra*) which binds the sealant. This accordingly provided the caulking compound and waterproof sealant. Additionally 'A top coating of lime which has been procured from coral by firing it in a furnace, crushed to a powder and pounded with coconut oil, is applied to the hull under the waterline, which serves to both smoothen the surface as well as act as an anti-fouling.'

GAMBOGE

Gamboge from the tree *Garcinia hamburii* is another resin of Thailand, Cambodia and Cochin China. It is used as a medicine and as a yellow pigment for paint and varnishes. Crawford

(1828: 425), defined the area of growth on the east coast of the Gulf of Thailand from latitude 10°–12°.

LACQUERWARE

Fragments of material with orange-red designs on a black background represent the remains of at least two items of lacquerware recovered from the Ko Si Chang I ship. One, with the imprint of woven bamboo or wood on the underside of the lacquerware, probably represents a square or rectangular shaped box with ridges or ribbing. The other item, which seemed to be made of wood, was an incomplete circular lid with the remains of what was probably a lotus bud shaped handle.

The pieces from the box-like object were decorated with a dragon together with foliage and geometric arrangements. The lid was decorated with foliage and concentric circles, much the same as similar items made of ceramic at the Si Satchanalai kilns. The nature of the decoration indicates that the Ko Si Chang I item was of either Chinese or Thai origin.

Singer (2002: 123) relates that the technique of lacquering, practised for over 3000 years, spread from China to neighbouring southern states and from there to Thailand and Burma. It is said that the art became more common during the Ming Dynasty. Chiang Mai is the traditional centre of the trade in Thailand. Warren and Invernizzi Tettoni (1996: 14) say that the earliest known pieces of Thai lacquerware date from the Ayutthaya period. Fraser-Lu (1985: 8/9) explains it is usual that the lacquerware process begins with the construction of an object in either split bamboo or wood and that the best quality lacquerware is usually made from a base of bamboo. Boisselier (1976: 48) says that lacquer is the latex from *rak yai* of the ANACARDIACEAE family. According to Singer, the lacquer is extracted from the tree *Melanorrhoea usitata* or *M. usitatissima*, the Thai names being *rak* or *hak* (Warren & Invernizzi Tettoni, 1996). This tree grew widely in northern Thailand and Burma.

In the second half of the 17th century, Gervaise, through Villiers (1998: 91) describes the process of lacquerware gilding, mentioning the use of a gum called *chéran* (transcribed as *khreuangkhin* 'lacquerware') '...which is derived from the branches of certain trees that grow in the forests near the Cambodian frontier'.

Fraser-Lu (1985) states that the best lacquer is black. Having a comparatively low water content to brown and yellow varieties, it gives a better gloss. According to Warren and Invernizzi Tettoni (1996), the milky sap turns black when exposed to the air after which it is applied in layers, each being polished after drying. Fraser-Lu (1985: 13), tells that the colourant is inserted into incisions made by engraving the surface after the multi-layering of lacquering is completed. The red colour, which Warren and Invernizzi Tettoni (1996: 14) say is often used in northern Thai lacquerware, is obtained from finely ground cinnabar (mercuric sulphide) which at least in the case of Burma, is imported from China. Fraser-Lu (1985) tells that an inferior red ochre is sometimes used as a colourant but has a tendency to flake; the colour dull, lacking a high gloss. To make orange, orpiment (arsenic trisulphide as mineral—Oxford Concise Dictionary) is added. It is difficult to determine if the Thai shipwreck items, retrieved from the water after nearly four hundred years lacked gloss, were slightly dull or whether

the colour was flaky due to the technique of manufacture. They certainly passed a durability test, if only in fragments.

In Burma, some of the items commonly made of lacquerware include the 'betel-box', boxes or bowls for containing liquids, pickled tea, cheroots, cosmetics and for other items including those used for religious purposes. It is possible that the lacquerware boxes from the Ko Si Chang 1 site formed part of a 'betel set'.

In conclusion, the vegetal decoration on the boxes from the Ko Si Chang 1 site are of a Thai type and the circular lid is likely to be of a Thai shape, differing to the Burmese items illustrated by Fraser-Lu (1985).

MISCELLANEOUS ORGANICS

Areca (*Areca catechu*)

PALMAE, FAMILY: ARECACEAE

This palm tree is said to be indigenous to Indonesia and if not indigenous, certainly cultivated in Southern India, Ceylon, Thailand, Malaysia and the Philippines for centuries. In fact Dansilp and Freeman (2002) say that betel and areca seeds were found in the Spirit Cave near Mae Hong Son, Thailand, dated between 5,500–7,000BC.

Areca was found on several of the Thai shipwreck sites, however not in any quantity. One nut was found on the Ko Si Chang 1, several on the Ko Si Chang 3 and according to Intakosai (1983) some were found on the Rang Kwien site. Lime containers were also found on these sites, indicating that together with the areca nut they may have been part of the personal belongings of the crew (lime being one of the ingredients used with areca to make a stimulant). A lime container was recovered from the Ko Samui site, but it is not known by this author if any areca nuts were found. A large quantity was found on the Royal Nanhai wreck site, according to Sjostrand (1997).

The fruit of the areca, contains one seed which when chewed is mildly narcotic. The seeds are harvested unripe and the fibrous husk removed where after it can be chewed fresh or cured by boiling in water and sun drying. The seeds contain alkaloids. According to Dansilp and Freeman (2002: 26) the '...arecoline in the nut is hydrolysed by the lime into another alkaloid, arecaidine; the latter reacts with the oil of the fresh betel leaf to produce the euphoric properties.' It is apparently also an inferior source of latex. The nuts can be made into beads and fancy articles. They are used to cure worms, including tapeworms, to reduce fever and as an astringent.

Dansilp and Freeman (2002: 26) describe the most well known role of areca: 'There are three essential ingredients in a quid, which combine to create a euphoric effect and are addictive, if not more so, than nicotine. The first is areca nut, called *maak* in Thai, a hard seed about the size and consistency of a nutmeg, which grows encased in a white husk and hangs in clumps from the tall, slender areca palm (*Areca catechu*)... The betel is actually a green leaf—the second ingredient—from a creeper of the pepper family, Piper betel, or *phlu* in Thai. The third ingredient is lime paste, made from cockle shells that are baked to a high temperature to produce unslaked lime, to which water is added; it is then pounded into an edible paste. Cumin (*Cuminum cyminum*) is often added to the paste, giving it a red colour.' Usher (1974: 56) indicates that in some parts

cutch and possibly cloves (or occasionally cardamom or tumeric) are used for chewing whereby it is mildly stimulatory'.

Crawford (1828: 315) comments of the Thai people in terms of the habit of chewing, 'Of the areca and betel-nut they are perhaps the most constant and persevering consumers of all the people of the East, exceeding in this respect even the Malays themselves. The soil and climate are peculiarly suited to the production of both, and the cheapness which is the consequence, no doubt contributes, along with the indolent character of the people, to render the consumption so great'. He indicated that the preparation was the same as in other countries except that catechu formed no part of the ingredients. Cannon (1994: 42) and Lemmens, *et al.* (1995: 37) designate *Acacia catechu* as the source of 'cutch'—a powder resulting from grinding down of the wood, from which a dye is made.

Balfour-Paul (1998: 121–2) describes how powdered 'betel nut' and tamarind juice are both ingredients which are added '...to propitiate threatening spirits' in the making of Indigo dye but...would in fact have genuinely aided fermentation'. She indicates that 'betel nut' and tumeric was used for dyeing on Savu Island (between Sumba and Timor in the Savu Sea).

According to Dansilp and Freeman (2002) 'The offering of betel was a sign of goodwill to guests; affection in courtships and honour at court. The preparation of the 'quid', or a packet of ingredients to be chewed, was considered an essential social skill'. They say that the first documented use of areca in India was at least 2,000 years ago. It is mentioned in Chinese texts as early as the 7th century as a product (together with sapanwood) from Tan-tan on the east coast of the Peninsula (Wheatley (1961: 52 from Chinese texts).

Betel chewing is mentioned in China during the Tang dynasty (7–9th century) as part of marriage ceremonies, according to Valdes (2004: 108). It was also a highly exalted custom in the Philippines where it was prevalent from the north to the south. 'The offering of betel was an essential component of every rite of passage such as birth, courtship, betrothal and marriage, healing and finally death' Valdes (2004: 104). Where the Thai used a small box in which to carry the necessary ingredients, the Visayan carried little baskets or pouches.

Wheatley (1961: 56) refers to the discussion in the text Hsin T'ang Shu (completed in 1060) where the value of areca nut is illustrated – 'When a man (of Ko-lo) takes a wife he makes a present of areca nuts, sometimes of as many as two hundred dishes'

Simkin (1968: 216) includes areca as an export of Thailand at the end of the sixteenth, beginning of the seventeenth century and indeed 200 years later. A description by Gervaise in the second half of the 17th century and retold through Hutchinson (1940: 10) recounts '...the familiar picture of wide padi plains intersected by long rows of graceful bamboos lining the banks of a river or canal. Oases of dark green areca and coconut palms mark the site of villages nestling in their shade'. Further, he acknowledges that 'Bangkok, as it appears in the letters of early Roman Catholic missionaries, was little more than a collection of villages noted for their plantations of areca-nut trees'.

*Tamarind (Tamarindus indica)***Caesalpiniaceae**

Tamarind seeds and the remains of pods, together with gourd seeds, were recovered from a large jar on the Ko Si Chang 1 ship. The height of the tamarind tree reaches 25 metres, spreading 5 metres. The fruit is in the form of pendant pods with thin, brittle shells.

Tamarind is rich in minerals and vitamin B complex. Barwick (2004) indicates that tamarind is used as a preservative for fish; the seeds are sometimes ground for flour and that it is also used for cleaning copper and brass. Tanaka (1976: 716) explains that tamarind seeds and pods are pressed for use in drinks, preserves, curries, jellies, syrup, sauces and chutneys. Balfour-Paul (1998: 121–2) advises that the juice of tamarind is in some places, added to indigo vats to aid fermentation. Boisselier (1976: 45) explains that crushed and boiled tamarind seeds were traditionally used as a binder for the primer before painting on walls in temples.

Pires, mentions tamarind several times in his early 16th century report from India and Malacca indicating that there were many growing in southern India as well as on Java, the islands of Sunda and the Island of Bima (Byma). Used instead of vinegar, he indicated that it was good merchandise in these parts, even though it was worth very little. He says of Java, (Cortêsão, 1967: 180), ‘...it has tamarinds (enough) to load a thousand ships’.

Due to the nature of the find, it is likely that the tamarind on board Ko Si Chang 1 was intended for culinary use or for the preservation of fish.

All who have participated in the Thai-Australian excavations of the Ko Si Chang 1, 2 and 3 shipwrecks are aware that their temporary home, not far from the wreck sites, is known in Thai as Ko Kham Yai—*island of the large tamarinds!*

Gourd

Seeds, identified on site as gourd, were recovered from the Ko Si Chang 1 ship, together with the tamarind remains. Thompson (2002: 158) says ‘Many types of green gourd which are of Chinese origin, are now used extensively in Thai cuisine’.

Ivory

Fragments of ivory have been recovered from several Thai Gulf shipwreck sites representing what was in fact a significant item in Southeast Asian trade. Tusks in varying stages of decay were recovered from the Ko Si Chang 2, Ko Si Chang 3 and Rang Kwien shipwreck sites. Intakosai (1984) reports that an ivory ring and a ruler were also retrieved from the Rang Kwien. Several chess or games pieces, said to be of Thai origin were recovered from the Ko Si Chang 1 shipwreck site. It was not determined at the time whether these items were made of ivory or a wood such as ebony. Similarly, the composition of a small item, possibly a handle, from the Ko Si Chang 1 could not be determined between ivory and bone.

The elephant, and ivory too, has always held a place of high significance with Thai royalty. Crawford’s observation in the 19th century (Crawford, 1828: 430) that ‘Ivory is a royal monopoly; but not one very rigidly enforced’ is a demonstration of a tradition of underground trade. The fact that ivory was

recovered from one of the Dutch shipwrecks (*Vergulde Draeck*) wrecked off the Western Australian coast in the 17th century when none was itemised on the cargo inventory demonstrates what was probably a wide spread black market trade in ivory.

Of interest is the fact relayed by Dansilp and Freeman (2002: 38) ‘...visible tusks only sometimes grow in the male Asian elephant’. They relate that some elephants have hidden tusks about 3 cm long. Although fragments of ivory tusks were recovered from the Ko Si Chang 2 and Ko Si Chang 3 sites, no relatively complete items were found. It is considered that these items were of a reasonable length. The tusks may have come from Africa. Rinaldi (1989: 32) indicates that Portuguese vessels brought ivory and rhinoceros horns from Africa to Malacca and thence to Macao. African ivory is said to be longer and softer for carving.

It is apparent from historic accounts—such as those of Anderson (1890), Wheatley (1961), Pires and Crawford that the interest in the ivory trade extended over centuries. Huge quantities of elephants fell victim to the extensive trade in ivory. Simkin (1968: 27) acknowledges that trade in Indian ivory was occurring in the early Hinduization of Southeast Asia and that Chinese ivory was traded via Indians. Wheatley (1961: 61) details the total amount of elephant tusks imported into China between 1049 and 1053 showing that it was already a well represented trade item in that century.

At the beginning of the 16th century Malacca was an entrepot for some of the Thai ivory, according to Pires (Cortêsão, 1967: 108), a significant amount going to China, Pires (Cortêsão, 1967: 123). At the same time ivory from Champa was coming to Thailand. In his discussion on Banda, Pires indicates that ivory was brought from other islands to be sold. According to Floris, Mooreland (2002: 86), in 1613 at the entrepot of Pattani, ivory was bartered with the Chinese, for pepper, skins and silk.

In the 19th century Crawford (1828: 407) explains that ivory was imported into Thailand from Laos and Cambodia by land and river transport. China was one of the chief foreign traders. Crawford (1828: 430) wrote that ‘The quantity received yearly by the King is said to amount to no more than 400 piculs. Not only the ivory, but the hides and bones of the elephants are in request in China, and in every year largely exported to that country’. Trade in ivory was complex and wide spread.

It may be relevant that ivory was recovered from those ships (Ko Si Chang 2, Ko Si Chang 3 and Rang Kwien) which carried comparatively high proportions of Chinese or Vietnamese wares as part of their cargo. This poses the question as to whether the ships were fulfilling the role as coastal traders, picking up items thought to be able to be sold at the next port or were they heading to a large entrepot to off-load the ivory?

Eggs

Duck eggs were recovered from inside a jar from the Ko Si Chang 3 shipwreck site, Green, *et al.* (1987), they were also recovered from the Rang Kwien site, Intakosai (1984: 135/6) and the Turiang site, Brown & Sjostrand (2000) Plate 47.

Kurlansky (2002: 22–3) indicates that the Chinese soaked eggs in brine for a number of weeks in order to transport them more easily. They encased some of the brine treated eggs in

salted mud and straw. Eggs could also be treated with salt, ash, lye and tea in order to attain a very long keeping egg.

Fish Bones

Fish bones were found inside storage jars on the Royal Nanhai wreck site, Brown & Sjostrand (2002) CP1 14. Analysis revealed them to be from a salt water fish of the *Rastrelliger* genus. Fish bones were also recovered inside a jar from the Ko Si Chang 1 wreck site. These were not identified, however they seem to have the same general appearance as the bones from the Royal Nanhai.

Fish sauce (*nam pla*), made from fermented small fish, forms an integral part of the Thai diet. According to Kurlansky (2002: 70) in reference to the Roman period, around the Mediterranean Sea 'To make the sauce, the fish scraps were put in earthen jars with alternating layers of salt and weighted on the top to keep them submerged in the pickle that developed as salt drew moisture from the fish'. A similar practice still occurs along the Thai coastline where nowadays the plastic barrel replaces the clay jar.

Lime

Another item which appeared on some of the Thai wreck sites was lime. It was found, sometimes in quite large quantities, inside the jars (Type 4.1 above). A jar believed to be from the Ko Samui ship wreck site held lime residue almost up to the rim. A substance, possibly lime, was found inside a large jar from Ko Si Chang 1 (KSC1 3976). The remains of lime was also found inside a metal lime container (KSC1 1983 03), Green (1983: 33). In this case it would have been used in the preparation of a 'quid' in 'betel' chewing.

Lime formed a component of the sealing agent in ships' caulking. It was also used in the production of '100 year old eggs'.

PART 6. The Human Element—Trade, Travel, the People

Fitting the Thai Shipwrecks into an Historic Context

A Brief Chronology of Infiltration and Trade from the West and the East to the Thai Peninsula and Continental Thailand Touching on the Areas and Times most Pertinent to the Shipwrecks Investigated by the Thai–Australian Team

Introduction

To search toward the unknown is human nature, despite, or even perhaps because of, any adversity likely to be encountered. Early maritime trade in Southeast Asia in former times was precarious due to the intrepid nature of unknown waters, great distances, variability of the seasons, unpunctual and often unpredictable winds, the relatively unsophisticated technology of the times, the patrol of waters by pirates and a heightened sense of the supernatural. Material bounty of discovery was seen as exotic and in turn became prime subject of desire to those who hadn't their own source.

Before European arrival, trade within Southeast Asia, including ceramics, had existed for centuries. A surge in exploration by Europeans occurred in Southeast Asia after the gigantic maritime feat of mastering the route around the Cape of Good Hope to the East Indies. The West had greater access to exotics. Some demanded ivory, gold and precious stones. Other cravings appear more surprising today, such as noted by Pires in Cortesão (1967: 287) in the 16th century '...in Malacca they prize garlic and onions more than musk, benzoin, and other precious things'. The attraction of spices from the East Indies is well known. Perhaps less understood is the chaos caused by tulip bulbs brought from central Asia to the west in the mid-16th century creating a frenzy of monetary activity, changing hands for exorbitant prices. Dyewoods, jade and carpets fell into the same category. Even seemingly humble rhubarb was seen as an exotic import from China. In this context it is understandable why skilfully decorated and glazed ceramics of China, Thailand and other Southeast Asian countries were sought after, not only throughout Asia itself, but much further afield.

The Chronology

It is estimated that the loss of the ships excavated by the Thai and Australian teams during the 1980s occurred over several centuries. A potted history of Thailand is presented here with a focus on the known ceramic production areas such as Sukhothai, Si Satchanalai, Suphanburi, Singburi and northern Thailand. Other areas are included when perceived to be of relevance to trading patterns, the ship itself, the cargo or the crew, in an effort to ascertain their provenance.

In order to understand how the Thai wrecks excavated by the Thai–Australian team fit into the known history of the time, it is valuable to look at Chinese, Arab and European exploits leading up to and covering the period over which the ships met their fate in the Thai Gulf—estimated to be from the fifteenth to the nineteenth centuries.

As previously stated, this author is not a scholar of Thai history. Readers are referred to more recent texts and publications such as those of the *Journal of the Siam Society* for stimulating discussions on many aspects of Thai history.

Much information has been gained from Wheatley's studies into the historical geography of the Thai–Malaysia Peninsula before 1500 where he uses Chinese and Arab texts to gain some insight into exploration and exploits of that time. Other information has been gained from the journal of the Portuguese apothecary Tome Pires who gives an account of his time based in India and Malacca at the beginning of the 16th Century. Reference has also been made to accounts of European explorers and ambassadors of the nineteenth century particularly Crawford whose journal of the 1820s, long after the time of the shipwrecks investigated by the Thai–Australian team, still gives an insight into pre-industrialised Southeast Asia.

The country which is understood today as Thailand has in fact come together after constant change of borders between mighty powers such as the Burmese and Khmer and small kingdoms lead by local kings and princes such as Mengrai in the north and Ramkhamhaeng in Sukhothai. Kingdoms enlarged or declined during wars and takeovers and changes in family groupings. Throughout the ages, because of its position between the great civilisations of India and China, Thailand was invariably influenced by the flow of people traversing and settling within what is the present day Thai border.

Shaw (1981: 40) postulates that the northern Lanna kingdom was originally populated by the Lawa, who could be styled the 'Celts of Thailand'. They were succeeded by the Mon.

The traditional history of the Mae Nam Chao Phraya Valley at the head of the Gulf of Thailand is that it was inhabited by the Mon of whom it is said were closely related to the Khmer. They were overcome by the Tai who were, according to the Han Chinese chronicles in the first century, a distinct people from Yunnan, at the lower reaches of the Yangtze River (Thompson, 2002: 6).

Much of Southeast Asia in previous times was under the umbrella of the Chinese empire and subjugation to China in relation to Southeast Asian trade was acknowledged. As Pires through Cortesão (1967: 103) explains around 1512–1515 '... the land of Malaca is called a land of Siam, and the whole of Siam, Champa and thereabouts is called China', Champa being an area of southern coastal Vietnam.

