DEVELOPMENT OF CERAMICS PRODUCTION IN AYUTTHAYA

By
Pakpadee Yukongdi

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree
DOCTOR OF PHILOSOPHY
Program of Historical Archaeology
Graduate School
SILPAKORN UNIVERSITY
2009

DEVELOPMENT OF CERAMICS PRODUCTION IN AYUTTHAYA

โดย

นางสาวภัคพดี อยู่คงดี

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาปรัชญาดุษฎีบัณฑิต

สาขาวิชาโบราณคดีสมัยประวัติศาสตร์

ภาควิชาโบราณคดี

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ปีการศึกษา 2552

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The Graduate School, Silpakorn University has approved and accredited the Thesis title of " Development of Ceramics Production in Ayutthaya " submitted by Miss Pakpadee Yukongdi as a partial fulfillment of the requirements for the degree of Doctor of Philosophy in Historical Archaeology

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A comparative study and typological classification in the archaeological excavation record and ethnological data is applied to interpret archaeological data in explanation the development and change in Ayutthaya ceramic manufacture. Ceramic production of Ayutthaya was located on both banks of the Klong Sra Bua, north of the island city at about the second half of 15th century A.D. Firstly, they produced mainly architectural materials especially tiles probably on royal demand. The ceramic makers as experts in oblong updraft kiln firing technique firstly settled on the western bank of the canal and played their acquainted role of ceramic makers for more than a hundred years. Then a further need for architectural materials brought them to change to a new kiln technology. This would be a semi dome cross draft kiln.This technique was applied throughout the later period of Ayutthaya, dating from the first half of 17th century until the 18th century or the declining of the Ayutthaya kingdom. Apart from architectural materials, various earthen potteries were also produced. Also on the eastern bank of Klong Sra Bua, another ethnic group, whose open bonfire techniques were typically practiced settled and made mainly storage vessels and pots to serve as kitchen ware.

Program of Archaeology Graduate School, Silpakorn University Academic Year 2010
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ภัคพดี อยู่คงดี:DEVELOPMENT OF CERAMICS PRODUCTION IN AYUTTHAYA
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การศึกษาทางโบราณคดีแสดงว่า พื้นที่บริเวณคลองสระบัวด้านทิศเหนือของเกาะเมืองพระนครศรีอยุธยาเป็นแหล่งผลิตเครื่องปั้นดินเผา ด้านทิศตะวันออก เป็นแหล่งผลิตภาชนะที่เรียกกันว่าโอ่งอีเลิ้ง งานปั้นรูปคน สัตว์ และด้านทิศตะวันตก เป็นแหล่งผลิตกระเบื้องมุงหลังคาอาคาร หลักฐานสำคัญที่ยืนยันคือ การค้นพบเตาเผาเครื่องปั้นดินเผา ที่มีรูปทรงและเทคนิคการเผาหลากหลาย โดยมีรูปแบบเตาหลายรูปแบบ ได้แก่ การเผาแบบเปิด คือเผากลางแจ้งไม่มีการสร้างเตา เตารูปสี่เหลี่ยมผืนผ้าขนาดความกว้าง-ยาว ประมาณ 3.5 x 4 เมตร ก่ออิฐ เว้นช่องใส่ไฟตามด้านยาวของเตาด้านละ 4 ช่อง เป็นแนวตรงกัน พบร่องรอยของเถ้าตามแนวของช่องใส่ไฟ ลักษณะการเผาเป็นการระบายความร้อนในแนวดิ่ง (Updraft) อาจกล่าวได้ว่า เตาเผากระเบื้องนี้เป็นรูปแบบที่เก่าแก่ และเป็นที่รู้จักมาก่อนหน้าที่จะมีการสร้างเตาเผากระเบื้องขึ้นใช้ในบริเวณนี้ สัมพันธ์กับสภาพพื้นที่คลองสระบัว ซึ่งเป็นคลองที่ขุดขึ้นในช่วงสมัยอยุธยาต้อนต้น ประมาณต้นพุทธศตวรรษที่ 21

ในระเวลาต่อมา รูปแบบเตาและวิธีการเผาเปลี่ยนแปลงไปจากเดิม เป็นรูปคล้ายเรือท้ายตัด ตัวเตาก่อด้วยอิฐ ด้านท้ายก่ออิฐขึ้นไปเป็นผนังสี่เหลี่ยมไม่มีหลังคา ส่วนด้านหน้าตั้งแต่แนวโค้งของผนังเตา จนถึงปากเตาก่ออิฐเป็นประทุนสำหรับใส่ไฟลักษณะเป็นการเผาโดยใช้ความร้อนผ่านตามแนวนอน (Cross draft) สรุปผลวิเคราะห์ได้ว่าผู้ผลิตกระเบื้องในสมัยอยุธยา ได้รับรู้เทคโนโลยี่การเผาเครื่องปั้นด้วยการใช้เตารูปแบบใหม่ วัตถุประสงค์เพื่อเพิ่มปริมาณการผลิตให้มากเพียงพอกับความต้องการ หรือการขยายตัวทางเศรษฐกิจของอยุธยาที่เพิ่มขึ้น ความต้องการใช้วัสดุก่อสร้างของผู้ปกครองเพื่อสร้างอาคารถาวรวัตถุ ไม่ว่าจะเป็นการขยายตัวของวังของพระมหากษัตริย์ในระยะเวลาต่าง ๆ หรือการสร้าง ขยายวัดวาอารามทั้งในและนอกเกาะเมืองพระนครศรีอยุธยาด้วย ทั้งนี้น่าจะพัฒนาปรับเปลี่ยนรูปแบบเตาเผาในประมาณปลายพุทธศตวรรษที่ 22

