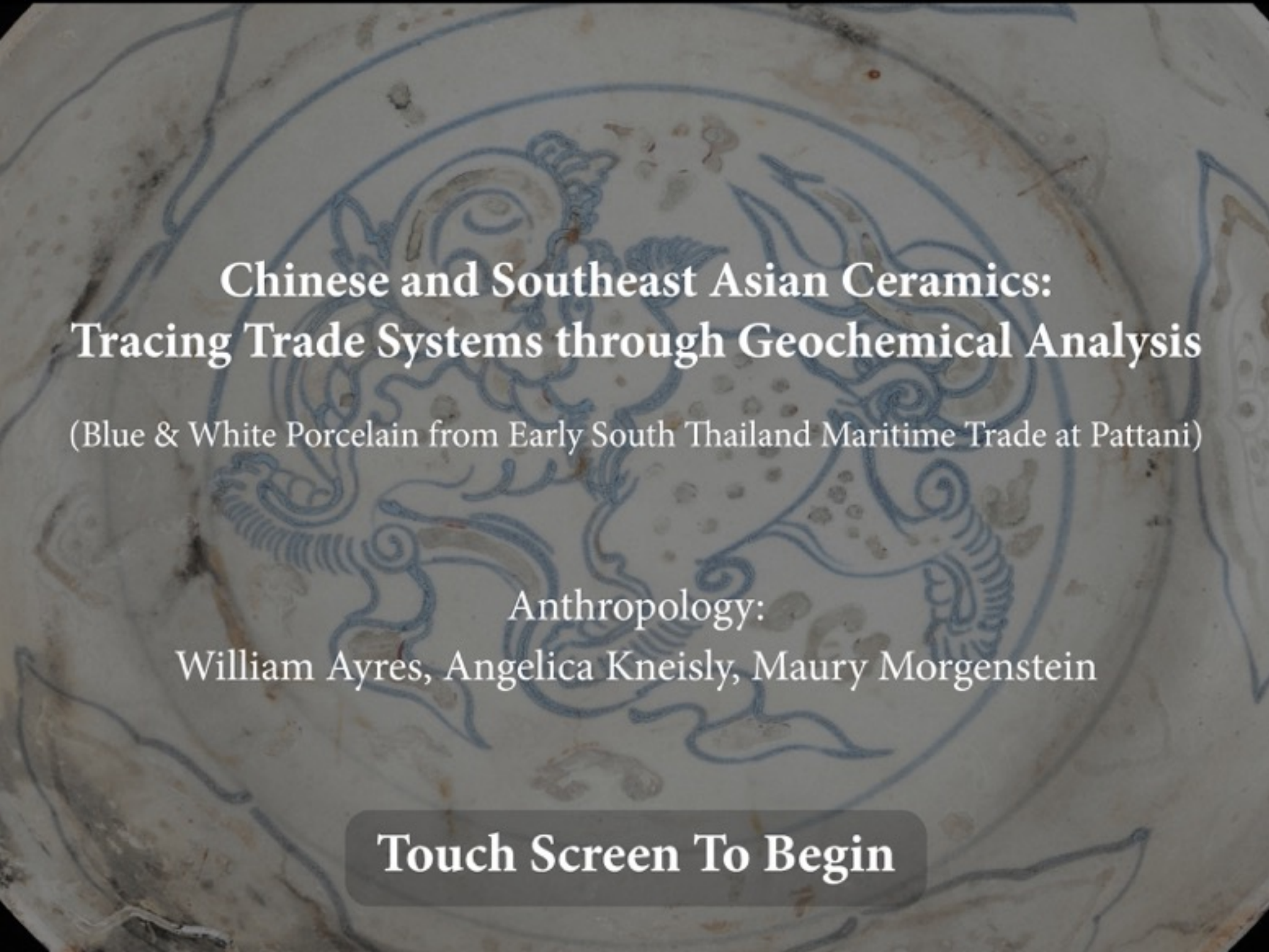


The background of the slide is a close-up of a blue and white porcelain plate. It features a central circular medallion containing a stylized dragon or mythical creature, surrounded by swirling cloud patterns. The porcelain has a slightly aged, off-white appearance with some minor staining and wear visible around the edges and within the design.

Chinese and Southeast Asian Ceramics: Tracing Trade Systems through Geochemical Analysis

(Blue & White Porcelain from Early South Thailand Maritime Trade at Pattani)

Anthropology:

William Ayres, Angelica Kneisly, Maury Morgenstein

Touch Screen To Begin

Acknowledgements

Ayres wishes to acknowledge the efforts of Ajarn Khate Ratanajarana, the Rector's office, and the Center for Southern Thai Studies, of the Prince of Songkla University, Pattani, Thailand, and also Ajarn Amara Srisuchat, for assistance with the original field study. The research was supported in 1985 as well by the Thai-US Fulbright program. Dr. Maury Morgenstein provided the equipment and supervised the XRF and Raman analysis. Angelica Kneisly and Sam Eat participated in several aspects of the research while students at the University of Oregon.

Research Guide

Introduction

Chinese and Southeast Asian Ceramics: Tracing Trade Systems through Geochemical Analysis

Interpreting the significance of early ceramics as material culture has long attracted archaeological and art historical investigation. These studies have traditionally focused on comparison of such attributes as pottery vessel size and shape, color, and manufacturing details to delineate chronology and cultural affiliation. In many cases, trade relationships can be understood in this way.

Southeast Asia has a wealth of highly sophisticated pottery remains spanning over 8000 years and including earthenware, later stoneware, and finally, within the last few hundred years, porcelain production. The archaeological and historical records attest to the importance of traded ceramic products that reflect their involvement in a global network and economy.

The museum and archaeological specimens exhibited here reflect the on-going interest in early pottery remains and include application of contemporary scientific methods to consider issues about provenance, age, and stylistic relationships in new ways.

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Research Guide

**Sherd Imagery
and Details**

**JSMA Artworks
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**Archaeological
Specimens from
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Southern Thailand Sites and Collection: Pattani

Archaeological specimens, pot sherds, considered here are from an archaeological and historic site near the present town of Pattani, South Thailand. This coastal area on the Gulf of Thailand has been continuously occupied for more than 2000 years, but the location has shifted from inland, up-river down towards the present coast line as the shore prograded. Thus, ancient ports involved in trade are today inland as the coastline has migrated to the east compared to today. Transport of trade goods by elephant caravans across the peninsula from the west coast of what is now Thailand and Malaysia to Pattani is historically known. The international maritime trade from East and South Asia included coastal ports such as Pattani.

