THE EXCAVATION OF THE KO KRADAT WRECKSITE

THAILAND 1979 - 1980

by:

JEREMY GREEN AND
ROSEMARY HARPER
Dept. Maritime Archaeology,
Western Australian Museum.

SAYANN PRISHANCHITTARA
Faculty of Archaeology,
Silpakorn University.

Report - Department of Maritime
Archaeology, Western Australian
Museum: No. 17

1981

CONTENTS:

LIST OF FIGURES

1. INTRODUCTION

In 1979, one of the authors, (Green) was invited to Thailand to conduct a maritime archaeology training course as part of the South-east Asian Ministers of Education Organization (SEAMO) Project in Archaeology and Fine Arts (SPAFA). The course lasted for three weeks, the first week being formal lectures at Silpakorn University, Bangkok. The subsequent two weeks involved a field excavation. The site selected for excavation was the shallow water site (circ.2m) off the island of Ko Kradat. This site had been discovered in 1977 by a Thai-Danish Expedition, which explored a number of wrecksites off the Thai coast, (Howitz, 1977). During the 1979 expedition, part of the site was excavated. As the finds were extremely interesting and encouraging, a second and slightly more ambitious expedition to excavate the whole site was planned for 1980. This work, together with the archaeological finds of both seasons, is the subject of this report.

It should be noted that the spelling of Thai words is extremely flexible. As far as possible the common usage of Sawankhalok has been retained, however, we have chosen Ko instead of Koh as it is used on the Thai Admiralty Charts.

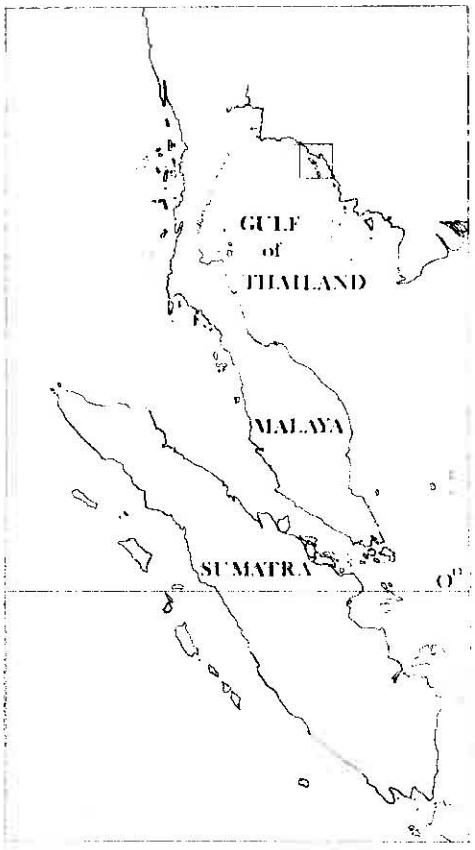


FIG 1. Plan of S.E. Asia showing the location of area of Ko Kradat.

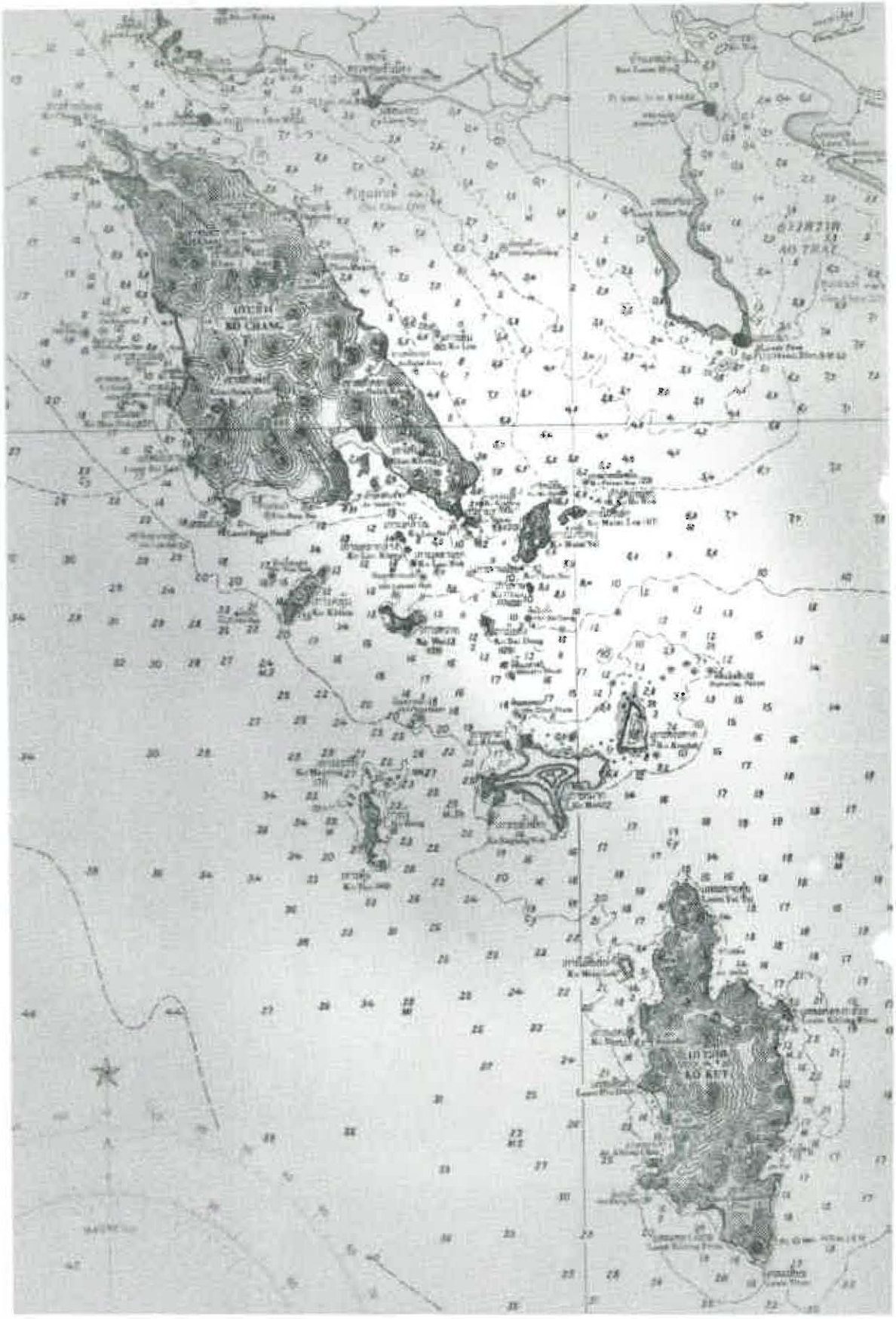


FIG 2. Plan of area around Ko Kradat showing mainland coast and neighbouring Islands.

2. THE WRECKSITE

The island of Ko Kradat lies in latitude 11°51'N longitude 102°32'E off the province of Trat, in south-east Thailand, Fig.1. The island is about 2.5km long, rising to a height of 35m. An extensive coconut plantation covers the island and comprises almost the exclusive vegetation. A small village of about 20 or so families, comprising the plantation workers, lies at the southern end of the island. Associated with the village, is a defunct tourist holiday resort, which operated for a short period of time, until it was abandoned a few years ago.

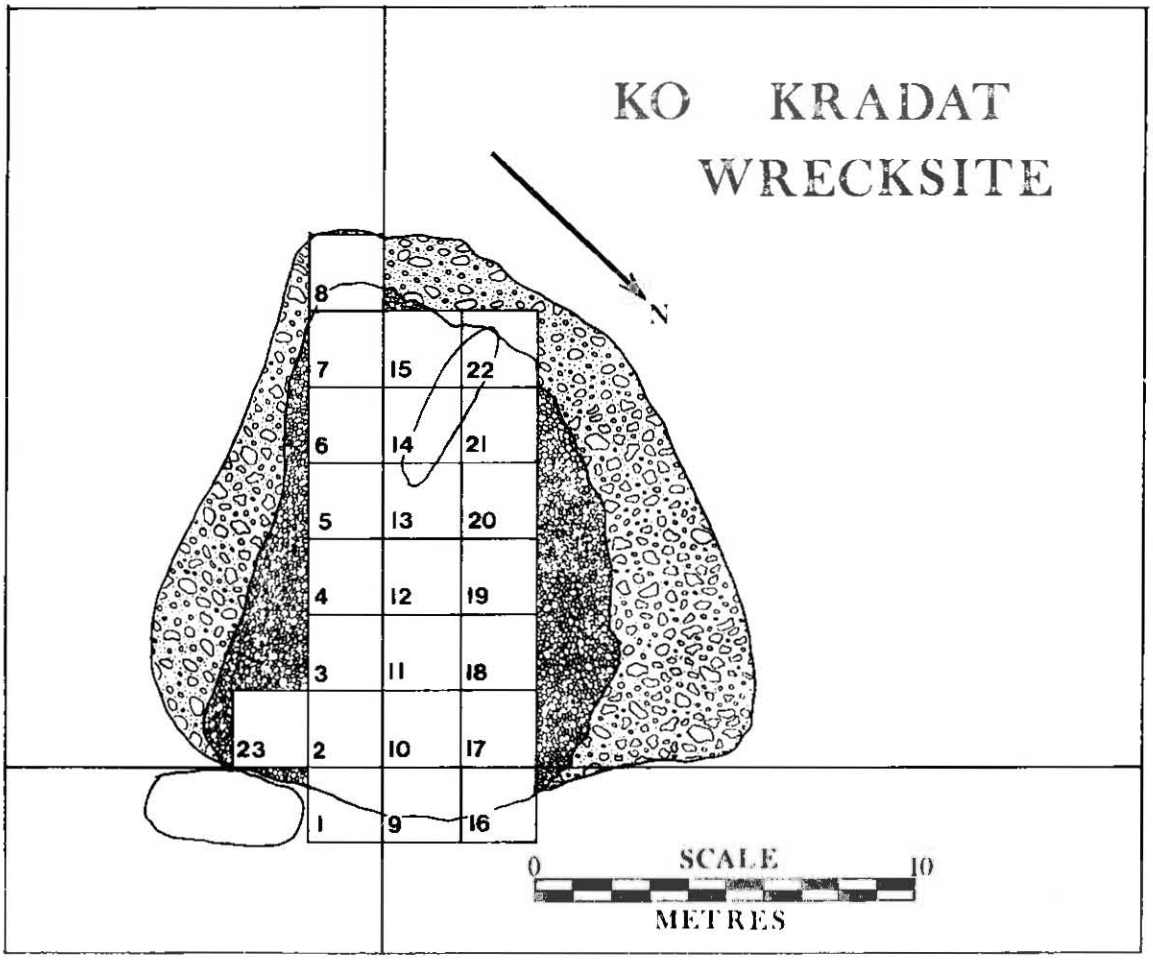


FIG 3. Plan of Ko Kradat Wrecksite.

Bordering the island, is a shallow fringing reef, about 500m wide and about 2-5m deep, extending about 5km, to Thi Tun Richelieu, in the north-east. The edge of the reef drops off to about 10m, to a flat featureless sandy sea-bed. The spring tidal range in the area is about 2m.

The wrecksite, Fig.2., lies about 1km north of the northern end of the island of Ko Kradat, some 200m in from the edge of the fringing reef. The depth of water on the site is about 1.5m at low water spring, with some nearby shallows that dry at low water. The seabed in the area is essentially living coral. The site, Fig.3., is distinguished by: a mound of boulders about 15m across, standing about one metre above the seabed; and a scatter of sherds of large stoneware storage jars around the site at distances up to 50m from the centre of the site. The boulders (up to 500mm in diameter) are clearly intrusive, being river-washed and of a dark-grey, fine grained granite. Some signs of previous activity were noted on the site: two roughly rectangular cleared areas were noted, possibly the result of the 1977 exploratory survey of the Thai-Danish expedition, discussed by Howitz, (1977).

3. THE 1977 SURVEY

This survey has been reported by Howitz (1977), and is described here briefly for convenience. The work was carried out in February 1977, and artifacts noted and recovered included: "Planks, lumps of wood, pottery and sherds..." The finds were classified into planks and pegs, stones, sugar palm pots (2), basin (1), vases Sawankhalok underglaze, pearshaped (2), cover boxes (4), lotus-bud lids (2), mangosteen lids (2), earthenware lid with lotus-bud handle (1), large storage jars - Sawankhalok (2), bowl (1), and Chinese Ming bowl fragments. The author concluded that the blue and white sherds were from the Wan-Li period (1573 - 1619) and that: "the shipwreck was evidently a sea adventurer during the early period of Ayutthaya, and was wrecked no later than the mid-seventeenth century A.D.".

4. THE 1979 EXCAVATION

A 40m base line, bearing 315^{o} was established across the edge of the site. From this base line, a simple two-tape trilateration of the perimeter of the site was made. This was complemented with an off-set survey; using a 2m grid on the base line, off-sets were measured to the perimeter by sighting along the edge of the frame. The survey was an approximation as the underwater surveyor had to make a subjective decision as to where the perimeter of the site lay. This was difficult to determine as the density of the boulders dropped off from the centre of the site.

A trench, running at right angles to the base line was then excavated across the whole site. The trench was delineated by two lines, set 2m apart. Excavation of two, two metre grid squares was started at either end of the trench, Nos. 1 and 8, Fig.3. There were eight students who were divided into two teams; one team worked on the site in the morning and processed the results in the afternoon, the other team worked the alternate shift.

The first two grid squares, delineated by a metal (Dexion) frame were cleared of boulders by hand. The boulders were taken from the grid squares and moved to a dump well off the site. As the boulders were removed from the squares, they were counted, so that a record was kept of the number of stones and boulders removed from each grid square. Once the boulders and large lumps of coral were removed from the site, the remaining coarse stoneware sherds were collected into a large basket. This then left the grid squares with a surface layer of small lumps of coral, (about 10 to 20mm in diameter), together with sand. By using a technique known as hand-fanning, this light layer was shifted from the grid square in a systematic manner. Starting at one side of the grid square, and ensuring that the current carried the fine sediment behind and away from the operator, the grid square was excavated down to the sterile level, usually about 200mm below. All small ceramic objects, and their associated sherds were collected and placed in numbered polythene bags, so that all the artifacts from individual grid squares could be recorded and registered. Once the two initial grid squares at the extremities of the trench had been excavated, further grid squares were excavated by back filling, a process whereby the spoil from one grid square is shifted into an adjacent and previously excavated grid square. This technique is exceedingly efficient, as it cuts down the time consuming process of removing spoil from the site. The grid squares were excavated systematically, until the whole trench was excavated.

At the end of the excavation, 100 randomly selected boulders and stones were weighed, so that an estimate of the total weight of stone could be made. Eight, two-metre grid squares (Nos. 1 to 8, Fig.3), comprising 32 square metres, were excavated during this expedition. A total of 160 man-hours were spent diving on the site during the eight days of this expedition; diving being carried out using SCUBA tanks. A preliminary report of this work has been published, Green (1980) and Howitz (1980).