ภาควิชาโบราณคดี บัณฑิตวิทยาลัย มหาวิทยาลัยศิลปากร ปีการศึกษา 2553
ลายมือชื่อนักศึกษา.....
ลายมือชื่ออาจารย์ที่ปรึกษาวิทยานิพนธ์ 1. ..... 2. ..... 3. .....

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Chapter I

Introduction

1. Statement and significant of the problems

Ayutthaya, the former capital of Thailand, established by King U-Thong in 1350 A.D., was ruled by 33 kings from 5 dynasties and lasted 417 years. Each king in his turn built his town, fostered Buddhism and culture. From western sources, Ayutthaya was a glorious city with beautiful landscapes, crowded inhabitants and served as an international port with continuous flows of sea-faring ships. Ayutthaya had been one of the great port cities of Asia, with trade routes stretching from Persia to China, and a political and economic hinterland focused on the basin of the Chaophraya river system. The society of this hinterland had evolved over prior centuries and people clustered in city-states. Society was organized around personal ties of service and protection. However, it is changed with an era of warfare from the thirteenth to sixteenth centuries, which saw the emergence of a powerful militaristic kingship buttressed by Brahmanical ritual, trading profits, and systems for marshalling forced labor. In the seventeenth century, this social and political order began to shift with the expansion of the commercial economy, a loosening of labor ties, the emergence of an aristocracy, and the new vitality of Theravada Buddhism.[1]

All aspects of architecture, religion, medicine, government, external relations, traditional court ceremonies, agriculture and economics

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[1] Chris Baker and Pasuk Phongpaichit, A History of Thailand, (Port Melbourne: Cambridge University Press,2005)

reached their peak during the Ayutthayan period, resulting in more prosperity and wealth. These riches also brought with them a number of enemies focusing on robbing the wealth and capturing slaves. The kings had to fight at least 70 battles, in which the two major defeats left the city empty, temples and palaces burnt to the ground, together with the nation written testimony of the past. Many historical records refer to plenty of temples and buildings being constructed and existing everywhere in the city. Although only ruins of those constructions still remained more than five hundreds of temples and others buildings were said to be visible within the past hundred years. It comes to the question of where people found sufficient construction materials, such as woods, bricks, tiles, all necessary for a baked-clay based infrastructure to match their needs.

The most well-known historical record among Ayutthayan historians that mentions about Ayutthaya ceramic production is The "Record of Ancient Architecture in Ancient Phra Nakhon Si Ayutthaya". Written a short while after the decline of Ayutthaya, it states that *"...above the city island there were 5 villages, one of which were making potteries, various kinds of tiles, limes and liqueur. This area was called Thung (field) Kuan and the opposite area called Thung Kaew..."*[2] These were described by Prayaboranratchatanin (Porn Dechakhup), a senior scholar as the area along the man-made Klong Sra Bua canal. It comes to the primarily assumption that there might have existed a factory producing architectural materials which processed adequate supplies for building construction needs of Ayutthaya. However this might not be enough to conclude the fact unless further evidence is acquired.

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[2] พระยาโบราณราชธานินทร์, รวมเรื่องกรุงเก่า, (พิมพ์ในงานพระราชทานเพลิงศพนางสาวเพ็ญ เดชะคุปต์ เป็นกรณีพิเศษ) , กรุงเทพฯ : 2541,107

For many years, Ayutthayan researchers focused on the history of the kingdom, and the political, economic, trade and foreign relations. Archaeological work in Ayutthaya also has been aimed at uncovering abandoned monuments, mostly temples, rarely approached in prior topics. For the moment, no other studies were recorded, until 1999 when the Department of Fine Arts was pointed out a project to study this specific issue. Archaeological processes began in A.D.2000 and ended in 2002. The head of this project was Mr. Sod Daeng-ied, the director of the third regional office of Archaeology and National Museum, which I, myself, was a conductor in charging in archaeological and ethnographical works.

1.1 Archaeological work

Primarily ground surveys had been performed to locate features and artifacts that were able to identify kilns and other features that were linked to ceramic production. It is found that there were a number of surface finds associated to kilns, especially wasted fragments of vase product of earthen potteries and tiles. These artifacts are found along both sides of Klong Sra Bua, stretching to the northern area of Klong Bang Kuad, and among human habitations and their ancient monasteries. Some features of kiln construction were found scattered in the area Pa-niead, or “The elephant trail of Ayutthaya”. It might then be assumed that there is a possibility to future finds the kilns of Ayutthaya pottery and tile.