It is undeniable that the Peninsula, sections variously administered by Thailand throughout time, had enormous bearing on the exploration and trade patterns of the Gulf of Thailand and the hinterland. The Peninsula was 'halfway' between India and China—requiring a lengthy sea voyage, or a trans-peninsular crossing for travellers. Seasonal winds governed the period sailing ships could undertake voyages—they used the predictability of the monsoons for their outward and return voyages. As Wheatley (1961: Fig. 4) shows, in order to avoid some of these obstructions, over the centuries most of the larger rivers and suitable landways were used in order to cross the Peninsula from the west bordering the Andaman Sea to the east bordering the Gulf of Thailand and the South China Sea. Many of these trade routes would have come as a natural evolution of migratory patterns—people following the most accessible routes down fertile river systems. Wheatley and others give archaeological examples to substantiate this. Though this transpeninsular transport would have required great strength of human resources the voyage time saved was apparently deemed worthwhile. Shallow and difficult waters of

the western side of the Peninsula and pirate attacks on laden ships made the land crossings more justifiable.

In early times, it appears that Mediterranean or Egyptian merchants went from the Red Sea to the southern point of India, but not beyond. Navigational techniques progressed to a stage whereby the ships could reach the Peninsula by following regular wind patterns. Brissenden (1976: 6) indicates, from Miller (1969) that the cinnamon trade across the Indian Ocean from Indonesia to Madagascar was operating in the first century and probably before, and that India to Indonesia trade existed around then also. From the eastern approach, voyaging to the west, (according to Wheatley, 1961: 84), the Chinese followed the coast to the Mekong estuary from where an overland route could be taken to the Bay of Bengal or a sea route, around the Peninsula. The latter route from China took four months more and like the western access was at the whim of the 'barbarians' or pirates who controlled the trade of the south China sea and Malay waters.

Wheatley (1961: 9) demonstrates that the Chinese knew part of present day Thailand as Shen li and Burma as Fukan-tu-lu as early as 100BC and that Shen li was amongst the chief ports on both overland and maritime routes from the Mediterranean to China. At this time a journey across the Peninsula from the upper Thai Gulf was estimated at ten days. Some of the earliest settlements in Chinese records were located on the Peninsula because it was a barrier between 'east' and 'west'. Unfortunately many of these settlements are unable to be pinpointed today.

At the close of the first century the kingdom of Langkasuka was founded on the east coast in the neighbourhood of modern Pattani according to Wheatley (1961: 194). Tun-sun, existed as a trading mart in the extreme north of the Peninsula, together with Ch'u-tu-k'un and the port of Chu-li. Other early towns of importance were P'an P'an and Tambralinga.

During the third century, Chinese from the Empire of Funan a state in the Mekong delta, important because of her transitory ports between China and the West, (Hall, 1985), extended its territory by attacking the kingdom of Chin-lin. This country was seemingly situated on the northern shores of the Gulf of Thailand. According to Hall (1985: 64) Funan, through the leadership of Fan Shih-man, campaigned to assume direct authority over trade centres on both sides of the Peninsula '...solidifying Funan's dominance over the flow of commerce through Southeast Asia'. Until then the Chang-hai (Gulf of Siam) had not yet been crossed directly but the Chinese records of Liang-shu say that the King '...ordered the construction of great ships...' and crossed right over the Chang-hai, according to Wheatley (1961: 15 and Fig. 47). The area was considered to be either a small, or immense, sea according to different interpretations. Already the area surrounding it was seen as a place of enormous wealth. During the 4th and 5th centuries Asian trade became increasingly seaborne. Because of barbarian activity in northern China, the Chin dynasty no longer had access to central Asian caravan routes (Brissenden, 1976: 69 and Hall, 1985: 72). As a result the Isthmus of Kra route over the Peninsula fell into disuse. Ships from India and Sri Lanka used the Straits of Malacca into the Java Sea.

According to Hall, in the 5th century shipping started to use the South China Sea without stopping at Funan. Ships passed from Borneo to China and from China to the north Java coast. Cham ports were used. The Khmer dominated Chenla (states which occupied Cambodia).

The demise of Funan's prominence came in the 5th and 6th centuries. According to Wheatley, in an effort to control trade-routes, Funan held the Isthmus until the collapse of the empire upon which a period of independence followed. After the 8th century it was divided between the Khmer in the north and Srivijaya in the south. After the 13th century the T'ai established a suzerainty still existing in the northern Peninsula today.

Hall, (1985: 176) says that between 670–1025 Srivijaya, centred at Palembang, dominated commercial trade throughout Southeast Asia. Takuapa (midway down the west coast of the Peninsula) was the terminus of Arab-Persian trade up to mid 11th century. It shifted to the Kedah Coast. Kalah (as the Isthmus of Kra region was called) was the centre of Arab—Persian trade.

The Buddhist Kingdom of Dvaravati arose in the sixth century, first at Nakhorn Pathom then at Lopburi. According to Hall (1977: 24) the Indian penetration into Thailand particularly favoured the river valleys of the Isthmus of Kra, the Three Pagoda Pass by the Kanburi (sic) River (Mae Klong), to the Mae Nam valley from Tavoy, and the Raheng Pass (near Tak) from Moulmein to the Mae Nam. Settlements such as Nakhon Pathom and Suphanburi (from where, at the beginning of the 15th century some of the ceramics from the Ko Si Chang 2 shipwreck are believed to have been manufactured) capitalized on the overland trade between the Gulf of Martaban and the Gulf of Siam via the Three Pagoda Pass, Wyatt (1984: 21). They had access to coastal junk trade whilst commanding the eastern end of the Three Pagoda Pass to the Mon kingdoms of Irrawaddy.

In the voyage of the Sui envoys from China 607–10, of particular interest in reference to our shipwrecks, there is reference in Chinese to a 'Lion Rock' which some have interpreted as being Ko Si Chang. Wheatley (1961: 35) says in the twentieth century Ko Si Chang was known by sailors as 'the Lion'. However, Ko Si Chang, around which many of the wreck sites occur, lies at the head of the Bight of Bangkok and may not have been the subject of their description as Ko Si Chang translates as Four Elephant Island. There may be confusion with Ko Chang further to the south, in the vicinity of Trat, however, it does indicate that the Chinese had become further acquainted with the Gulf.

A pilgrimage taken by Hsuan-Tsang from China to India in 629–45 as described by Wheatley (1961: 41) was undertaken both ways by land illustrating that despite the difficulties of an overland voyage it may still have been more practical than sea travel.

In the seventh century, according to Wheatley (1961: 164), Langkasuka emerged as a sovereign kingdom, becoming a main port of call on the sea route between China and India. Its chief export was aromatic wood (eaglewood—of which the heartwood is termed aloeswood).

It is recorded that Tan-Tan, another settlement on the Peninsula mentioned by Wheatley (1961: 52) around the

seventh century produced sapanwood and areca, both items with some significance to our ships.

Hadimuljono (1985: 8) notes that from the Annals of the Song dynasty it is known that China was already exporting porcelain very early on. Chinese ceramics dating from the early Song dynasty have been recovered from the Mae Klong, Thailand. During this dynasty (960–1279), Chinese private merchants are said to have boarded Malay ships and traded in the Southern Seas, (Hall, 1998: 196).

Wheatley (1961: 217) details that the Arab Abu-Zaid relates that up to 1000 Kalah was the ‘...centre of commerce for aloeswood, camphor, sandalwood, ivory, tin, ebony, baquamwood...’. In fact Wheatley (1961: 73) quotes ‘To the Chinese the Peninsula states were sources of jungle products, notably aromatic woods, spices, ivory and rhinoceros horn...’. In return merchants supplies included iron, earthenware, porcelain and also lacquer-ware ‘...for the members of the ruling hierarchy...’.

Thompson (2002: 6) tells that over several centuries Chinese migrated to Yunnan from further north so by the 9th century T'ai began to move southwards, reaching the area of modern Thailand about the 10th century. There is much discussion regarding this history as well as the development of the Thai ceramic kiln sites with new information frequently coming forward. Hein, *et al.* (1986: 30 Fig. 11) indicated that the ceramic industry was likely to have been established at Si Satchanalai as early as the 10th century.

In the 10th century troubles in the areas then know as Nan-Chao (north of the Khmer and Burmese realms) blocked overland commercial networks connecting the Irrawaddy plains to China, generating Burmese interest ‘...in opening commercial channels to the south’, Hall (1985: 198).

During the 10th and 11th centuries Khmer authority spread into the lower Chao Phraya basin, providing access to international commerce at Tambralinga (Chaiya-Surat Thani area southern Thailand). As a result the Khmer had more direct access to international trade through the trade routes of the Isthmus of Kra, Hall (1985: 171).

Hall (1985: 176) points out that the Khmer presence in Surat Thani during the 11th century gave mainland commercial networks access to the ‘...international China market as well as this Western market of Persian and Indian goods’. Dvaravati maintained its independence up to the reign of Suryavarman I (1011–50).

During the 11th and 12th centuries there was an increasing influence of Theravada Buddhism throughout. In the Mae Nam valley the Khmer expanded. Main centres of the Angkorian kingdom included Suphanburi, Phitsanulok, Sawankhalok and Sukhothai amongst others. According to Wyatt (1984: 27) as part of the Angkorian kingdom, a system of relatively sophisticated roadways existed probably at least as far as Lopburi.

At the beginning of the twelfth century the T'ai had begun to infiltrate into the Mae Nam valley and had settled in the state of Lavo (Lo-hu/Lopburi). By 1155 it appears that the Chao Phraya valley was free of Khmer control, Hall (1985: 205–6).

Struggle for a stronghold on the Peninsula was demonstrated by Hall (1985: 202) from Luce and Wyatt, indicating Tambralinga was controlled for periods by the Burmese and

Singhalese. In the 1160s there was conflict between Sri Lanka and Burma regarding the upper Peninsula.

By 1225 the lower Mae Nam Basin, according to Chinese sources related through Wheatley (1961: 65), was called Teng-liu-mei, a dependency of Chenla. The Peninsula was primarily under the control of the Sri Vijayan (Indo-Javanese) empire. From the 13th to 17th centuries Java was in control of the spice trade and was the dominant commercial power, Hall (1985: 197).

The state of Ligor (in the area of Nakhon Si Thammarat and former kingdom of Tambralinga) on the Peninsula was very powerful by 1230. Wyatt (1984: 51) believes that a T'ai ruling house was there by no later than the middle of the thirteenth century where for two centuries the Khmer, Malay, Burmese, Mon and south Indian rulers ‘...had sought to control international maritime trade by establishing their power there. By the mid 13th century Nakhon Si Thammarat was a major Buddhist centre. The T'ai took control over most of what is the Kingdom of Thailand. During this century the plain west of the Mae Nam Chao Phraya was dominated by the principality of Suphanburi stretching from about Chainat in the north to Chumpon in the south, Wyatt (1984:64).

In 1270 King Ramkhamhaeng defeated the Khmer governor of the Upper Mae Nam Valley and established the Kingdom of Sukhothai encompassing the area around Sukhothai, Sawankalok, Uttaradit, Kamphaengphet and Tak. His submissions were said to be received at places as far as Vientiane, Suphanburi, Nakhon Si Thammarat and Luang Prabang so that the area was nominally subject to Ramkhamphaeng. It appears that personal allegiances and family connections largely tied the country together and dictated who was in control.

Wyatt (1984: 64) says that Suphanburi ‘...probably maintained influence, if not control, over the dependent regions stretching to the south’. She, along with other towns of the western Chao Phraya and Peninsula wished to be independent from Angkorian rule. Wyatt (1984: 59) illustrates that power ‘By doing so, it blocked Sukhothai’s access to its vassals farther south and set in motion a series of developments that by the mid-14th century would lead to the creation of Ayudhya, the state that ultimately would absorb Sukhothai. Thus, by about 1320 at the latest, Sukhothai again had become a relatively small kingdom of local, rather than regional, significance’. It is known, however from the recovery of ceramics from datable shipwrecks, that the kilns at Si Satchanalai continued to operate for a much long period, producing quality material and that the Sukhothai kilns were almost certainly in operation at the beginning of the 15th century.

By the end of the century many smaller communities now regained control of their religious and cultural decision-making. New chiefs and princes founded new communities and ruled some of the old such as Phitsanulok.

In regards to trade from the area in the thirteenth century, according to Wyatt (1984: 52), as early as 1200–05 the state Chinese called Chen-li-fu (he says located perhaps in the Phetchaburi region) was involved in ‘...sending diplomatic missions to China...seeking political recognition and trade...’. Embassies were also sent from Lavo to China after it regained its independence according to Hall (1977:172). Thirteenth

century trade between the Malaysian Peninsula and China included the export of ivory and the import of earthenware bowls, iron, lacquer-ware and porcelain vessels, Wheatley (1961: 66–7).

During this period, the beginning of the Chinese Yuan Period (1280–1368), large Chinese junks developed by the Song, took part in trade to Southeast Asia and South India, where major ports had many resident Chinese traders according to Simkin (1968: 140). Trade was encouraged.

In the North, at the end of the 13th century the T'ai chief Mengrai, conquered Pegu, the capital of the Mon region of lower Burma in 1289. He also conquered the Mon state of Haripunjaya in 1290–2 and founded the Lanna Kingdom of Chiang Mai.

In 1293 came the beginning of the breakdown of Srivijaya and the formation of the Majapahit Empire in Java. According to Wyatt (1984: 132) during the late 13th century, the Chinese Mongols campaigned as far as Java, extending their power into Southeast Asia.

There has been much discussion and debate about the importance of the Sukhothai and Si Satchanalai regions, for how long their kilns operated and the origin of the manufacturers. Advancement in archaeology appears to be changing long held perceptions on the dating and outputs of these kilns, as illustrated through Hein (2001), Vickery (1990) and other works. Hein (2001: 115) says that there was no sign of Chinese or Vietnamese wares in the early material (termed MON—Most Original Mode) from Si Satchanalai. He proposed that production of glazed stoneware at Sawankhalok commenced mid 13th century suggesting that there was a strong relationship between the northern kilns from the earliest phases of production. Hein (2001: 242) says 'The proliferation of ceramic sites in the north, many at urban centers of the greatest antiquity such as Phayao and Nan (Hall, 1970: 169), is suggestive of the heartland of a tradition. Their generic relationship to MON-like traditions imply an existence, at the latest, coeval with the earliest phase of Sawankhalok.' It is Hein's explanation as to why the latter kilns were established so far from the sea.

Interestingly, Shaw (1981: 22) states that Khmer pots were well known to inhabitants of Sukhothai before independence in 1238—sherds being found at Sukhothai, Si Satchanalai, Chalieng and Lanna. Then, as Shaw (1981: 21) notes 'The first record of a Sukhothai mission visiting the Yuan court was in 1292; a further mission went in 1295, and in 1299 the eldest son of King Ramkamhaeng went...'. Therefore there must have been knowledge of the wares and possible copying of painted and celadon ceramics. He says however 'There seem to be no cases of the court deliberately giving away know-how and trade secrets that would compete with one of their major export staples'. Shaw also says it is reported that in 1282, 200 Chinese refugees settled near where Ayutthaya was later to be situated. Shaw says Ramkamhaeng may have brought back a few potters from Khmer kilns after his raid on Angkor in 1294, if there were not already some at the Thai kilns.

According to radiocarbon dating, the earliest possible times for construction of the Pattaya ship was 1330 and the Ko Khram, 1380. As this is the date of the timber used in the manufacture of the ships it stands that they would have been

built some time after. Ceramics or coins carried on board ship are potentially a more reliable aid in dating the actual voyage time of a ship.

Of the Thai region, Wheatley (1961: 298) says that to 1300 'Communication was by way of the sea and, except on the isthmus, land routes were almost nonexistent...'. As previously acknowledged however, movements across land had gone on for centuries. Roads were built in eastern Thailand as part of the Khmer kingdom and land tracks, probably along river valleys, must have been used when in 1301 the Chinese invaded the T'ai region, reportedly with an assemblage of 20,000 men and 10,000 horses '...reinforced by Mongol archers', Wyatt (1984: 49). It is interesting to note that some of the decoration on the ceramics from the Suphanburi kilns feature archers on horseback, Green and Harper (1983) Plate 29 and Vilaikaew (1989).

Shaw (1981: 8) states that: 'From the middle of the 14th century Sukhothai, blocked by expansion to the north by the new and powerful state of Lanna, cut off from the rich rice-growing plains to the south and all access to the sea except with permission, rapidly lost its importance except as a centre of religion and as a centre of the ceramic industry'. As indicated above archaeological evidence, particularly from the excavation of the shipwrecks in the Gulf of Thailand and further afield, concludes that the Sawankhalok/Si Satchanalai kilns probably continued production into the 16th century and the Sukhothai kilns into the 15th century.

In the mid 14th century (1350), by the union of Lopburi and Suphanburi (Shaw, 1981: 8) the Kingdom of Ayutthaya emerged. The territory under its control became known as Siam (Hall, 1977: 175). Baker (2003: 45) indicates that there are traces of an earlier Khmer style settlement to the east of the island where Ayutthaya was built. From Arabic texts of the 15th and 16th centuries, Wheatley explains that Arabs sailing down the west coast of the Peninsula referred to the city of Ayutthaya as Shahr-i Naw which Wheatley explains is Persian for 'new town'. Anderson, (1890: 16–17) gives reference to a number of versions of the name. Wheatley (1961: 240) translates that from Tenasserim there was an estuary '...which never has rain, being dry and the people of Tenasserim travel in it to Shahr-i Naw. So do the Arabs travel to Shahr-i Naw.' On Fig. 4 given by Wheatley it appears that they used this route to travel to somewhere in the vicinity of present day Prachuap Khiri Khan. It is not clear whether the trip to Ayutthaya was completed by land or by sea. However, Chamoraman (1984: 102) indicates that travellers went from Tenasserim to the small districts of Kui and Pran in Prachuap Khiri Khan Province from where they could easily pass to the sea front then sail to Phetchaburi—an entrepot.

The Kingdom of Ayutthaya gained control over the middle and lower Mae Nam, and much of the Peninsula including Tenasserim and Tavoy. It gained suzerainty over Sukhothai. According to Hall (1977: 176): '...it was the weakness of the Mongol power in the middle of the 14th century that made possible the creation of so strong a kingdom as Ayut'ia became.' He continued 'As soon as the Mongols were supplanted by the Ming Dynasty (1368–1644), the situation changed radically. The Siamese kings seem to have been aware of this, for they sent frequent embassies to Nanking, the Ming Capital, and

sedulously cultivated friendly relation.’ Promboon (1984: 108) tells that between 1351 and 1511 Siam despatched 78 missions to China where they received favourable treatment.

Praicharnjit (1988i: 13) estimates that kilns had been established in the area of the Mae Nam Noi kiln site, Singburi Province, north west Ayutthaya (from which it is estimated many ceramics, jars in particular, were manufactured), since the early Ayutthayan period. Ayutthaya had the advantage of being at a strategic position placed on an island at the confluence of the river systems dominating Thailand, within easy reach of the Gulf of Thailand and thence to places east and west through either sea or land routes. Trade from India to China increased. Both other major cities of the time (Suphanburi and Lopburi) were within easy reach by water. King U Thong (Ramathibodi) with his political and kin connections was, according to Wyatt (1984: 66) rapidly able to construct a kingdom that soon overwhelmed his nearby rivals. It is Wyatt’s belief the main problem in Ayutthaya was the succession to the throne which altered between the Lopburi and Suphanburi sides of the family for some generations.

During the latter half of the 14th century the centre of trade was at the northern part of the Peninsula around Ligor and Pattani, according to Promboon, and some traders were using the trans-peninsular routes from the Isthmus to China. Trade transactions developed at other ports, forming entrepôts—including Ayutthaya—and on the west coast of the Peninsula Mergui and Tenasserim were used by Muslim traders. Promboon says that the Chinese controlled most of the internal and external commerce.

According to Wheatley (1961: 77–80), from Chinese texts, during the 1330s and 1340s trade from the Ligor area included tin as an export and blue and white porcelain bowls as imports. Other areas on the Peninsula exported sapanwood and areca nuts whilst blue porcelain and coarse bowls were included in the imports together with iron and copper cauldrons, lengths of iron and lacquerware. Unfortunately further description of the ceramics is not given. An area on the east coast of the Peninsula imported copper, ironware and lacquerware all of which feature on one or other of our ships. Yet another area, Ting-chia-lu, about halfway down the eastern side of the Peninsula, was receiving blue and white porcelain as a trade item according to Wheatley (1961: 82).

Though Hung Wu, the first Ming emperor (1368–98), regulated against private trade the practice apparently thrived as Promboon (1984: 113) ‘...in 1373 the Cham King informed the emperor he had captured twenty private Chinese ships loaded with great quantities of sapanwood’. Manguin (2003: 31) says prices of Southeast Asian products escalated. It is not unreasonable to assume this was an impetus to expand the Thai ceramic industry. According to Promboon sapanwood was classed as a luxury item and was one of the commodities used as a form of currency. It is suggested that the restrictions imposed by Hung Wu increased the importance of the trans peninsular trade leading to the collapse of Srivijaya in 1377.