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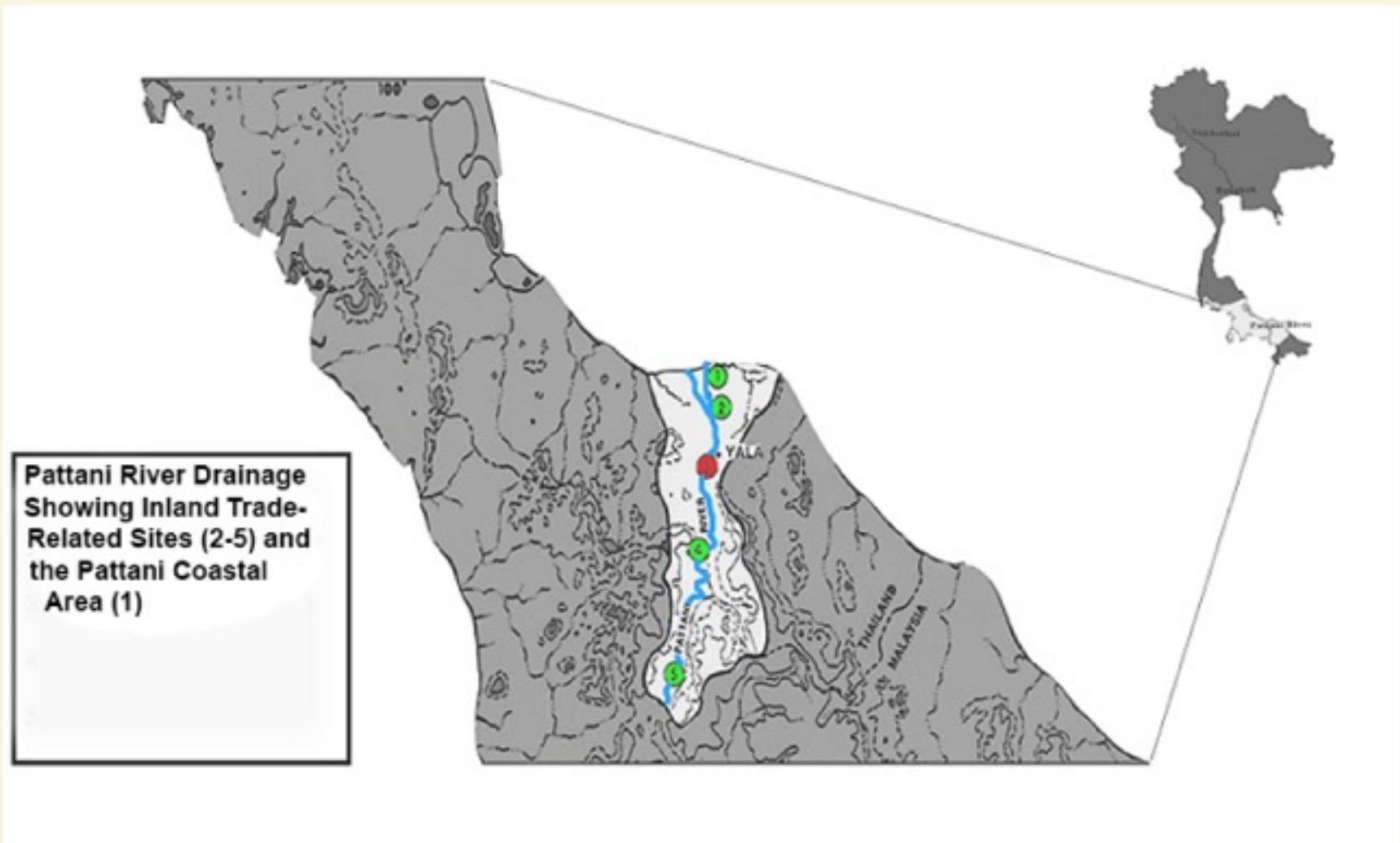
Map of Southeast Asia



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Pattani Map River Drainage

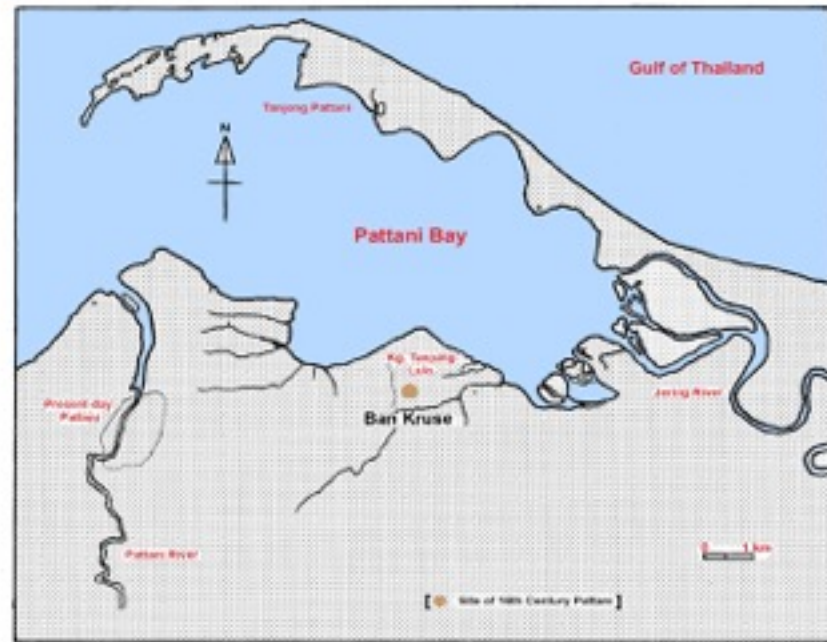


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Map of the Pattani coast showing the 16th to 18th century trade center and the ruler's residence area near Ban Kruse.

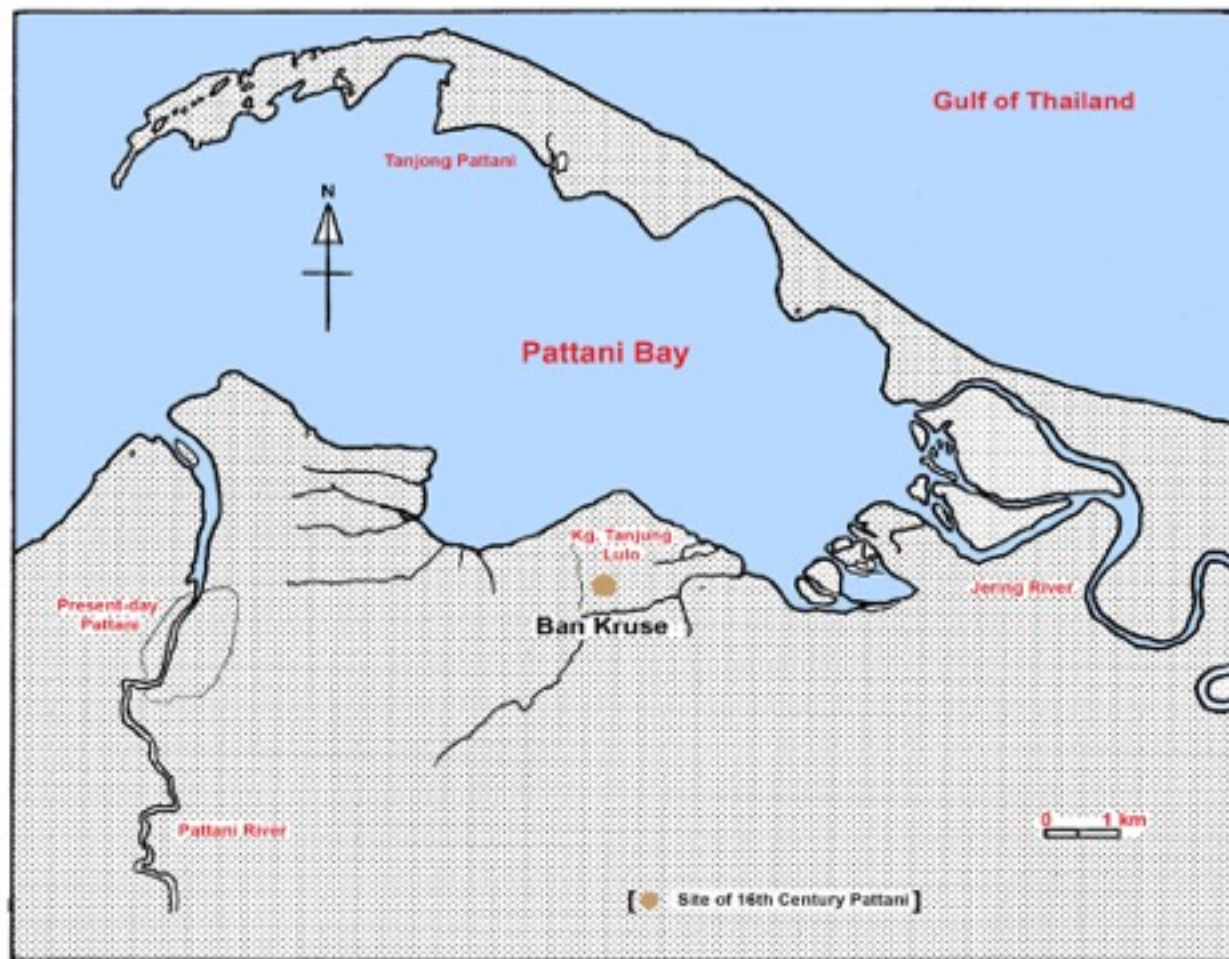
(after Welch and McNeil 1989; Bougas 1990)



Tap Map for Larger Image

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The Pattani coastal area at Ban Kruse. This area is somewhat inland today but provided protected space for foreign trading “factories” and access via river and canal to storage sheds for trade goods in the 16th century and later.