1.2 Ethnological survey

In present day there are some kilns that still in use by local peoples. Their products are earthen potteries, tiles and also bricks. There are also many kilns have been left unused and abandoned, but only one of earthen pottery kiln is currently in use. It is located in the middle area of Klong Sra Boa. This present is an updraft kiln. It consists of two parts, two to three meters square firing chamber, having one or two clay grates underneath which connect to the fire box at one side. This type of kiln can produce either

earthen tiles or potteries. After the inspection of this kiln, it appears that the production of earthen pottery is not in fashion nor need in the present.

In comparison, many productive baked-brick kilns have been found in the northern area of Klong Bang Kuad and further north. This shows that that brick making is more economically preferable. These pottery and brick makers say that their ancestors settled down in this northern part of Ayutthaya for hundreds of years and were ceramic producers for a long period of this time. It was in doubt whether these people were a new generation of old Ayutthayan people who came back to their home town and continued their expert workmanship. Lf this is correct, the study to understand the entire process of Ayutthaya ceramic production shall be clearly identified.

2. Goal and objective

2.1 To study ceramic and describe whole process of Ayutthaya ceramic production in Klong Sra Bua and Klong Bang Kuad kiln sites, Phra Nakhon Si Ayutthaya through archaeological and ethnographic data.

2.2 To explain the development and change in Ayutthaya ceramic manufacture.

2.3 To identify cross-cultural regularities and variability in production systems in Klong Sra Bua and Klong Bang Kuad sites, Phra Nakhon Si Ayutthaya (trace the origin and influence of ceramic manufacture)

3. Scope on delimitation of the study

3.1 Archaeological evidences from the Department of Fine Arts' excavations in 1999 - 2002 at Klong Sra Bua and Klong Bang Kuad kiln sites, Phra Nakhon Si Ayutthaya.

3.2 Literature evidences related to Ayutthaya ceramic production

3.3 Contemporary ceramic ethnographical observation and survey in related regions, especially Pattani provinces, southern Thailand and other associated regions of the world: Far-east, Middle-east of Indian subcontinent.

4. Hypothesis to be tested

4.1 Some ceramic manufactures in Ayutthaya period were learned from experience potters, taught o the next generation through traditional methods.

4.2 Sudden change in process of ceramic manufacture in Ayutthaya Klong Sra Bua and Klong Bang Kuad Kiln sites, primarily process of kiln firing technique resulting to increasing quantity of production were introduced from cross-cultural potters, and later applied and generated their products to matched their own styles, behavior and environment.

5. Method of the study

5.1 Comparative study and typological classifying in archaeological excavation record.

5.2 Applying ethno archaeology to interpret archaeological data for ceramic production.

6. Process of the study

6.1 Review archaeological excavation and ceramic ethnographical records of Klong Sra Bua and Klong Bang Kuad kiln sites, Phra Nakhon Si Ayutthaya.

6.2 Ethnographical observing and exploring ceramic manufacture and production in related ethnic groups.

6.3 Analysis the above said data.

6.4 Interpreting Ayutthaya ceramic manufacture and production.

Chapter II

Historical and Archaeological Record Review

2.1 Literary Evidences

There is no direct historical record to provide a clear-cut answer concerning the introduction of ceramic technology. However, many studies on contacts between Ayutthaya and other regions or nations reveal the ties between them. The revision of historical records was done by using various sources. The first primary source mentioning about foreign relations is the Legend of Princess Sroi Dok Mak. She was a Chinese princess who was supposed to marry a king of Ayutthaya. Although the exact period of time was not referred to in the legend, it shows a close relationship between Ayutthaya and China. The most prominent material evidence that show Chinese influence is the shrine of Chinese god and goddesses. The shrine is situated on the compound of Wat Panang-choeng, the oldest temple of Ayutthaya located near the river to the south of the Ayutthaya Island. Another is a set of maps of Ayutthaya which had been traced by many western visitors who came to Ayutthaya in various periods between fifteenth and seventeenth century A.D. Most of the maps show the location of Chinese community in the city, especially the area near Bang-kacha, the main ship port of Ayutthaya.

Historians agreed that Chinese might have been the first foreigner merchants who came to trade for a long time before the establishment of Ayutthaya in A.D.1440. Charnvit, a Thai Historian suggested that the founder of Ayutthaya and U-Thong could possibly be the Chinese merchant residents actively engaged in trade in the Malay peninsular and southern Siam. The ability of Ayutthaya to attract Chinese traders assured its

status as a leader regional entrepot in Southeast Asia[1] The role of the Chinese in Ayutthaya's international trade was adequately documented[2]