5. THE 1980 EXCAVATION

In view of the interesting and encouraging results of the 1979 expedition, a further and more ambitious expedition was planned for the following year. With expedition staff of five Australians and seven Thais, a further ten day excavation was carried out in April 1980, in order to complete the excavation. During this excavation, essentially the same techniques were used as before. However, to improve diving efficiency, hookah, or surface-demand breathing equipment was used. Two additional two metre trenches were excavated adjacent to the north and parallel to the 1979 trench; in this case, back filling was carried out directly from the new trench to the old one, rather than from grid square to grid square. Similar two metre squares were used as before and the old baseline was re-established. The expedition lasted for 10 days, 15 grid squares (Nos. 9 to 23, Fig.3) were excavated and a total of 250 man-hours were spent diving on the site.

GRIDSQUARE		23	19	18	17	16	15	14	13	12	11	10	9	Total
STONEWARE BODY		244	0	123	156	39	88	61	300	452	241	342	775	2695
UNGLAZED		23	0	10	11	11	2	8	5	32	12	31	31	118
BLACK E.WARE		10	0	3	12	0	3	20	40	55	0	49	0	193
BROWN GLAZE		0	0	0	4	0	0	3	24	19	0	12	18	80
E.WARE PLAIN		0	0	0	0	0	12	0	94	78	27	23	61	295
WHITE WARE		0	0	2	2	0	1	6	3	0	0	0	0	12
HANDLES MISC.		5	0	0	3	3	1	1	14	0	0	0	3	56
BASE PLAIN	BLACK DECORATED	6/9	0/0	3/8	0/13	0/13	0/2	0/3	11/13	3/61	3/15	2/33	0/0	25/151
FOOTRIM BASE	BLACK DECORATED	0/12	0/0	0/0	0/2	0/0	0/2	0/1	0/2	0/5	0/2	1/1	0/0	2/27
MANGOSTEEN	BLACK DECORATED	0/8	0/0	0/0	0/6	0/3	0/0	1/1	4/8	2/13	3/5	6/23	0/6	16/73
LOTUS BUD	BLACK DECORATED	0/5	0/0	0/1	0/1	1/1	0/1	0/1	0/1	0/6	0/0	2/7	0/2	3/26
PLAIN	BLACK DECORATED	0/5	0/0	0/4	0/7	1/3	0/4	0/0	3/3	1/10	1/7	3/7	0/0	9/60
JARLETS	BLACK DECORATED	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/0	0/0	0/1	9/0	0/0	10/1
JARS	BLACK DECORATED	0/1	0/0	1/0	0/0	0/0	0/1	0/5	0/3	1/0	0/0	0/0	0/0	2/10
BOWLS		0	0	0	1	0	0	3	1	0	0	0	0	5
GOURD JAR		0	0	0	1	0	0	0	1	0	0	0	0	7
RING JAR		0	0	0	2	0	0	4	5	0	1	0	1	13
SPOTTED JAR		0	0	0	1/1	0	0	0	1/0	0	0	6/10	0	8/1
B. & W.		1	0	10	1	2	1	14	4	3	2	14	0	52
STAMPED E.WARE		54	54	59	9	0	37	224	152	119	23	121	10	882
STOVE		12	0	3	0	0	0	2	0	1	1	0	0	19
E.WARE BOWLS		1	0	0	1	0	0	15	11	0	0	0	1	39
S.WARE JAR N H		4	0	0	5	0	6	25	31	0	0	19	0	100
S.WARE JAR HANDLES		6	0	6	3	0	1	6	23	0	0	10	4	59
GRINDSTONE		0	0	0	0	0	0	0	0	0	0	1	0	1
ELEPHANT		0	0	0	0	0	0	2	1	0	0	0	0	3
METAL					*			*	*					4
E.WARE LIDS		1	0	2	1	0	0	2	1	1	3	4	2	29

FIG 4. Table of finds from Ko Kradat. Upper line indicates gridsquare number as per Fig.3. The figures are numbers of sherds found in gridsquares. Where box is divided diagonally, upper left figure is number of complete objects and lower right is number of sherds.

6. THE FINDS

In both seasons, all material recovered from the grid squares was recorded. However, the 1979 registration book was unfortunately not available for this present analysis. Fig.4 shows a table of distribution of material from the 1980 expedition for grid squares 9-23, and the totals of each category. It is interesting to note the different bias of material to different parts of the site. Thus, Fig.5 is a graph of the distribution across the site of fine stonewares, coarse stonewares, earthenwares, and ballast (taken during the 1979 expedition, see 7 below). In order to rationalise the graphs, the figures for each grid square are expressed as percentage of the total for each group.

In both seasons, all the complete objects were photographed on site, and where possible, drawn and recorded. At the end of each dive, each team would be responsible for recording the material they had collected from the grid squares. Since there was almost no stratigraphy of any significance, material was recorded in different classes as indicated in Fig.4. The sherds of each class were sorted out, and counted, and interesting and unusual examples were put on one side for photography. All the complete objects, together with all blue and white material and interesting sherds were photographed in black-and-white and colour. Subsequently, they were stored in fresh water prior to their return to Silpakorn University at the end of the expedition.

The finds can be broadly divided into seven main classes of material: fine stonewares, coarse stonewares, earthenwares, blue-and-white porcelain, ship's structure, ballast and a miscellaneous group. The fine stonewares are Sawankhalok and include three basic sub-groups: black underglaze (cover boxes, jars and jarlets), brown glaze (eared jars and gourd shaped jarlets) and brown spotted glaze (jarlets). The coarse stonewares include the Sawankhalok jars with looped handles both with squat necks and jars and bowls, glazed and unglazed, of uncertain origins. The earthenwares include rice bowls with stamped decorations, kendi fragments, various lids to palm sugar pots, bowls, a pot stand, and a small figurine of an elephant.

Because of the number and variety of material, drawings of representative examples of each type or sub-type are given in the catalogue below; where a drawing is not suitable a photograph is given.

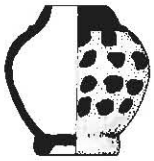
7. CATALOGUE OF ARTIFACTS

i. SAWANKHALOK BROWN

TYPE 1: SAWANKHALOK BROWN SPOTTED JARLET

TYPE 1A: No. 122 and Howitz (1979), Fig.116. General shape as Type 1, but decorated with brown dots (spotted) and brown band on parallel sided neck. No foot rim.

TYPE 1B: No. 123 to 126 and Howitz (1979), Fig.12a. General shape as Type 1B, but with brown spotted decoration and brown band on sloping or tapering neck. There appears to be cutting or shaping bands at base of neck. Footrim.



REFUGE, (1976) Form as Swankalok bruin en wit (here it is brown underglaze, not on white).

RICHARDS, (1977) As miniature jar No. 141.

TYPE 1C: No. 127 and Howitz (1979), Fig. 126. This type has footrim, but has short parallel sided neck.

ALL ARTIFACT DRAWINGS ARE AT A SCALE OF 1:2 EXCEPT WHERE STATED OTHERWISE.

TYPE 2: SAWANKHALOK BROWN GOURD-SHAPED BOTTLE WITH SMALL SHOULDER HANDLES.

No. 128 to 133 and Howitz (1979), Figs.15 and 16.
Thickish brown glaze on upper part of body. Flared mouth; two ring handles at junction of neck with shoulder or body; waist unglazed; footrim. Nos. 131 and 133 have slightly bigger ring handles.

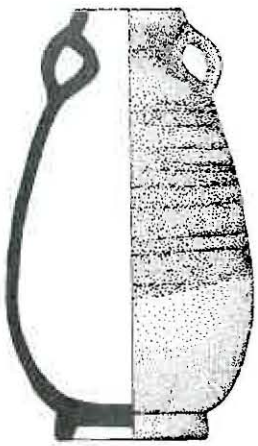
SPINKS, (1959) Fig. 34 (centre), similar to Chalieng ware from S.W. Sulawesi.

SPINKS, (1971) Fig.5 (upper right).

WILLETTS, (1973) No. 227.

REFUGE, (1976) Afb. 169a and c. Kruick-vazen met oren, Swankalok bruin.

TYPE 3: SAWANKHALOK BROWN EARED BOTTLE



No. 134 to 138 and Howitz (1979) Figs. 20 and 21.
Narrow pear or ovoid-shaped bottle, with eared handles in groove between neck rim and shoulder. Footrim. Thick brown glaze on upper part of body. Feint traces of banding on upper part of body, caused in potting, but no deliberate banding.

SPINKS, (1959) Fig.17 (right) Chalieng from central Sumatra.

SPINKS, (1971) Fig.5 (middle) Chalian brown monochrome ware.

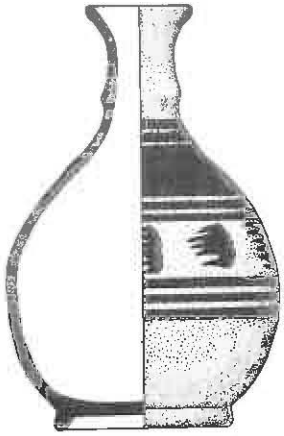
REFUGE, (1976) Afb. 165b. Kruiken met oren Swankalok bruin.

RICHARDS, (1977) No. 147

ii. SAWANKHALOK BLACK UNDERGLAZE

TYPE 4: SAWANKHALOK PEAR-SHAPED BLACK UNDERGLAZE DECORATED BOTTLE

TYPE 4A: Nos.142 to 146 and Howitz (1979), Fig.22, 23 and 25.



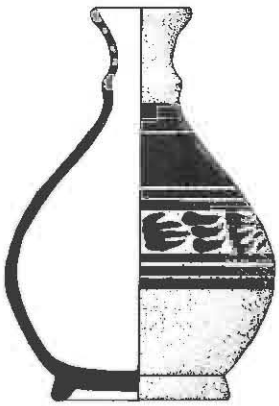
Everted mouth rim, and slight swelling on neck. Footrim. Banded with black underglaze, usually several bands of different widths on neck and shoulders; a series of comb-like motifs on lower shoulders, usually pointing to left but one example (146) in opposite direction, three bands below ending about one quarter from base. Apparently glazed on upper three quarters of body.

SPINKS, (1959) Fig.45 (left) in form only.

REFUGE, (1976) Afb.109c. fles-vazen in body and motif.

RICHARDS, (1977) No.32 in form only.

BROWN, (1977) No.135 Kalong ware (see conclusions below).

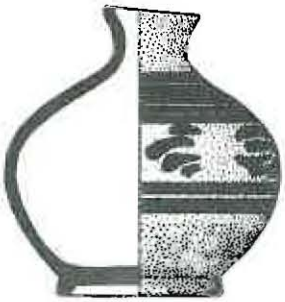


TYPE 4B: No. 141.

Shape as Type 5, but decoration on lower shoulders consists of a series of downward pointing star-points.

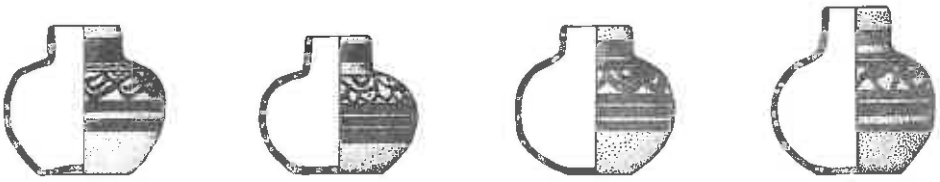
GROEPPER, (1977) No. 139 (similar).

TYPE 4C: No. 140
Decorated as Type 5 but with a truncated neck.



TYPE 4D: No. 139.
Tapering neck with slightly everted neck-rim; base and lower body missing; neck and body banded, with stylistic floral sprays in panel on shoulders.

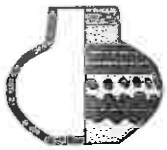
TYPE 5: SAWANKHALOK BLACK UNDERGLAZE JARLET



TYPE 5A: Nos. 111-120 and Howitz (1979), Fig.14
Roughly globular body, with parallel sided neck. Height range from 35 to 45mm. Three bands between neck and shoulders; scolloped black underglaze pattern on shoulders, usually double scollops; and three bands on waist. No footrim. Glaze appears to be on upper threequarters of the body.

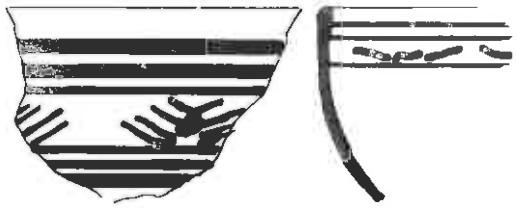
REFUGE, (1976) Swankalok beschildered Afb. 104c., note footrim group 2, Type 1 and 3, (here, Type 1 and 2).

TYPE 5B: Howitz (1979), Fig. 13.
An unusual varient in decoration, with double row of dots on lower shoulders instead of scollops.



TYPE 5C: No. 121
Varient of type with neck tapering to the mouth.

TYPE 6: SAWANKHALOK BLACK UNDERGLAZE BOWLS



No.163.
Rim of a bowl. Inside cavetto three lines and a type of decoration. Outside two sets of three lines enclosing a regular pattern. Crackled.