Towards the end of the 14th century King Borommaracha 1 (1370–88) came from Suphanburi to the throne of Ayutthaya. There were wars with Sukhothai which had recovered its strength and regained many dependencies. By 1378

Borommaracha had captured Nahorn Sawan, Phitsanulok and Kamphaeng Phet (Wyatt, 1984: 69).

At the latter half of the 14th century, Ayutthaya and Majapahit Java were the most powerful kingdoms of Southeast Asia, taking over the dependencies of Srivijaya, Promboon (1984: 108). Wheatley (1961: 312) says that during the fourteenth century the Malaccan Strait ‘...was the crucial sector of the world’s major trade-route which has one terminus in Venice—or even further westwards—and the other in the Molucca Islands.’

It was most likely during the fifteenth century that several of the ships investigated by our team sailed the Gulf of Thailand and ultimately, met their demise. Hein, (2001: 153) estimated that the Sukhothai kilns operated for at least one century. It would appear that at least some of the kilns must have operated in this century. There was certainly a close alliance between the Si Satchanalai, Sukhothai and Suphanburi kilns at the time of the Ko Si Chang 2 shipwreck estimated at early to mid 15th, with an earliest possible date of 1403 estimated from a coin (Chinese cash) on board. Sukhothai material was recovered from the Ko Khram shipwreck of around the 1470–80s estimated by carbon dating of timbers and from ceramic material from the Go Sanh kilns, Champa which are said to have been operating at this time, Brown (1975), thus dating the Sukhothai operation to the second half of the 15th century. Ceramics appeared to be of the Transitional stage of the Si Satchanalai kilns whilst at the same time Sukhothai fish designed items were in production, Hein (2001: Fig. 40 and Fig. 18).

Promboon (1984: 111) reports that there were 27 Siamese missions to China between 1400–1435. Under Yung-lo, for about two decades, over 2000 sea going vessels were constructed in China and great fleets sailed long distances under the command of Cheng Ho. Goods were purchased at the source and Chinese traders and settlers were encouraged to Hsien-lo (the lower Chao Phraya area) by the Chinese. Quantities of Chinese ceramics would have circulated in Thailand at that time. Many of our shipwrecks were connected in one way or another to the Chinese import and export trade, most obviously evidenced by the appearance of Chinese blue and white porcelain or other Chinese wares on most of the sites. Mikami (1985: 13) notes that Chinese underglazed blue was everywhere during the 15th century and that the Chinese ceramic production increased again in the 16th century. Interestingly, none of the shipwrecks of the 15th century investigated by the joint Thai-Australian team had huge quantities of Chinese blue and white porcelain, unlike for example, the Ko Si Chang 1 ship, determined to be late 16th, early 17th century.

In the 15th century Malacca was seen as an international emporium, lorded over by Siam though conflict occurred between Siam and Malacca frequently. Wheatley (1961: 321) relates that by the mid-15th century Malacca had no king only a chieftain and the country was under the rule of Siam to which it paid an annual tribute. During the 1460s the state of Pahang became part of Malacca. The rest of the Peninsula was under Siamese control, the east coast being governed by a T’ai official from Ligor and the west by another in Tenasserim.

Pires tells that at the end of the 15th century, Malacca received up to ten junks from China annually and from Siam up to thirty vessels arrived annually with cargoes of lac, benzoin, brazilwood, ivory, copper-ware, precious stones, precious and base metals and quantities of coarse Siamese cloth according to Wheatley (1961: 316). Some of these items correspond with items on our shipwreck recoveries.

Promboon (1984: 112) points out that there were two types of trade—that of the port being used as an entrepot for foreign goods and the other for local trade which may also include foreign goods. The most favoured ports by the Chinese were Ayutthaya, Ligor (Nakhon Si Thammarat), the Bay of Bandon (Surat Thani), Singora (Songkhla), Pattani and Petchaburi. Wheatley (1961: 319–20) says of the ports, that they ‘...seem to have engaged in a coastal trade which extended to Cambodia and Champa, Java, Malacca and the east-coast port of Sumatra’. He indicates that their chief export was pepper.

Wyatt (1984: 86) puts the position of Ayutthaya during the 15th and 16th centuries most succinctly ‘The effects of economic development, spurred by dramatic increases in international trade in the 15th and 16th centuries, on the rise of Ayudhya cannot be understated. They worked at times in an almost circular fashion. The more the king gained wealth through trade, the better able he was to overawe or overcome both domestic and neighbouring rivals and join their territory to his, thereby improving his ability to trade.’ Ayutthaya was however, constantly at war in the second half of the 15th century. In the 1450s Ayutthaya had the T’ai states of Lanna and Lan Sang to contend with for leadership of the T’ai world.

There were continuing difficulties during the 15th and 16th centuries. For example, there was a shortage of Chinese ceramic wares due to an interregnum (period when a state has no normal ruler) between the Xuande (1426–35) and Chenghua (1465–87) periods (Hadimuljono, 1985: 3). During this period, there was, according to Brown (1988: 27), a stoppage of the kilns at Jingdezhen.

Chinese foreign policy was seen as unstable. Chinese middlemen wary of fluctuating availability of Chinese porcelain looked for alternatives, Miksic (1985: 6–7). Consequently, Thai trade had good opportunities to grow, creating openings or opportunities for Thai and other producers and traders, as suggested by the Ko Si Chang 2 cargo, however internal problems sometimes interfered with this. It has been suggested that Thai trade may have been limited to those short periods during the late 14th and early and late 15th century. Miksic suggests that between 1403–33 purchasers might have experienced difficulties finding merchandise not only because of the large scale expeditions of Cheng Ho but also when exports from China and later Annam were lowest because of the conquest of Annam by the Ming 1407–28.

At the same time, Shaw (1981: 25) says ‘Chinese ships, now banned from trading out of China, may have moved their base to Ayuthya giving an additional advantage to the Ayuthyan merchants’. He estimates that during this time there were vast demands from Indonesia and the Philippines for cheap ceramics. His estimation is that Chinese traders at Ayutthaya probably seized the opportunity to develop the kilns in the Sukhothai—Si Satchanalai area. Miksic (1985:

13) states that ‘Many countries were involved in the maritime commerce which brought Thai ceramics to Indonesia in the 15th century’. Additionally, Miksic (1985: 7) says that Spinks (1965) suggests that the carriers of Thai ceramics probably included Chinese, Indians and Arabs.

Despite the Chinese situation, internal reasons may have made exporting from Thailand difficult at particular times including the lack of access to the sea via Ayutthaya (Sukhothai had broken away from Ayutthaya during the first years of the 15th century Shaw, 1981: 26), and wars between Ayutthaya and Chiang Mai mid 15th century. During the last 25 years of the 15th century when Trailoke moved to Phitsanulok and regained control of Si Satchanalai, trouble would have made continuous production difficult.

A précis of particular internal events of the 15th century of possible relevance to our shipwrecks in terms of the kiln sites and access of ceramic cargoes to the trading stations is as follows. In 1400 King Mahathammaracha III of Sukhothai seized Nakhon Sawan (at the confluence of some of the primary rivers making up the Mae Nam Chao Phraya), blocking river transport. Later, King Intharaca (1409–24) came from Suphanburi to mount the throne of Ayutthaya. In doing so he acted to establish the kingdom’s authority in the Sukhothai domain and a settlement, in 1410, Sukhothai being a vassal state of Ayutthaya from 1409, Wyatt (1984: 69). In 1412 an Ayutthayan chief resident was installed in Sukhothai, as Shaw (1981: 26) says, possibly to control the source of the ceramic industry and export trade. Mahathammaracha IV (1419–38) was installed on the Sukhothai throne and moved his seat to Phitsanulok around 1430. In the 1430s the Ayutthayan prince Ramesuan (who later became King Trailok) the son of King Borommaraja II of Ayutthaya, was appointed ruler of Sukhothai based in Phitsanulok, Sukhothai became an integral part of Ayutthaya. This brought Ayutthaya into contact with Lanna for first time, Shaw (1981: 10). There were repeated wars for the old Sukhothai Kingdom. Sukhothai, Si Satchanalai and Kamphaengphet were all annexed by Lanna for a time, Wyatt (1984: 78). Brown, (1975: 58) says that in 1447, a group from ‘Sawankhalok’ who had plotted against Ayutthaya were forced to flee to the Chiang Mai side and later settled in Phayao.

In 1459 King Tilokaraja of Lanna besieged Phitsanulok. Ayutthayan forces withstood the siege, Wyatt (1984: 78). According to Woodward (1978), in 1460 Lanna took control of Sukhothai for two years and Si Satchanalai for fourteen years. Lanna attacked again with the assistance of the governor of Si Satchanalai, rebelling against the Ayutthayan Kingdom. In 1462 Sukhothai rebelled against Ayutthaya and in 1463 Trailok of Ayutthaya transferred his capital to Phitsanulok to maintain strong military and political presence, and stayed 25 years. Lanna ultimately lost all territorial gains. In 1474 Sukhothai attempted to seize Si Satchanalai but was repulsed. Despite all the warfare, from 1488 Ayutthaya prospered. Again Wyatt (1984: 86) puts it succinctly: ‘By the 1460s, the Kingdom already had established a commanding presence on the Malay Peninsula and on the coast of the Bay of Bengal, and so was in a position to profit from a major upsurge in international trade that followed the foundation of Malay Malacca as an important international entrepot at the beginning of the century. Through much of the century, the rulers of Malacca

acknowledged the suzerainty of the kings of Ayudhya, and Trailok included Malacca in a list of his major dependencies in mid-century.' Shaw (1981: 10) notes that by the end of 15th century Ayutthaya had undisputed control of Sukhothai.

Shaw (1981: 67) relates from a letter of Nimmanahaeminda (1979) how the Yonok Chronicles tell that in 1451 the Governor of Phitsanulok went to Phuka then to Payao (both northern kiln sites). Nimmanahaeminda proposed that as he came from Chalieng it is likely he took with him, potters from Chalieng (Si Satchanalai area).

Earlier authors have proposed that in 1459, Chiang Mai forces destroyed the kilns at Si Satchanalai, Hein (2001: 171) does not agree. He estimates that the Pa Yang kilns were the last operating at Si Satchanalai. Ceramic material from the Ko Kradat shipwreck (of the 16th or early 17th century) and others carrying material manufactured at the Pa Yang kilns, support Hein's proposal.

Woodward (1978:6) understands from the Chronicles, that Chiang Mai control of Si Satchanalai between 1460 and 1474 may have brought intensive production at the Sawankhalok kilns. He suggests therefore that significant artistic exchange between Chiang Mai and Sukhothai-Si Satchanalai could have taken place during that period. There are indeed similarities between some ceramics produced at the northern kilns and at Si Satchanalai.

The Peninsula underwent great activity in the 16th Century. Between 1500 and 1560 there was rapid growth of seaborne trade in Southeast Asia. There were new trade connections with Muslim states like Pattani, Aceh and Bantam from Malacca. After the Portuguese reached Malacca in 1511 western traders and trading practices became predominant throughout the area including the Javanese archipelago.

Trade developed as such even though at the first part of the 16th century China was said to have tightened trade under the 'Ming Ban'. It is evident that at the time Pires was in Malacca (at the beginning of the century) Thailand's international trade, including that with China, was vibrant even though the Chinese, at this period, had limited their ships to two masts only. Simkin (1968:151 & 185/6), tells that Ming junks sailed in the second half of the 16th century though in 1557 they were still discouraging their subjects from venturing abroad.

In 1512 the first Portuguese agent went to Ayutthaya. In 1516 the first treaty between Siam and a western state was concluded. A trading station was set up at Pattani in 1516. Portugal was given permission to trade with Ayutthaya, at Mergui and Tenasserim, and at Pattani and Nakhon Si Thammarat, then under the kingdom of Siam. Both Ayutthaya and Pattani did a considerable Chinese trade, and the Portuguese factories at both places flourished according to Hall (1977: 246).

Pires, (Cortêsão, 1967: 103) details facts of these times. He explains 'The land of Siam is large and very plenteous, with many people and cities with many lords and many foreign merchants and most of these foreigners are Chinese, because Siam does a great deal of trade with China.'

Pires, (Cortêsão, 1967: 255) notes that in Malacca there were many merchants from the Coromond coast of India who '...have the bulk (of the trade) in their hands...' and '...trade on a large scale and many junks' illustrating that

though there is apparently not a great deal of evidence on the shipwreck cargoes of the Gulf of Siam, India played a major part in Southeast Asian trade. Inventories included large volumes of textiles.

Throughout Thailand there were dramatic increases in trade with the entrance of Europeans to Southeast Asia and Ayutthaya was a wealthy and powerful centre of trade. Thailand had a very healthy system of trading between coastal ports of the Gulf and eastern Peninsula through to the western side.

Between 1516–1538 many Portuguese settled in Siam. English trade in Siam followed in 1587, the Dutch in 1595 (first at Pattani and then Ayutthaya in 1608) and the Japanese between 1605–1610. The Dutch entrance into Siamese trade opens the question as to whether Chinese porcelain on the Ko Si Chang 1 ship, similar to the ware known as Kraak, could be connected to their trade, considering this type of material was much sought after in the Netherlands at that time?

Further information relevant to the 16th century trade along the eastern Peninsula and Thai Gulf can be gained from Pires, based in Malacca. He says (Cortêsão, 1967: 123) that ships from Siam anchored at the port of Hucham (near Canton) and that the Siamese trade in China was about 6–7 junks a year. He also tells that the Siamese traded with Burma, Laos, Sunda, Palembang and other islands and mentions vessels from Champa and Cambodia. Of Cochin China (the delta area of the Mekong) Pires says they had many vessels but they were very '...weak on the sea...' and sailed to China and Champa rather than further afield. The cargoes to China from Cochin China included porcelain and pottery. In turn Pires says the Siamese would go to Malacca with the Chinese in their junks. He mentions, (Cortêsão, 1967: 107) that at the time (1512–15) up to 30 junks a year went from Siam to Malacca whereas prior to that there had been no trade for twenty two years because of the '...difference between the kings of Malacca and Siam'. An interesting fact mentioned by Pires, (Cortêsão, 1967: 106) was that junks belonged to the merchants and lords of the ports along the Siamese coast, not to the King. Pires also noted that the people of Macassar traded with Malacca, Java, Borneo and Siam and '...all the places between Pahang and Siam'. They went as far as Pegu, the Moluccas and Banda, (Cortêsão, 1967: 226). By Pires' account there was from the Kingdom of Pasé (Sumatra) '...a great deal of trade from Turks to Rumes to Indians to Siamese.' Of the Philippines, Pires says they had only 2 or 3 junks and the merchandise was taken to Borneo and thence to Malacca.

In examining this century there are several aspects pertaining to the Thai kilns which are subject to discussion. These include the dating of the Pa Yang and Sukhothai kilns and the Calatagan burial sites in the Philippines. Unfortunately, limited carbon dates are available from the Si Satchanalai kilns and the site itself is complex. There are a large number of kilns over several kilometres. The use of individual kilns over extended periods and the tendency for part of a pre-existing kiln to be used in the construction of a new one confuses any dating attempt. The contamination due to looters or through change in usage of the area since the kilns ceased production alters stratification. The inability of the sciences to estimate precisely the date of organic material recovered from a kiln site makes any firm dating of production difficult. However

Barbetti and Hein (1989: 64), say it would appear from results that it is very likely that the kilns were still in production during the 16th century and possibly even later.

As mentioned previously, the Ko Kradat ship, wrecked near Trat in the Gulf of Thailand was dated at the time of excavation to the reign of Jia Jing (1522-1573) from the inscription on a Chinese blue and white porcelain plate, Green et al (1981). This has since been challenged and the later dating of Wanli (1573-1619) has been suggested for the blue and white material from the Ko Kradat. Because of her cargo of covered bowls believed to have been produced at the Ban Pa Yang kilns of Si Satchanalai (Harper, 1984 & 1987), the operation of those kilns has also been pinpointed to the 16th century perhaps even to the early 17th century. Covered bowls were recovered from the Ko Kradat, Ko Samae San and Ko Rin sites. Hein estimates that the Ban Pa Yang kilns production lasted for up to a century.

Hein (2001: 164–8) indicates that the Ban Pa Yang kiln site generally operated at the same time as the Later Stoneware (LASW) period of Ban Ko Noi, Si Satchanalai. LASW ceramics appear on the Ko Samui, Ko Kradat, Ko Rin, Ko Khram and Pattaya sites. However, the Ko Khram site held Transitional Stoneware (TRSW), as estimated by Hein, together with Later Stoneware, indicating a slightly earlier time than the other sites.

A summary of internal events on continental Thailand during the 16th century, most pertinent or significant to the cargoes of our ships include the following:

In 1507 the Kingdom of Lanna invaded the Sukhothai region, Ayutthaya captured Phrae in 1508 and Lampang in 1515. King Ramathibodi adopted defensive policy in the North and appointed his eldest son the governor of Phitsanulok in 1526, Wyatt (1984: 89). Between 1534 and 47 King Chairacha improved the Chao Phraya River channel (lower Mae Nam) around the site of present day Bangkok, significant in terms of access of ceramics to the Gulf of Thailand and further afield, via Ayutthaya. In mid 1545 the king led his army to Chiang Mai but retreated back to Ayutthaya.

From 1548–9 the Burmese lay siege on Ayutthaya unsuccessfully but they attempted to subjugate all of the Thai Kingdom within reach. They sacked all major Thai capitals from 1558 until 1569 when Ayutthaya fell to the Burmese, Wyatt (1984: 98). As a result of the Burmese attacks there was depopulation of the area, as Wyatt (1984: 99) put it ‘The engulfing of once bustling thoroughfares mirrored a similar choking off of social and cultural institutions. The social will and self confidence of Thai communities suffered too; when the order and regularity of several centuries of common life came to an end and they were faced with an uncertain future.’ This would have had an effect on the Thai ceramic production sites.

In 1571 Naresuan, took charge of the Phitsanulok region, maintaining that Sukhothai lines had traditional claims on the region. Ayutthaya itself suffered ongoing difficulties, Wyatt (1984: 101).

In 1580 the walls of Ayutthaya were dismantled and rebuilt to make them stronger. By 1583 the Burmese were building a road to Ayutthaya, Wyatt (1984: 101) and expeditions against Siam lasted until 1587 when Ayutthaya was again besieged by the Burmese, Hall (1977: 272). Shaw (1981: 11) explains that in 1583 Naresuan brought northerners including those from

Sukhothai and Si Satchanalai to Ayutthaya to help defend the town. In 1593 a battle between Burma and Ayutthaya at Nong Sarai near Suphanburi secured Ayutthaya. The Burmese were forced to retreat and Ayutthaya began to assert herself in the wider world. She imported firearms from the Portuguese and developed a powerful navy in the 16th and early 17th centuries. The Cambodians invaded around this period, attacking the Thai area six times between 1570–1587 but in 1594 Siam captured the Cambodian capital, Hall (1977: 137).

There had been weaker enforcement of the Chinese trade ban and it was lifted in 1567. Shaw (1981: 27) draws attention to the profusion of Ming sherds which have been recovered in the vicinity of Ayutthaya, demonstrating the pressure from Chinese merchants to buy ceramics in exchange for Thai raw material. The cheapness of Chinese mass-produced ceramics, and arguably, the superiority of blue and white pieces probably helped force the closure of the Si Satchanalai production. Hein (2001: 176) states that the collapse of the Sawankhalok kilns may be due to the huge production capabilities of Chinese kilns. These kilns would have been producing vast quantities for the East India Companies and for huge markets of expatriate Chinese throughout Southeast Asia as commerce developed. An increase in the number of affluent people as a result of new trade patterns may have affected the balance of demand between Chinese and Thai produced wares throughout Southeast Asia. Due to the movement toward Ayutthaya it is likely that at this time the Bang Rachan kilns on the Mae Nam Noi in Singburi Province were increasingly active in producing utilitarian wares for local and trade usage.

The Ko Si Chang 1 ship sank either at the end of this century or the beginning of the next, estimated by datable ceramics of the Chinese Wanli period—1573–1619. Significantly, there was no material from Suphanburi, Si Satchanalai, Sukhothai or the northern kilns recovered from this wreck site.

Volker, (1971: 11) indicates that at the beginning of the 17th century Siam was independent from China and the Siamese kings had their own merchant marine which ‘...on several occasions competed with the Dutch and other western nations on the coasts of India’.

King Naresuan died in 1605 and his brother Ekathotsarot took over the Kingdom (Hall, 1977: 357). International trade flourished with the Portuguese, the Philippines, China, Japan and the Ryukyu kingdom. However, Crawford (1828) notes that La Loubere recorded that around 1687, the Chinese trade with Thailand did not appear to have exceeded a few junks annually.

The Portuguese closed down their Thai operation in 1608, the Japanese in 1612 and the English in 1622. The Dutch were left as almost the sole participants of the European market. Thai exports included tin, ivory, saltpetre, lead, sapanwood and areca.

In regard to overland access to the Gulf of Thailand, according to Wheatley (1961: 328), ‘Already by the 15th century the isthmian tract had lost its pre-eminence. In relation to the developing commerce of the Archipelago it occupied a peripheral position, and its ports declined until in the 17th century the Tenasserim River route again came into prominence as a channel for European trade with Siam’.