Less-known evidence is the second "pillar" of Ayutthaya's international trade: the Muslims. The trade of Muslims to Ayutthaya is equally complicated, but with a few exceptions, has not received the attention it deserves. It was during the reign of King Narai (circa 1656-88) that the Muslims played an important role in Ayutthaya because of their intrigues in court involving foreign communities. However, the Muslims were not an ephemeral presence, but an influential force in the region since the fifteenth century A.D. An attention to the large picture of the Islamic world helps create a context for a greater understanding of the prestige that Muslim merchants enjoyed, and therefore the influence they could exert in Southeast Asian lands.[3]

Also the evidence of Muslim habitants in Ayutthaya was found in many ancient maps. Cham and Malayu Muslims stayed outside the city at Plata-khu-cham village to the south of Bhudhaisawan temple. Pattani, Moors and Indo-Iranian Muslims were settled in the city near Bang-kacha, a very convenient location for trade. The most prominent material evidence is the Muslim cemetery where Phra Nakhon Si Ayutthaya Rajabhat University is now situated. Thus, we can assume that Muslims had a very close relationship to Ayutthaya.

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[1] Charnvit Kasetsiri, The rise of Ayudhya (Kuala Lumpur: Oxford University Press,1976)

[2] Sarasin Virapol, Tribute and Profit: Sino-Siamese Trade,1685-1853, (Cambridge: Harvard University Press,1977)

[3] Andaya Leonard Y., Ayudhya and the Persian and Indian Muslim Connection, in Proceedings for the International workshop, Ayudhaya and Asia, 18-20 December 1995, p 134.

The other important primary source discovered by Hluong Prasert Aksornnit is the Chronicle of Ayutthaya, mentioning about the Sultan of Pattani. It is said that in 1548, during King Chagrapatt's reign, the Sultan of Pattani brought his men to Ayutthaya to help them fight the Burmese troop. In turn, he tried to conquer the King's throne, but was finally defeated and fled away. However, Pattani was claimed to be "prathesaraj" (tributaryship) of Siam or Ayutthaya between the sixteenth and seventeenth century A.D. Pattani was one of the large cities that grew in trade and mercantilism and was especially famous during the Ayutthaya period. The European records confirmed that Pattani was a trade city in Malay peninsular. Many foreign nations especially those who came from the west of Ayutthaya such as India, Persia, Portuguese and so on would contact and exchange their goods at the Pattani port. The city populations are predominately Muslims who preserve many aspects of their tradition and culture. Some conceptual thought were exchanged among people who had the same beliefs remarkable in the ancient great mosque at Krue-se village, an old community in Pattani. Its platform or base is built in a typical Thai design, slightly square in plan, forming an elephant belly-like curve of the late Ayutthaya art style. It comprises pointed and rounded arch window and door frames and is ceiled by a huge dome of western style.

Fig. 1: Water color wide-angle picture of Ayutthaya, it is believed that it was painted in 1660.

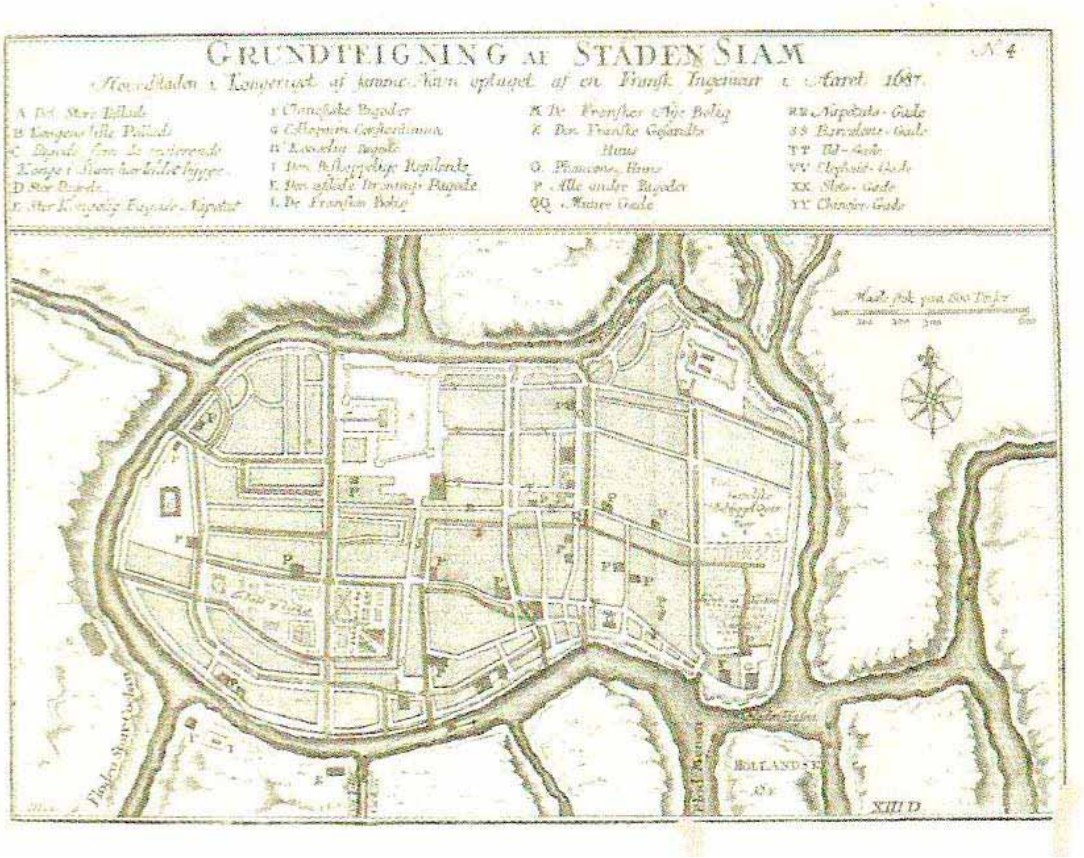

Fig. 2: Map of Ayutthaya in 17th century showing foreign settlement in the city.