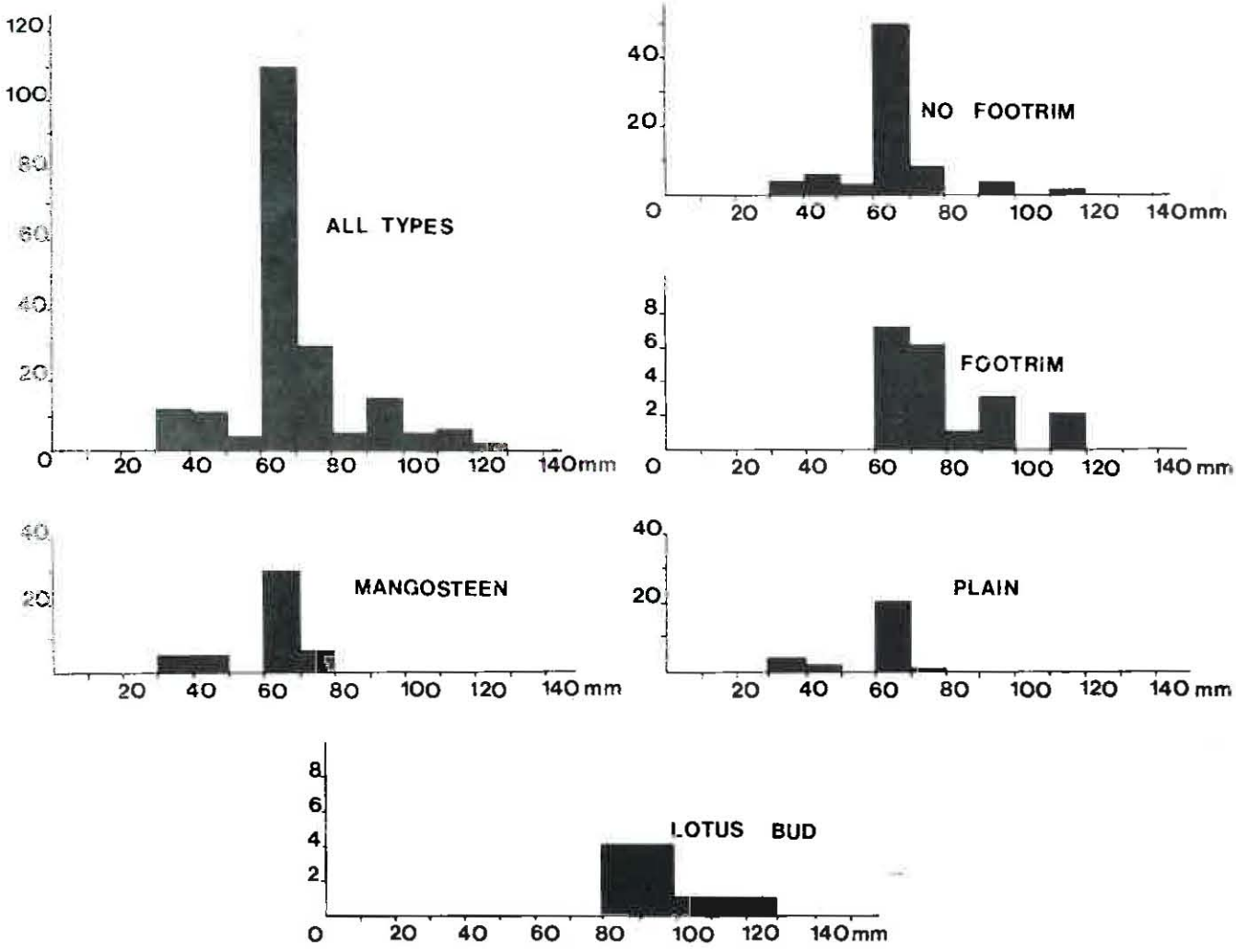
iii. SAWANKHALOK BLACK UNDERGLAZE COVER BOXES

There are three types of lid and two types of base that make up the cover box group.

LIDS : 1. Mangosteen
2. Lotus-bud
3. Plain

BASES : 1. No footrim
2. Footrim

Measurements were made of the rim diameters of the different types of lids and bases. Fig.7 shows the



histograms for measurements of this diameter taken at 10mm increments. The histogram for the total of all the readings shows a clear peak at 60-70mm and smaller peaks at 30-50mm and +90mm. Breaking the readings into the different types shows quite clearly that the plain and mangosteen are similar but different from the lotus-bud lid. Unfortunately, the differential between the bases with and without footrims is less clear. Thus, it appears that the lotus-bud lids go with the base with a footrim. The diameters of the lids tends to match the mouth of the bases with footrims; hence the association.

The predominant mouth diameters are: large (90-120mm); medium (60-70mm); small (35-40mm). Thus:

the mangosteen lids are of small and medium type;
the lotus-bud lids are all of large type;
the plain lids are all of small and medium type;
the bases without footrim are all small and medium with a few large types;
the bases with footrims are all medium and large type.

The predominant decoration is a series of concentric circles (usually 4 or 5) on the centre of the lid, then a band of decoration usually covering, or close to, the junction between the lid and base. This decoration consists of a repeated pattern or frieze of three panels with trellis, verticle lines, and stylistic vegetation. This pattern is repeated around the rim either two or three times. Occasionally due to size, there may be only two trellis and one vegetal panel. There are other types of decorations, including scolloped and four box, (gadrooned, lotus-petal, or quatrefoil shaped) panels.

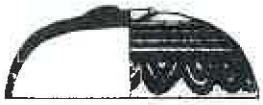
A number of boxes were found with the lid still in place. In a number of cases the glaze had run over the joint thus physically sticking the lid to the base. This indicates that the boxes were fired with their lids in place, and that they were being transported empty. It was noted that in most cases, the smaller boxes were of two types, one clearly black underglaze. Here, the black iron decoration is painted on the box and a very thin glaze applied. As a result of differences in the firing, the glaze varied from a thin shiny clear type through to an almost undetectable glaze. The other type had a thick greenish glaze with a blurred decoration, in some cases the decoration appeared to be brownish. The blurriness may be a result of the glaze fluxing the decoration and the two running together.

TYPE 1: SAWANKHALOK COVER BOX LID : MANGOSTEEN

Nos. 5-56 and Howitz (1979) Fig. 5.
Mangosteen fruit, sepals and stalk as a type of handle. Four black underglaze rings, a band or frieze underglaze decoration (trellis, vertical lines, and vegetal) and three underglaze rings on lower body.

RICHARDS, (1977) No. 40 and 44.

TYPE 1A: No. 57 and 107 and Howitz (1979) Fig.7
Scolloped decoration consisting of double loops or scollops in place of trellis-vegetal frieze.



TYPE 1B: No. 105.
Miniature version of Type 1A.

TYPE 1C: No. 59.
Small with two bands and a series of reversed commas, this may possibly form a vegetal pattern with base.

RICHARDS, (1977) No. 47.

TYPE 1D: No. 99 to 104.

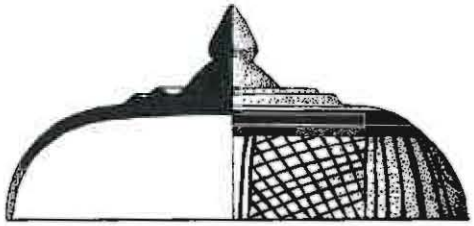
Miniature, with four roughly pentagonal (gadroon, quatrefoil or lotus-petal-shaped) panels, the painted apex following the shape of the mangosteen handle. The panels are outlined with three bands, the base of the panels stand on two rings around the waist, just below the waist. The panels are decorated alternately with trellis and vegetal patterns.

TYPE 1E: No. 13.

Four gadroon shaped lotus-petal or quatrefoil panels. Two, containing trellis with small circles in centre of the lattice, the other two having a series of smaller semi-circles the spaces having circles.

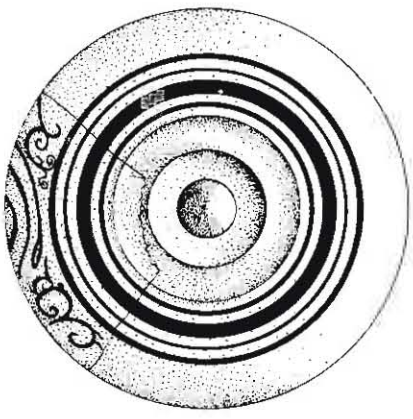
TYPE 2: SAWANKHALOK COVER BOX LID : LOTUS-BUD

Nos. 60-63 and Howitz (1979) Fig.17,18C and 19.
Lotus-bud consists of a bi-conical handle sitting on a tapering stem; the stem extends into a shallow depression and then a raised ridge. A series of 5 to 8 concentric black underglaze rings, and then a trellis and vegetal frieze as in Type 1. In large examples the frieze has three sets of trellis and vegetal panels.

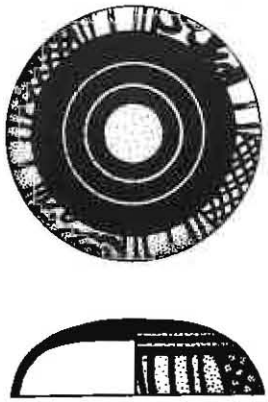


TYPE 2A: No. 64.
As type 1., except uneven scolloped decoration in place of trellis-vegetal frieze.

TYPE 2B: No. 18 (frag.)
Unusual vegetal decoration.



TYPE 3: SAWANKHALOK COVER BOX LID : PLAIN



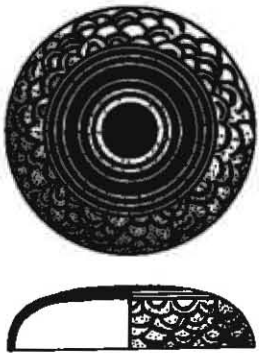
Nos. 66,68,70,72,73,75 to 77 and Howitz (1979) Figs. 8-10.
Three to six annular rings progressing outwards to a trellis-vegetal frieze and finally three rings on lower body.

TYPE 3A: Nos. 108-109.
Plain lid with a series of three rows of scollops.

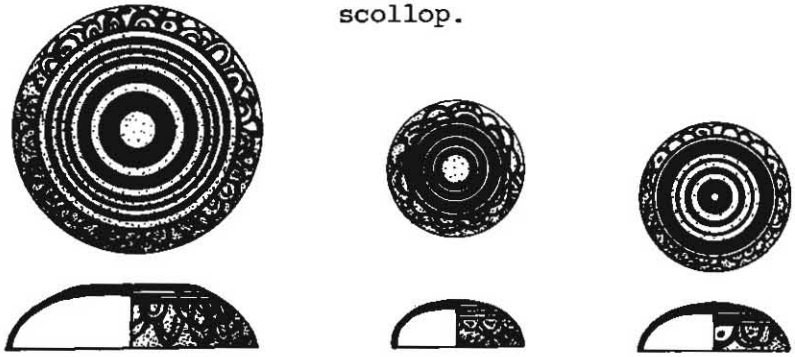
TYPE 3B: Nos. 71 and 78.
Plain lid with large frieze of scollop decoration.

WILLETTS, (1971) No. 206.

RICHARDS, (1977) No. 41.



TYPE 3C: Nos. 67 and 71.
Similar to 3B, but dot in centre of scollop.

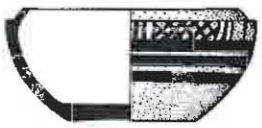


TYPE 3D: No. 15.

As Type 3, but trellis decoration consists of groups of three bars, leaving diamond shaped spaces in which are either crosses or circles.

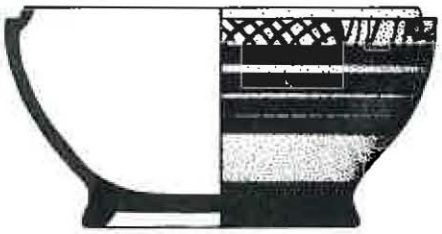
SAWANKHALOK BLACK UNDERGLAZE COVER BOX BASES

TYPE 1: NO FOOTRIM



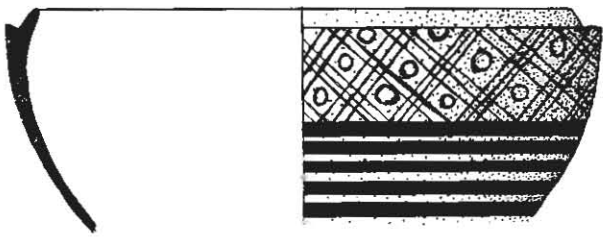
The most common of the two types, predominantly medium and small diameters. Usually the frieze runs through middle of join so that part of frieze can be seen on base. Three lines below and an unglazed base. No. 86 shows clearly the depth to which the box is dipped in glaze.

TYPE 2: WITH FOOTRIM



No. 95 - 99.
All have black underglaze on foot, but not under foot, and four lines.

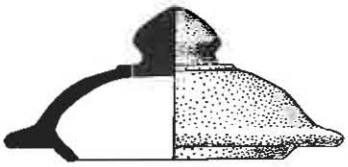
TYPE 2A: No. 26. Possibly with footrim.



Decoration consists of trellis made up of three lines intersecting to form a rough diamond. In the centre of the diamond is a circle.

iv. WHITEWARES

WHITEWARE LID



No. 148.
With knob handle on dome of lid; resembling a flattened lotus-bud; hollowed inside with a ridge on the lid base to locate the lid.

SPINKS, (1971) Fig.10 (lower).

WILLETTS, (1971) No. 243.

REFUGE, (1976) Afb. 151.

RICHARDS, (1977) Fig. 175

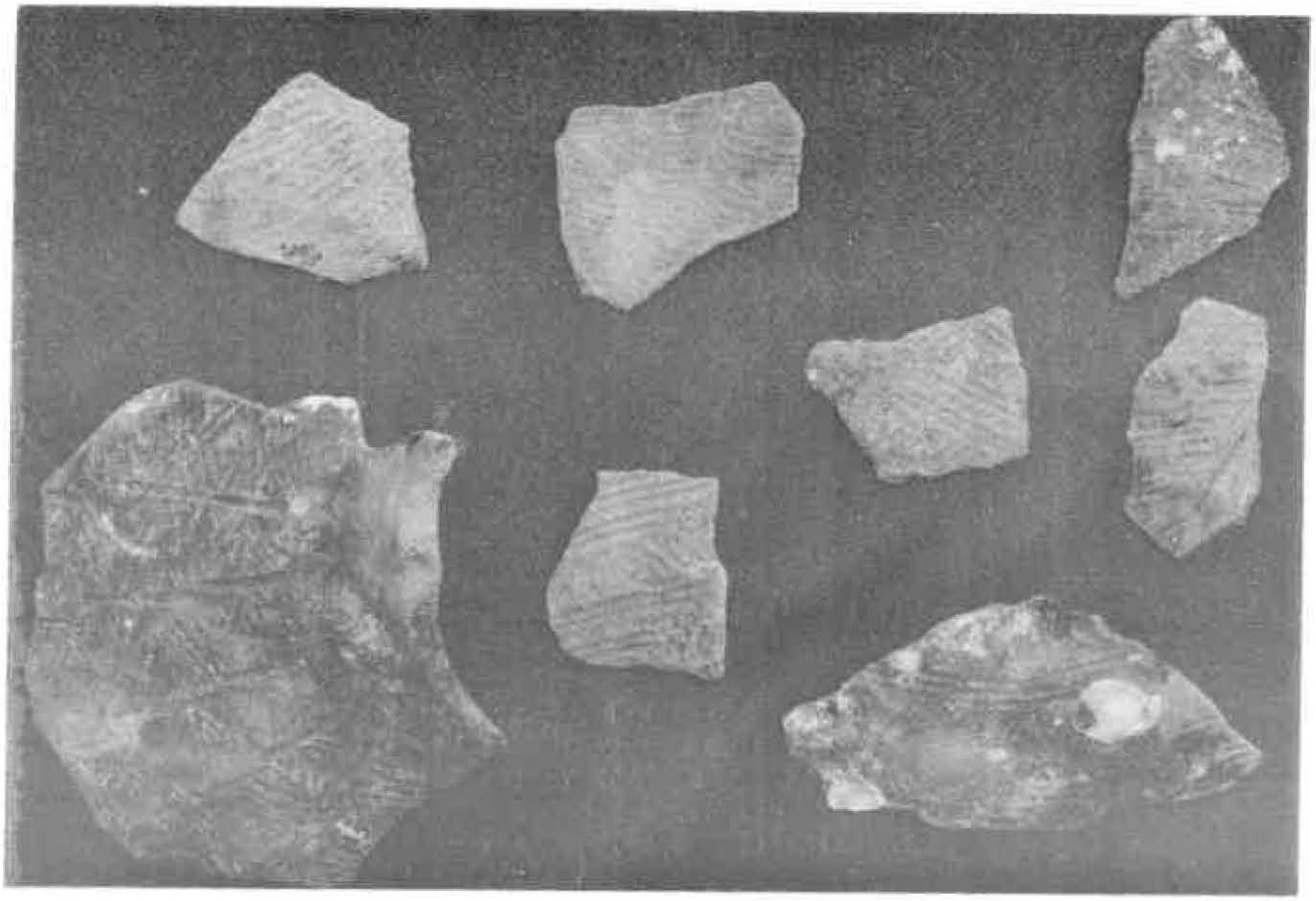
GOEPPER, (1977) No. 195.