Left: view of Pattani River as it enters the coastal plain.

(photos: W. Ayres)

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Existing archaeological collections provide only broken pot pieces (sherds) and these come from the site surface, as no excavations have been done in the coastal trade centers. There is thus limited information about pottery age from the archaeological context. The place is the ancient site area of Kerisik, including Ban Kruse, located near the present city of Pattani. The specimens on display here include porcelain (with Blue-and-White underglaze decoration), various stoneware pieces (many with Blue-and-White design, one of green glaze, a celadon type), and an earthenware sherd (one with a stamped design indicating an age of some 1000 years).

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On View: 13 Sherds from the Pattani Surface Collection (PAT-series and BK-series)



PAT 09



T-BK-13



PAT 02



PAT16



PAT 18



PAT 24



PAT 22



PAT 23



PAT 25



PAT 03



PAT 27



PAT 28



PAT 01

Tap Image for More Information

Guide

Summary

Pattani Sherds:

PAT 09 - small bowl base
Jingdezhen kiln core cluster (Sr-Rb-Zr)

Pigment Group 1b
High Si (Silicon), low Ca (Calcium)
and Al (Aluminum).



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Pattani Sherds: Ban Kruse site, "BK."

T-BK-13 –small bowl base
Zhang Zhou kilns Grp 1 (Sr-Rb-Zr)

Pigment Group 1a
Porcelain/stoneware
High Si, mid Al, low Ca.
(compare JSMA 23.68)



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Pattani Sherd:

PAT 02 – bowl base
Zhang Zhou Grp 2 (Sr-Rb-Zr)

Pigment Group 1b
Low Si and Al, mid Ca.
Compare PAT-22.



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Pattani Sherds:

PAT 16 – small bowl rim
Jingdezhen kiln core cluster
(Sr-Rb-Zr)

Pigment Group 2
Mid Si and Ca, low Al.



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Pattani Sherd:

PAT 18 – plate base
Jingdezhen kilns core cluster
(Sr-Rb-Zr)

Pigment Group 1a
Mid Si, Ca, and Al.



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Pattani Sherd:

PAT 22 – small bowl body
Jingdezhen kilns outlier cluster
(Sr-Rb-Zr) Stoneware or coarse
porcelain

Pigment Group 1a Low Si and Al,
mid Ca (see PAT 02).



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Pattani Sherd:

PAT 24 - plate

Jingdezhen kilns core outler
cluster (Sr-Rb-Zr)

Pigment Group 2a

Porcelain Mid Si, Ca, and Al.
(compare JSMA1981:11)



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Pattani Sherd:

PAT 23 – cup or small jar
Jingdezhen kilns core cluster

Pigment Group 1a
Mid Si, Al and mid-low Ca
concentrations.



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Pattani Sherds:

PAT 25 – bottle neck
Jingdezhen kilns core
cluster based on Sr-Rb-Zr
2nd half of 14th century;
perhaps Yuan Dynasty

Pigment Group 1b
High Si; low Ca and Al.



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RED-GREEN PIGMENT

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Sets for non blue-and-white
examples:

PAT 03 – bowl body
Jingdezhen kiln cluster core outlier

Green-red pigment
Pigment Group 3 Pb



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Pattani Sherd:

PAT 27 – jar rim

Jingdezhen kiln cluster core outlier

Green-red pigment; Stoneware
Pigment Group 3 Pb sky blue, but
not from cobalt Pigment Group 3
Pb green, brown



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Green Glaze Set

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Pattani Sherds:

PAT 28 - open bowl rim
Northern Thai Production
Pigment Group 2 green



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Earthenware-complex stamping

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Pattani: from a concentration of sherds
at Ban Kruse.

PAT 01 – jar neck

Group: Earthenware; local production

Compare to PAT 11

Neck sherd from large restricted-mouth
pot No glaze, so comparisons limited.



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“Chinese and Southeast Asian Ceramics— Tracing Trade Systems through Geochemical Analysis”

Methods of Analysis include:

- > Comparative study of form
- > Compositional Analysis
- > Low power magnification of ceramic paste
- > Thin sections for microscopy
- > PEDXRF spectrometry (Portable Energy Dispersive X-ray Fluorescence, Niton models XLt 592KY and XL3t Gold ++).
- > Raman analysis using laser technology