The evidence mentioned above shows the close relationship among the nations that reflect the composition of ideas, life style, or probably an introduction of a new technology at that time. It also provides some ideas to trace for other cultural materials and for the study of ceramic technology, using the archaeological evidence along with ethnological studies, correlating to historical sources that would bring possibilities to proof the hypothesis.

2.1.1 Record related to ceramic production

The most well-known historical record among Ayutthayan historians that mentions about Ayutthaya ceramic production is The "Record of Ancient Architecture in Ancient Phra Nakhon Si Ayutthaya". Written a short while after the decline of Ayutthaya, it states that "...above the city island there were 5 villages, one of which were making potteries, various kinds of tiles,

limes and liqueur. This area was called Tung (field) Khaon and the opposite area called Tung Kaeo..." [4]

These were mentioned by Phraya Boranratchatanin (Porn Dechakhup), a senior scholar as the area along the man-made Klong Sra Bua canal. He again described about the ways of life of Ayutthayan whom settled along Klong Sra Bua, produced earthen potteries, clay firepots, tiles and toys in Prachumpongsawadarn Section 63 “Ruam Rueang Krung Kao” explained about areas of activities were explained as:

“…Yan (area) Sampanni, Ban Hmo made and sold potteries, Ban Krabueang made and sold various kind of tiles, Ban Salapun baked and sold lime, Ban Kao Hluang Chin brew and sold liquor. These 5 Tambon (village) were located in Ko Tung Khaon…” [5]

This may refer to the western bank of Klong Sra Bua.

“… Ban Ko Khad cast and sold bronze lime boxes, Ban Wat Khrut made and sold Lerng (large vessels), near Ban Wat Taranee they was sawmill. At Ban Wat Prao, Bhraminists and Thai sold perfumed powder, aromatic oil, incense sticks and papers. Ban Tha Khlong was various kinds of nail manufactures. Ban Kun Di was made earthen vases, lamps, various toys. Ban Rong Gong sold bananas which is meant the eastern bank of Klong Sra Bua These 7 Tambon (village) was located in Ko Tung Kaeo…”

This may refer to the eastern bank of Klong Sra Bua.

2.1.2 Record related to canals or klong and rivers

- Klong Sra Bua

The same record is also mentioned about Klong Sra Bua, Klong Bang Kuad and Klong Mueang. The name of “Klong Sra Bua” was mentioned as early as 15th century in early Ayutthaya period. The Royal Chronicle of

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[4] พระยาโบราณราชธานินทร์, ประชุมพงศาวดาร ภาคที่ 63 เรื่องกรุงเก่า, (พิมพ์เป็นอนุสรณ์เนื่องในงานพระราชทานเพลิงศพนายพิมล บุญอาภา ณ เมรุวัดเทพศิรินทราวาส วันที่ 23 มิถุนายน พ.ศ. 2511) กรุงเทพฯ : โรงพิมพ์การศาสนา 2511, p. 107

[5] Ibid, p. 107

Ayutthaya describes that Khun Worawongsa (June-July 1548) was dethroned by the officials loyal to the late King Chairacha and his descendents. During their escape Khun Worawongsa, Tao Si Sudachan and their baby daughter were travelling by boat through Klong Sra Bua route[6]. However they were taken away to be executed and their corpse exposed. The officials then invited Phra Tianracha, who was in monkhood to ascend the throne as King Chakraphat (1548-1569). Some scholars assumed that after the extension of the eastern waterway, so-called Ghu Ghue-na in the reign King Chakraphat to be finished in the reign of King Maha Thammaracha (1569-1590), the water from Pasak River changed its route of flow. Klong Sra Bua was also purposely dug for irrigation in order to supply the water from Bho Sam Ton River to the middle of the northern protection waterway to strengthen and increase water quantity of Klong Mueang.

- Klong Bang Kuad

It is always mentioned together with “Paniad” or elephant kraal of Ayutthaya such as during the reign of King Chakraphat , a preparing troop to Khmer in1532 was set at Paniad[7], or in the reign of King Narai (1656-1688), by his command, Kosa Pan set a troop to conquer Chiangmai at Paniad[8].