WHITEWARE BOWL

No. 20.
A simple bowl with an incised line in the cavity of the bowl. Inside white slip, buff fabric.

v. EARTHENWARE

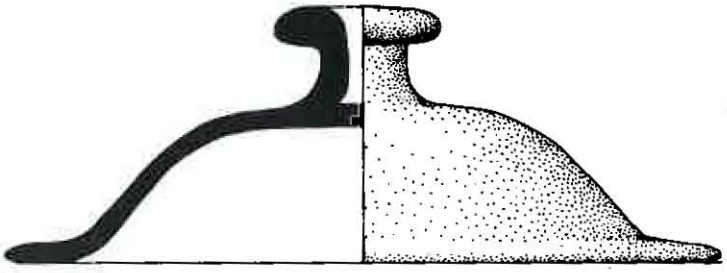
POTS WITH STAMPED DECORATION



These pots are of a soft brown clay and have stamped pattern on the body. The pots are roughly spherical with an everted plain neck, and no base. Similar pots have been found on the Pattaya site (Howitz, 1977 Fig. 21-22).

LIDS:

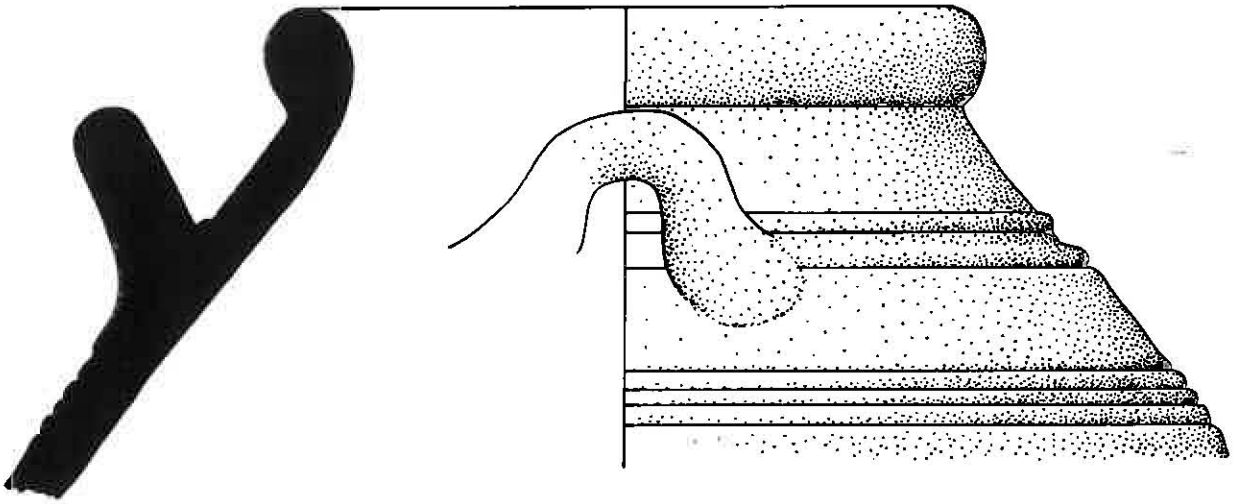
Palm sugar pots. Nos. 42 and 43.
A number of these lids were found, again earthenware but of a number of different bodies. Apart from soft brown as above, there was also coarse grey and black bodies. Two types of lid handles, one with a lotus-bud (No.42), the other (No.43) with a button. The latter was also found by Howitz (1977) Fig. 10.



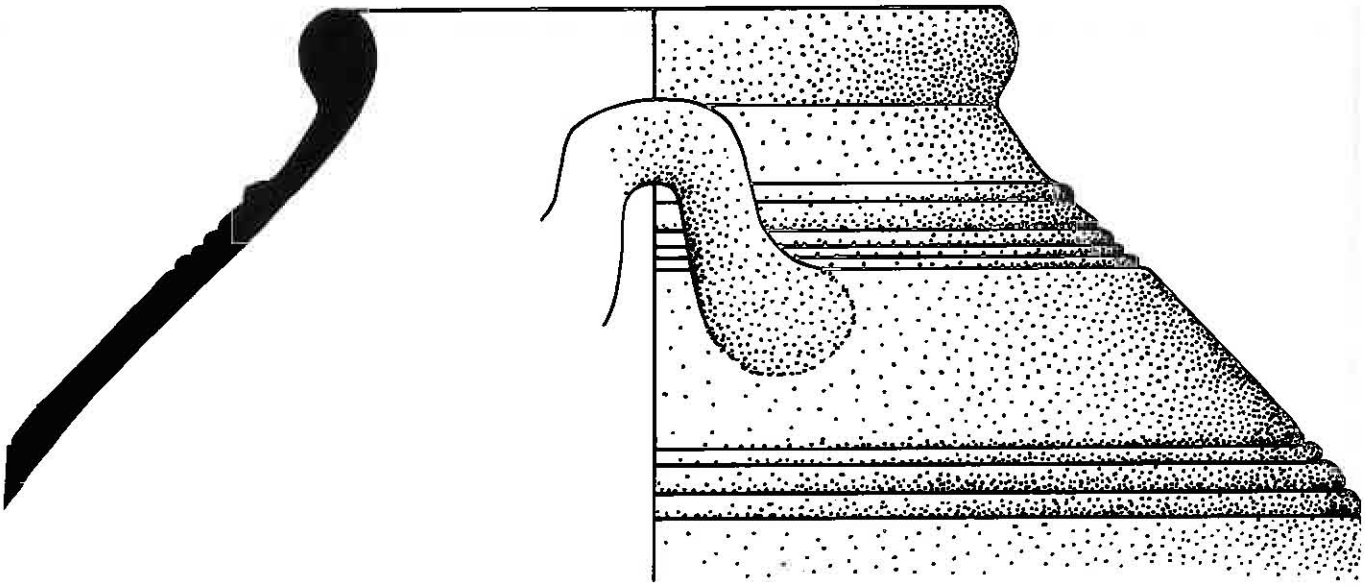
No. 41.
A dome shaped lid with a tubular handle rolled flat at top.

vi. COARSE STONEWARES

LARGE JARS - LARGE THICK MOUTH-RIM, NO NECK, LUG HANDLES.



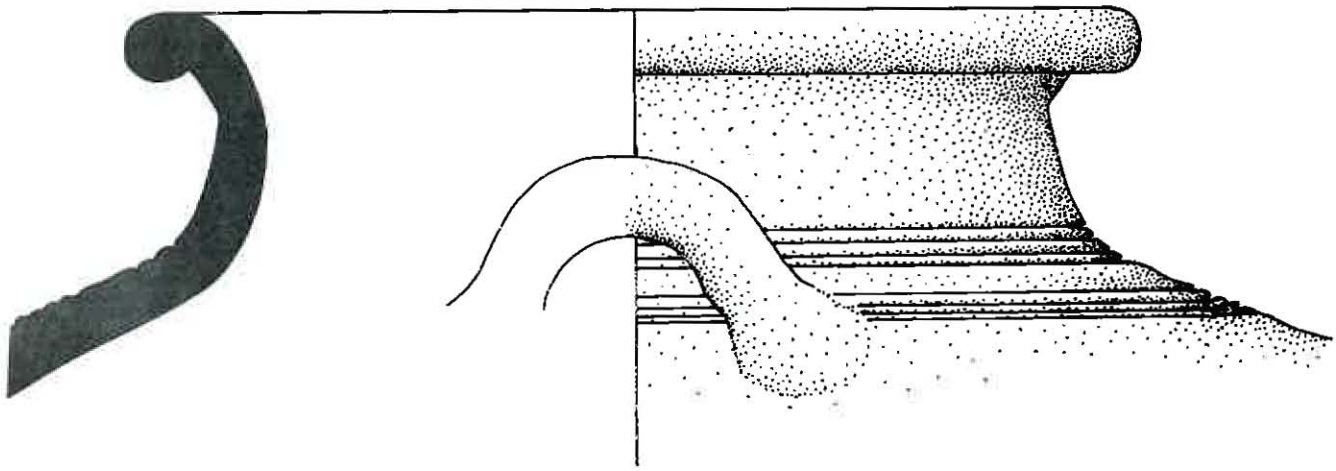
No. 36.
Four handles; grey body with a yellow-brown slip.



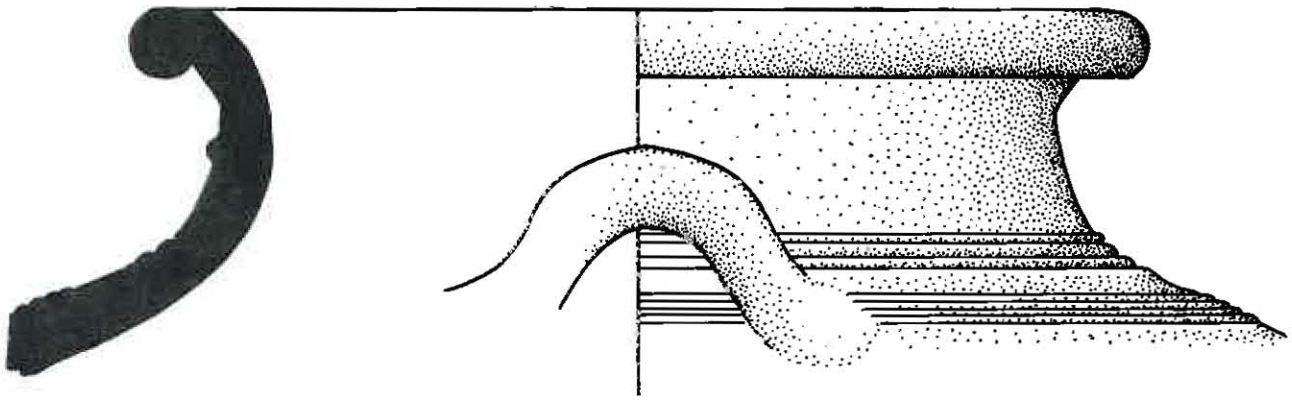
No. 38.
Two handles, grey body, with pinkish patches.
These two jars have similar mouth rim diameters (190mm) and no noticeable neck. Four large lug handles on the shoulder. The typical Sawankhalok ridge just above the handle, less pronounced than normal; both examples having two

sets of carved lines one just on or slightly above the handles, the other set below. A thick round mouth rim, and no neck make these an unusual type. Brown (1975) has noted similar types of storage jars from the Ko Khram site, noting that they resemble Sawankhalok material but are unfamiliar. Similar in shape are two examples in the Museum Pusat (Nos. 369 and 2761) illustrated in Adhyatman and Lammers (1977). III M1 & 2.

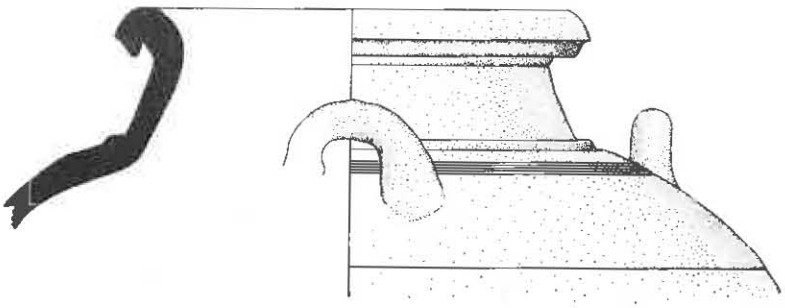
LARGE JARS - ROLLED MOUTH-RIM, WITH NECK, LUG HANDLES.



No. 34.
Grey outside, black-grey inside, olive green slip.



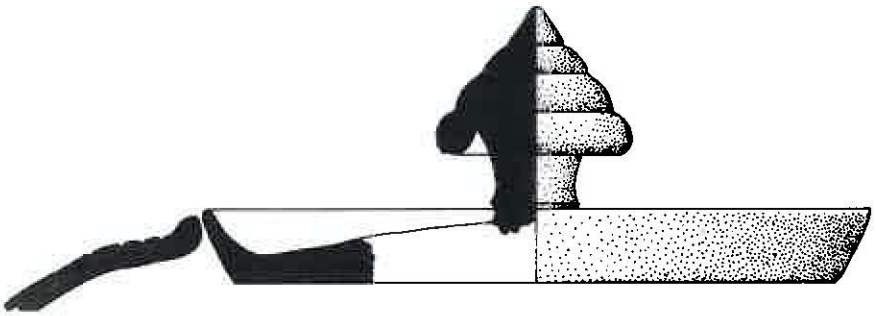
No. 35.
Grey body, no slip.



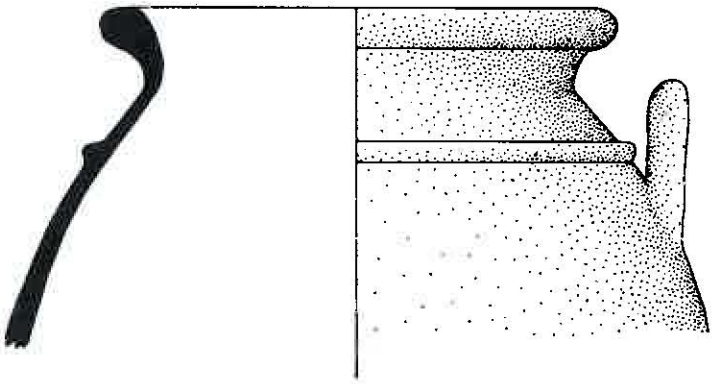
Scale 1:4

No. 37.
Grey body, with black inclusions.

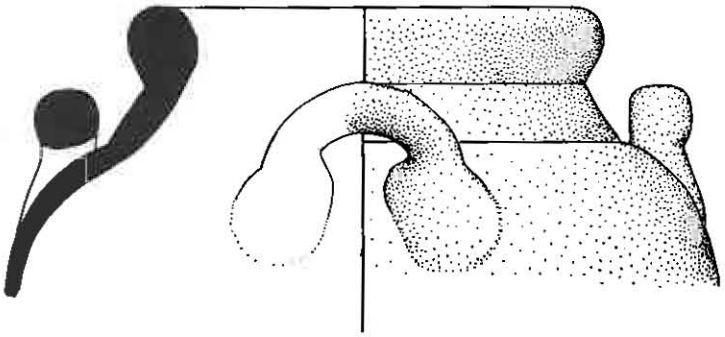
These jars have a large mouth diameter (circ.270mm) more typical of the Sawankhalok storage jars. Nos. 35 and 37 have the pronounced ridge above both the handles and the band of incised lines onto which the handles are applied.