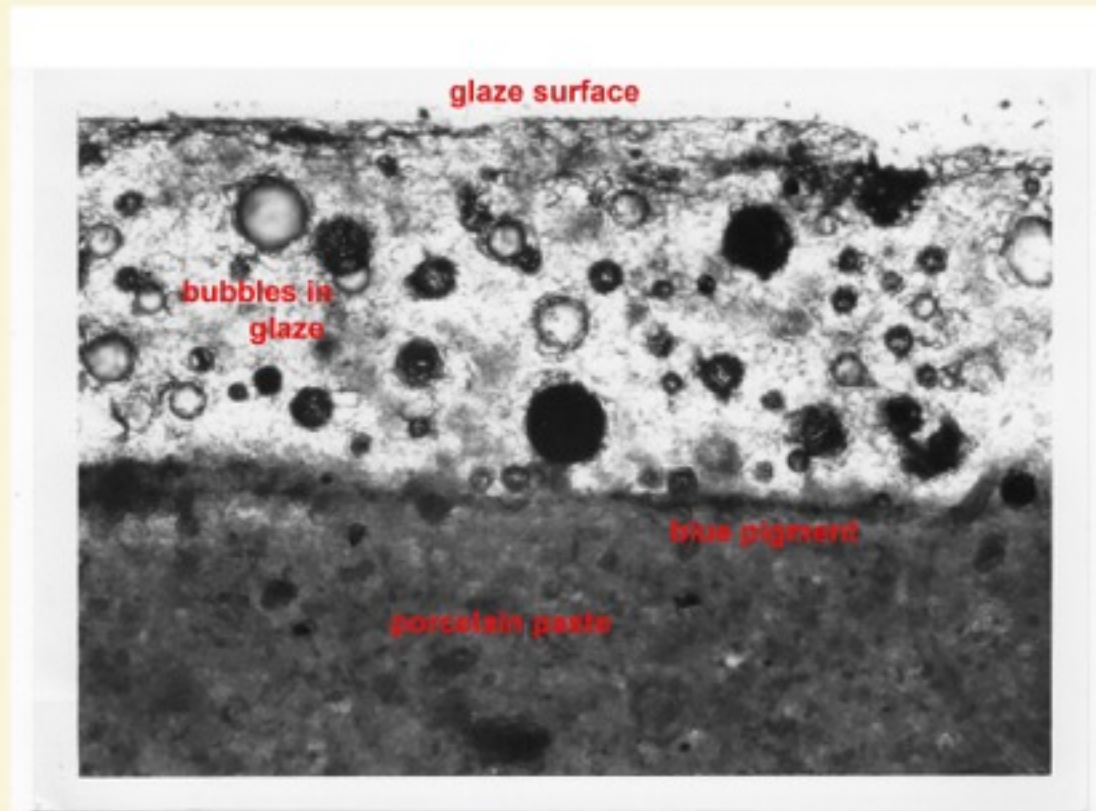


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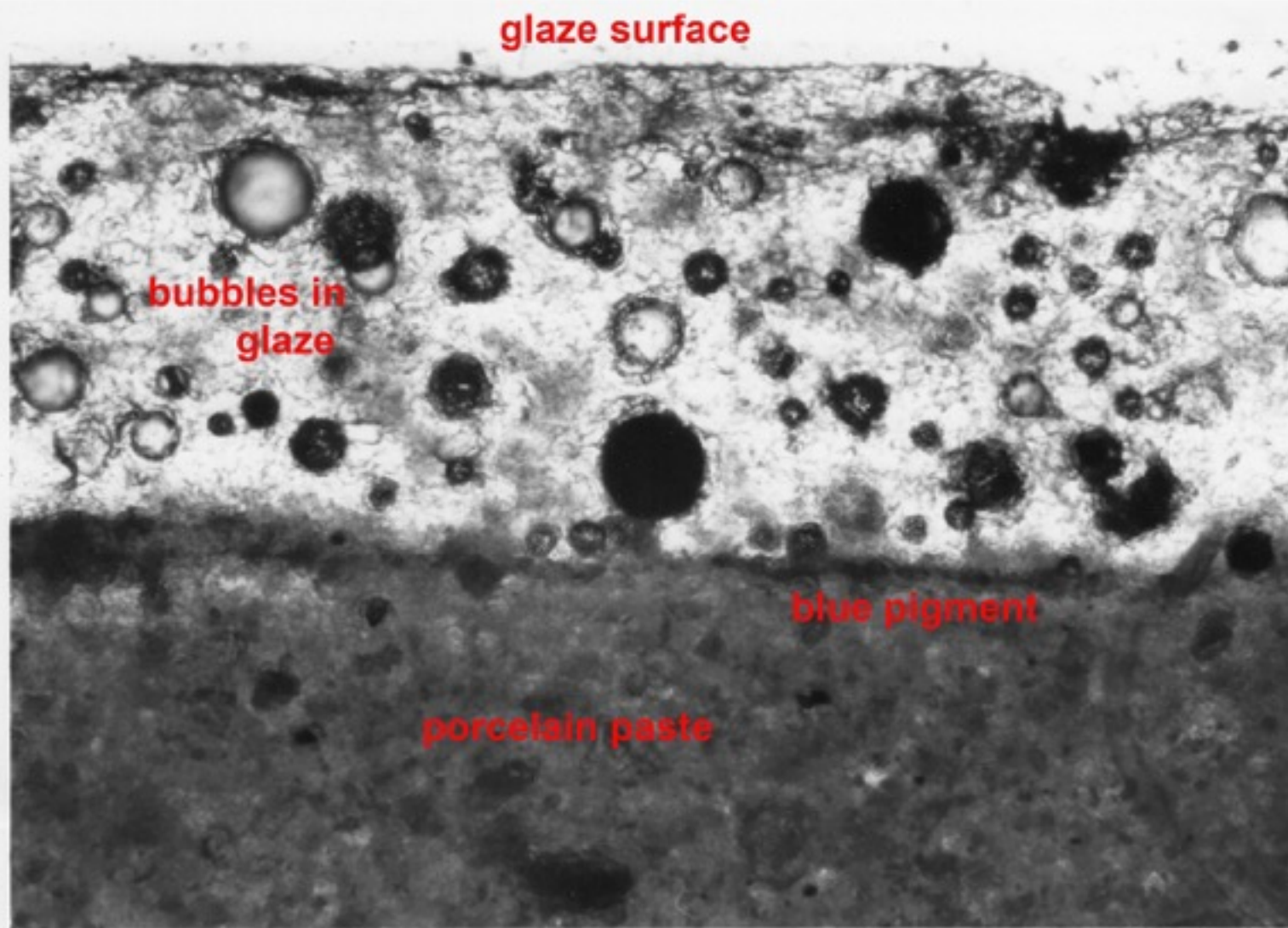
Tap Image for Larger View

Petrographic thin section for microscopic analysis
of porcelain showing glaze bubbles and pigments

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**JSMA specimens for EXHIBIT: “Chinese and Southeast Asian
Ceramics—Tracing Trade Systems through Geochemical Analysis”?”**

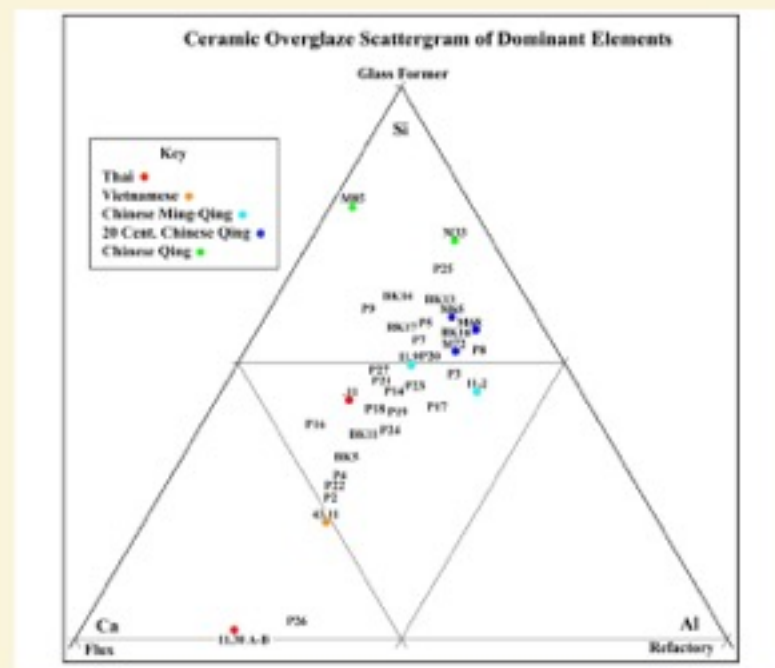
Text and plots for EDXRF and Raman distributions

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EDXRF measurement of ceramic overglaze for the sherds and vessels on exhibit. Dominant elements include Ca (Calcium), Si (Silicon), and Al (Aluminum). These correspond to Flux, Glass Former, and Refractory attributes. This plot shows the full complement of measured sherd samples. Selected sherds on exhibit are discussed throughout this presentation.