This area was served as elephant training field. They were trained to be keen as vehicles for royal or military transporting. The Royal Chronicle of Ayutthaya mentioned the round-up of elephants with ritual participation of the Court Brahmins took places in the reign of King Narai, Phra Phetracha, King Suea, etc. Besides, this area was a good location to observe the enemy’s troop from the north and become battle field as

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[6] พระราชพงศาวดาร ฉบับพระราชหัตถเลขา เล่ม 1 กรุงเทพฯ : อมรการพิมพ์ 2516, 68

[7] Ibid., 71

[8] Ibid., 48

mentioned in many chronicles[9]. In additional of general survey of temples, there are fewer temples along this river, which is meant less population was settling. It is confirmed that this area was used by the Royal Elephant Department (Krom Khachapan) from mid 15th century till declining of Ayutthaya capital.

2.2 Archaeological study of Klong Sra Bua and Klong Bang Kuad kiln sites

2.2.1 Location of sites

Geographically, there are three main rivers flow through the northern part of Ayutthaya namely Chao Phraya, Lopburi and Pasak. The Lopburi, join the Pasak at the north-eastern corner to the city. It then turns westwards to become the protection waterways of northern part of the city, called Klong Mueang. Klong Sra Bua, as previously mentioned, was dug deeper for strength and runs in north-south direction for about two kilometers to join Klong Bang Kuad and Klong Mueang.

- Klong Bang Kuad

Klong Bang Kuad presently appears as dead canal due to modern development by blocking its flow. It is a tributary of Lopburi River, is also called Bho Sam-ton River, which runs from the northwest pass the area of Tung (field) Tha-le ya, Wat khrut to south-east direction. From this point the Bho Sam Ton and Lopburi parallel closely and form a long narrow land where the elephant kraal or trail, the Pavilion of Pa-niad, Wat Chedi Daeng, Wat Sam Vihara are located then adjoining the main Lopburi River, a part of protection waterway to the north.

- Klong Mueang

It is actually the main Lopburi River. It flows from the north to join Pasak River, turns westward to meet Bho Sam Ton or Klong Bang Kuad then merge together, which is served the northern protection waterway of the city island,

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[9] Ibid., 68-90

before bends toward south forming a circular curve-liked western protection waterway.

- Klong Sra Bua

It starts from the north at the Bho Sam-ton River where Wat Khrut is situated as a landmark; cut straightly southward to join the lower part of the main Lopburi River, which is part of the city protection moat, where is the situation of Wat Na Phra-main and the northern corner of royal palace is noticeable in the city island. High levees on both bank of this canal are fertile for habitation and suitable for any communication. Many temples which were dated back to the early period of Ayutthaya are situated along this 2 kilometers man-made canal namely Wat Hutsadawat, Wat Takrai, Wat Charam and Wat Chongkrom,etc. This is meant the areas along the canals are well-known and used as settlement as early as its emergence.

Fig. 3: Arial photograph of Ayutthaya.

These three adjoining rivers as triangular area are suitable for activities, which were able to support the city at any times. The most important activities focused on providing infrastructure materials supplies to supporting the royal court demands, and for those of other people in or within a close proximity of the city island. Presently this area is located in sub districts (Tumbon) of Klong Sra Bua, Suan Prik, Hua Ror and Tha Wa-sugri of Phra Nakhon Si Ayutthaya District, Phra Nakhon Si Ayutthaya Province. Its location to the north is Ban Pa-niad in Suan Prik sub districts, to the south is Ayutthaya City Island, to the east is Lopburi River and to the west is Tung Khaon marsh.

2.2.2 Area of Study and excavations

. The area of study is located within 100 meters along both sites of these three waterways. It is included the area 2 kilometers of Klong Sra Bua, Klong Bang Kuad and 1.5 kilometers of Klong Mueang. After a closer topographical survey, the decision was made to divide the area along 3 waterways into 7 separate areas; 3 parts in Klong Sra Bua area, 3 parts in Klong Bang Kuad and 1 part in Klong Mueang. Using the common knowledge of local Thai Buddhist-belief society, present or past, the appearances of the Ayutthaya ancient temples, that a monastery or temple is usually located at the middle of the village surrounding by houses.

Area 1: the uppermost northern part at the mouth of Klong Sra Bua where Wat Khrut is located toward Klong Bang Kuad. Potsherds are found in this area shown different kind of pottery manufacture. There are one local earthen potteries and a brick making factory in practicing.

Area 2: the northern part beginning from Wat Bho Si to the north-western part of Klong Sra Bua area is a kilometer long by 50-100 meters wide mound along both site of the canal, where its elevation is about 8 meters from sea level about 2 meters to lower-leveled by removing soil from this area whereas the north–eastern part is heavily disturbed by modern development. Plenty of artifacts, especially potsherds are densely found on the mounds.