As none of the shipwrecks investigated by our team fall into the 18th century range Thai activities of this century are not examined here.

Apart from the Samed Ngam, about which details of timber samples are included in this report, all of the wreck sites in the Gulf of Thailand investigated by Thai-Australian teams are dated well before the 19th century. However, many interesting observations were made by Crawford (1828), who visited Thailand in 1825. For instance he mentions the use of the trans-peninsular route from Junk Ceylon (Phuket) to the eastern side of the Peninsula taking about two days. He also mentions a route from Talung to Trang involving six hours travel up a small river followed by six days travel by elephant. Other aspects of Thailand, such as vegetation cover and many products of Thailand appear to have changed little for centuries. It is worthwhile including some of his observations.

Crawford (1828) indicates that the external trade of the time was conducted as follows: coastal trade which Bangkok carried on with the Siamese ports of the eastern and western side of the Gulf; and trade with Kamboja (Cambodia) and Cochin China. There was also trade with the different countries of the Malayan Archipelago. The object of the coastal trade, Crawford (1828: 413) states: ‘...is to collect produce for the Chinese market,—such as pepper, cardamoms, gamboge, ivory, eagle-wood, dyewoods, and barks’. Some consistencies can be seen with the items appearing on the wreck sites of the Thai Gulf (ivory and possibly dyewoods). He describes areas where sapanwood grew and also areas of mineral production. Crawford (1828) remarks that a considerable number of the junks used in this coasting trade belonged to the King. An interesting observation he makes is ‘It may here be remarked, that the intercourse between Bangkok and the eastern coast of the Gulf which is sheltered by the long chain of islands, may be carried on without interruption nearly throughout the year, the monsoons opposing no serious obstacle’. He could not have known that unfortunately, the shipwreck sites around Ko Si Chang and other areas of the Thai Gulf bear testimony to the unpredictable nature and power of the monsoons which can be experienced in the area. Members of the joint Thai-Australian expeditions remember the loss of one of our team, Phil Clegg, who among many others drowned when an oil rig was hit during a cyclone in the Gulf of Thailand in the 1990s. An incident in the 17th century is recalled by Hutchinson (1940: 260) whereby a Chinese junk en-route to Japan under the control of the somewhat infamous Constans Phaulcon (who was an employee of the English East India Company) had barely emerged from the Chao Phraya river into the Gulf ‘...when a violent storm arose which drove him down on to the Malay coast’. He suffered the added misfortune of being stripped naked and the wreck looted by profiteers!

THAI TRADE WITH THE PHILIPPINES AND INSULAR SOUTHEAST ASIA.

Many ceramics excavated in grave sites, or recovered elsewhere in the Philippines, Malaysia and Indonesia are similar to items recovered from sites in the Gulf of Thailand. These were manufactured in a variety of Thai kiln sites, most notably at Si Satchanalai, Sukhothai and the Mae Nam Noi kiln site,

Singburi. In many cases Thai wares represent a relatively high percentage of the ceramic material recovered from the overseas sites.

It has also been acknowledged that many of the timbers known to have been used in the construction, or forming part of the of the Thai Gulf shipwreck cargoes, have a widespread pattern of growth throughout Southeast Asia.

An interesting exercise is to pursue the possibility that a Thai built and operated vessel, of the capacity of those recovered by our team in the Gulf of Thailand, could have reached distant ports of trade outside the immediate parameters of the Gulf of Thailand. Likewise, it is interesting to follow the possibilities of a vessel of Philippine origin entering Thai waters through other than the routes chosen by Chinese vessels.

The Philippines is an opportune place to research the place of Thai vessels and their cargoes for several reasons:

- Thai ceramics have been located throughout insular southeast Asia through to the Philippines.
- There has been a wide variety of Thai ceramics recovered from grave sites and appearing in collections throughout the Philippines;
- Chemical analyses have been undertaken on some of the sherds recovered in the Philippines and comparison made with sherds from Thai kiln sites and sherds from Thai shipwreck sites;
- The Philippines are located between Thailand and China and China and the rest of Southeast Asia;
- The areas of growth of many of the tropical timber species used on the Thai ships extended to the Philippines;
- A ‘junk of Siam’ was recorded in the Visayas by Pigafetta on Magellan’s voyage in 1521, Noone (1986: 68).

Early Thai-Philippine contact has a tenuous connection by the recovery in the 1980s of eleven boats at Butuan, Mindanao in the southern Philippines. Three of these, with C14 dates of between 320 and 1250, were associated with Chinese ceramics dated between the tenth and thirteenth century, Cembrano (1998: 4). No Thai ceramic items were recovered directly from the site but there is a commonality to the Thai wrecks in that the Butuan boats were also edge-joined in construction. A timber from one of the boats was of the *Heritiera* species, Bearing in mind that this is a common tree along waterways there is the connection with the Ko Si Changr 3 ship which also had a member of this species in its construction as an outer plank. None of the other timbers used on the Butuan boats were the same as any used on the Thai vessels. According to Cembrano (1998), other ceramic material said to be Southeast Asian was recovered in the vicinity. This included Satingpra ceramic wares (900–1100) from Songkla province, southern Thailand and Haripunjaya wares (an ancient name for Lampoon Province, northern Thailand, Rungrujee (1985)). These are significant finds in terms of an early Thai connection. Because there are no references to the Philippines by the Chinese prior to the Song dynasty (960–1279) it may be that ceramics recovered from archaeological sites dated prior to that period arrived by ‘non-Chinese agents’ indicates Scott, (1984: 63).

The highly respected place that ceramics represent in Philippine society, present and past, is well illustrated by Cembrano (1998: 36) under Burials and Ritual—Ritual paraphernalia—‘...valuable and beautiful object offerings that

can enhance effective connection and communication with the deities, ancestral spirits and spirit beings. Large celadon vessels are still used as containers of food and betel chew offering in rituals for planting and harvesting rice.' Cembrano (1998) continues 'In critical healing rituals...the spiritual potency of the ceramic vessel containing food, betel quid and wine can appease offended spirits. It is believed that the rich sound emitted by the ceramic when struck during rituals attracts and pleases the deities and spirits more than any other. The porcellaneous and stoneware jars became irreplaceable ceremonial vessels and paraphernalia in feasts and rituals like weddings...peace pacts...and intra-tribal covenants...where local wines fermented from sugarcane...cooked rice...and palm...were sipped. As a measure of socio-economic status, the ceramic was also used as a funerary gift/offering, and as payment of bride price or for settlement of debt fine'.

Over the centuries, the trade routes from the Philippines to the rest of Asia have varied from a route to China via Taiwan; to China through the Paracel Islands and Champa (Vietnam); the Philippines to Borneo and beyond; the Philippines to the Moluccas and further south or from Moluccas along the Javanese coast, Harrison (2003), Reid (1984), Hall (1985), Manguin (2003).

Because of the reliance on wind power, early long voyage travel between east and west was known to have been undertaken in sections between one entrepot and another. Lewis (1972) explains how Pacific seafarers for example, used steering by stars; dead reckoning; swell patterns; phosphorescence; birds; clouds and other variants, skills passed down through generations. In the case of insular Southeast Asia, Brissenden (1976: 78) gives examples of Javanese shipping to east Indonesia, Bugis and Borneans to Malacca and Sundanese to Java. Cembrano (1998: 19 & 26) discussed how the Sama '...perhaps in collaboration with a varied ethnic composition of traders, sailors and crews, were carriers of various goods emanating from the regions of Borneo, Sulawesi, the Moluccas, New Guinea, Sumatra, Java, Malay Peninsula, and perhaps even South Asia including India'. Could it be that ceramics from at least some of the vessels which floundered in the Thai Gulf were intended to form part of this trade network?

As outlined in Brissenden (1976: 74-6), Indonesia had long been involved with large scale international trade exemplified in the empire of Srivijaya (about 7-13th century) where it controlled the straits of Malacca. By forcing Indian and Arabic shipping to call at its ports under a tributary system, it controlled the sea trade between China and the west. According to Brissenden (1976), after about the 13th century, foreign ships including those of the Gulf of Siam, West Kalimantan and the Philippines came to ports previously ruled by Srivijaya after their tributary system broke down. During the Song dynasty the Chinese began to take over the route to India by capturing coastal routes and constructing large junks. Brissenden (1976: 76) says at this stage 'Other foreign ships sailed to new ports, since the resources to force them into Srivijaya's entrepots no longer existed'. Chinese and Arab ships came to the harbours on the coast of Java, in the Gulf of Siam, in northern Sumatra, west Kalimantan and the Philippines. Miksic (1985) indicates that Spinks, 1965 (89-90) suggested that Thai ceramics were carried by Chinese, Indian and Arabs.

Hall (1985: 24) tells that in the 11th and 12th centuries, the Chinese established trade bases in the Philippines. Scott (1984: 67) says that by the end of the Song dynasty direct trade which existed between the countries was '...probably being handled by Chinese junks out of Fukienese ports that made their last landfall at the southern headland of Taiwan'. It is indicated though (back of book) '...there is no evidence for Chinese settlements or Arab trade routes before the Spanish advent...'. Early Philippine traders must have been other than Arab, or Chinese working without large infrastructure.

As evidence of a Thai connection in the 15th century, that is, before Magellan's arrival, the decoration of a dish from a burial site on Bohol, the Philippines, Woodward (1978: Fig. 5) closely corresponds to the item Ko Si Chang 2 1315 (above), therefore dated from 1403 onwards. However, in the early 16th century Pires, (Cortêsão, 1967), noted that there was no direct trade between Siam and the Philippines and that it was not until King Naresuan made a treaty with the Philippines at the latter part of the 16th century that it occurred. Wyatt (1984: 104) indicates that the Kingdom of Ayutthya had a powerful navy in the 16th and early 17th century and that their fleets '... ranged widely in east Asian waters, to the Philippines, Taiwan, and the Ryukyu Islands, for example'. Hall (1977: 250) says that after 1580, the Portuguese barred Spanish traders from eastern Asia and pursued a policy of attracting Asian traders. 'Manila became the resort of traders from China, Japan, Siam, Cambodia and the Spice Islands'.

With the advent of European involvement in Southeast Asian trade, it is not unrealistic to assume that the Thai themselves, along with Chinese traders working through Siam, would become directly involved with the trading of spices and other exotic products much sought after in Europe. They may well have made lucrative gains in exchanging a ship load of ceramics for one of cinnamon and ginger in the Philippines and cloves in the Moluccas. These commodities were able to be sold on to European traders at vastly inflated prices.

Whilst acknowledging that a smaller ship could not cross the South China Sea, it is interesting to question whether a Thai ship could use a route following more closely the Javanese coast. As Harrison (2003: 107) 'An alternative route to one commonly used from the Moluccas along the Javanese coast was to proceed northwards via the Celebes Sea, Sulu and Brunei', thus indicating that the Javanese coast was accessible.

Reid (1984: 263) talks of the Chinese visiting Luzon centuries before the Spanish arrival, however, he indicates, it was not as important as the island-hopping trade which took place between the Malay world. Further, he indicates that one of the southern routes to the Philippines and eastern Indonesia ran along the eastern coast of Malaya and Sumatra and further afield. Manguin (2003: 29) states that the eastern route was primarily for regional purposes, indicating 'It also connected with the network of western South-East Asia and provided an alternative route to the Straits zone for goods coming from the Moluccas (the latter were regularly sent to Melaka via the Java Sea route)'.

There are various reports which support the use of a sea route from the southern Philippines by Europeans. Noone (1986: 99) in the discussion of Magellan's voyage, records how the *Victoria* with two native pilots set sail in December 1521

through the Molucca Sea towards her voyage west through the Indian Ocean. Noone (1986: 372) indicates that the Legazpi expedition noted that Portuguese ships arrived at Cebu from the Moluccas. Noone (1986: 21) records that Pigafetta reported that junks from Malacca were going to Banda to collect nutmegs. The nutmeg was being carried from the Moluccas to Banda to save time. Since Banda is south of the Moluccas, this may be indicative of junks using a southern route via Macassar.

Harrison (2003: 110) indicates that in 1601, the Dutchman, Admiral van Noort arrived in Brunei from Palawan 'Having explored the passages connecting Brunei with the Spice Islands, he was convinced that the southerly route, via the Sunda Straits and the Javanese coast, was to be preferred'.

The large number of Thai, together with Chinese ceramics in southern Sulawesi (Hadimuljono (1985), Harkantiningasih (1985) and Miksic (1985)), illustrates a steady trade in these ceramics, even though, as Brown is quoted through Miksic (1985: 7) as saying Chinese ships did not reach southern Sulawesi until 1615. They could not have come, therefore, on Chinese ships. Even if, as some researchers propose, the Ko Kradat shipwreck with a cargo of Si Satchanalai ceramics is later than originally estimated it is unlikely that the Si Satchanalai and Sukhothai kilns were still operating after 1615. The Thai ceramics must have arrived there by other means.

Thus, the knowledge is that a '...junk from Siam...', Noone (1986:68) was present in the Visayas, in the early 16th century when the Spanish first arrived, that shipping was conducted through to the Moluccas and environs, and that many Thai ceramics have been recovered from southern Sulawesi. The question is whether the ceramics recovered in the Philippines came via Borneo or was a more southerly route used, perhaps with Thai ships or Thai traders? Could there even be a possibility that vessels from the Philippines ventured all the way up the Gulf of Thailand, since it is known that they ventured as far as Malacca? It was reported that produce from Mindanao was available in Malacca in 1509, Noone (1986: 19). Trade is known to have been undertaken by Philippine owned ships around 1521 as Noone (1986: 90) gives references to three junks arriving in Borneo belonging to the King of Luzon. According to Scott (1984: 80–81) by the time of the arrival of the Spanish, 'Filipino merchants and mercenaries were spread all over Southeast Asia...'. He says Luzon shipping consisted of a triangle with Manila, Timor and Malacca '...that includes all of insular Southeast Asia' whereas Pires says that there were only two or three boats between Luzon, Borneo and Malacca. This could be an indication that in fact trade other than through Chinese vessels, was directed inter-island in a more southerly direction—that is towards southern Sulawesi?

In fact, pinpointing the nationality of ships and their cargoes in the Philippines proves to be elusive. There are references, by the early Spanish in the Philippines, of Chinese junks trading as far south as Mindanao, Cebu and other islands in the vicinity. In the second half of the sixteenth century Legazpi acknowledged that vessels trading in the islands and referred to by the locals as Chinese were in fact from Luzon and Brunei. Their cargoes were transferred to smaller boats for inter-island travel, the Chinese junks being too heavy to negotiate the shallow waters of the islands, Noone (1986: 309). Was the 'junk from Siam' really a vessel constructed in

Thailand, carrying Thai cargo, manned by Thai sailors? Was it a local vessel carrying a Thai cargo, or was it a Chinese vessel with a Thai cargo and possibly manned by Thai sailors? Through Noone (1986: 412) there is an account telling of goods displayed by Chinese merchants and others 'coming in boats from abroad', presumably to the Butuan area. Could this include vessels from Thailand? Noone (1986: 392) mentions an account (by an anonymous author) of Chinese junks off Mindoro which were '...loaded with silk, gold thread, musk, glazed porcelain bowls...and the decks, filled with earthen jars and crockery'. Could in fact, these junks have carried Thai ceramics including low fired earthenware items and jars which are ubiquitous finds from the Gulf shipwrecks and also recorded in Philippine sherd collections? Pigafetta (Noone, 1986: 87) mentions rice being cooked in earthenware pots by a chief in Mindanao. Cembrano mentions that earthenware is manufactured only in limited localities in Mindanao/Sulu due to a lack of suitable clay. Many of the Thai shipwreck finds referred to as rice pots and lids have associated finds in the Philippines (eg. Cebu City, Plate IIIB, Hutterer, 1973). This suggests that in fact Thai earthenwares may have been most sought after in the Philippines.

By whichever route they came, archaeological finds in Southeast Asia indicate that the Vietnamese and Thais were actively trading ceramic wares and that their ceramics feature in particular prominence in both southern Sulawesi and Java, as indicated by Hadimuljono (1985: 4). Hadimuljono (1985: 6), says that in southern Sulawesi ceramics, including Thai covered bowls, have been found in connection with pre-Islamic funeral system. According to Hall (1977: 207), Islam reached Macassar around 1604. As stated above, Miksic (1985: 7) tells that the first Chinese ships reportedly reached southern Sulawesi only in 1615. Thai ceramics are always found in the same places as Chinese ceramics and form the highest percentage of Asian ceramics other than Chinese (Harkantiningasih, 1985: 5–6).

Research by Harkantiningasih (1985: 6–8) illustrates that there are more Si Satchanalai than Sukhothai ceramics occurring in Indonesian collections, Thai wares equalling 5.43% total—Sukhothai 0.25% and Si Satchanalai 5.18%. This may support Hein's estimation that the Sukhothai kilns were shorter lived than those of Si Satchanalai. It may also mean that most of the trade from Thailand was toward the end of, or post production time at Sukhothai. The statistic of 5.43% for Thai ceramics is quite high considering the long period of Chinese ceramic production, large production areas, and their domination of seaways. It is also feasible that a percentage of the unidentified wares, could well have originated at the Thai kilns.

Thai ceramic finds are widespread throughout the Philippines. There has been considerable debate over the dating of ceramics found there. Sherd collections in museums and private collections reveal ceramics from Sukhothai and Si Satchanalai and from the Mae Nam Noi kiln site, Singburi or an area closely aligned to it. Chemical analyses also indicates that some material may have come from the Kalong kilns and some fit into the MON (Most Original Node) and Nong O categories of Si Satchanalai wares, Harper (1988 (i)a). It should be noted however that these results are not necessarily definitive of an item produced at the earliest production time

of the Si Satchanalai kilns but may be indicative of a particular clay source used at a particular period.

To this author's knowledge, no sherds from the Suphanburi kilns have been found in a land based archaeological context in the Philippines. Items from these kilns do appear in private collections such as shown in Peralta (1982) Plate 78, said to be from Puerto Galera.

Cembrano (1987) states that Thai ceramics (including fish plates) were recovered in the Visayas and Mindanao from archaeological excavations and earthmoving operations. Hutterer (1973: 53) furthers that a higher proportion of Southeast Asian ceramics, especially 'Sawankhalok wares' were found in the Visayan Islands than in the northern Philippines. He also indicates, (Hutterer, 1973: 15), that at Cebu in the southern Philippines, 40% of intrusive ceramic in excavations are of a Siamese provenance. Could these figures indicate that the Thai material was arriving by a more southerly route?

Fox's work at the Calatagan grave sites in Luzon is well known. Chinese, Annamese and Thai material was recovered from the burial sites which Fox (1959: 326) records Beyer dating from late Yuan 1280–1368 to the end of the fifteenth century (early Ming). Woodward (1978: 2) tells that Addis argues a dating of Chinese wares at Calatagan of more likely late 15th and first half of the 16th century. As at the Calatagan site, covered bowls and whiteware were amongst the wares recovered from the Ko Kradat shipwreck. Initially the Ko Kradat was dated, by an inscribed plate, with a Jia Jing reign date (1522–66). Hein (2001: 184) tells that some experts now believe that some of the Chinese blue and white ceramics may belong to the reign of Wanli (1573–1619) or later. This being the case then Hein's (2001: 183) indication that Ban Pa Yang painted cover boxes and Ban Ko Noi white covered jars and brown glazed bowls and jarlets were only made in the final production phase of Si Satchanalai has extended the previous datings for both the Si Satchanalai kilns and the Calatagan sites. Hein has pointed out that there is no material produced at Si Satchanalai later than the types found at Calatagan—that is the spotted jarlets, covered black bowls, etc.

Woodward (1978: 4) indicates that the first period Santa Ana, Calatagan wares were imported until about 1405. No Suphanburi, Si Satchanalai or Sukhothai ceramics were amongst the wares of that period recovered at Santa Ana.

From the primary excavations of Pulong Bakaw and Kay Tomas sites, Calatagan, it was estimated that seventy percent of the Thai material was termed jarlets (large and small) whilst cover bowls were also well represented. Significantly no Sukhothai or European wares were recovered from Fox's excavations though they are found in other areas of the Calatagan Peninsula. Sukhothai fish plates were recovered from other Luzon excavations, such as the Carolina site, Bolinao, Pangasinan; Palapat Melian; Lumban, Laguna. Sherds of probable Sukhothai items were located from other sites throughout the Philippines, Harper (1988(i)b).

Several results in the material analyses of sherds from Philippine sites fit a MON protocol. A bowl from Intramuros, (whether recovered in an archaeological context is not known), physically resembled the early Thai product recorded at Si Satchanalai and also an item from the Rang Kwien shipwreck. Of note is Hein (2001: 115) who says there is no sign of Chinese

or Vietnamese wares in context with MON wares recovered in archaeological excavations at Si Satchanalai.