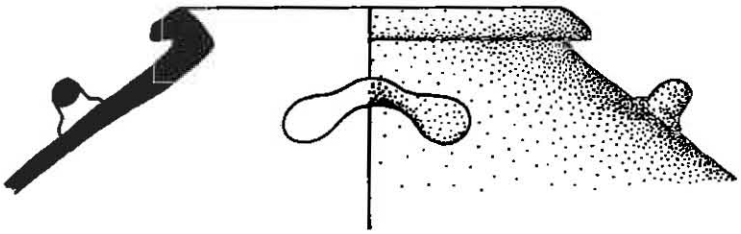
No. 22.
Jar and lid with lotus-bud handle, blue-grey with brick-red straitions inside. Yellow-olive green "orange peel" on inside surface. The surface of this body resembles that the the *Batavia* (Stanbury, 1979) BAT 545 and the *Vergulde Draeck* (Green, 1977), GT 913 which have been discussed by Green (1981) in relation to material from the Ko Khram shipwreck.



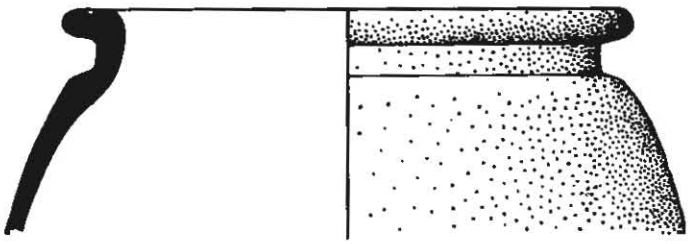
No. 25.
Tall, narrow jar with lug handles. Grey-brown body with red, black and quartz inclusions. Possibly two vertical slender lug handles, with a ridge above, and flared out neck rim.



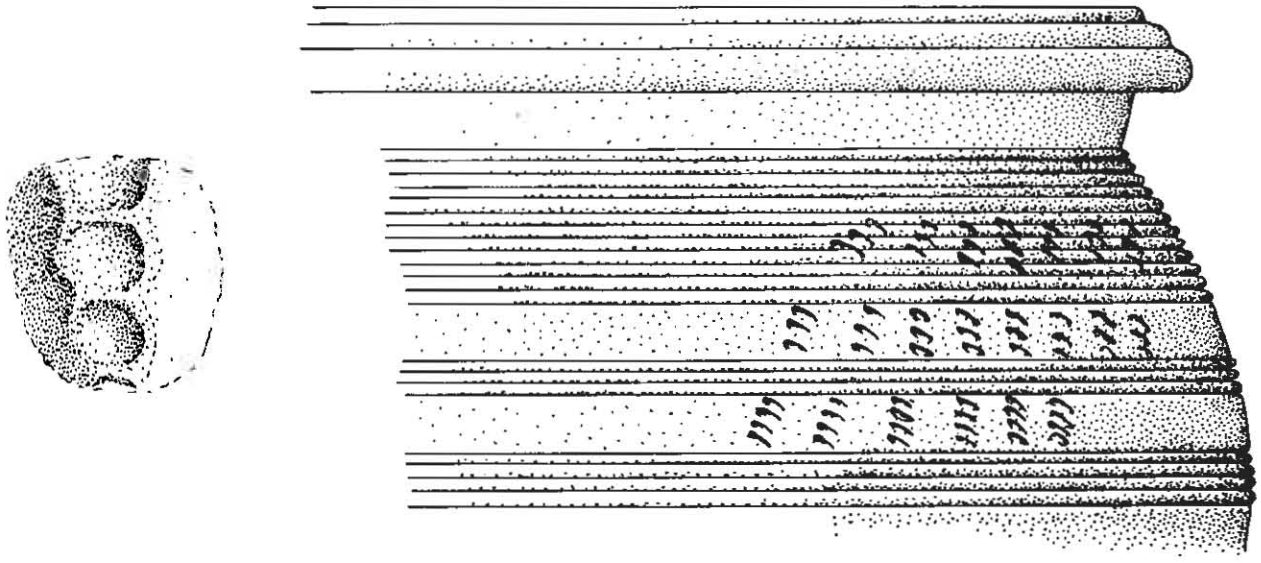
No. 26.
Tall narrow jar with four lug handles. Light brown body, thick round mouth rim. This jar is similar in size and shape to one found on the *Witte Leeuwe* (Sotheby Mak van Waay, 1977, No. 977) and from the Ko Khram site (Brown, 1975, Fig. 12C).



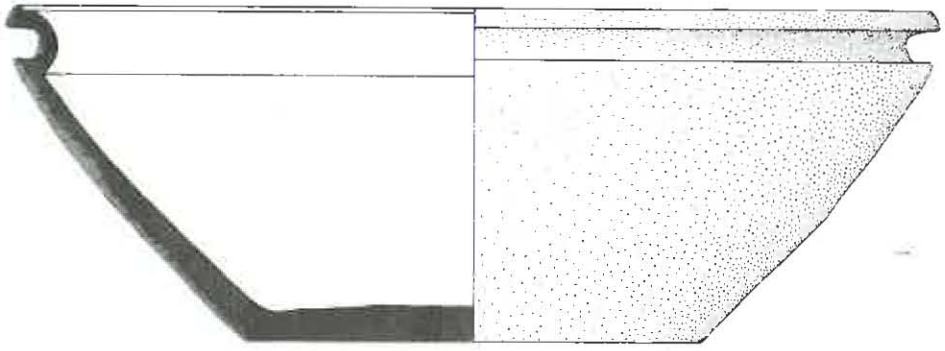
No. 27.
Bulbous jar with four small lug handles. Light brown body. This type is similar to a group found on the *Witte Leeuwe* (Sotheby Mak van Waay, 1977, No. 976).



No. 28.
Tall straight jar without handles. Grey outside body, red inside.

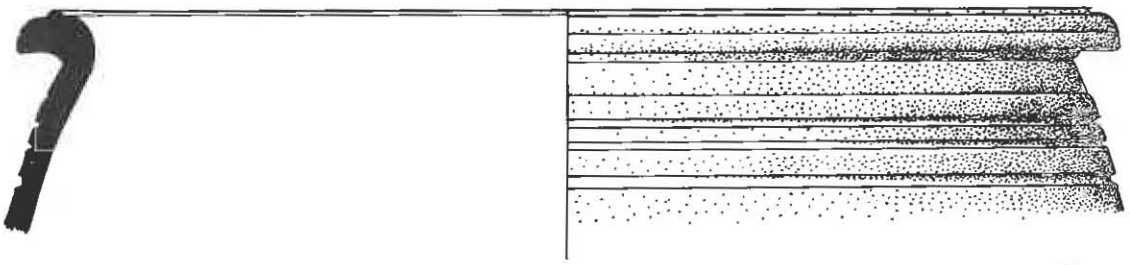


No. 32.
Greenish glaze on brown fabric. This basin appears to have an oval mouth. Three groups of incised grooves, 12-4-5 starting at base of neck. Three bands of stab mark decoration in the 12 groove area and in the two panels of plain body between the 12 and 4 and 4 and 5. A number of very unusual handles, ovoid with four dimpled depressions in a line.

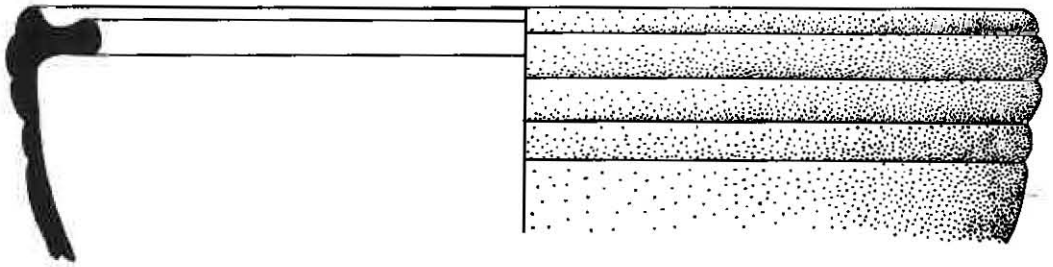


Scale 1:4

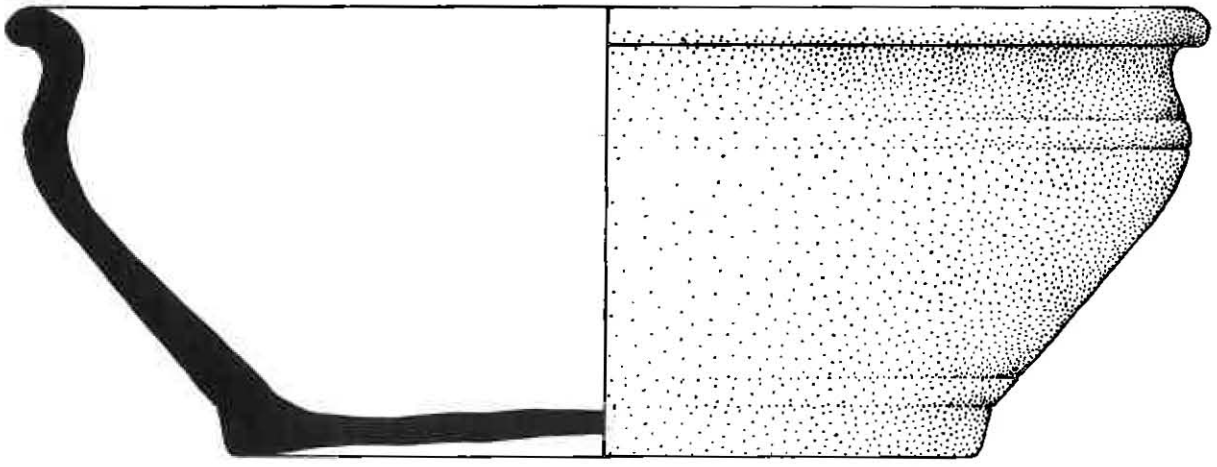
No. 39.
Grey outside body, brick-red inside, typical of Sawankhalok. This large basin has a diameter of 488mm and a height of 176mm, and a rounded mouth-rim. It is similar in size and to one illustrated by Brown (1975) Fig.15.



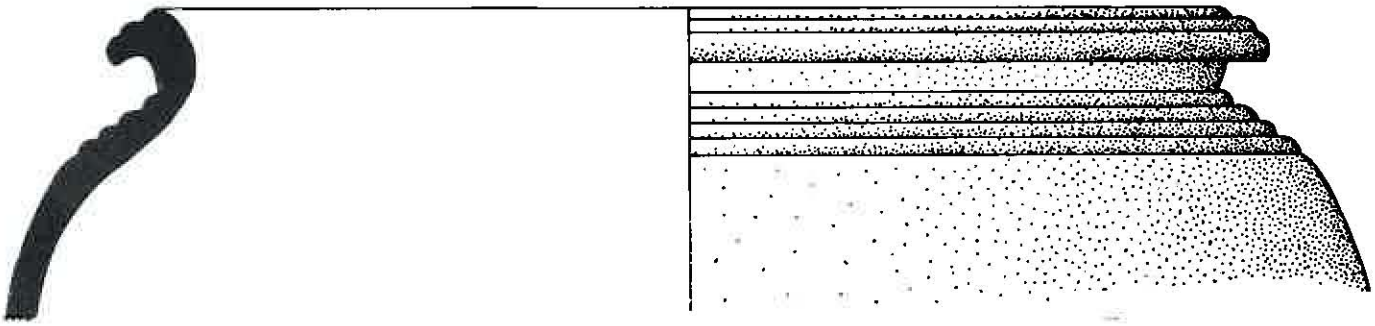
No. 29.
Brown outside body, brick-red inside, diameter 290mm. Roll over mouth rim with small ridge on top of rim. One fine and three pronounced incised grooves.



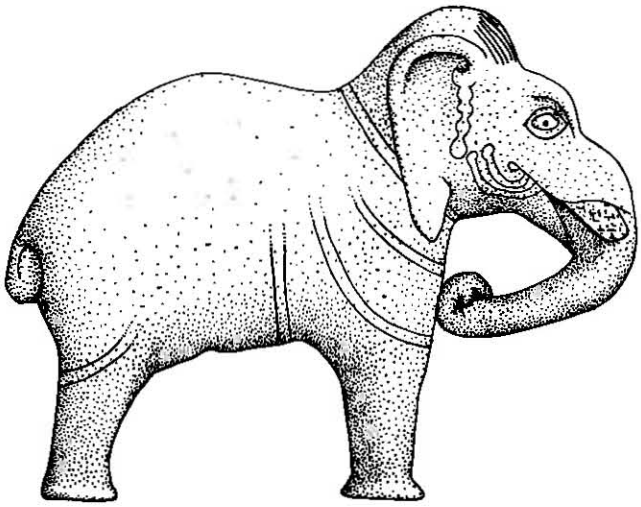
No. 30.
Grey body, diameter 274mm. Mouth rim has a flange sticking out into body of basin, clearly to locate a lid. Four incised grooves, formed into rounded bands.



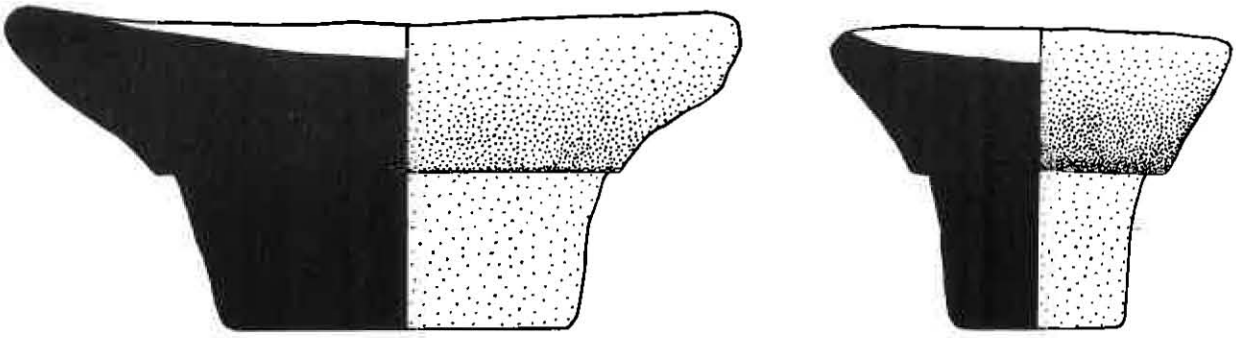
No. 31.
Greyish body, 314mm diameter, slightly flared mouth-rim. This is similar in shape to an earthenware basin, Howitz (1977), Fig.4.