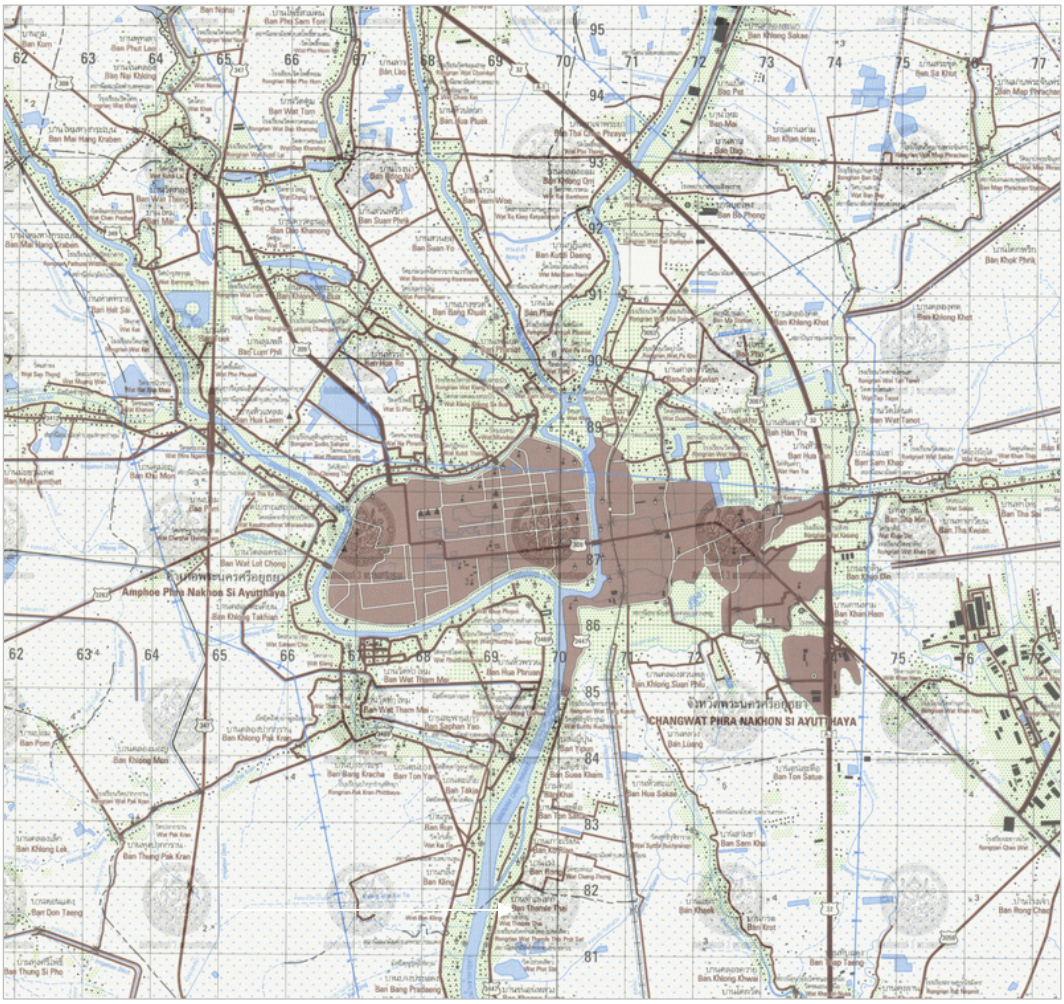

Fig. 4: Geographical Map of Ayutthaya.