It would be of interest to ascertain if any of the ceramics from the excavations of sites such as Kay Tomas and Pulong Bakaw represent material estimated to be manufactured in the vicinity of the Mae Nam Noi kilns, Singburi Province, Thailand. Material from the area of Calatagan, collected and stored at the National Museum of the Philippines, does, from physical appearance and material analyses, seem to be associated with these kilns, Harper (1988 (i) a). This type of material was recovered in abundance from the Ko Si Chang 1 ship of the Wanli period and to a lesser extent from many other shipwrecks of the Thai Gulf.

Hutterer's excavation of a grave site at Cebu uncovered Chinese, Siamese and possibly Annamese material. A point of interest is Hutterer (1973: Plate VIB) grave furniture of B#5 of the Magellen site where an incised celadon bowl of Si Satchanalai origin was recovered. This bowl is comparable to items from the Pattaya site. It was found together with a Si Satchanalai bowl (perhaps more similar to those recovered from Ko Khram) and probable Vietnamese painted bowl and saucers similar to some recovered from the Ko Khram site. Perhaps close examination of the ceramics recovered from the Pattaya and Ko Khram wreck sites together with the Magellen and other land sites in the Philippines will assist in the determination of when and how those ceramics arrived in the Philippines.

ACCESS THROUGH THAILAND—LAND, RIVERS AND WATERWAYS—FROM HISTORIC ACCOUNTS

At the early stages of this authors investigation into the origin of those timbers used in the construction of the ships wrecked in the Gulf of Thailand, a source was not always able to be located in Thailand or other parts of Asia. *Podocarpus neriifolius*, for example, was known by the author to have grown in the Himalayas but at that stage a region of growth was unable to be ascertained elsewhere. This instigated an exploration as to the avenues through which timbers could have arrived at the Gulf of Thailand from distant parts. It is feasible, although arguably unlikely, that timbers or other artefacts could have come from China, or other parts of Asia, by way of land, river or ocean transport.

Baker (2003: 53) says that 'Ma Huan indicated in the 1420s that there were trade routes that led north all the way into Yunnan...by a back entrance'. It is also recorded, Volker (1971: 5), that during the Song dynasty, Chinese traders carried porcelain overland on pack animals to Bahmo, upper Burma. These were then carried down river to Martaban from where porcelain, celadons and jars were also said to have been shipped. Thus the use of rivers and waterways for the partial or complete transport of cargoes such as ceramics and possibly even ships timbers to the Gulf of Thailand or other ports under control of the Thai kingdom must be considered. It should be noted however, that demographic and geomorphic changes have altered the navigability of rivers over time. For example, it has been acknowledged by Cubitt and Stewart-Cox (1995) that deposition of fluvial sediment has resulted in towns, such as Suphanburi, being located further from the

coast than was previously the case. Likewise, the mouth of the Mae Nam Chao Phraya has been the subject of the build up of silt, penetration of which was dependent on seasonal conditions. Accessibility through river transport has constantly changed over the centuries.

An additional complexity in regards to the origin of ships timbers is presented through the following: passage by Floris in 1612, Mooreland (2002: 46). Whilst moored outside the bar at the mouth of the Mae Nam Chao Phraya they sheathed their ship the *Globe* which was being eaten by worms ‘...having brought planks from Bantam expressly for that purpose.’

Sophisticated mechanical transport being unavailable, the main form of land transport was by elephant, horse and buffalo, together with carts. Accounts of Thailand in the 17th to 19th centuries describe highways of water, such as the Mae Nam Chao Phraya, through densely vegetated landscapes of forests, bamboos and padi plains. Wild animals such as lions, tigers, rhinoceros and elephants were in abundance. Water transport encountered its own hazards including the difficulties in transfer from land to boats or rafts. Despite this, it was considered by far the most expedient form of transport. Accounts show that the river transport system could be viable even when travellers were forced to skirt rapids, waterfalls or other unnavigable areas by physically carrying goods around these encumbrances.

Northern Access

An understanding of the major river systems of Northern and Eastern Thailand and her neighbours was the object of exploration in the 19th century, notably by Garnier in relationship to the Mekong River (Osborne, 1995), Mouhot in Thailand, Cambodia and Laos (Smithies, 1995), Scott investigating Burma’s eastern borders (Dalby, 1995) and Bock in Northern Thailand (Reece, 1995).

Crawfurd’s travels in the beginning of the 19th century lend an excellent impression of life in Thailand in pre-industrial times, Crawfurd (1828: 406) ‘The inland and coasting trade is very considerable; the principal part of this domestic traffic is carried on the Menam and its branches, and the produce is carried in flat boats, or on large rafts of bamboo. The upper part of the Menam where it begins to be navigable, is practicable in the months of August and September. Boats which quit Lao in these months, do not arrive at Bangkok until November and December, when the river is crowded with them. Grain, salt, cotton, sapan wood, oil, and timber, are brought to the capital by this mode of conveyance’. Crawfurd illustrates the true extent of the value of the river systems as trade routes, the details of which are said to have been obtained from his communication with Siamese and Chinese traders. Importantly, Crawfurd (1828: 427), indicates that teak in fact was brought down the river for the building of temples and ships.

Crawfurd (1828: 325) attributes the important part played by elephants in trade ‘In the upper parts of Lao again, as well as in the mountains to the south west, much of the commerce and intercourse of the country is conducted by means of these animals, which are the beasts of burden best suited to the narrow and steep pathways, which in these parts supply the place of roads.’ Further insight into the integral part elephants played in the transport of timbers or other cargoes downriver to ports

may be gained from an account of the Burmese jade trade in the 19th century by Bayfield through Levy and Scott Clark (2001). Boulders bearing jade deposits were ‘...dragged out of the valley by elephants, floated down the river on bamboo rafts and then auctioned on the bank’.

Crawfurd (1828: 407) discusses the inland traffic between Siam, Laos, Cambodia, Yunnan and the Malaya peninsula. ‘From Lao there are imported stic-lac, benjamin, some raw silk, ivory and bees-wax, with horns and hides; and the exportation to that country consists of salt, salt fish, and Chinese, Indian, and European manufactures. Between the river Menam and the great river of Kamboja, there is water carriage all the way by the river Ban-pa-Kung, which in the season of the rains has generally a depth of five cubits, and in the dry season from a cubit to a cubit and a half being therefore navigable during the former for boats of considerable burthen, and at all times for small boats.’ A cubit is a measurement the approximate length of a forearm. Crawfurd was writing of what we know as the Mae Nam (translated as mother water) Chaya Phraya and tributaries, the Mekong River, the Mae Nam Bang Pakong and their tributaries. This was written before Garnier’s exploration of the river between 1866 and 1873 (see below). It is important to note that the waters of the Ping, Wang, Yom, Nan and Pasak Rivers make up the Mae Nam Chao Phraya.

In fact, at the beginning of the sixteenth century, Pirez, (Cortesão (1967: 111) was noting ‘They affirm, and it seems reasonable, that they can go overland from Pegu and Siam to take the pepper and sandalwood to China—on the hinterland side of China—because the people of Pegu and Siam trade with Burma in *lancharas* and *paraos* up the rivers there are the said kingdoms; and the merchants who go in this way say what they please and within a month they come back’.

Simkin (1968: 159) quotes that one Duarte Barbosa, a Portuguese who visited Pegu after 1569 mentioned the use of ‘Martaban jars’...for the export of rice to Malacca or Sumatra...’. There has been much debate about the large storage jar, referred to as Martaban in deference to the Burmese port of that name, and used for water, rice, oil, sugar, and other wares. Simkin (1968: 157) suggests that these jars had been produced in China from which they came, usually by sea, ‘...but sometimes by ass-caravan through Bhamo to the Mon port of Martaban, which became the centre of the jar trade’. He says that Sawankhalok’s jars were also found to be acceptable, and went to Martaban by elephant-caravan through the Three Pagoda Pass. Chandavij (1985) and Wheatley (1961) detail routes said to connect points to the east and south with Martaban through Rahaeng (Tak) by foot and the Ping River, as far as Chiang Mai, Phitsanulok, Sukhothai and Bangkok. A further route from Martaban and Tavoy by river and foot and crossing the Kwae Yai river to central Thailand enabled trade between Suphanburi, Ang Thong, Ayutthaya and Bangkok via various rivers.

On the other hand, Hein (2001: 236) questions the part played by Martaban in the export of Sukhothai and Si Satchanai ceramics. He claims there is a paucity of Sukhothai and Si Satchanalai ceramic sherds on the Andaman Coast, demonstrating that this was not a well used venue for the export of these ceramics.

The difficulties and hazards of travel on the Mekong River encountered by Frances Garnier in his endeavour to find the source of the Mekong River are admirably revealed by Osborne (1995). Garnier determined that continual transport by water was not possible due to the frequency of rapids, seasonal flooding and waterfalls. On occasion during the journey stores had to be transferred into canoes, where, Osborne (1995: 74) states: 'Time and again, the explorers were forced to resort to portage, hauling their canoes through rapids and supervising the carriage of their supplies by their boatmen and porters.' Thus, the Mekong River was not navigable for commerce in its entirety. A similar scenario must have existed on other Thai rivers. Notwithstanding the fact that the Mekong had its particular difficulties there is no doubt that on the rivers leading into the Chao Phraya basin, the transport of ceramics and other potential ship cargoes including perhaps the timbers themselves, would have been undertaken with immense difficulties.

The access between the southern Chinese region of Yunnan to present day Vietnam through Hanoi was also investigated by Garnier. Though rapids on the upper reaches of the Red River were not navigable, the southern reaches (from about 130 miles south of K'un-ming) were accessible by boat and commerce could pass up and down. This was actually proven by an associated Frenchman, Dupois in 1871. Likewise the Yangkse at least from K'un-ming, reached the Chinese coast at Shanghai uninhibited, according to Osborne (1995). Simkin (1968: 342) put forward that '...the Mekong was useless as a trade route between Saigon and Yunnan owing to the rapids of its wild upper reaches, and that the Red River (Song Koi) was a more feasible route to China from Tongking'.

Central Access

Ships of the 15th century, such as the *Ko Si Chang 2* and those discussed by Brown and Sjostrand (2002) also carried large jars, perhaps via the Mae Nam Tai Chin. It is more likely that the jars recovered from the 16th and 17th century shipwrecks were carried down the Mae Nam Chao Phraya towards the Gulf. According to Hutchinson, (1940: 30), a journey taken by Englishmen Samuel and Driver around 1612–1615 from Ayutthaya to Chiang Mai took two months. Crawford (1828: 427) tells that the downriver trip for teak was about one month. Another account of travel up river in the late nineteenth century was by Bock who was taken to Muang Nakhon Sawan at the junction of the Ping and Nan Rivers, then by river boat to Tak. His luggage was taken from there to Chiang Mai by river. According to Reece, in King (1995: 220), from Chiang Saen to Muang Fang, Bock's boatmen negotiated the hazardous rapids beyond Ban Mejau: 'The river here ran between almost perpendicular walls of rock, so that there was no chance of taking the boats or their freight overland, and there was nothing for it but to force the boats by the laborious exertion of "poling" by sheer strength of arms and legs up through the seething water'. From Muang Fang access to the rivers of China would have been possible as is known by Garnier's exploration.

Travelling downriver from Chiang Mai, Bock's party safely shot another set of rapids above Raheng (Tak). His description of the craft used for this purpose is a good example of his

sharp and practical eye: Reece (1995: 220) 'The ordinary native boats, from thirty to sixty feet long...are singularly well adapted for the work. They are flat-bottomed craft without keels, the lower part of the hull being constructed of a solid log of teak...which is scooped out with the adze...A number of wooden beams are then placed across the hollow trunk inside, like thick thwarts reaching from gunwale to gunwale, and the hull is then placed on logs...and fires lighted underneath its whole length. This has the effect of causing the sides to expand, giving greater beam to the boat, and the crosspieces are then replaced by larger ones, to give the boat stiffness and keep it in shape. A long bamboo or board 'house', open at the ends, but closed at the sides, is then built amidships to a height of four or five feet above the gunwale; a high, projecting stern is then added, through which an enormous oar, which is used as a rudder, protrudes. At the stern of the boat a second house, somewhat higher than the other, is built for the use of the steersman, who is provided with a three-legged chair, perched on which he can keep a look-out ahead over the roof of the main house.' It is not unrealistic to believe that this mode of transport had a long tradition.

In the 1980s quantities of wares including Thai, Chinese and other ceramics were recovered in mountainous areas in Tak Province. Tak or Raheng as it was previously known, was said to be an important transit area on the Martaban route as illustrated by Chandavij (1985). The Tak finds confirm that ceramic material from Sukhothai and Si Satchanai did pass in a north westerly direction overland. However, Hein during discussion on papers at the SPAFA Technical Workshop on Ceramics in 1985 expressed the opinion that indications lead him to believe the Tak findings were funerary wares, not items of trade bound for Martaban. Indeed Hein (2001) refers to the finds as burial pieces.

Another explorer who left an account of travel in Burma's eastern borders at the end of the 19th century was Scott. All people had considerable knowledge of the roads, paths, and ferries he concluded, citing (Dalby, 1995: 109) 'Though no one, Asian or European, had travelled its inhospitable length, Tibetans of the upper valley of the Salween were able to assure explorers that their river was the same that reached the sea in the Gulf of Martaban'. A map (Dalby, 1995: 120) shows the cart roads near the Panlaung River in Burma. Having visited the area in the vicinity of the Tak finds in the 1980s, this author can vouch for the seemingly impenetrable vegetation and steep inclines from which cart roads would have been carved.

Smithies, through King (1995), also records Mouhot's travels by boat on a river he assumes to be the Pasak, passing boats coming down from Petchabun. The river Pasak must have been navigable for a long distance, joining other rivers to form the Mae Nam Chao Phraya at Ayutthaya.

Another consideration to be taken into account is the possibility of more extensive use of canals in earlier times. In fact Crawford (1828: 324–5), discussing Bangkok, notes 'The absence of public roads is not less remarkable. We were informed that there were but two considerable roads in the kingdom—that from the new to the old capital, and that from Chantabon to Tung-yai. In the vicinity of Bang-Kok there are none at all, and here travelling is almost entirely aquatic. In extenuation, however, it ought to be remarked, that both here

and in other parts of the low country, the internal navigation is so extensive, cheap, and commodious, as to account in some measure, for the absence of public roads, and even to compensate for that absence. At Bang-Kok, wheel carriages are altogether unknown; and even elephants are prohibited, except to a few of the principal lords.' The use of canals is well known in the lower reaches of the Mae Nam Chao Phraya and the other rivers entering the Gulf of Thailand. The major waterways are often connected by canals, as detailed in Clarac (1981). Hutchinson, (1940: 10), in the 17th century was recording 'Then, as now, the waterways intersecting the central plain provided the means of communication between villages and towns.'

Hein (2001) has investigated a quay structure in the area of Ban Pa Yang at Si Satchanalai. His Fig. 10 shows canals leading out of Si Satchanalai. Hein estimates that in the earlier stages of ceramic production jars were loaded onto boats very close to the kiln where they were manufactured. Hein indicates that MON (Most Original Node) wares are commonly found along its banks. The kiln sites straddle the banks of the Mae Nam Yom, one of the tributaries of the Chao Phraya.

Hein notes that there is evidence of a vast complex of canals in central Thailand, able to be ascertained from aerial photography. It is feasible that not only did they span the distance between rivers, but that they skirted difficult river courses. Hein (2001: 159) mentions a Thanon Phra Ruan, a canal extending approximately north-south between Kamphaeng Phet on the Ping River and Si Satchanalai, passing through Sukhothai. Godley *et al.* (1993: 108) summarize that although it is reasonable to suggest that the canal system away from Ban Ko Noi and Ban Pa Yang was used for communication and transport it remains to be clarified due to a lack of sherd evidence along the system.

The kiln sites at Suphanburi, from where many of the Ko Si Chang 2 ceramics most likely originated were also located on a river bank. The old city of Suphanburi was formerly located on the right bank of the Mae Nam Tha Chin. According to Clarac (1981: 77) it is still possible to go from Suphanburi to Ayutthaya via canal and river. The Tha Chin itself flows south from Suphanburi where it meets the Gulf at Samut Sakhon. It is not unrealistic to speculate that this direct route was used in bringing the Suphanburi produce to the Gulf and that produce from the Sukhothai and Si Satchanalai kilns may also have used this alternative route at least during a particular period. This is supported by a sherd recovered by this author from the river bank near the Suphanburi kiln site in 1988. The poorly manufactured item, believed to be from the Si Satchanalai kilns, closely resembled some excavated from the Ko Si Chang 2 shipwreck site. It is also noteworthy to record that ceramic sherds from Sukhothai and Si Satchanalai, were recovered in a canal adjacent to the Mae Nam Noi kiln site. The Mae Nam Noi is a tributary of the Mae Nam Chao Phraya.

Chandavij (1985) details a route by which Martaban was connected by boat and foot to the Three Pagodas Pass then by boats along the Kwae Noi and Kwae Yai rivers from where transport continued along various rivers connecting Kanchanaburi, Ayutthaya and Bangkok. Tavoy was also connected to the south by foot and river. One of these rivers, the Mae Klong was well used judging by the vast amount of

Chinese, Vietnamese and Thai ceramics and other artefacts recovered from the environ, Gumperayarnont (1985). The remains of at least four ships of different periods had been located in the river. The area was favoured for settlement in the early period of Chinese migration to Thailand.

It can be seen therefore, that in conjunction with the other routes mentioned above and below, almost all places of ceramic production in central Thailand were accessible to one another through various configurations of river, canal and land.

Despite the sediment build up which comes with development and subsequent geographical change it is still possible to use river transport to sail up river to Sukhothai from Ayutthaya. According to Associated Press (2002), Chuay Kaepasert, long time diver for antiques in the river at Ayutthaya, still recovers artefacts from the great 'mother water', evidence of the extraordinary trade which has passed through Ayutthaya for centuries.

Eastern Access

The histories of Thailand and Cambodia have been aligned for centuries, the boundaries under constant change. A paved road between the two was said to have existed from early times. Crawford (1828: 407) noted that 'The importations from Kamboja into Siam consist of gamboge, cardamums, stic-lac, varnish, raw hides, horns and ivory'.

Another river with relevance to our sites is the Mae Nam Chanthaburi where the Samed Ngam shipwreck is located. In the nineteenth century Henri Mouhot, King (1995: 111) recorded that he travelled by boat to Chantaboon (Chantaburi). According to Clarac (1981) this river was quite silted.

Peninsular Access

The crossings of the Peninsula are described by Wheatley (1961), Anderson (1890), Promboon (1985), Hutchinson (1940) and Crawford (1828). These links allowed access between the Gulf of Thailand and Burma and beyond. Usage of the various crossings altered over the centuries.

Peninsular crossings, despite the hardships, were undertaken because they avoided many of the constraints encountered in the straits of Malacca associated with winds, pirates and other aspects previously covered in this work. According to Simkin (1968: 26) use of the Kra Isthmus crossings on the Peninsula shortened a trip from India to China by 1000 miles. Likewise, a similar shortening of a trip from India or the west coast of Burma to the Thai Gulf would occur. Simkin (1968: 221) discusses how Indian goods could compete with those brought by the Dutch ships from the east coast of India. Ayutthaya was by then a well established trading centre with products from China, Japan, Thailand and elsewhere.

The peninsular routes, include one starting on the Burmese coast around Tavoy and following the Ping and other rivers similar to the southern aspect of the Martaban route. There was a Tenasserim River route which had several permutations and there were further southern routes.

The Tenasserim route is of particular interest in this research because its termination ports are quite close to the Prachuap Khiri Khan site. Cargoes were despatched by small ship to Bangkok or Ayutthaya after crossing the Peninsula. Writers in the seventeenth century give various accounts and offer variations to this route.

Hutchinson (1940: 12–13) shows that goods travelled from Mergui on the western coast of the Peninsula to Tenasserim, forty miles by sea-going ships. From here they transferred to small boats in which they travelled about thirty miles until impeded by rapids. Goods were then carried manually over a mountain pass to a place called Jalinga from where they journeyed on foot to Prachuap. He indicated that the whole trip to Ayutthaya could be accomplished in ten days though it usually took longer.

Anderson (1890: 6 & 227) in the 19th century tells that ‘doolies’ (palanquin), carts and elephants were used from Jalinga. One terminal point was Pram (presumably Pran) from where they walked to Phiphri (believed to be Phetburi). From here boats were taken down river to the sea from where they sailed 24 hours to reach the mouth of the Mae Nam Chao Phraya. It took five or six days to reach the capital from the river mouth on the particular voyage detailed by Anderson.

A further account by Anderson (1890: 240) tells that a trip from Tenasserim to Jalinga took six days. From there the voyagers travelled to Kui by bullock cart (they originally intended to go to Phiphri but the road, normally passable was inaccessible due to heavy rain). From Kui they took a boat to Ayutthaya taking four days. Another destination from Tenasserim given by Anderson (1890: 8) was to a town to the southeast, known as Bangnarom. Anderson (1890: 40) indicates that goods described as ‘Acheen’ and from Burmese ports, came to the Gulf via this route, those given being mainly textiles. Travelling in an east-west direction were items including Chinese porcelain, textiles, tin, aloe and sapanwood.