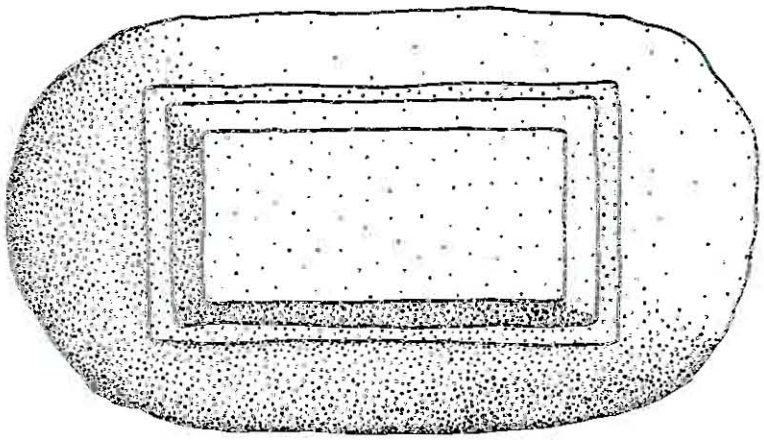
No.33.
Ridged and pronounced mouth rim. Five incised bands on shoulders.



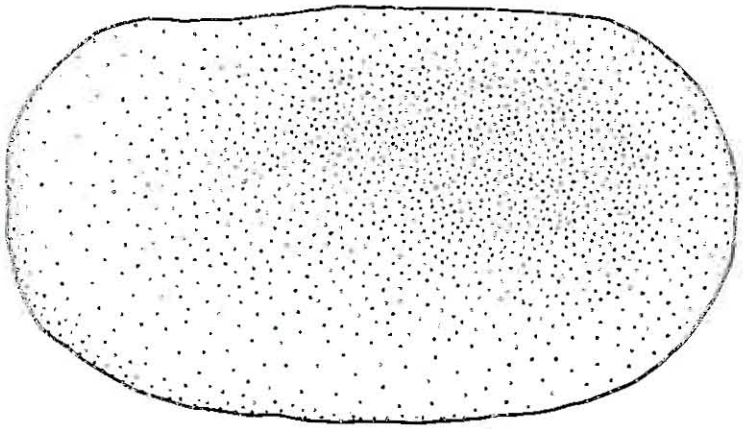
No. 165.
Elephant: Earthenware elephant about 150mm high, hollow, decorated with incised lines indicating harness and strappings. A hole in the top of the head 10mm in diameter and another smaller (circ.2mm) in base of rear right foot. Both front legs and tusks were missing, one leg was found subsequently, together with another leg which clearly belonged to another example. The elephant was badly abraded and had a lot of marine growth on it.



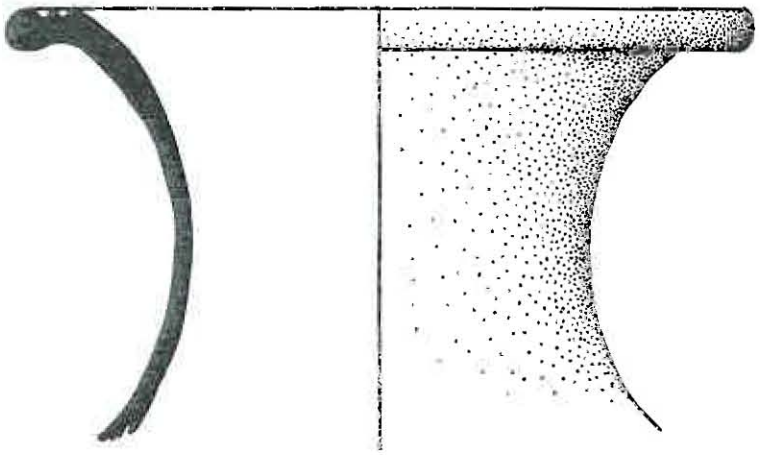
No. 174.
Grindstone anvil: Rectangular base with a flared cut ovoid rubbing surface.



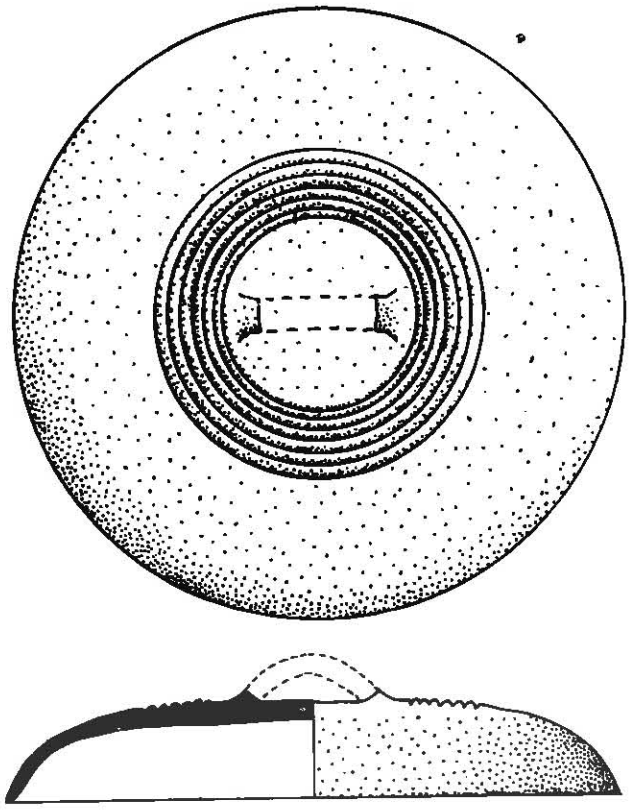
Grindstone anvil, base



Grindstone anvil, top surface

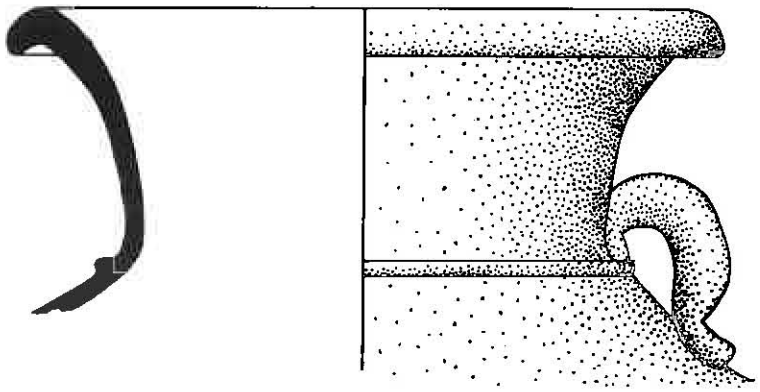


No. 23.
Fine red-brown body, stoneware neck flared with a flattened-out mouth-rim.

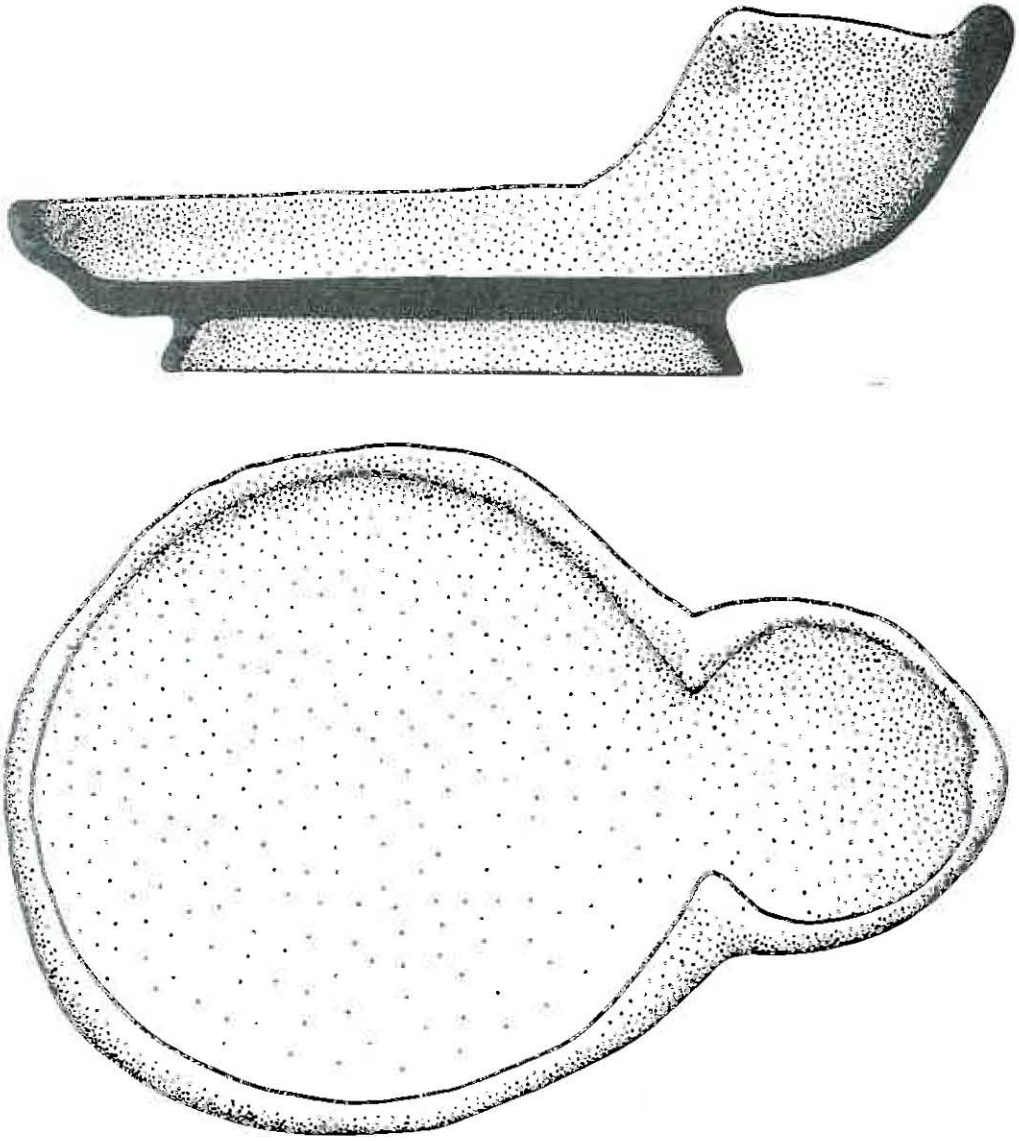


No. 24:
Brown body, stoneware lid 59mm diameter. Flattened disc shape, seven incised concentric circles around strap handle.

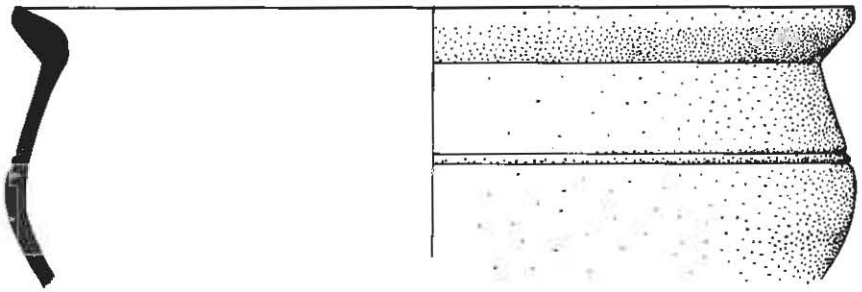
No. 19.
Small stoneware dish, said to be a rushlamp dish.



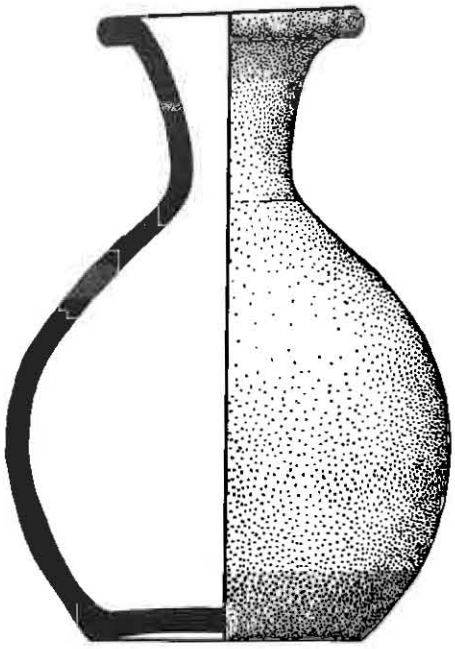
No. 166
Neck fragment. Black soft fabric.



No. 40.
Stoneware stove: The stove consists of a roughly oval footrim, with a large flat dish 380mm in diameter and 44mm high. At one end is a raised section forming a second circle 180mm in diameter when viewed from above. Three projections on the rim form the pot stand or support, and two holes in projection are of an unknown function. The stove works by lighting a fire in the large pan, and allowing the wind to funnel the heat up to the pot sitting in its stand. A similar stove is illustrated in Guy (1980) front end paper, from the Santa Ana excavation, Manila.

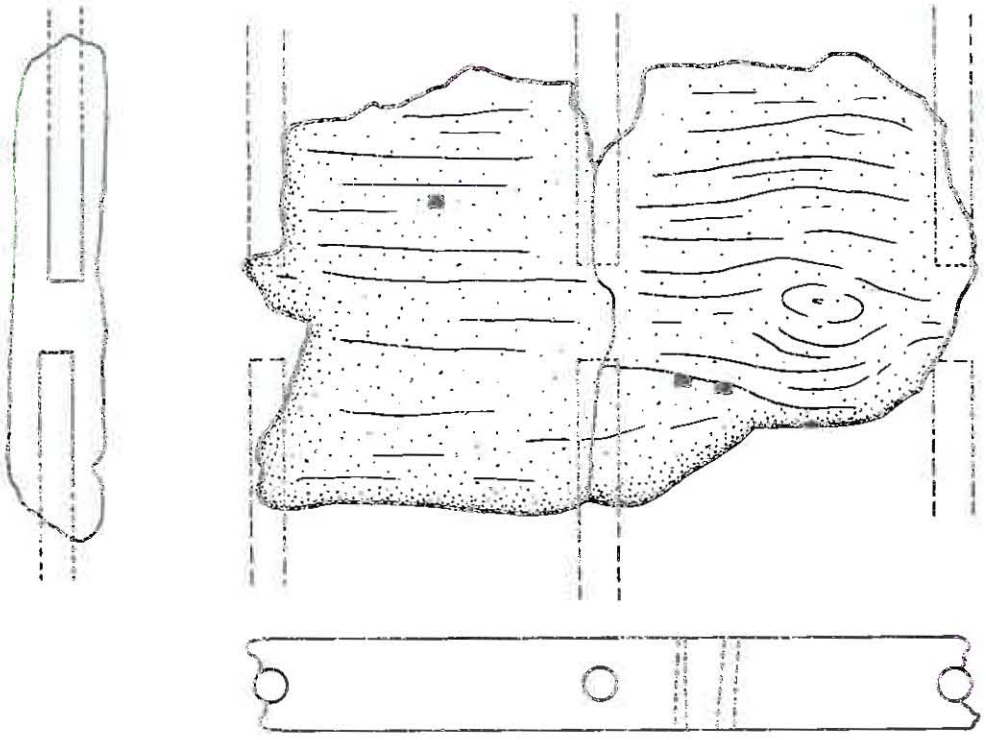


No. 44:
Broken, possibly round bottomed, a single incised band round mid-waist, and a simple out-turned lip. Black soft and flaky fabric.