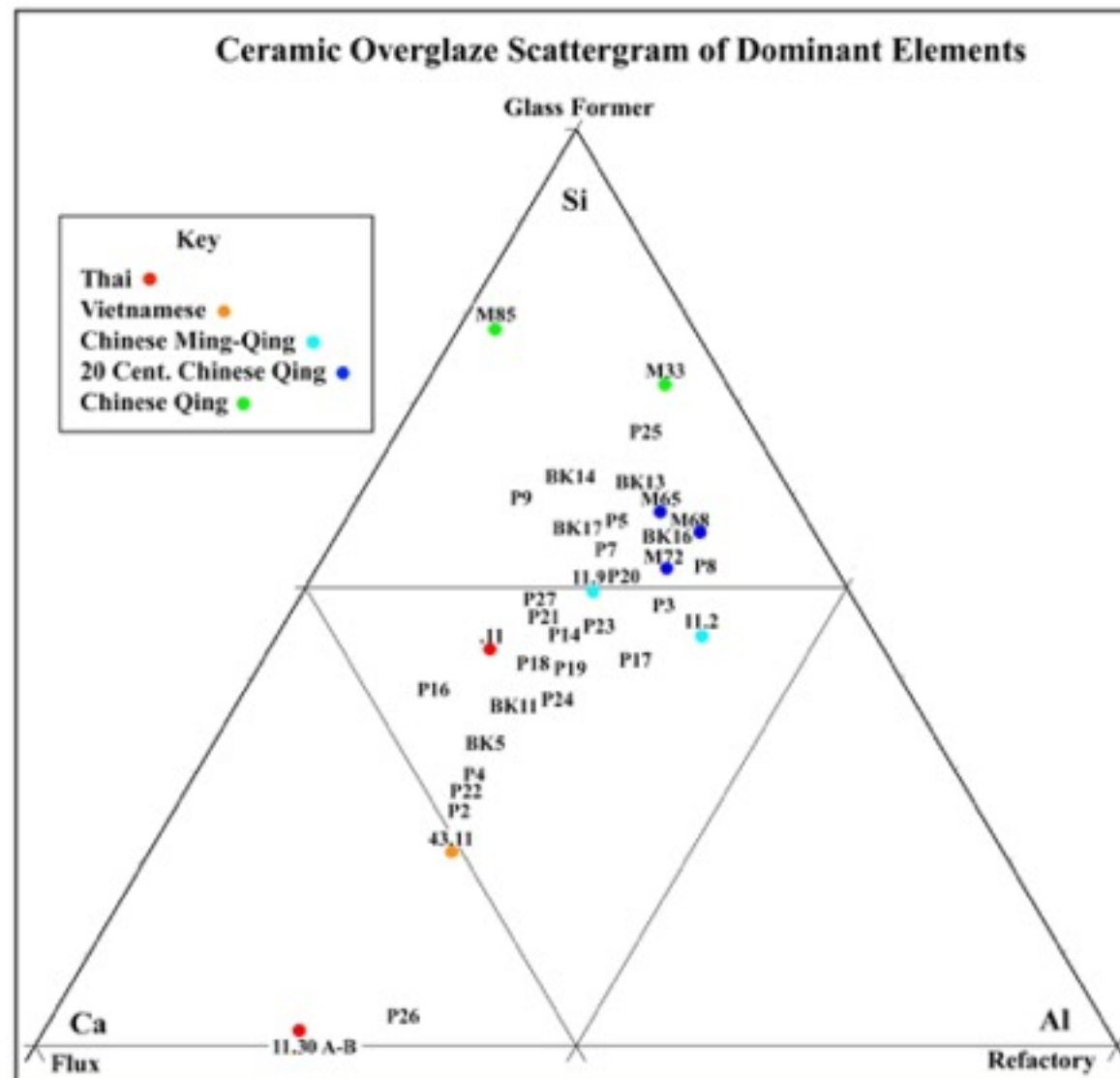


Tap Graph for Larger Image

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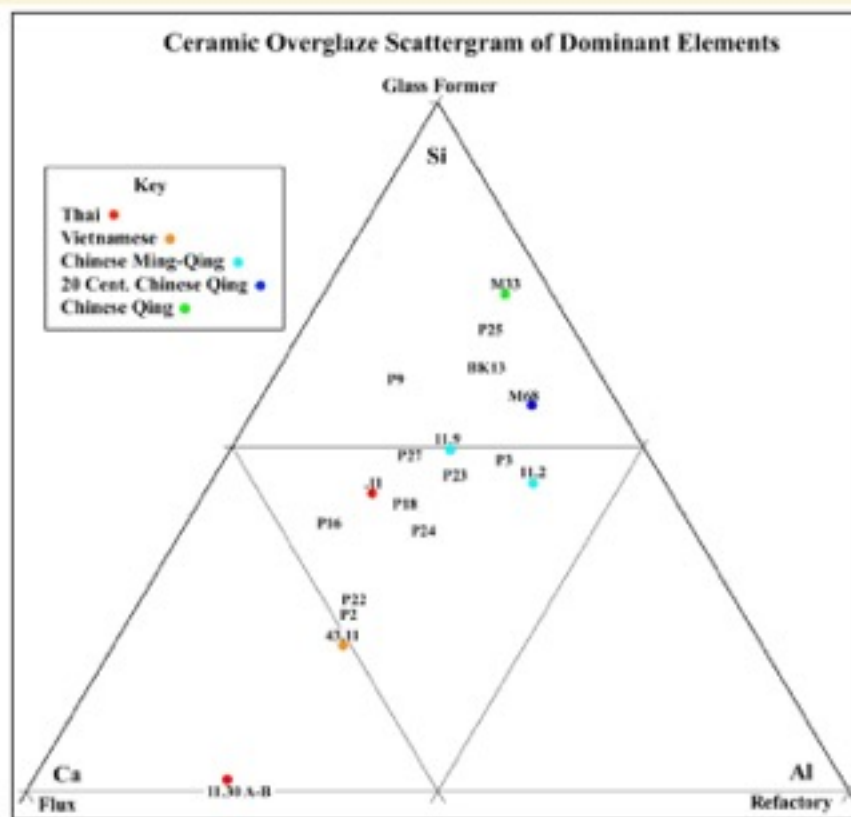
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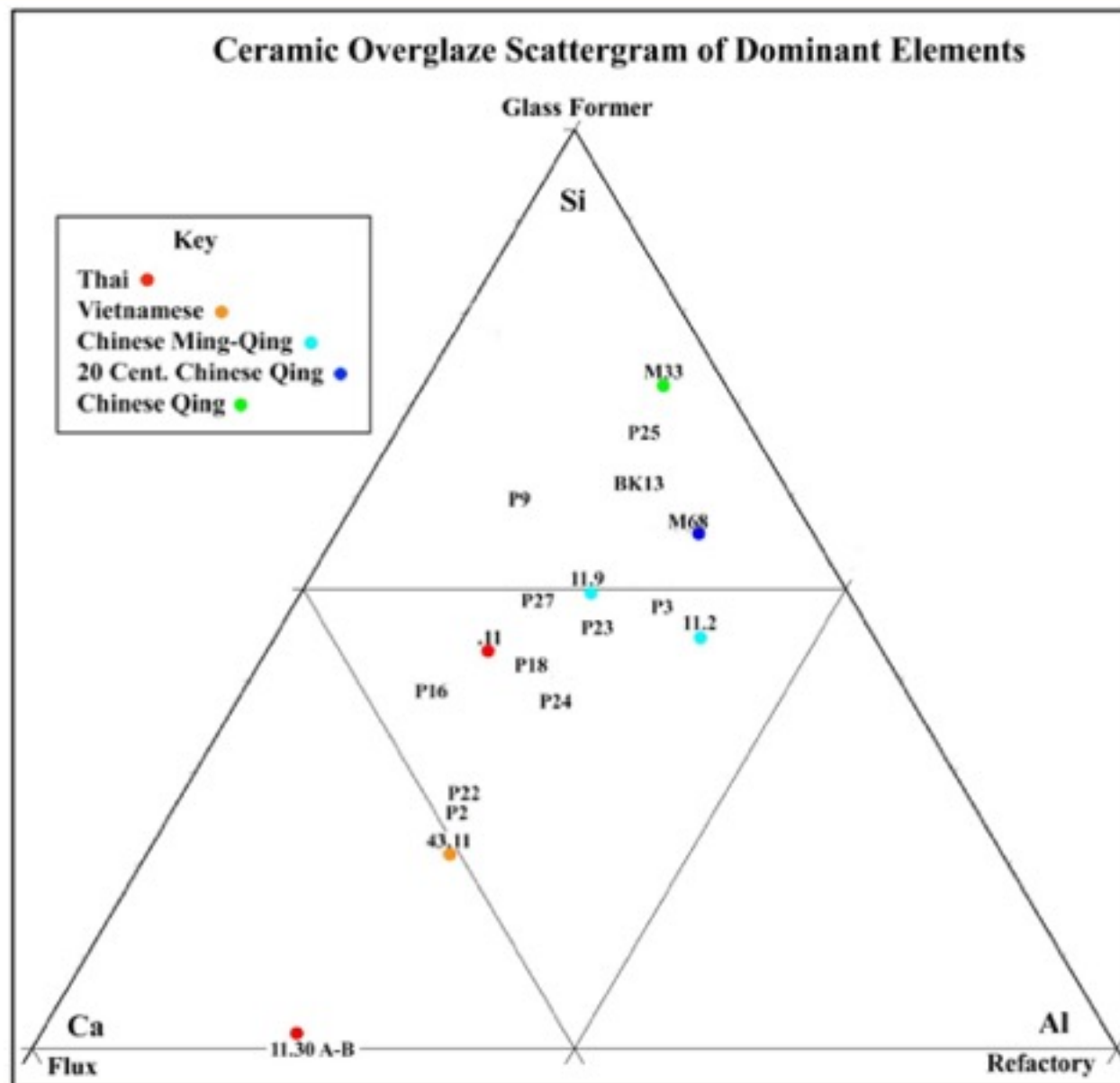
Tap Graph for Larger Image