In summary, the exploration by Garnier, Dupois and the insights by Crawford and others showed what locals were already aware of: that access to the hinterland of Southern China, Burma and Thailand to southern Thailand and the Chinese and Vietnamese coasts could be accomplished by river and land routes despite the difficulties.

It is clear that overland trade between Thailand and other parts of Asia has a long established pattern. It is not unthinkable that sought after timbers could have been brought from Burma or Assam through the use of river and land transport, particularly with the use of elephant labour. It is known that some timbers came down the rivers to ports where they were used for ship construction, teak in the 19th century, for example. However, it is unlikely that a timber would be brought this way if an alternate source was available in close proximity to the shipbuilder. It is certain that ceramics were part of the trade passing down the rivers from kilns further north to the entrepot of Ayutthaya or directly to sea ports.

The fact that river and overland transport was used, in some situations in preference to maritime travel, despite extreme difficulties, demonstrates just how challenging a sea voyage was.

SI CHANG ISLAND (KO SI CHANG)

The great rivers of Thailand, the Mae Nam Chao Phraya, the Mae Khlong and the Mae Nam Tha Chin enter the Gulf of Thailand to the northwest, and the Chonburi River (Mae Nam Bang Pakong) enters to the northeast of the islands of Si Chang and Kham Yai, where three of the wrecksites examined by our team were located. It is apparent from historic texts such as Anderson’s account of the English in Siam in the 17th century and Crawford’s in the 19th century, that these

islands served as a safe harbour, probably over centuries, for ships waiting to enter, and upon leaving, the rivers. In the days of sailing ships, sailors were forced to wait, quite often for lengthy periods of time, until the monsoon changed, allowing them to continue their travel. Even then the weather was not entirely predictable, and there are accounts of ships heading, with haste, for the shelter and perceived safety of the islands.

An account of the voyage of the *Return* of 1681 by Anderson (1890: 161) gives an early reference to the English pinpointing these islands when: ‘The vessel sailed on the 9th August and arrived at Amsterdam at the mouth of the Menam, on the 1st September’. Crawford (1828: 193) from Hamilton’s account of the East Indies from 1688 to 1723 relates that the islands below the river mouth were called: ‘...the Dutch Islands, and the principal one, or Si-chang, ‘Amsterdam’ They appear to have received these names on account of the ships of the Dutch East India Company which frequented Siam in the 17th century, being in the habit of taking shelter at them in the south-west monsoon. English ships, it would appear, had been occasionally in the habit of doing the same thing.’

In the mid 17th century Gervaise (Villiers, 1998), tells that ascending the river in order to fulfil trade at Ayutthaya, Bangkok or other ports, could only be undertaken during the south winds and ships could be forced ‘...to remain at sea for two or three months without being able to land’. Crawford (1828: 186–7) at the end of July (25th), illustrates further the difficulties of traversing the river mouth ‘About nine o’clock last night, we crossed the bar of the River, having taken no less than seven days, in warping the ship over a mud flat, ten miles in extent...’. ‘The highest water on the bar of the Menam in the hot months from February to September, is about thirteen and a half feet; and in the remaining four months somewhat more than fourteen feet—a difference probably produced by the accumulation of water at the head of the bay, after the south-west monsoon, and by the heavy floods of the rainy season. The extensive mud flat and bar of the Menam are serious obstacles to its navigation, and, on this account, foreign trade ought perhaps to be confined to vessels not exceeding 200 or 250 tons burthen. In all other respects, the River is extremely safe and commodious.’

Crawford continues: ‘From the 26th of July till the second of this month, we were occupied in putting the ship in a condition to enable her to sail with safety to a group of islands close at hand, called by our old navigators the Dutch Islands, and by the natives Ko Si-Chang; for, in order to enable her to pass the bar, she had been dismantled, and her draft of water reduced from fifteen to twelve feet. During all this time, and indeed from the moment we quitted Bang-Kok, we had a constant succession of fine and serene weather. We reached the group of islands in question yesterday afternoon, and had the satisfaction to find a safe and beautiful harbour, formed between Si-Chang, the principal island, and Koh-kam, the next in magnitude’.

There are many references by Anderson to ships waiting at the bar of the Mae Nam, which could be interpreted as the boats anchoring in the proximity of the Si Chang Islands, close to the mouth of the Chao Phraya river. There is also mention by Anderson, in 1691, to some untoward behaviour of the infamous Phaulkon whereby it was suggested that the

situation might be dealt with ‘...by sending two small vessels, fitted and manned to Siam’s river mouth, or some adjacent island to wait for the junks,...’.

Clarac (1981: 97) says of Ko Si Chang, ‘For a long time it served as the terminal point for boats with draughts too deep for them to enter Bangkok. After the canal was cut through the bar which blocked the entrance to the Mae Nam Chao Phraya, this inconvenient practice of off-loading at Ko Si Chang stopped.’ Bowring’s (1857: 29) account in the 19th century is as follows ‘The harbour is very fine, affording complete shelter for any number of vessels, and has great facilities for watering from a fine fresh stream, which will fill one hundred casks in a day’.

It is evident that the tradition of sheltering by these islands, is one which has taken place for centuries and will continue to do so. In the 1980s, members of the Thai-Australian Expedition witnessed ocean going ships being loaded at anchor from barges near the islands. The barges were more able to traverse the river mouth carrying cargoes such as rice. In fact the barges retreated to the lee of Ko Si Chang and Ko Kham Yai during severe inclement weather such as occurs during the early cyclone season.

During March, April and May, Holbrook and Suriya (2000) say ‘...the whole of the Gulf enjoys relative calm, and some coastal areas always remain free of storms: Ko Si Chang, Bang Pakong and Samut Songkhram’. However, Floris, in Mooreland (2003: 47–49) relates how on 26 October 1612 (possibly around the time of the demise of the Ko Si Chang 1 ship), shortly before his ship’s departure from Siam a storm blew up and ‘...rayne that olde folkes had never seene the lyke in that country; the trees were blowne oute of the ground... The shippe (at the bar) being in a thowsand dangers, with 2 anchers oute, wente awaye...they gott a cable to the third anker and lette that fall, by which shee was stayde and so was saved, for it was alreadye gotte from 6 faddem to 4 and not passing an English myle from the land, whereas were very sharpe rockes... This storme lasted not passing 4 or 5 houres and then began to grow less, so that the nexte morning the sea was as smooth as yf there had bene no wynde att all; and it is to bee wondered howe the sea can bee so rough in this baye, seeing the corners poynte oute so farre, having some islands (1), and being by reporte one of the beste bayes that can bee wished, being butt [i.e. only] this winde comming from the S.S.W. or whereabowtes that can do harme, for that maketh [i.e., bowls through] the opening betweene the land and the ilands.’

Another account from Purchas, related through Anderson (1890: 51) tells that ‘In the November and December of 1613 there were serious inundations at Patani, destroying many houses and a great number of animals’. It is very likely that at least some of the shipwrecks lying off Ko Si Chang and others in the Thai Gulf give testimony to the severity of similar storms.

The islands may also have been used as a base from which to confirm position before entering the rivers, owing to the difficulties in visibility near the mouths. Crawford (1828: 70) ‘The high mountains of Bang-pa-sao were in sight to the eastward, but no land a-head. By our reckoning, however, we were within a few miles of the roads of Siam, and at five in the afternoon we came in sight of them, which we only ascertained by discovering three large Chinese junks lying at

anchor, for the land at the head of the gulf was extremely low, and not yet visible.’

If, as it appears to be the case, ships had been on occasion, loading and unloading at anchor near the islands, there is the distinct possibility that errors of judgement occurred in the process. The bar at the entrance to the Chao Phraya was frequently impassable to larger vessels over a certain draft and the necessity of travelling with the monsoon winds may not have always coordinated with access to the river. It is highly likely that small boats carried trade items to and from the mainland to the vessels at anchor. Handling goods such as tonnes of lead ingots and large jars could be a recipe for disaster and may well have been so in the case of the ships wrecked off Ko Si Chang.

IN RELATIONSHIP TO TRADE IN THE GULF OF THAILAND—SOME REFERENCES TO SHIP TYPES, SHIP BUILDING, SHIPYARDS AND CREWS.

The Crews

Crawford (1828: 415) indicates that in coasting-trade (that is within the Thai Gulf as far as insular Southeast Asia), the crews were partly Chinese, partly Siamese, but almost always Chinese for long distance and difficult travel. Crawford (1828: 411) indicated that at the time (early 19th century) Siamese were excluded from all other parts of China apart from the port of Canton. Anderson (1890: 99) in 1889 pointed out that in travel to Japan, Siamese were considered somewhat inept and that the trade was carried out by Japanese and Chinese mariners. There is no evidence on shipwrecks investigated by the Thai–Australian team in the Gulf of Thailand of a crew other than Thai.

Packing and Shipping

Apart from the possible use of porcelain discs for the separation of small cups and bowls, no clear indicator as to how the ceramic items were packed has been found on any of the excavations the Thai–Australian team have undertaken.

It is likely however, that large jars were used for storage on board ship. This style of transport was used on the Brunei Darussalam site, according to Richards (2003: 57) where a large jar held small Thai celadon jarlets (similarly shaped to the brown glazed jarlets seen on the Ko Rin site). Richards also illustrates another large jar which contained Chinese blue decorated jarlets similar to one recovered from the Ko Si Chang 1 site.

Other recorded forms of packing include porcelain surrounded with straw and carried in wooden tubs Rinaldi (1989: 54). Volker (1971) indicates that barrels or matting tied with bamboo were used, depending on the class of wares being transported. The Dutch found that the dishes and porcelain packed in barrels travelled well but cups, bowls and small saucers broke and ‘...it would be very well advised to pack the fine saucers and cups in wooden barrels and cases’ (Volker, 1971: 83) ‘...so that the porcelains are well stowed in the junks and come to the market undamaged...’ (Volker, 1971: 85).

On the Thai Gulf shipwrecks no loose timber or metal pieces were identified as having belonged to a tub, barrel or case. A few pieces of bamboo were recovered from the Ko

Si Chang 1 excavation however these were thought to have been associated with the ship itself rather than directly with the ceramic cargo.

Some Craft Recorded in the Gulf of Thailand in the 1960s

The hull of the Ko Si Chang 3 ship is estimated to be a little more than 20 metres long (with a beam of about 6 metres), Green, *et al.* 1987. Brown and Sjostrand (2002: 67) estimate the Nanyang to be about 18 metres in length whilst the Turiang, Longquan, Royal Nanhai, Xuande and Singtai are estimated to be about 25–28 metres.

Holbrook and Suriya (2000) detail the different coastal vessels plying Thai waters in the 1960s. Several are selected here to demonstrate the capabilities of these vessels, and possibly their forerunners under sail power.

Of Class 6 Type 1 (Holbrook and Suriya, 2000), many were converted from sailing boats. They were 7–18 metres in length, gross 6–45 tons, net 3–23 tons. They plied every coastal province in Thailand, were capable of being away two months, taking on supplies at various villages. These were fishing or cargo vessels (mainly carrying coconuts and lumber).

Class 6 Type 2 shows a type of vessel found in all coastal provinces from Trat to Narathiwat, length 7–17 metres, gross tons 1–17, net tons up to 12. Some of these vessels were converted from sailers. None were known to have watertight compartments. Some of the larger were able to cross the Gulf (presumably this was also possible under wind power). They were mostly fishing boats, a few hauled cargoes.

Class 6 Type 10 were found from Chonburi to Prachuap Khiri Khan. They were from 12–14 metres, gross tons 9–17. They had no watertight compartments, were seaworthy, though operated mainly 5–10 miles off shore.

Class 7 Type 3 and 12 were said to be amongst the last of the large Thai sailing vessels, Holbrook and Suriya (2000: 323) 'Easily recognized by their Chinese lug sails and overhanging poop deck, they have the pointed bow and sliding rudder of the typical South Chinese and Hainan junks. But the pointed stern and extended stem are peculiar to Thai and Cambodian craft of this type.' These vessels extended from Trat to Nakhon Si Thammarat. They were 12–25 metres, gross tons 18–40 and had two Chinese lug sails. They were capable of crossing and sailing anywhere in the Gulf, but most followed the coastline, leaving the home port from five days to two months. These vessels were able to operate at all times of the year waiting for high tide and sufficient wind to leave port. Holbrook and Suriya say that the typical crew was four Thai seamen who were Buddhist. Some were owned by Chinese and occasionally had all Chinese crews. Cargoes were charcoal, firewood, lumber and stone.

The Class 8 Type 3, seen from Trat to Prachuap Khiri Khan were converted from old sailing vessels and motorised. They were from 11–17 metres, 10–18 tons gross. They were coastal and carried salt, coconut, clay and thatch.

Class 8 Type 12 were found between Trat and Prachuap Khiri Khan. From 12–17 metres, the sails of these two-masted vessels had generally been replaced by inboard engines. They had no waterproof compartments and rarely ventured more than thirty miles out to sea. They hauled cargo between villages

of the upper Gulf and included those carrying gravel from Ko Si Chang. They also carried wood, fish and bamboo strakes.

Class 8, Type 14 were found in every coastal province. They varied from 5–18 metres and 1–27 tons. Many had been converted from sailers. Primarily they were a fishing boat, the hull shape ideally suited for a sailing vessel but too sensitive in heavy sea according to Holbrook and Suriya.

Malaysian 2-masted were from 10–23 metres in length, 8–55 gross tons. These vessels had two sails and were found from Malaysia to Ban Laem (Phetchaburi Province). This type of vessel demonstrates that long coastal trips could be made as they carried sand for ballast to Ban Laem (smaller boats brought shrimp paste) and returned to Malaysia with salt. The round trip was of twenty to thirty days. They were seaworthy, capable of staying at sea for extended periods.

Summary

As previously indicated, one of the original reasons behind this research was to clarify whether any of the ships recovered in the Gulf of Thailand could have had their origin, or at least the capability to voyage, outside the relatively protected waters of the Gulf of Thailand. Despite their small size could they have ventured to areas as far as the Philippines and China or to the western side of the Thai-Malay Peninsula? Were they in fact limited to coastal shipping within the Gulf? This section looks very briefly at a few references to shipbuilding and other shipping activities in Thailand and further afield.

It may be that the presence of teak in the structure of a ship could be one measure of its ocean-going prowess. One made of teak, *Tectona grandis* – valued for its strength and durability, would be expected to cope more succinctly with the challenges faced in the open seas than one built with a weaker timber. Teak is native to India, Burma, Thailand, Indo-China and Indonesia, particularly Java, according to Chudnoff (1980: 745). Manguin (2003: 39) says of all the many hybrid ships, that is, usually fastened with iron nails together with wooden dowel and with bulkheads, rudders and V-shaped keel, the main timber used in construction is teak. Teak was not used in the construction of those 15th and 16th century vessels excavated by the Thai-Australian team in the Gulf of Thailand. Other timbers of strength and quality were used, as shown in the section on timbers (above). Crawford (1828: 427) indicates that by the early 19th century, teak was much used by the Siamese in construction of junks.

According to Wiens in Holbrook and Suriya (1967), the word junk comes from *djong*, a Malay word meaning 'sailing craft'. Junks, officially classified as 'flat-bottomed sailing vessels used in China seas, with prominent stem and lug sails', (*Concise Oxford Dictionary*) traded between Bangkok and China over the centuries.

Promboon (1984: 112) points out that there were two types of trade in the region, that of the port being used for foreign goods and the other for local trade which may also include foreign goods. The ports most favoured by the Chinese were Ayutthaya, Ligor, the Bay of Bandon, Singora, Pattani and Phetchaburi. Pires (Cortesao 1967: 107) at the beginning of the 16th century, recorded that some junks belonged to the merchants and lords of the ports along the Siamese coast. Wheatley (1961:319-20) tells of ports which '...seem to have

engaged in a coastal trade which extended to Cambodia and Campa, Java, Malacca and the east-coast ports of Sumatra'. Their chief export was pepper. There was no recovery of pepper recorded from any of the ships investigated by the Thai-Australian teams.

Of Thai junks used in the China trade in the early 19th century, all were built in Bangkok according to Crawfurd (1828: 410–11), their frames commonly of the timber *Metrosideros amboinensis* (said to be called *marboa* by the Malays) and the deck and planks of teak. The teak grew above 16 degrees latitude, that is north, from about the vicinity of Nakhon Sawan. Crawfurd explained that the teak was floated down the Mae Nam during two months of the year, taking about one month to reach Bangkok from where, at the time 6–8 of the largest vessels were launched annually.

In order to exact a possible point of manufacture of the ships recovered in the Gulf of Thailand, it is pertinent to look at the observations made by Crawfurd as he sailed the coastline of the Gulf of Thailand at the beginning of the 19th century when presumably the vegetation differed little to that of prior centuries. On the eastern side of the Gulf of Thailand, in the vicinity of the coast north of Chantaburi, Crawfurd (1828: 441–42) reports that the area was '...nearly covered with primeval forests which afford rose-woods, barks, dye-woods, and timber for shipbuilding; among which, however, teak is not included'. To the west of the Mae Khlong to probably as far as Pran, the area was poorly inhabited and the forest described by Crawfurd as '...of no value but for the firewood which it affords to the capital'. Below Pran the area was also thinly populated but the forests abounded in sapanwood according to Crawfurd. From the Champon area Crawfurd reports '... timber fit for shipbuilding'.

Areas outside the Gulf of Thailand where large scale shipbuilding reportedly took place included the Burmese Kingdom of Pegu which was the source of junks and cargo ships made in the vicinity of Dagon (Rangoon) from where they sailed to Malacca and Pasé. Pires (Corteseão 1967: 97–98) tells that 'The junks are made in this port because of good wood there'. It is likely that teak was represented on the vessels, Pegu having easy access to this timber, as well as to many of the other timbers used in the Thai Gulf shipwrecks. Pires records that fifteen to sixteen junks and twenty to thirty cargo ships—long with a shallow draught departed Pegu, presumably annually. In Malacca they were sold, along with their cargo, Hall (1977: 227).

Of Malacca itself, Hall says one of the few industries was shipbuilding but for war vessels only. Of interest is a tenuous connection with the Ko Si Chang 1 ship—Malacca's other industries, apart from woodwork, were the forging of arms and the drying and salting of fish—armaments and the remains of preserved fish both appearing on the Ko Si Chang 1 shipwreck.

The North Javanese ports also supplied Malacca with commercial vessels. According to Hall, the Javanese, good ship builders, were able to build large junks and they also practised their craft in Malacca. Though Pires (Corteseão, 1967: 189) records that junks were made in Rembang, Java and the Central Islands, which he says were a source of junks for the Javanese. He indicates, contrary to Chudnoff (above) that there was little timber suitable for ship building in the

whole of Java and that most of the Javanese junks came from Pegu. Manguin's (2003: 37) opinion is that in the 15th and 16th century, ships were built along the coasts of Java and South Borneo '...where timber was readily available in quantities sufficient for building such large ships'.

Of the Kingdoms of Pasé and Pedir in Sumatra, Pires (Corteseão, 1967: 145) tells that neither produced junks, the scarcity of *jaty* wood being the reason in the case of Pasé. However, smaller boats, *lancharas*, were made throughout, as evidenced in Pires' report. Pasé included Siam in its trade. The only possible reference this author found for *jaty* wood is through Whitemore (1972: 51) who refers to *podobukit (jati)* as *Podocarpus neriifolius*, (one of the timbers present on the Ko Si Chang 2 ship).

According to Pires (Corteseão, 1967: 226) the people of the Macassan Islands, traded as far as Siam in their *paraos* of which he said, they had many. Of Sunda Island (southeast of Java) Pires (Corteseão, 1967: 167) says they had up to six junks and many *lancharas* of 150 ton capacity.

Pires (Corteseão, 1967: 133) tells that the Philippines had only two or three junks at the most with which they took their merchandise to Borneo and from there to Malacca.

Hall (1985: 324–25) includes a translation by Gibb, of Ibn Battuta of the 14th century, which states that Chinese junks were only built in Ch'uan-chou and Canton (Guangzhou), from which they sailed southwards. Crawfurd (1828: 411) writes at the beginning of the 19th century 'The shipping belonging to China carrying on the Siamese trade, are built at the respective ports of that country from which they sail, and cost differently at each. They are built of inferior woods, to the Siamese junks, I think, generally of fir—their rudder, anchor, and masts being commonly of suitable wood procured in Kamboja, Siam, or the Malayan islands'. Crawfurd says, (1828: 414–5) that of about 200 junks from Bangkok, about one quarter traded at the Straits of Malacca and '...are all built and owned in Siam, and are formed and equipped in a manner considerably different from the junks intended for the Chinese trade, and such as to make them more manageable, and more cheaply navigated. Their ordinary size runs from 1000–3000 piculs, although there be a few which are as large as between 6000 and 7000'. The picul being about 60 kg. Donnelly (1924: 115), in regards to vessels termed Ch'ao chou traders, reiterates Crawfurd's findings, that in early times, junks in the Chinese trade were built in Siam and owned by Chinese settlers in Siam or by Siamese nobels.