No. 147. and Howitz (1979) Fig.24.
Pearshaped bottle. Flattened disk shaped lip; neck flaring outwards to lip; pear shaped body; no footrim, (stoneware?)

viii. TIMBER - SHIP'S STRUCTURE

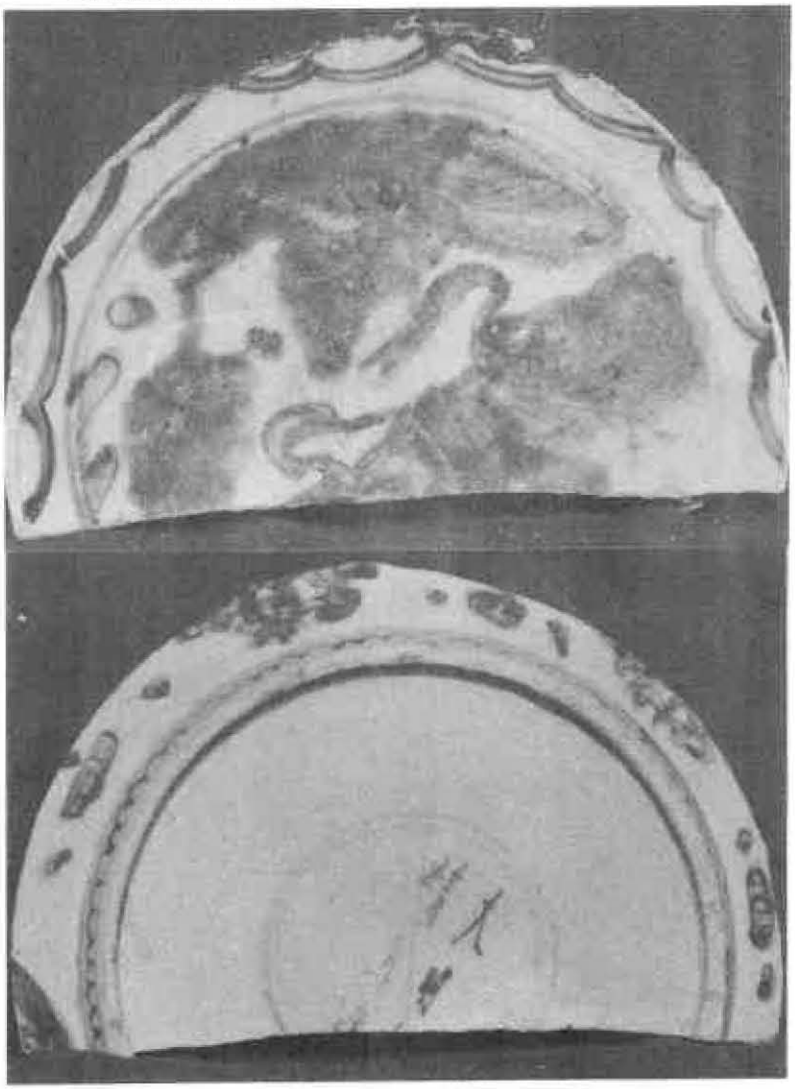


Some fragments of ship's structure were found. These were extremely badly eroded and very fragile. They appeared to be outer planking, which was edge joined with dowels. Unfortunately, the planking was extremely difficult to recover intact because of its fragile nature. Two pieces were recovered, one 370mm by 280mm had a thickness of 50mm. The dowels were 18mm long, but unfortunately it was impossible to tell what the thickness of the plank was. The planking lay almost north-south on the site, bearing 330°.

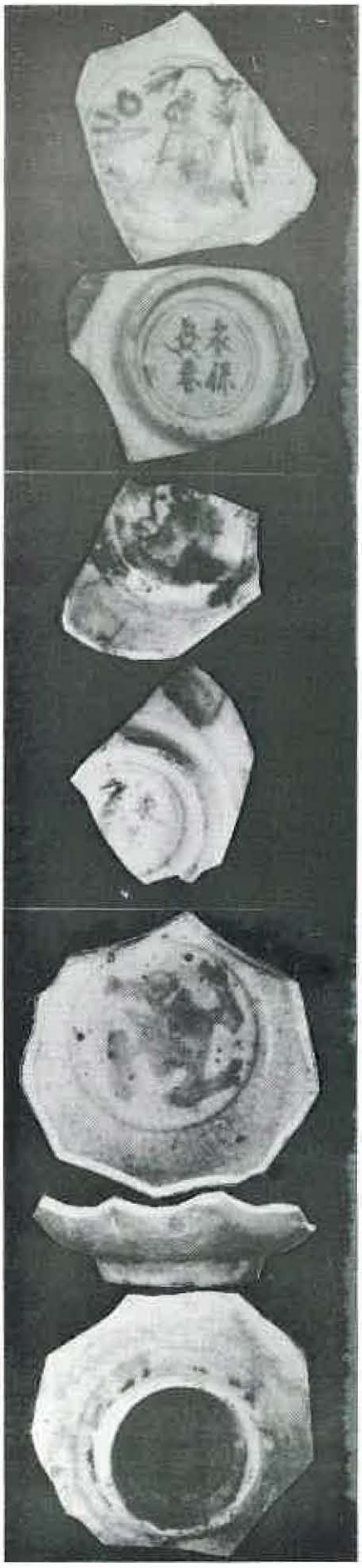
ix. CHINESE BLUE AND WHITE

The identification of this material was kindly supplied by Mr. S.R. Parker and Mr. Lu Yaw of Southeast Asian Ceramic Society. They emphasise that their conclusions are to be treated with caution, as it is virtually impossible to express a reliable opinion without sight of the material.

INSCRIBED MATERIAL



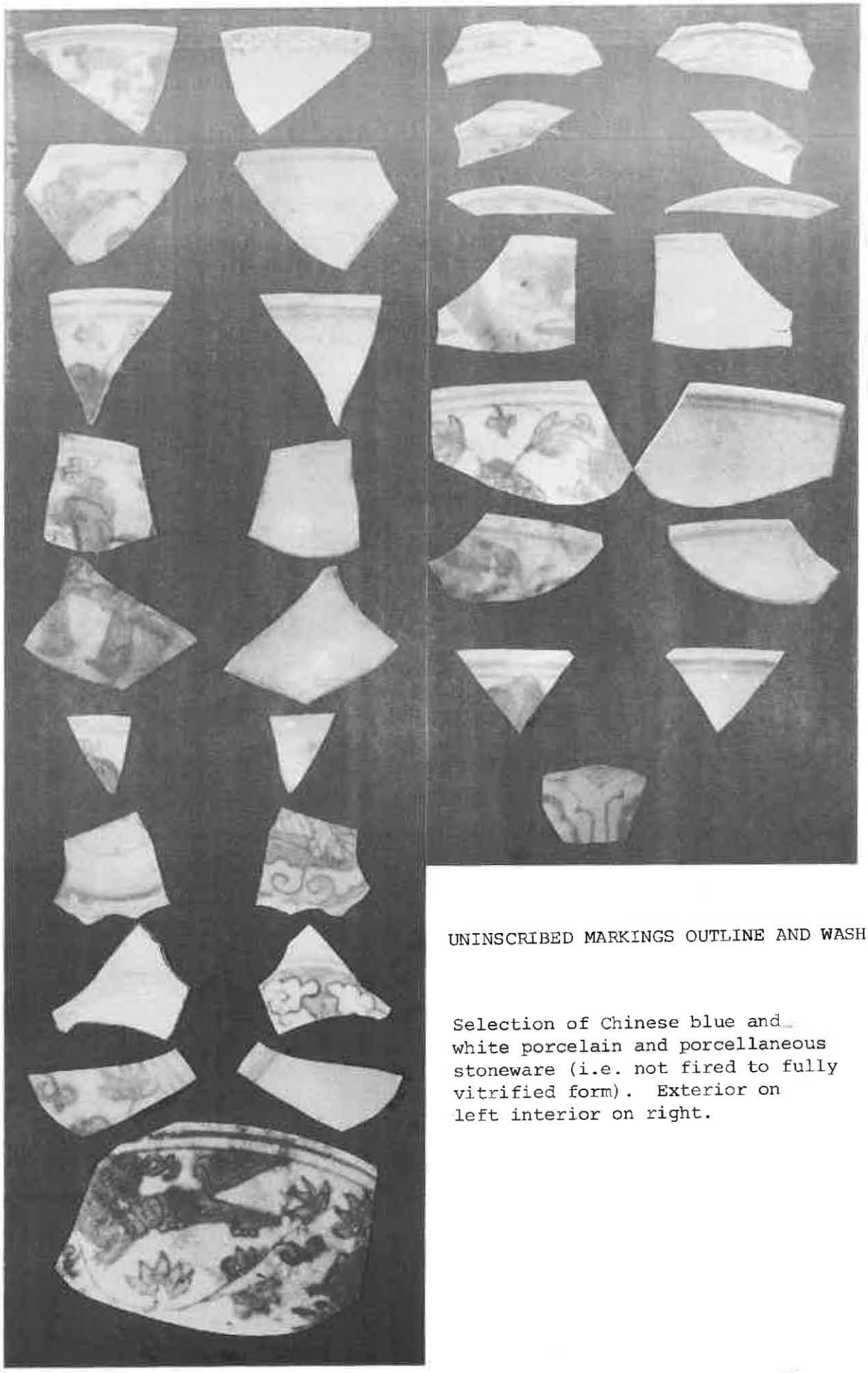
No.153: PLATE FRAGMENT
Interior of cavetto: cranes under pine trees a design symbolic of longevity. Exterior base inscription: "Ta Ming Chia Ching Nien Chi". Translated: made in the Chia Ching reign of the Great Ming Dynasty (1522-1566).



No.152: BOWL FRAGMENT
Interior of cavetto: Sage in garden with rocks and trees. Exterior base inscription: "Yung Pac Ch'ang Ch'an". Translated: "To preserve forever eternal spring". possibly Chai Ching.

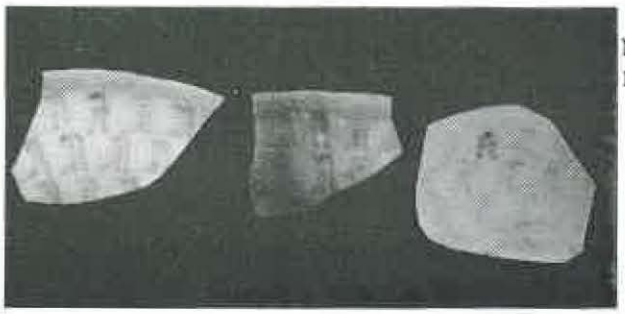
No.157: SMALL BOWL FRAGMENT
Interior of cavetto: Sage in garden with rocks and trees. Exterior base inscription as above.

No.151: BOWL FRAGMENT
Interior cavetto: Exterior base inscription "Ta Ming Nien Tsao". Translated: Made in the Great Ming Dynasty.

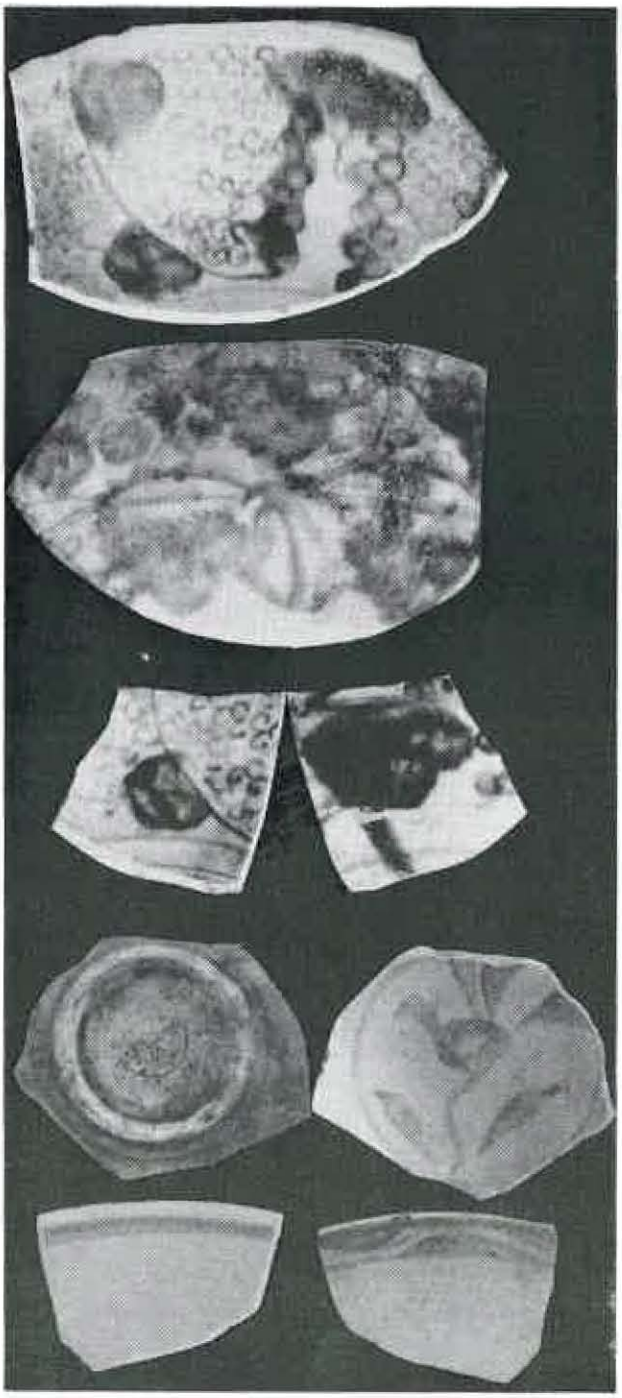


UNINSCRIBED MARKINGS OUTLINE AND WASH

Selection of Chinese blue and white porcelain and porcellaneous stoneware (i.e. not fired to fully vitrified form). Exterior on left interior on right.



No.159-60: RIMS OF BOWL
Degraded sanskrit characters.



Rough outline and wash of unusual design. It has been suggested that it is vine and grape motif, possibly of Sawankhalok origin.

BONELESS PAINTING STYLE

x. BALLAST

During the 1979 excavation, the number of ballast stones from each grid square were counted, see Fig.5. At the end of the excavation 100 stones were randomly collected and weighed. The average weight was 3.5kg with a variation of 2.4kg. This shows the considerable weight range of the stones, indicating that there was no particular size preference when they were loaded. The total number of stones removed from the seven grid squares was 1578 which an average of 56 stones per square metre of the site. The average weight of stones removed from the excavation area was 5.5 tonnes. The whole site covers an area of 180 square metres and assuming the same density of stones per metre, the approximate weight of the stones is 35 tonnes. The stones which are clearly river washed are reported to be a type of granite which is indigenous to Thailand.