EDXRF Measurement of Ceramic Overglaze
for the sherds and vessels on exhibit

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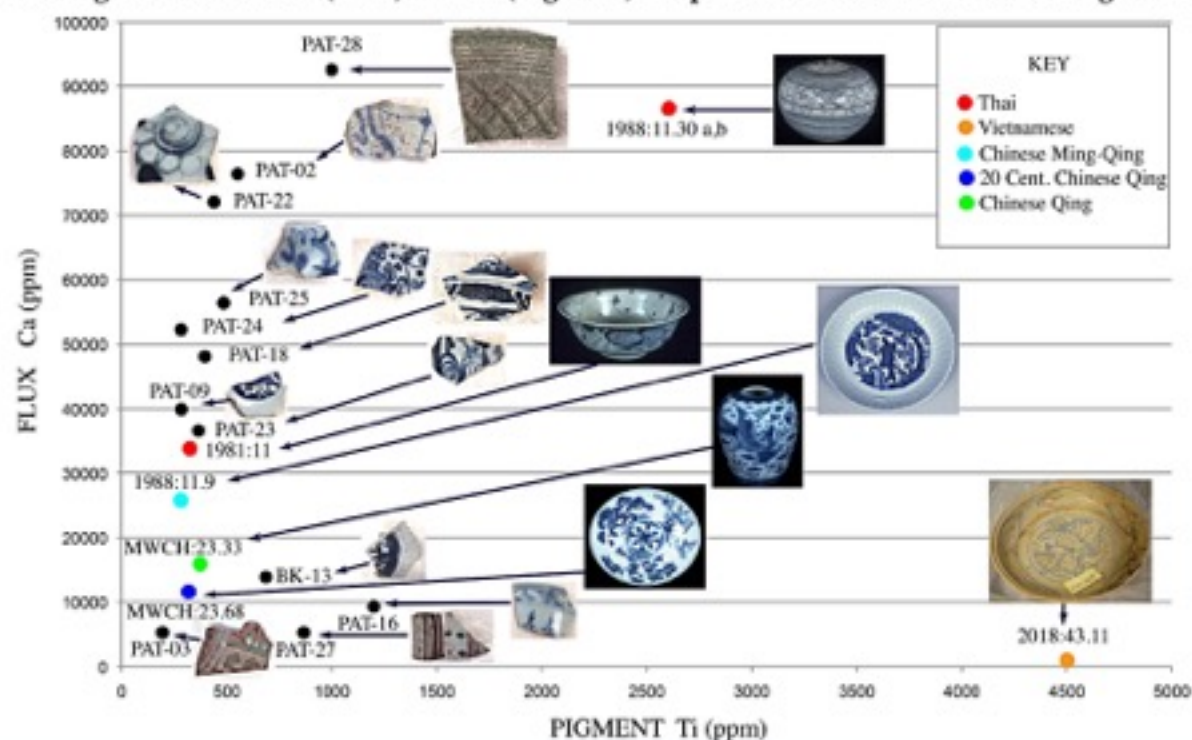
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Scattergram Plot for Ca (Flux) and Ti (Pigment) for pEDXRF Data from Glaze + Pigment



Tap Graph for Larger Image

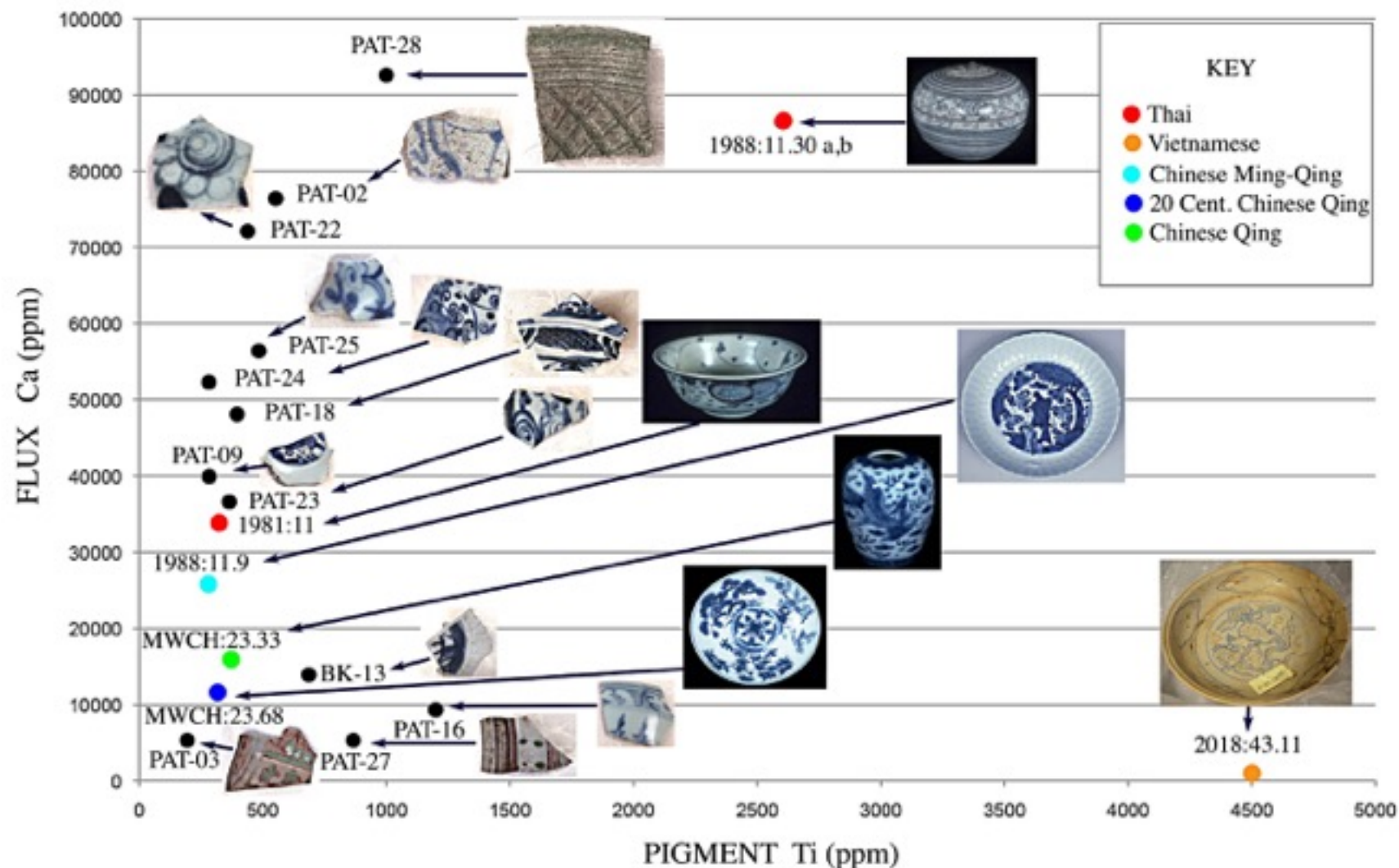
Plot showing Ca and Ti comparisons for glaze and pigment in selected porcelain pieces.

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Scattergram Plot for Ca (Flux) and Ti (Pigment) for pEDXRF Data from Glaze + Pigment



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Ceramic Artworks in the Jordan Schnitzer Museum of Art Collection



2018:43.11



MWCH 23.68



1988:11.9



1981:11.30a,b



1981:11



MWCH:23.33

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JSMA Blue-and-White Collection 2020

Large shallow bowl or plate with Lion, Ball and Stylized Floral Lozenge Design. Vietnamese; 15th century as it was salvaged in 1999 from the Hôi An Wreck in Vietnam.

Stoneware with underglaze cobalt blue and red/brown(?) decoration.

Pigment Group. This shows that it is not Jingdezhen, but a ZZ Sr-Rb-Zr outlier. Very low Co and Pb, but high Ti in scatterplot for pigment. (Compare the 1988:11.30a,b piece). The overglaze scattergram shows this piece most closely plotting with the same small jar.



*H. 2-7/8 x Diam. 13-5/8
inches; Gift of H P Lin JSMA
CAT 2018:43.11*

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JSMA Blue-and-White Collection 2020“M68” in
overglaze scattergram

Medium dish or plate, Blue-and-White, Chinese; Qing
dynasty, Daoguang period, dated 1848, [actually early
20th century]

Blue and white ware; Circular Dish with Three Friends
of Winter and Swirling Cloud Design; porcelain with
decoration painted in underglaze cobalt blue.

Pigment Group 1a; this falls into the center of the
cluster in the plot of Si-Ca-Al. High Si content in
glaze, low Ca, and low to mid Al. For the plot of Sr-
Rb-Zr, 23.68 falls into the core area considered to
be Jingdezhen kilns. This is the same provenance for
MWCH:23:33.



Medium plate
H. 1-1/4 x Diam. 6-1/8
inches; Murray Warner
Collection JSMA CAT
MWCH:23.68

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JSMA Blue-and-White Collection 2020 - “11.9” in overglaze scattergram.

Blue and white ware; molded porcelain with decoration painted in underglaze cobalt blue (high cobalt blue pigment). Dish with Foliate Rim and Bird and Flower Design. Chinese; Ming - Qing dynasty, 17th century.