To conclude, it must be acknowledged that since some junks did not belong to the King but to private entrepreneurs operating along the Siamese coast it is possible that they were built from locally procured timber, at local ports. It is natural that smaller craft would have been built along the coast wherever suitable timbers were available. As has been shown many fine shipbuilding timbers were available in various parts of the Thai hinterland. They were found to be used on the ships wrecked in the Gulf of Thailand and excavated by the Thai-Australian team. It is feasible that some of the ships were from further afield but because of their stature and the nature of their wares it is unlikely. However, it is certain that they played a part in international trade due to the Chinese and possible Vietnamese wares they carried.

References

- Adhyatman, S., 1981, *Antique Ceramics Found in Indonesia*. The Ceramic Society of Indonesia, Jakarta.
- Adhyatman, S. & Ridho, A., 1984, *Martavans in Indonesia*. The Ceramic Society of Indonesia.
- Amdel see Australian Mineral Development Laboratories.
- Anderson, J., 1890, *English Intercourse with Siam in the 17th Century*. Copied and published by Chalermnit, Bangkok 1981, Thailand.
- Associated Press, 2002, Thai river gives up its treasures. *The West Australian Newspaper*, 2 March, p.30. Perth, Western Australia.
- Atkinson, K., Green, J., Harper, R. & Intakosai, V., 1989, Joint Thai-Australian underwater archaeological project 1987–1988 Part 1: Archaeological survey of wreck sites in the Gulf of Thailand, 1987–1988. *International Journal of Nautical Archaeology*, 18.4: 299–315.
- Auret, C. & Maggs, T., 1982, The Great Ship *São Bento*: remains from a mid-sixteenth century Portuguese wreck on the Pondoland coast. *Annals Natal Museum*, 25.1: 1–39. Pietermaritzburg.
- Australian Mineral Development Laboratories, 1987, Service Report M7860.
- Australian Mineral Development Laboratories, 1988, Service Report AC1251, 1252, 1253.
- Australian Mineral Development Laboratories, 1988, Service Report Bang Rachan/Mae Nam Noi Kilnsites.
- Australian Mineral Development Laboratories, 1989, Service Report AC 1219.
- Australian Mineral Development Laboratories, 1989, Service Report Philippines.
- Baker, C., 2003, Ayutthya Rising: From Land or Sea? *Journal of Southeast Asian Studies*, 34.1: 41–62.
- Balfour-Paul, J., 1998, *Indigo*. British Museum Press.
- Barbetti, M. & Hein, D., 1989, Paleomagnetism and high resolution dating of ceramic kilns in Thailand: A progress report. *World Archaeology*, 21.1: 51–70.
- Barwick, M., 2004, *Tropical and Subtropical Trees. A Worldwide Encyclopaedic Guide*. Thames & Hudson, London.
- Beurdeley, M. & L., 1974. *Chinese Ceramics*. Thames and Hudson.
- Blake, W. & Flecker, M., 1994, A Preliminary Survey of a South-East Asian wreck, Phu Quoc Island, Vietnam. *International Journal of Nautical Archaeology*, 23.2: 73–91.
- Blake, W. & Green, J., 1986, A mid-XVI century Portuguese wreck in the Seychelles. *International Journal of Nautical Archaeology*, 15(1): 1–23.
- Bodkin, F., 1990, *Encyclopaedia Botanica. The essential reference guide to native and exotic plants in Australia*. Angus and Robertson, North Ryde, Australia.
- Bohmer, H., 2002, *Koekboya. Natural Dyes and Textiles. A Colour Journey from Turkey to India and Beyond*. Weppert, Schweinfurt.
- Boisselier, J., 1976, *Thai Painting*. Kodansha International, Tokyo, New York and San Francisco.
- Bosomworth, D., 1995, *The Encyclopaedia of Patterns & Motifs: A Collection of 5000 Designs from Cultures Around the World*. Studio Editions, London.
- Bowring, J., 1857, *The Kingdom and People of Siam*. Oxford University Press Reprint 1969.
- Brennan, H., 1987, The Making of a Lambo the Traditional Way. *The Straits Times*, 18 November 1987: 6.
- Brissenden, R., 1976, Patterns of Trade and Maritime Society Before the Coming of the Europeans. In: *Studies in Indonesian History*, E.e McKay (ed.). Pitman, Australia.
- Bronson, B., 1992, Patterns in the Early Southeast Asian Metals Trade. Early Metallurgy, Trade and Urban Centres in Thailand and Southeast Asia. In: *13 Archaeological Essays*. I. Glover, P. Suchitta & J. Villiers (eds), Bangkok, p.63–114.
- Brown, R., 1975, Preliminary Report of the Koh Khram Sunken Ship. *Oriental Art*, 21(4): 356–70.
- Brown, R., 1977, *The Ceramics of South-East Asia, their dating and identification*. Oxford University Press, Kuala Lumpur.
- Brown, R., 1988, *The ceramics of South-East Asia, their dating and identification*. Oxford University Press, Kuala Lumpur.
- Brown, R., 2004, The Ming Gap and Shipwreck Ceramics in Southeast Asia. A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy in Art History, University of California, Los Angeles (unpublished).
- Brown, R. & Sjostrand, S., 2000, *Turiang: A Fourteenth-Century Shipwreck in Southeast Asian Waters*. Pacific Asia Museum.
- Brown, R. & Sjostrand, S., 2002, *Maritime Archaeology and Shipwreck Ceramics in Malaysia*. Dept of Museums and Antiquities, Kuala Lumpur, Malaysia.
- Brown, W.H., 1978, *TRA red booklet Timbers of the World 3 (Southern Asia), 4 (South East Asia) and 5 (Philippines and Japan)*. Prepared by W.H. Brown in collaboration with TRA publishing panel. Timber Research and Development Association, High Wycombe, England.
- Burger, W., 1976, *Ch'ing cash until 1735*. Mei Ya Publications, Inc.
- Burns, J., 2005, Personal communication.
- Cannon, J. & M., 1994, *Dye Plants and dyeing*. The Herbert Press. in Association with The Royal Botanic Gardens, Kew.
- Carre, D., Desroches, J.-P., Goddio, F. & Giordan, A., 1994, *Le San Diego. Un trésor sous la mer*. Association Francaise d'Action Artistique, Ministeres des Affaires E'trangeres, Reunion des Musees Nationaux.
- Casa-Museu Dr Anástacio Gonçalves, 1996, *Chinese export porcelain: from the Museum of Anástacio Gonçalves, Lisbon*. Philip Wilson, London.
- Cembrano, M., 1987, Personal communication.
- Cembrano, M., 1998, *Patterns of the Past: The Ethno Archaeology of Butuan*. National Museum of the Philippines.
- Chaffers, W., 1965, *Marks and Monograms on European and Oriental Pottery and Porcelain*. ed. G.A. Godden, F. Litchfield & R.L. Hobson. W. Reeves, London.
- Chamoraman, C., 1984, *Notes on Some of the Place Names in Peninsular Thailand during the 12th–14th Centuries*. SPAFA consultative workshop on research on maritime shipping and trade networks in Southeast Asia. (I-W7). SEAMO (Southeast Asian Ministers of Education Organization), Indonesia, p. 97–105.
- Chandavij, N., 1985, *Ceramics from Tak Province. Country Report*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4) Bangkok and Chiangmai, Thailand. SEAMO.
- Charoenwongsa, P. & Diskul, M.C. Subhadradis, 1978, *Archaeologia MVNDI. Thailand*. Nagel Publishers, Geneva.
- Chonlaworn, P., 2004, Relations Between Ayutthaya and Ryukyu. *Journal of Siam Society*, 92: 43–63.
- Christie's Australia, 2004. *The Binh Thuan Shipwreck*. Christie's Australia, Melbourne, 1–2 March.
- Christie, Manson & Woods Ltd., 1989, *The ceramic cargo of a medieval south Asian trading vessel*. Christie, Manson & Woods Ltd, London.
- Chudnoff, M., 1980, *Tropical Timbers of the World*. U.S. Department of Agriculture Forest Service. Forest Products Laboratory, Madison, Wisconsin.
- Clarac, A., 1981, *Guide to Thailand*, (ed. & trans. M. Smithies), Oxford University Press, Duang Kamol Book House, Bangkok.
- Corner, E.J.H., 1988, *Wayside Trees of Malaya*. The Malayan Nature Society, United Selangor Press, Kuala Lumpur, Malaysia.
- Corner, E.J.H. & Watanobe, K., 1969, *Illustrated Guide to Tropical Plants*. Hirokawa Publications, Tokyo.
- Cortêsão, A. (trans. & ed.). 1967, *Suma Oriental of Tome Pires. An Account of the East, from the Red Sea to Japan, written in Malacca and India in 1512–1515 and the book of Francisco Rodrigues Rutter of a Voyage in the Red Sea, Nautical Rules, Almonac and Maps. Written and drawn in the East before 1515*. Vol. 1. Reprint. Hakluyt Soc. 1944. Kraus Reprint Limited Nendeln/Liechtenstein.

- Crawford, J., 1828, *Journal of Crawford's Embassy to Siam and Cochin China*. Oxford in Asia Historical Reprints, Oxford University Press, Kuala Lumpur.
- Crow, D., 1976, Chinese Medicine Bottles. *Arts of Asia*, 6.6: 69–75.
- Cubitt, G. & Stewart-Cox, B., 1995, *Wild Thailand*. New Holland Publishers Ltd. London, Capetown, Sydney. Produced in association with the Seub Nakhasathien Foundation.
- Dalby, G., 1985, *Natural dyes, fast or fugitive*. Ashill Publications, Ashill Craft Studio, Dulverton, Somerset. England.
- Dalby, J.G., 1995, Scott (1851–1935) Explorer of Burma's Eastern Borders. In: *Explorers of South-East Asia—Six Lives*, (ed.) Victor T. King. Oxford in Asia, Kuala Lumpur.
- Dansilp, T. & Freeman, M., 2002, *Things Thai. Crafts and Collectibles*. Asia Books.
- Dastur, J.F., 1977, *Useful Plants of India and Pakistan*. D.B. Taraporevala Sons and Co. Private Ltd.
- Donnelly, I., 1924 & 1988, *Chinese Junks and other Native Craft*. Kelly and Walsh Ltd, Shanghai, China.
- Dumas, J., 1981, *Fortune de Mer a L'Île Maurice*. Atlas Films, Paris.
- Dupoizat, M.-F., 1984, *Recherche Sur les Jarres en Malaysia et a Singapour*. Vol. II. Diplome de L'Ecole des Hautes Études en Sciences Sociales, France.
- Elf Aquitaine pamphlet (in French), undated.
- Evangelista, A., 1987, Personal communication.
- Fehervari, G., 2004, Herb Containers of Arabia. Syrian Glazed Jars of the Mamluk Period. *Arts of Asia*, 34.5: 41–55.
- Flecker, M., 1980s, Personal communication.
- Flecker, M., 2004, The Binh Thuan Shipwreck. In *The Binh Thuan Shipwreck*, Christie's Australia, Melbourne, 1 and 2 March, p.2–15.
- Food and Agricultural Organization of United Nations, 1960 *Standard Nomenclature of the Exportable Timbers of the Asia-Pacific Region. Standard export names within the supplying country. Botanical Name*. Rome.
- Flora of Taiwan Editorial Committee, National Science Council of Republic of China and National Science Foundation of United States, 1975. *Flora of Taiwan*. Part I Volume. Epoch Publishing.
- Flora of Taiwan Editorial Committee, National Science Council of Republic of China and National Science Foundation of United States, 1977. *Flora of Taiwan*. Part I Volume 3. Epoch Publishing Co. Ltd.
- Flora of Taiwan Editorial Committee, National Science Council of Republic of China and National Science Foundation of United States. 1979. *Flora of Taiwan*. Part I Volume 6. Epoch Publishing Co. Ltd.
- Fox, R.B., 1959, The Calatagan excavations: two 15th century burial sites in Batangas, Philippines. *Philippine Studies*, 7(3): 325–90.
- Fraser-Lu, S., 1985, *Burmese Lacquerware*. The Tamarind Press, Bangkok.
- Fraser-Lu, S., 1989, *Handwoven Textiles of Southeast Asia*. Oxford University Press.
- Friis, G., 2005, personal communication.
- Frost, R.J., Hin, H.C. & Ng, B., 1974, Sha Tsui, High Island. *Journal Hong Kong Archaeological Society*, 5: 23–33.
- Fundter, J.M., 1982, *Names for dipterocarp timbers and trees from Asia. Vernacular names and trade names*. Centre for Agricultural Publishing and Documentation. Pudoc, Wageningen, the Netherlands.
- Garner, H., 1970, *Oriental Blue and White*. Faber and Faber, London.
- Gervaise, N., 1998, (ed. & trans. J. Villiers), *The Natural and Political History of the Kingdom of Siam*, originally published 1688. White Lotus Press, Bangkok.
- Godley, D., Bishop, P. & Supajanya, T., 1993, Recent Data on Thanon Phra Ruang between Sukhothai and Si Satchanalai: Road or Canal. *Journal of Siam Society*, 81.2: 99–109.
- Gompertz, G. St. G.M., 1980, *Chinese celadon wares*. Faber & Faber, London and Boston.
- Green, J., 1983, The Ko Si Chang Excavation Report 1983. *Bulletin of the Australian Institute for Maritime Archaeology*, 7.2: 9–37.
- Green, J., 1986, The survey of the VOC fluit *Risdam* (1727), Malaysia. *International Journal of Nautical Archaeology*, 15.2: 93–104.
- Green, J., 1990, *Antiquity*, 64.243: 347–63.
- Green, J. & Harper, R., 1983, (a), Maritime Archaeology in Thailand. Seven wreck sites. In: W. Jeffery & J. Amess (eds), *Proceedings of the second Southern Hemisphere Conference on Maritime Archaeology*. Adelaide.
- Green, J. & Harper, R., 1983, (b), *The excavation of the Pattaya Wreck site and survey of three other sites 1982*. Australian Institute for Maritime Archaeology Special Publication No. 1, Fremantle, Western Australia.
- Green, J. & Harper, R., 1987, *The Maritime Archaeology of Shipwrecks and Ceramics in Southeast Asia*. Australian Institute for Maritime Archaeology Special Publication No. 4, Fremantle, Western Australia.
- Green, J., Harper, R. & Intakosai, V., 1987, The Ko Si Chang One shipwreck excavation 1983–1985: a progress report. *International Journal of Nautical Archaeology*, 15(2):105–22
- Green, J., Harper, R. & Intakosi, V., 1987, *The Ko Si Chang 3 Shipwreck Excavation 1986*. Australian Institute for Maritime Archaeology Special Publication No. 4, Fremantle, Western Australia.
- Green, J., Harper, R. & Prishanchittara, S., 1981, *The Excavation of the Ko Kradat wreck site Thailand 1979–1980*. The Western Australian Museum, Fremantle, Western Australia.
- Greenburg, S. & Ortiz, E.L., 1984, *The Spice of Life*. The Amaryllis Press, N.Y.
- Guelden, M., 1995, *Thailand. Into the Spirit World*. Limes Editions Pty. Ltd., Singapore.
- Gumperayarnnont, M., 1985, *Chinese Ceramics from Mae Klong River*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4), Bangkok and Chiang Mai, Thailand. SEAMO.
- Guy, J.S., 1986, *Oriental trade ceramics in Southeast Asia, ninth to sixteenth centuries*. Oxford University Press, Singapore.
- Hadimuljono, 1985, *Some Notes on Thai Ceramics discovered in South Sulawesi, Indonesia*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4) Bangkok and Chiangmai, Thailand. SEAMO.
- Hall, D.G.E., 1977, *A History of South-East Asia*. The Macmillan Press Ltd. London.
- Hall, K.R., 1985, *Maritime Trade and State Development in Early Southeast Asia*. George Allen and Unwin, Sydney.
- Harbeston, J., 2003, Correspondence. *Arts of Asia*, 33.1: 12.
- Harkantiningih, M. th. Naniek, 1985, *Thai Ceramics from Archaeological Sites in Indonesia*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4) Bangkok and Chiangmai, Thailand. SEAMO.
- Harper, R., 1982, Unpublished drawings and photographs.
- Harper, R., 1984, *Ceramic survey Sisatchanalai 1984*. Unpublished field report, Thai Ceramic Archaeological Project. University of Adelaide.
- Harper, R., 1985, *Visit to Bang Rachan kiln site, Thailand*. Unpublished report, Thai Ceramic Archaeological Project. University of Adelaide.
- Harper, R., 1987, *A study of painted underglaze decorated sherds Sisatchanalai Thailand*. Research Centre for Southeast Asian Ceramics, Papers 2. Art Gallery of South Australia, University of Adelaide
- Harper, R. 1988 (i) a, *Catalogue of ceramic material from sites in the Philippines. Section One—Material stored at the National Museum of the Philippines sherd storage office, Herran, Manila*. Unpublished report, Research Centre for Southeast Asian Ceramics, University of Adelaide.
- Harper, R. 1988 (i) b, *Catalogue of ceramic material from sites in the Philippines. Section Two—Thai ceramic finds from Philippine sites*. Unpublished report, Research Centre for Southeast Asian Ceramics, University of Adelaide.
- Harper, R., 1988 (ii) *A study of ceramics at and in the environs of the Mae Nam Noi kiln site, Bang Rachan, Singburi Province, Thailand*.