8. CONCLUSIONS

The Ko Kradat wrecksite was interesting for a number of reasons. Firstly, although it lies in very shallow water, it remains relatively intact, and not dispersed over a large area. The ballast mound, for example, must reflect to some degree the original centre of the ship, and thus its approximate size. The lack of dispersion may be because the area is not subject to violent seas or severe storms. Thus, after the ship ran aground, it broke up gradually; the large storage jars breaking up as the ship disintegrated, the smaller stonewares falling into, and among the ballast stones, where they survived relatively intact, in quite large numbers. Because of the high water temperature, (27-29^{o}C) and the presence of wood-boring marine organisms, the wooden structure, under the ballast, whilst preserved longer than the other ship structure, gradually disintegrated, so that in the end, only small fragments of the ship survived.

The presence of the large quantity of ballast, approximately 35 tonnes, poses a number of questions. There can be little doubt that the stones are simply river-washed granite boulders of a fairly random size, and that they are a type of ballast. This does not imply that they could not be paying ballast, as has been suggested by Mowitz (1979). Their presence however, indicates that the ship was either almost empty of cargo, or was carrying a very light cargo, which has subsequently disappeared. Whilst little is known of the ballasting arrangements of oriental sailing ships, it must be appreciated that one cannot sail a load carrying ship empty. All sailing vessels require something to counter-balance the force of the wind on the sails, which in turn is transferred to the mast and tends to want to turn the ship over. The use of ballast or a heavy cargo counteracts this force. Thus, if a ship unloads a certain weight of cargo, it has to take on approximately the same quantity to maintain its sailing characteristics. In the 17th and 18th century Europe, ballasting was considered an art, and the correct location of cargo and ballast was essential to ensure stability and good sailing characteristics. Taking the original estimate of 35 tonnes of ballast, it may be noted that this is quite large in relation to the ceramic cargo of about 200 large storage jars, even taking into consideration, losses, looting, and material drifting off. Thus, the ballast is about the same order of magnitude of weight as the ceramic cargo.

The conclusion is, therefore, that the vessel may have been carrying an additional light cargo, or, she was returning home in ballast, with a small proportion of her cargo unsold, or undischarged.

Virapho (1977), has recorded that Thai ships carried ballast in the 17th century: "The first mention of the Ch'ing authorities allowing Siamese to take aboard a Chinese 'ballast' on the returning voyage came in 1659, when a Siamese t'an-kung vessel dispatched by Marai to enquire after the well-being of his mission exchanged the ballast it had brought from Ayudhya to Canton for a Chinese kind.." It has been argued by Howitz (1979), that the stones may have been shaped and subsequently worn down by the current on the site. This is unlikely, as the stones were, in some areas, quite deeply buried under the mound. nor does the statement that it was doubtful if a skipper "in the olden days could afford to use considerable cargo space for having a useless and valueless ballast to stabilize his ship", seem to make sense, particularly from the considerations above. However, it may be, as suggested by Howitz (1979), that the granite was used on arrival at the destination, either as a building material for dwellings, well-walls or pavements.

Because of the survival of considerable numbers of complete fine stoneware objects, one is tempted to conclude that this was the main ceramic cargo. However, by estimation it would seem unlikely that the fine stonewares represent any more than about 200-500 items at the most (assuming half the site excavated and five sherds make a pot), whilst the coarse stonewares represent about 200 complete items on a similar estimation (50 sherds to a pot). The smaller quantities of earthenwares and porcelain may represent the crew's domestic ware, and the rice pots their provisions. It is obvious that the small fine stonewares were cargo, because of the sealed cover box lids. With the cover boxes went the other underglaze bottles and jarlets as cargo, and it has been suggested that these objects were used in connection with religious and funerary rites. Clearly, their small inpractical nature reflects this.

Examining the breakdown of complete objects found in fifteen of the 2m-square grid squares, there were 74 complete Sawankhalok fine stoneware objects, but no examples of other complete objects were found. Approximately 60% of the 5,500 sherds recovered were from the large coarse stonewares (jars and some bowls); about 30% were earthenwares, of which about 20% represented rice pots with stamped decorations; the fine stoneware sherds represented about 8% of the collection; and the Chinese blue-and-white porcelain about 1%.

These figures give some idea of the quantities of ceramics involved. Initially, it was thought that the coarse stoneware jars may have been the carriers for the smaller fine stonewares. This has been suggested on the Ko Khram site, where small celadons were said to have been found inside large Sawankhalok storage jars. Here, at Ko Kradat this may also be a possibility, however, there may be a bias in the survival or retrieval rate of the ceramics. Clearly

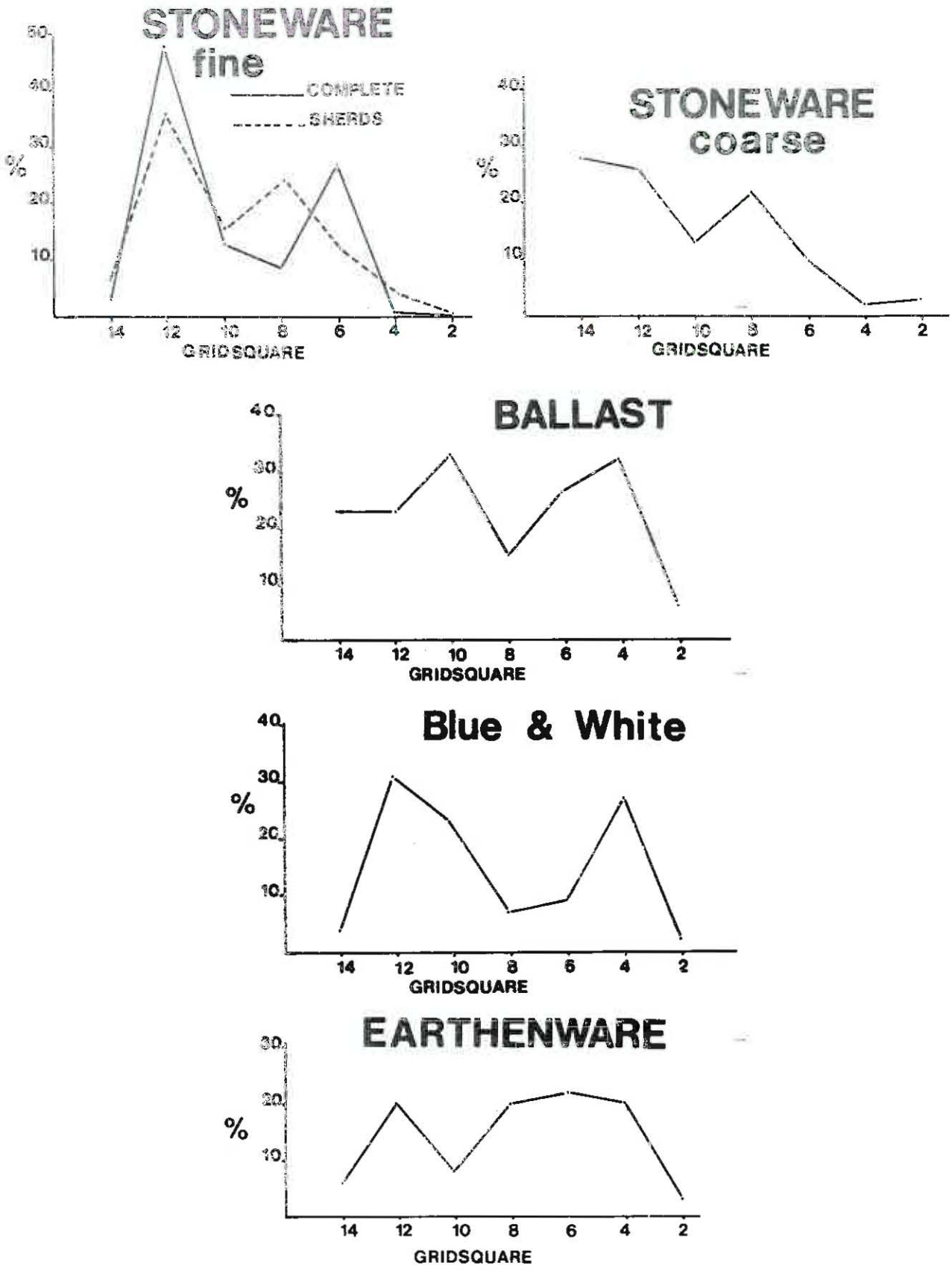


FIG 5. Graph of percentage of sherds per gridsquare. Thus, with fine stoneware, nearly 50% of complete finds came from gridsquare 12.

74 complete objects and only about 400 sherds in the fine stoneware group, and no complete objects and over 3000 coarse stoneware and about 1700 earthenware sherds tend to suggest a bias. Obviously, the complete large jars may have been salvaged or removed from the site in the past (Howitz (1977) records raising two in 1977). The size of the jars would tend to preclude their being buried, since the site was only about 0.5m deep. The fragility of the smaller earthenware rice pots would also make these less likely to survive intact. This does not explain the small numbers of fine stoneware sherds. Possibly the relative difference in the size of the objects may be the answer here. Thus, a large coarse stoneware pot may break into more sherds, than say, a small cover box, thus, resulting in relatively less fineware sherds. However, this hypothesis is not really convincing.

One of the most interesting findings were the number of Chinese blue-and-white porcelain and porcellaneous-stoneware found on the site. Four examples of bowls had inscriptions on the base. This material, and the inscriptions, have been examined by a number of experts, and the general conclusion is that they represent a collection of mid to second half of the 16th century. All the experts have expressed some reservations, because they have had only photographs to examine. However, one crucial piece has the inscription "Made in the Chai-Ching reign of the Great Ming Dynasty". Since the Chai-Ching reign lasted from 1522-1566 we have a highly reliable date around the mid 16th century, with a strong indication that this material dates from the second half of the 16th century. It is suggested here that the evidence from the Ko Kradat site indicates that the ship was lost in the mid 16th century, possibly in the second half of the 16th century, thus indicating an even later terminal date for Sawankhalok.

There appears still to be considerable differences of opinion as to the dating and even the history of the Sukhothai-Sawankhalok ceramic tradition. Recently, Brown (1977) has questioned the dating of Sawankhalok stating "the exact dating of the wares (Sawankhalok and Sukhothai) has never been conclusively determined, and at the moment rests on deduction, indication, inference and stylistic reference". Brown goes on to suggest that the cataclysmic end to the Sawankhalok kilns, suggests an abandonment caused by the strife during the second half of the fifteenth century. However, she notes evidence from abroad, where Chinese wares of the first half of the sixteenth century suggest that the kilns could have operated until the final Chiengmai raid of 1512. More recently, Volker (1979) has suggested that the theory of cataclysmic abandonment of Sawankhalok, may be based on a misunderstanding of Lucien Fournereau's account of his visit to the area in 1891.

Volker, further illustrates the complexity of the problem dealing with the various different pottery production sites within the Sukhothai-Sawankhalok area, including Chalieng, Ban Ko Noi, and Sri Satchanalai. Volker, however, gives a terminal date of 1460 for the end of the Sawankhalok period, stating that contemporary historical records do not give reference to the export of Sawankhalok wares later than this date. Other authors tend to agree with the late 14th, early 15th century date for the end of Sawankhalok, (Groepper, 1977), Spinks, (1959 and 1971). However, Watt (1971), Woodward (1978), Wagner (1980) and Guy (1980) have all suggested later dates, in particular the latter who has suggested a 16th century date. The only controlled archaeological investigation of Thai ceramics to date, has been the Calatagan excavations (Fox, 1959). However, Addis (1971) has suggested that the dating of the Calatagan burial grounds to the late fourteenth to fifteenth centuries, by the excavators, is one century too early. Watt (1971), dates some of the Chinese material at Calatagan to the sixteenth century.

The illustration of a pear shaped bottle by Brown (1977), No. 135, Plate 41, closely parallels similar bottles from the Ko Kradat site, even to the decoration. Brown attributes this material to the Northern kiln sites of Kalong, north east of Chiengmai reported in 1936 by Phrah Ram. However, the ware is characterised by a whitish body, where as our material has the more distinctive Sawankhalok buff to pinkish body with small black gritty inclusions.

Volker (1979), questions the whole existence of the Kalong kilns: "if they exist as such and are not a mystification by 'the original finder' because he mistook the northern kilns of Sawankhalok for kilns in the foot hill of Kalong", a distance of almost 200km!

GUY, J. (1980) *Oriental trade ceramics in Southeast Asia, 10th to 16th century, selected from Australian collections, including the Art Gallery of South Australia and the Bodor Collection.* Melbourne, National Gallery of Victoria.

HOWITZ, P.C. (1977) Two Ancient Shipwrecks in the Gulf of Thailand; a report on archaeological investigations. *J. Siam Society*, 65-2:1-22

HOWITZ, P.C. (1979) *Ceramics from the sea. Evidence from the Koh Kradat shipwreck, excavated in 1979.* Bangkok. Archaeological Division Faculty of Archaeology, Silpakorn University.

REFUGE, B. (1976) *Swankalok, de export-ceramiek van Siam.* Lochem. de Tijdstroom.

RICHARDS, R. (1977) *Thai ceramics : Ban Chiang; Khmer; Sukothai; Sawankhalok ceramics, the Art Gallery of South Australia.* Adelaide. Art Gallery of South Australia.

SPINKS, C.N. (1959) *Siamese pottery in Indonesia.* Bangkok. Siam Society.

SPINKS, C.N. (1971) *The Ceramic wares of Siam.* Bangkok, Siam Society.

STANBURY, M. (1979) *Catalogue of Dutch Relics.* Fremantle. Department of Maritime Archaeology, Western Australian Museum. Special Publication.

VIRAPHOL, S. (1977) *Tribute and Profit : Sino-Siamese Trade, 1652-1853.* Cambridge (Mass). Harvard East Asian Monographs, 76. Harvard University Press.

VOLKER, T. (1979) The Sawankhalok story retold. *Mededelingenblad Nederlandse Vereniging van Vrienden vande Ceramiek*, 93:1-52.

WAGNER, B.A. (1979) Stylistic Evidence for a Re-dating of Sawankhalok painted cover boxes. *Oriental Art*, 25-4:482-91.

WATT, J.C.Y. (1971) South East Asian Pottery - Thai in particular. *Bulletin Art Gallery of South Australia*, 52-4:1-6

WILLETTS, W. (1973) *Ceramic art of Southeast Asia : The Southeast Asian Ceramic Society First Annual Exhibition, the Art Museum, University of Singapore, June-July 1971.* Singapore, Southeast Asian Ceramic Society.

WOODWARD, H.W. (1976) The Dating of Sukhothai and Sawankhalok Ceramics : some consideration. *J. Siam Society*, 66:1-7