Pigment Group 1a. It lies in the center of the distribution for Si-Ca-Al (Mid SI; mid-low Al; mid-low Ca), along with M68 and M33, and 11.2. For the Jingdezhen Sr-Rb-Zr plot is an outlier with regard to the Jingdezhen clustering.



*Blue-White plate
H. 1-15/16 x Diam.
8-1/16 inches; Gift of John
and Emiko Kageyama
JSMA CAT 1988:11.9*

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JSMA Blue-and-White Collection 2020

Blue-and-White ware; Sawankhalok Round Box with Stylized Floral Design Stoneware with underglaze decoration; probable Thai production (contrast with 1988:11.9 (which is also identified as “Thai” but is probably a Chinese manufacture based on the Sr-Rb-Zr plot and the Ca Flux x Ti Pigment plot) 1988:11.30a,b is not a Jingdezhen production. Based on the overglaze scattergram, Si-Ca-Al; very low Si, and Al; high Ca.

Pigment Group xxxx; it lies outside the typical Jingdezhen clustering for Si-Ca-Al and for Co-Ti-Pb Pigment scatterplot showing high Ti and low Pb and Co. This ranks as a Zhang Zhou outlier (with BK5 and P2) and may be a Thai manufacture. (contrast cat 1988:11, also “Thai” which is Jingdezhen core) Thai; circa 1400



*H. 2-3/4 x Diam. 3-3/4 inches
Gift of J. and E. Kageyama
JSMA CAT 1988:11.30a,b*

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JSMA Blue-and-White Collection 2020

Bowl with Stylized Floral Design;
Sawankhalok ware; stoneware with iron oxide
decoration. Thai, late 18th – early 19th century.

Pigment Group 1a;
Jingdezhen Sr-Rb-Zr core; this implies that this
bowl is not a Thai production as stated in the
Museum catalog.

Thai manufacture is doubtful as it falls into the
core area of the Jingdezhen clustering, mid Si
and mid Ca; low Al. It also fits with the Cobalt
rich pigments in the Co-Ti-Pb plots.



*H. 2-3/4 x Diam. 5-3/4 inches
Gift of Florence A. Jessup, in
memory of Gretchen Jessup
Riley JSMA CAT 1981:11*

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JSMA Blue-and-White Collection 2020 – “M33” in overglaze scattergram.

Small jar, Blue-and-White; Chinese, Qing Dynasty; 19th century. Blue and white ware; Dragon and Phoenix Design; porcelain with decoration painted with underglaze cobalt blue Pigment group is 1a; it lies outside of the central cluster in the plot of Si-Ca-Al. Highest Si (Silicon) content in glaze; relatively low Ca (Calcium) and Al (Aluminum). Jingdezhen kilns production area.



*Small Jar
H. 3-1/8 x Diam. 2-11/16
inches; Murray Warner
Collection JSMA CAT
MWCH:23.33*

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**“Chinese and Southeast Asian Ceramics—
Tracing Trade Systems through Geochemical Analysis”?**

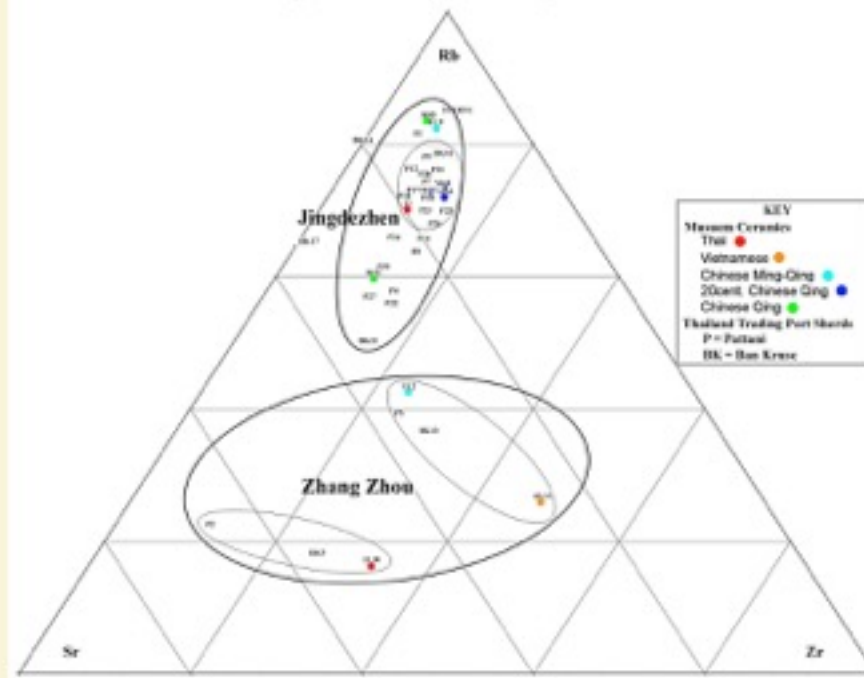
**Summary and Conclusions Regarding the Provenance and
Significance of the Pattani Collection**

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Methods & Analysis

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Manufacture Location Determined by pEDXRF Spectrometer:
Scattergram for Rb (ppm), Sr (ppm), and Zr (ppm)
From White Underglaze + Clear Overglaze + Paste



Tap Graph for Larger Image

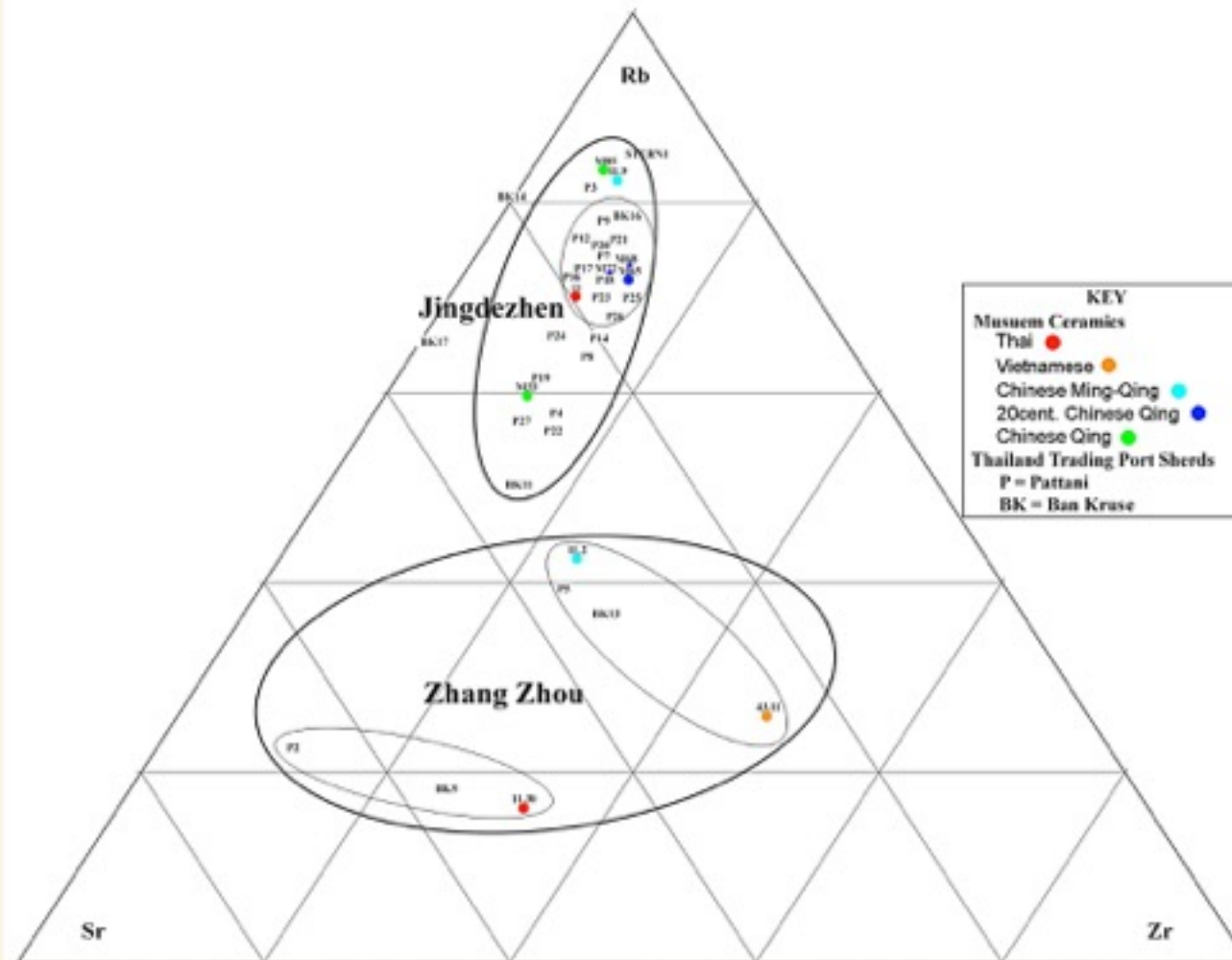
Shows tri-plot of three significant elements for comparing early porcelain. At least two key centers for early Chinese porcelain production are distinguished.