- Unpublished report Research Centre for Southeast Asian Ceramics, University of Adelaide.
- Harrison, B., Unpublished fieldnotes regarding Jars.
- Harrison, B., 1986, *Pusaka heirloom jars of Borneo*. Oxford University Press, Singapore.
- Harrison, B., 2003, The Ceramic Trade Across the South China Sea, 1350–1650. *Journal of the Malaysian Branch of the Royal Asiatic Society, Kuala Lumpur*, 76.1: 99–114.
- Harrison, B. & Shariffuddin, P.M., 1969, Sungai Lumut, a 15th century burial ground. *The Brunei Museum Journal*, 1.1: 24–57.
- Harrison, T., 1950, Some Borneo Ceramics. *Sarawak Museum Journal*, 2: 268–273.
- Hatcher, M. & Thorncroft, A., 1987, *The Nanking Cargo*. Hamish Hamilton, London.
- Hein, D., 1985, *Report on the Excavation of Kiln 42, Ban Ko Noi, Sisatchanalai, Thailand, 1984/85—Part A*. Unpublished Field Report, Thai Ceramics Archaeological Project, University of Adelaide.
- Hein, D., 1987 (1), *Thoughts on the Hypothetical and Evidential Origins of the Ceramic Industry at Sisatchanalai, Thailand*. Unpublished Report, Thai Ceramics Archaeological Project, University of Adelaide
- Hein, D., 1987 (2), 'Bullet' Coins found at Ban Ko Noi, Sisatchanalai, Thailand. Unpublished Report, Thai Ceramics Archaeological Project, University of Adelaide.
- Hein, D., 2001, *The Sawankhalok Ceramic Industry: From Enterprise to Regional Entrepreneur*. Doctoral Thesis, Deakin University
- Hein, D., Burns, P. & Richards, D., 1986, An alternative view on the origins of ceramic production at Si Satchanalai and Sukhothai, Central Northern Thailand. *SPAFA Digest*, 7.1: 22–33.
- Hein, D. & Sangkhanukit, P., 1987, *Report on the excavation of the Ban Tao Hai kilns Phitsanulok, Thailand*. Research Centre for Southeast Asian Ceramics, Papers 1. Art Gallery of South Australia, University of Adelaide.
- Hemphill, I., 2000, *Spice Notes. A cook's compendium of herbs and spices*. Pan MacMillan Australia Pty. Ltd. Sydney.
- Henson, F.G., 1985, *Ceramics and Spatial Analysis*, Unpublished paper from SPAFA Papers from Technical Workshop on Ceramics (T-W4) Bangkok and Chiangmai, Thailand. SEAMO.
- Higham, C., 2001, *The Civilization of Angkor*. Weidenfeld and Nicolson, London.
- Hobson, R.L., 1962, *The Wares of the Ming Dynasty*. Charles E. Tuttle Co., Rutland, Vermont, Tokyo.
- Hobson, R.L. 1976, *Chinese pottery and porcelain*. Dover Publication, Inc. New York.
- Holbrook, R.D. & Suriya, M., 1967, *Blue Book of Coastal Vessels of Thailand*, Joint Thai-US Military Research and Development. Prepared by RACIC Battelle Memorial Institute Columbus Laboratories. White Lotus Press, Thailand (2000).
- Homan, Brian, 1987, Personal communication.
- Howitz, P.C., 1986, *Thai pottery trade during the 14th—16th centuries A.D. Ancient ceramic industry in South and East China and the neighbouring region*. Symposium: 2–4 July, Centre of Asian Studies, Uni. of Hong Kong
- Hutchinson, E.W., 1940, *Adventures in Siam in the seventeenth century*. Reprinted with permission of The Royal Asiatic Society. From original publication of 1940. DD Books, Bangkok.
- Hutterer, K., 1973, *An archaeological picture of a pre-Spanish Cebuano community*. San Carlos Publications Series A: Humanities, No.9. University of San Carlos, Cebu City, Philippines.
- Indrawoath, P., 1985, *Pottery of Dvaravati Period*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4) Bangkok and Chiangmai, Thailand. SEAMO.
- Intakosai, V., 1983, Rang Kwien and Samed Ngam shipwrecks, SPAFA Digest, *Journal of SEAMO Project in Archaeology and Fine Arts*, 4: 11.
- Intakosai, V., 1984, *The excavations of wreck sites in the Gulf of Thailand*. SPAFA Consultative Workshop of Research on Maritime Shipping and Trade Networks in Southeast Asia. Indonesia, November, 1984.
- Jenyns, S., 1971, *Later Chinese Porcelain. The Ching Dynasty. (1644–1912)*. Faber and Faber, London.
- Jenyns, S., 1988, *Ming Pottery and Porcelain*. Faber and Faber, London and Boston.
- Keating, W.G. & Bolza, E., 1982, *Characteristics, Properties and Uses of Timbers. South-east Asia, Northern Australasia and the Pacific*. Division of Chemical Technology, CSIRO Inkata Press, Melbourne, Sydney and London.
- Khwanyuen, S., 1985, *The Excavation of Baranae Kiln Site, Thailand*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4) Bangkok and Chiangmai, Thailand. SEAMO.
- Kilburn, R.S., 1981, Transitional Wares and Their Forerunners. In: *Catalogue of An exhibition presented by the Oriental Ceramic Society and the Urban Council, Hong Kong and the Kong Kong Museum of Art*, p.11–49.
- King, V.T., 1995, *Explorers of South-East Asia. Six Lives*. Oxford University press, Oxford.
- Kirkman, J., 1974, *Fort Jesus. A Portuguese Fortress on the East African Coast*. Clarendon Press, Oxford.
- Kremmer, C., 2002, *The Carpet Wars*. Flamingo, Pymble, NSW, Australia.
- Kurlansky, M., 2002, *Salt. A World History*. Jonathon Cape.
- Lammers, C. & Ridho, A., 1974, *Annamese ceramics in the Museum Pusat, Jakarta*. The Ceramic Society of Indonesia.
- le May, R., 1927, *An Asian arcady. The land and peoples of Northern Siam*. Houghton Mifflin Co.
- Lemmens, R.H.M.J. & Wulijarni-Soetjijto, N. (eds), 1991, *Dye and tannin producing plants*. Plant Resources of SE Asia (PROSEA) No. 3. Pudoc Scientific Publishers, Wageningen, the Netherlands.
- Lemmens, R.H.M.J., Soerianegara, I. & Wong, W.C. (eds), 1995, *Timber Trees: Minor Commercial Timbers*. Plant Resources of S.E. Asia, 5.2. Backhuys Pubs. Leiden.
- Levy, A. & Scott-Clark, C., 2001, *The Stone of Heaven. Unearthing the Secret History of Imperial Green Jade*. Little, Brown and Co. Boston, New York and London.
- Lewis, D., 1972, *We, the Navigators*. The Ancient Art of Landfinding in the Pacific. Australian National University Press, Canberra.
- Li, H., 1996, *Chinese Ceramics. A New Comprehensive Survey from the Asian Art Museum of San Francisco*, Thames and Hudson, London.
- Linehan, W., 1930, Notes on some further archaeological discoveries in Pahang. *Journal Malayan Branch Royal Asiatic Society*, 8.2: 314–317.
- Locsin, L. & C., 1967, *Oriental ceramics discovered in the Philippines*. Charles E. Tuttle Co., U.S.A. & Japan.
- Lunsingh S.D.F., 1974, *Chinese export porcelain: Chine de commande*. Faber, London.
- Macoboy, S., 1979, *Trees for Warm and Temperate Climate*. Ure Smith, Sydney.
- Maggs, T., 1984, The Great Galleon *São João*: remains from a mid-sixteenth century wreck on the Natal South Coast. *Annals Natal Museum*, 26.1: 173–186.
- Manguin, P-Y., 1984, *Relationship and Cross-influence between Southeast Asia and Chinese Shipbuilding Tradition*. SPAFA Consultative workshop on research on maritime shipping and trade networks in Southeast Asia (I-W7), p.197–212. SEAMO, Indonesia.
- Manguin, P-Y., 2003, Trading networks and ships in the South China Sea. In *Lost for 500 years...Sunken Treasures of Brunei Darussalam*, (ed.) Dick Richards/Arts Exhibition, Australia, p.29–45.
- McIntyre, A., 1995, *Cooking Stoves/Tungku*. *Indonesian Heritage Society Newsletter*, February, p.6.
- McLeod, Ian, 1980s, Personal communication.
- McRae, B.A., 1993, *Colors from Nature. Growing, Collecting and Using Natural Dyes*. A Storey Publishing Book.
- Mecenat Elf Aquitaine (Elf Petroleum Asia b.v.), 1999, *Le trésor de la jonque engloutie. Enquête archéologique au large du Brunei*. Pamphlet.

- Medley, M., 1976, *The Chinese Potter. A Practical History of Chinese Ceramics*. Phaidon, Oxford.
- Mendez, T., 2006, China cons cracked as uni science falls away, *The West Australian*, Perth, Western Australia, 16 August.
- Miksic, J.N., 1985, *The Distribution of Thai Ceramics in Indonesia and Trading Patterns of the Fifteenth Century*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4) Bangkok and Chiang Mai, Thailand. SEAMO.
- Misugi, T., 1981, *Chinese porcelain collections in the Near East, Topkapi and Ardebil*. Vol. 3, The Ardebil Shrine Collection. Hong Kong University Press.
- Moore, E., 1970, A suggested classification of stonewares of Martabani type. *The Sarawak Museum Journal* (New Series), 18.36–37: 1–78.
- Moore, E., Stott, P. & Sukhasvasti, S. (1996) *Ancient Capitals of Thailand*. Thames and Hudson, London.
- Mooreland, W.H. (ed.), 2002, *Peter Floris, His Voyage to the East Indies in the Globe, 1611–1615*. Siam, Pattani, Bantam. The Contemporary Translation of his Journal. White Lotus Press, Bangkok, 2002.
- National Museum of Korea, 1977, *Proceedings of the International Conference on cultural relics found off Sinan coast*. National Museum, Seoul, Korea.
- Neave-Hill, W.B.R., 1975, *Chinese Ceramics*. John Bartholomew & Son Ltd, Edinburgh & London.
- Ng, F.S.P. (ed.), 1978, *Forest Department, Malaysia. Ministry of Primary Industries, Malaysia. Tree Flora of Malaya. A Manual for Foresters*. Vol. 3. Longmans, London.
- Nguyen-Long, K., 2001, Treasures from the Hoi An Hoard. Vietnamese Ceramics and the Cham Island Site. Significance and Implications. *Arts of Asia*, 31.1: 90–8.
- Nimmanahaeminda, K., 1983, *Sankampaeng. Glazed Pottery* (in Thai). Chiangmai Book Centre, Thailand.
- Noone, M.J., 1986, *General History of the Philippines, Part 1, Volume 1. The Discovery and Conquest of the Philippines 1521–1581*. Historical Conservation Society, 43, Manila.
- Oriental Ceramic Society of Hong Kong, 1979, *South-East Asian and Chinese trade pottery*. Catalogue of an exhibition—The Oriental Ceramic Society of Hong Kong.
- Oriental Ceramic Society of Hong Kong, 1981, *Transitional Wares and Their Forerunners*. An exhibition presented by the OCSHK and Urban Council, Hong Kong and the Hong Kong Museum of Art, 29 January—29 March, 1981.
- Oriental Ceramic Society of Hong Kong, 1984, *Jingdezhen Wares, The Yuan Evolution*. Catalogue of exhibition.
- Osborne, M., 1995, Francis Garnier (1839–1873) Explorer of the Mekong River. In: Explorers of South-East Asia. Six Lives, (ed. Victor T. King). Oxford in Asia, Kuala Lumpur.
- Oxford University Press, 1979, *Concise Oxford Dictionary*, Oxford, United Kingdom.
- Pacific Sea Resources, (undated), Unpublished report Archaeological Illustrations *Nuestra Señora de la Concepción*, Pacific Salvage Project for the Government of the Commonwealth of the Northern Mariana Islands.
- Paine, S., 1990, *Embroidered Textiles. Traditional Patterns from Five Continents with a Worldwide Guide to Identification*. Thames and Hudson.
- Pavord, A., 1999, *The Tulip*. Bloomsbury Publishing Place. London.
- Pearn, B.R., 1969, *An Introduction to the History of South-East Asia*. Longmans, Malaysia.
- Peralta, J.T., 1982, *Kayamanan. Pottery and ceramics from the Arturo de Santos collection*. Manila, Philippines.
- Pijl-Ketel, C.L. Van der (ed.), 1982, *The ceramic load of the Witte Leeuw 1613*. Rijksmuseum, Amsterdam.
- Pope, J.A., 1956, *Chinese Porcelain from the Ardebil Shrine*. Smithsonian Institution. Freer Gallery of Art, Washington.
- Praicharnjit, S., 1980s, Personal communication.
- Praicharnjit, S., 1988 (i) *Preliminary Survey, Excavation and Analysis. The Mae Nam Noi Kiln Site* (unpub.), Academic Subdivision, Archaeological Division, Department of Fine Arts, Thailand.
- Praicharnjit, S., 1988 (ii), (in Thai), Report of the Survey and Excavation Mae Nam Noi Kilns, (ed. P. Charoenwongsa), Archaeology Section, Department of Fine Arts, Thailand.
- Premchit, S., 1971, *Thai pottery in Philippine prehistory*. Submitted to College of Arts and Sciences, University of Philippines. Partial fulfilment Masters of Arts (Anthropology).
- Promboon, S., 1984, *The Siamese Maritime Trade, AD1351–1511*. SEAMEO Project in Archaeology and Fine Arts. SPAFA Final Report. Consultative Workshop of Research on Maritime Shipping and Trade Networks in Southeast Asia (I-W7) Cicerua, West Java, Indonesia Nov. 20–27, 1984, p.107–131.
- Rau, J.L. & Hughes, C., 1985, Significance of 13th–15th Century Ceramics and other Artefacts in Upland Burial Sites of the Tak-Mae Sot-Umphang Region, Western Thailand. *The Siam Society's Newsletter*, 1.2: 1–21.
- Reece, B., 1995, Carl Bock (1849–1932) Explorations and Travels in Sumatra, Borneo and Siam. In: Explorers of South-East Asia. Six Lives, (ed. Victor T. King). Oxford in Asia, Kuala Lumpur.
- Refuge, B., 1976, *Swankalok, de export-ceramiëk van Siam*. De Tijdstroom Lochem, Netherlands.
- Reid, A., 1984, *Trade Goods and Trade Routes in Southeast Asia: c. 1300–1700*. SEAMEO Project in Archaeology and Fine Arts. SPAFA Final Report. Consultative Workshop of Research on Maritime Shipping and Trade Networks in Southeast Asia (I-W7) Cicerua, West Java, Indonesia Nov. 20–27, 1984, p.249–272.
- Rendle, B.J., 1970, *World Timbers, Asia and Australia and New Zealand*. Vol. 3. London: Ernest Bern Ltd. University of Toronto Press.
- Richards, R.J. (ed.), 2003, *Lost for 500 Years...Sunken Treasures of Burnei Darussalam*. Catalogue, Art Exhibition Australia, Sydney.
- Richards, R.J., 1977, *Thai Ceramics, Ban Chiang, Khmer, Sukothai, Sawankhalok*. Art Gallery South Australia, Adelaide.
- Ridho, A, Edwards-McKinnon, E., 1997, In: *The Pulau Buaya Wreck. Finds from the Song Dynasty*. Ceramic Society Indonesia Monograph Series, No. 18, Jakarta, (ed. S. Adhyatman).
- Rinaldi, M., 1986, *Kraak Porcelain. The History and Classification of Dishes*. In Heritage, No. 8: 1–28. National Museum Republic Singapore.
- Rinaldi, M., 1989, *Kraak Porcelain. A Moment in the History of Trade*. Bamboo Publishing Limited. London.
- Roales, T., 1987, Personal communication.
- Robb, W., 1930, New data on Chinese and Siamese ceramic wares of the 14th and 15th centuries. *Philippine Magazine*, 27.3: 150–201 & 4: 220–254.
- Rungrujee, B., 1985, *Harijpurjaya Wares and its Related Technology to Early Lanna Wares*. Unpublished paper from SPAFA Technical Workshop on Ceramics (T-W4) Bangkok and Chianmai, Thailand. SEAMO.
- Sandberg, G., 1994, *The Red Dyes. Cochineal, Madder, and Murex Purple. A World Tour of Textile Techniques*. Lark Books, Asheville, NC.
- Santosa, N.I., 2003, Cultures come together to recreate ancient ship. *The Jakarta Post*. 6 July, 2003, p.5.
- Schery, R.W., 1972, *Plants for Man*. Prentice-Hall Inc. Englewood Cliffs, New Jersey.
- Scott, W.H., 1984, *Prehispanic Source Materials for the Study of Philippine History* (Revised Edition). New Day Publishers, Quezon City.
- Severin, T., 1997, *The Spice Islands Voyage. In Search of Wallace*. Little, Brown and Co.
- Shaw, J.C., 1981, *Northern Thai ceramics*. Oxford in Asia studies in ceramics. Kuala Lumpur.
- Simkin, C.G.F., 1968, *The Traditional Trade of Asia*. Oxford University Press, London.
- Singer, N.F., 2002, Myanmar Lacquer and Gold Leaf from the earliest times to the 18th century. *Arts of Asia*, 32.1: 40–52.
- Singer, N.F., 2002, Book Review. Burmese Lacquerware by Sylvia

- Fraser Lu. *Arts of Asia*, 32.1: 122–124.
- Sjostrand, S., 1997, *Skatter Fran Sjunkna Skepp: Vrakfynd från Syd kinesiska havet*. Östasiatiska Museet Stockholm. (In Swedish).
- Sjostrand, S. & Barnes, C., 2001, The Turiang: A 14th Century Chinese Shipwreck Upsetting Southeast Asian Ceramic History. *J. Malaysian Branch of the Royal Asiatic Society*, Kuala Lumpur. 75: 71–109.
- Smithies, M., 1995, Henri Mouhot (1826–1861) Siam, Cambodia, and Laos. In: *Explorers of South-East Asia. Six Lives*, (ed. Victor T. King). Oxford in Asia, Kuala Lumpur.
- Smithies, M., 1997, The Siam of Mendes Pintos's Travels. *Journal of Siam Society*, 85.1 & 2.
- Soerianegara, I. & Lemmens, R.H.M.J. (eds), 1993, *Timber trees: Major commercial timbers*. Plant Resources of South-East Asia. No.5(1). Pudoc Scientific Publishers, Wageningen, the Netherlands.
- Solheim, W.G. II, 1965, *The functions of pottery in Southeast Asia: from the present to the past*. Ceramics and Man, Aldine Pub. Co. Chicago.
- Solheim, W.G. II, 1967, *Two pottery traditions of late prehistoric times in South-East Asia. Historical, archaeological and linguistic studies in South China, S.E. Asia and the Hong Kong region*. Hong Kong University Press.
- Southeast Asian Ceramic Society Singapore (SEACS), 1979, *Chinese celadons and other related wares in Southeast Asia*. Arts Orientalis, Singapore.
- Southeast Asian Ceramic Society (SEACS), 1982, *Vietnamese ceramics*. Oxford University Press, Selangor, Malaysia.
- Southeast Asian Ceramic Society (SEACS) (Western Malaysia Chapter), 1985, *A ceramic legacy of Asia's maritime trade, Song dynasty Guangdong wares and other 11th to 19th century trade ceramics found on Tioman Island, Malaysia*. Oxford University Press.
- Spinks, C.N., 1959, *Siamese pottery in Indonesia*. The Siam Society, Bangkok.
- Spinks, C.N., 1965, *The ceramic wares of Siam*. The Siam Society, Bangkok.
- Spinks, C.N., 1976, The Ayudhdhaya Period Earthenware, some Contemporary Thai Kilns, Their Wares and Pottery Methods. *Journal of Siam Society*, 64.2:
- Steenis, G.G.G.J. van, 1954, (ed.) *Flora Malesiana: being an illustrated systematic account of the Malaysian flora, Series 1 (Spermatophyta)* Vol. 4. P. Noordhoff Limited, The Hague, Netherlands.
- Stevenson, J. & Guy, J., 1997. *Vietnamese Ceramics. A Separate Tradition*. Art Media Resources with Avery Press, Chicago State Library.
- Sutchit, P., 1984, *Ceramics at Ban Bangpun and Ban Prasat*. (In Thai), Muang Boran, Peninsular Thailand issue. 10.1.
- Tan, R.C., 2004, The Muller Collection of Chinese Ceramics at the Baur Museum, *Arts of Asia*, 34.3: 84–95.
- Tan, R., 2006, Report on talk given by Tan. *Southeast Asian Ceramics Museum Newsletter*, 3.2: 3.
- Tanaka, T., 1976, *Tanaka's Cyclopdia of Edible Plants of the World*. Ed. Sasuke Nakao. Keigaku Pub. Co. Tokyo.
- Thompson, D., 2002, *Thai food arharn thai*. 10 Speed Press, Berkeley & Toronto.
- Thorne, A. & Raymond, R., 1989, *Man on the Rim. The Peopling of the Pacific*. Angus and Robertson.
- Usher, G., 1974, *A Dictionary of Plants Used by Man*. Constable, London.
- Vainker, S.J., 1997, *Chinese Pottery and Porcelain from Prehistory to the Present*. British Museum Press.
- Valder, P., 1999, *The Garden Plants of China*. Weidenfeld and Nicolson. London.
- Valdes, C.O., 1992, Martaban Jars found in the Philippines, *Arts of Asia*, 22.5: 63–73.
- Valdes, C.O., 2004, Betel Chewing in the Philippines. *Arts of Asia*, 34.5: 104–15.
- Vickery, M., 1979, A new Tamnan about Ayudhya. *Journal of Siam Society*, 67(2): 123–186.
- Vickery, M., 1990, The old City of 'Chaliang'—'Sri Satchanalai'—'Sawankhalok'. A Problem of History and Historiography. *Journal of Siam Society*, 78.2: 15–29.
- Vilaikaew, C., 1988, Personal communication.
- Vilaikaew, C., 1988, *Kiln Sites: Ban Bang Pun* (in Thai), ed. Pisit Charoenwongsa, Archaeology Section, Fine Arts Department, Bangkok, Thailand.
- Villiers, J., (1998), Portuguese and Spanish Sources for the history of Ayutthaya in the 16th Century. *Journal of Siam Society*, 86.1 & 2: 119–30.
- Volker, T., 1971, *Porcelain and the Dutch East India Company as recorded in the Dagh-Registers of Batavia Castle, those of Hirado and Deshima and other Contemporary Papers 1602–1682*. Leiden, E.J. Brill.
- Von der Porten, E.P., 1972, Drake and Cermeno in California: Sixteenth century Chinese ceramics. *Historical Archaeology*, 6: 1–22.
- WA Art Auctions, 2006, *15th Century and 17th Century Shipwreck Ceramics. Items from the Hoi An and Binh Thuan Shipwrecks. 5 November*, Claremont, Western Australia.
- Walker, A. (ed.), 1989, *The Encyclopaedia of Wood. Facts on File Limited*. Quarto Publishing, Oxford, New York.
- Warren, W. & Tettoni, L.I., 1996, *Arts and Crafts of Thailand*. Thames and Hudson Ltd, London.
- Wheatley, P., 1961, *The Golden Khersonese. Studies in the Historical Geography of the Malay Peninsula before 1500*. University of Malaya Press, Kuala Lumpur.
- Whitmore, T.C. (ed.), 1972–1989, *Tree Flora of Malaya. A Manual for Foresters*. Vol. 1. Malaysian Ministry of Agriculture and Lands. Forest Department, Malaysia.
- Willets, W., 1986, Tracing the History of Sika Deer Bowl. *Business Times*, Singapore. 12 July, p.9.
- Willets, W., 1971, *Ceramic art of Southeast Asia*. Southeast Asian Ceramic Society, Singapore.
- Woodward, H.W., 1978, The dating of Sukhothai and Sawankhalok ceramics: some considerations. *Journal Siam Society*, 66: 1–11.
- Wyatt, D.K., 1984, *Thailand. A Short History*. Yale University Press. New Haven and London.
- Yeo, S.T. & Martin, J., 1978, *Chinese blue and white ceramics*. Southeast Asian Ceramics Society. Arts Orientalis, Singapore.
- Zainie, C. (with Harrison, T.), 1967, Early Chinese stonewares excavated in Sarawak, 1947–67. A suggested first basic classification. *The Sarawak Museum Journal*, 15(30–31): 30–89.