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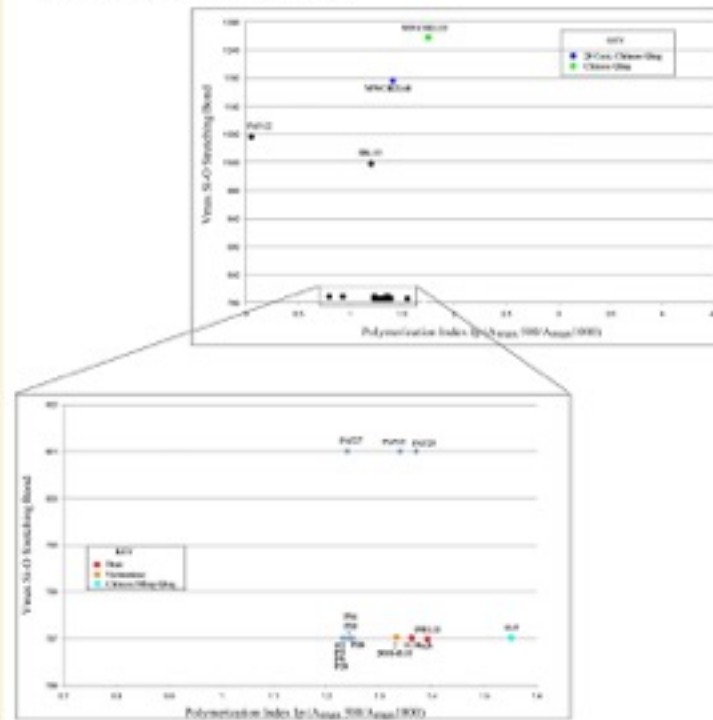
**Manufacture Location Determined by pEDXRF Spectrometer:
Scattergram for Rb (ppm), Sr (ppm), and Zr (ppm)
From White Underglaze + Clear Overglaze + Paste**



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**Polymerization Index for Ceramic Glazes Using 532nm Laser Excitation:
Determining Ceramic Chronology**



Tap Graph for Larger Image

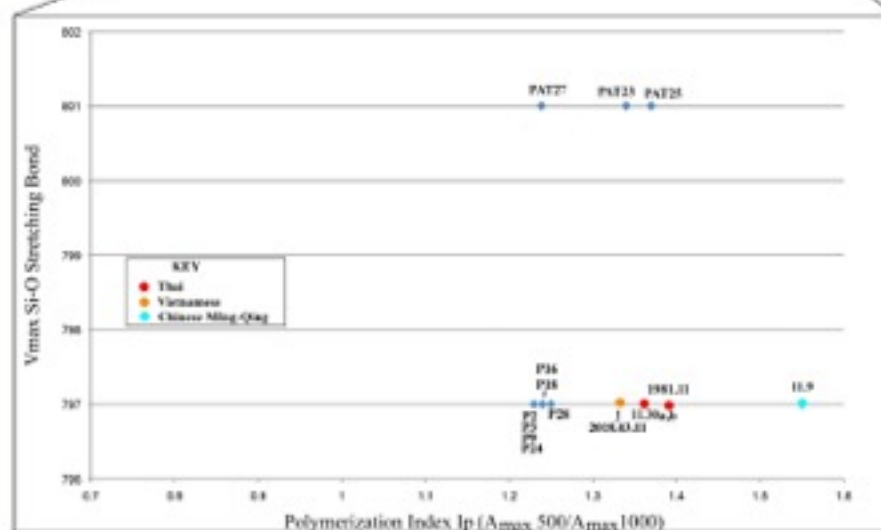
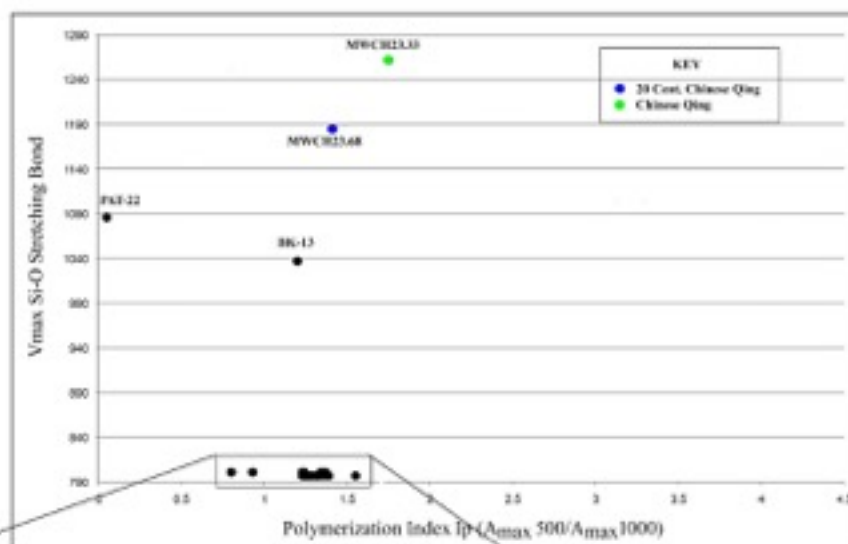
Raman laser analysis of sherds showing two main contrasts in glazes and chronological comparison.

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Polymerization Index for Ceramic Glazes Using 5.32nm Laser Excitation: Determining Ceramic Chronology



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“Chinese and Southeast Asian Ceramics— Tracing Trade Systems through Geochemical Analysis”

Raman laser excitation analysis (see plot above) suggests that two age groups can be distinguished:

Late Group (13): including 20th century Qing (23.65); Qing (23.33, 23.68, 23.85, and probably BK-05, BK-11); and Ming-Qing (11.2, 11.9, 11.30), a group of 9.

Somewhat earlier (4) within this grouping of 12 we could include museum pieces 23.65; and 23.72, and sherds PAT-22 and BK-13.

15th Century or earlier (16): including the Vietnam vessel (43.11) and possibly museum pieces 11.2, 11.9, 11.30, 81.11 as well as P4, P7, P20 from the sherd collection, a group of 8.

Dating to somewhat later within this grouping we could include sherds BK-14, BK-16, BK-17, PAT-23, 25, 26, 27, and Stern1 (8 total)

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“Chinese and Southeast Asian Ceramics— Tracing Trade Systems through Geochemical Analysis”

Four out of six Blue-and-White vessels held by the JSMA in the exhibit come from the Jingdezhen kilns or production areas. As seen in the tri-plot of Sr (Strontium)-Rb (Rubidium)- Zr (Zirconium), the other two are from the a more generalized “Zhang Zhou” cluster which shows more variability and two subgroups. Catalog 1988:11.30a,b is certainly a Thai manufacture and the 2018:43.11 is a Vietnam product.

Archaeological sherd specimens from Thailand in the exhibit show a preponderance of source data for porcelain and stoneware fitting within the Jingdezhen cluster (10 of the 13), as predicted, but some are from the Zhang Zhou production area (2 pieces). The older earthenware sherd (PAT-1) is a local production.

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“Chinese and Southeast Asian Ceramics—Tracing Trade Systems through Geochemical Analysis”

Some References pertinent to Pattani and the early porcelain trade:

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