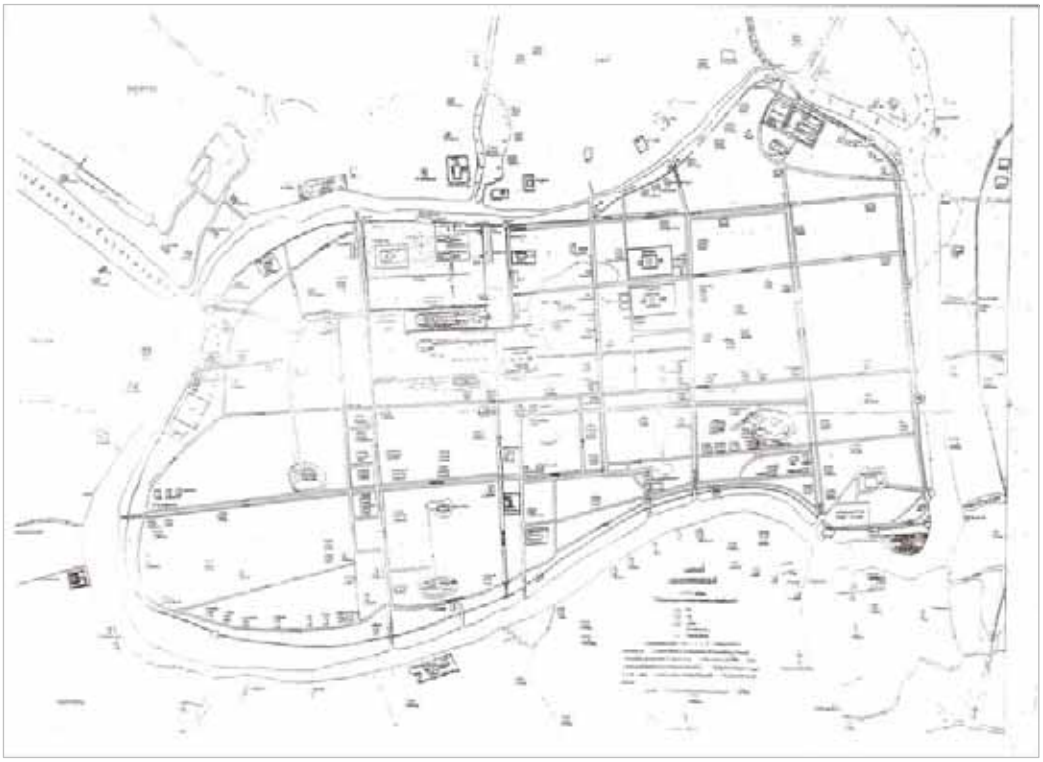

Fig. 5: Map of Ayutthaya drawn by interpretation of Phraya Boranratchatanin (Porn Dechakhup).

Fig. 6: Detailed map showing northern area of Ayutthaya island where Klong Sra Bua is located.

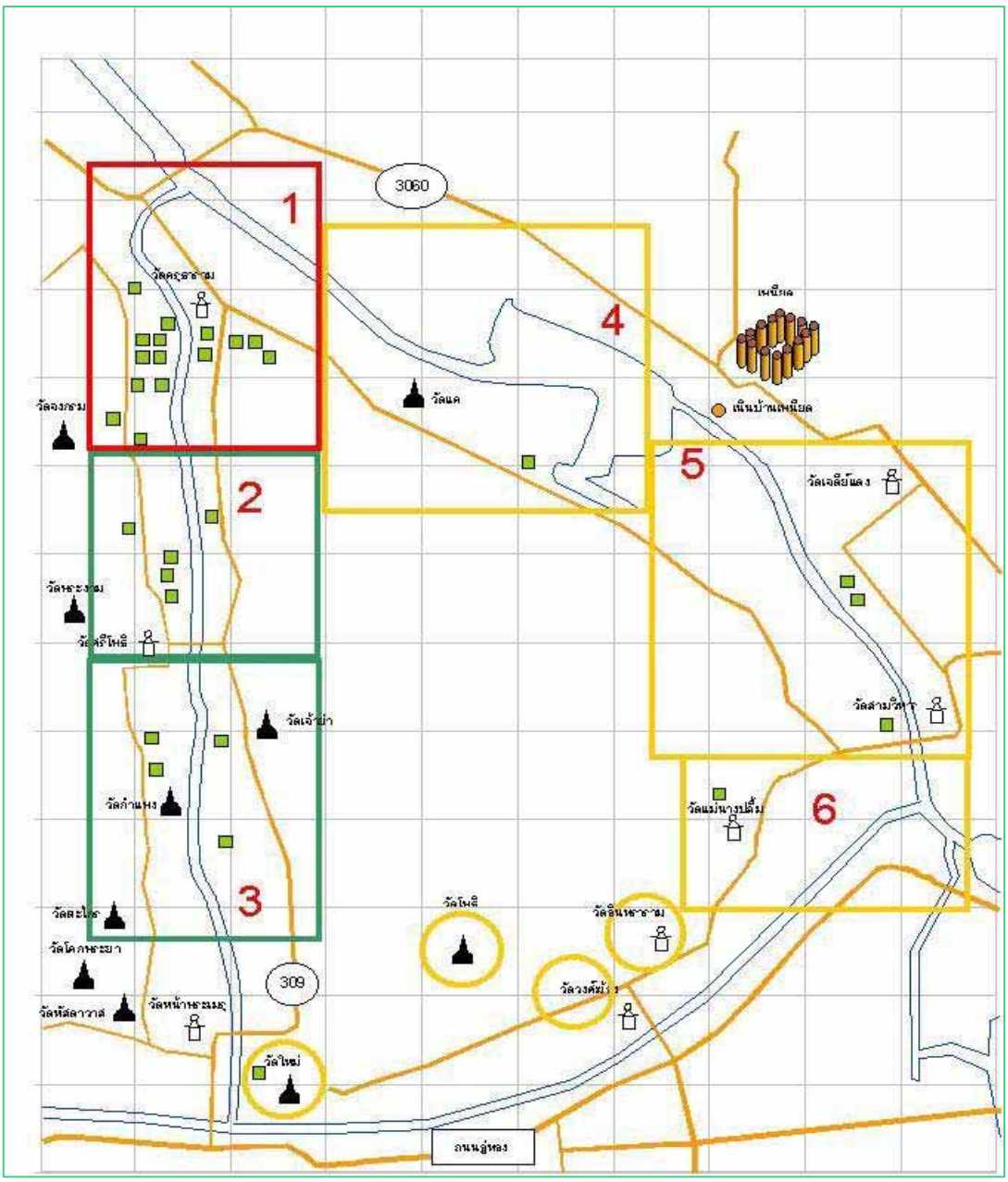

Fig.7: Map of Klong Sra Bua and Klong Bang Kuad showing 7 divided excavation areas.

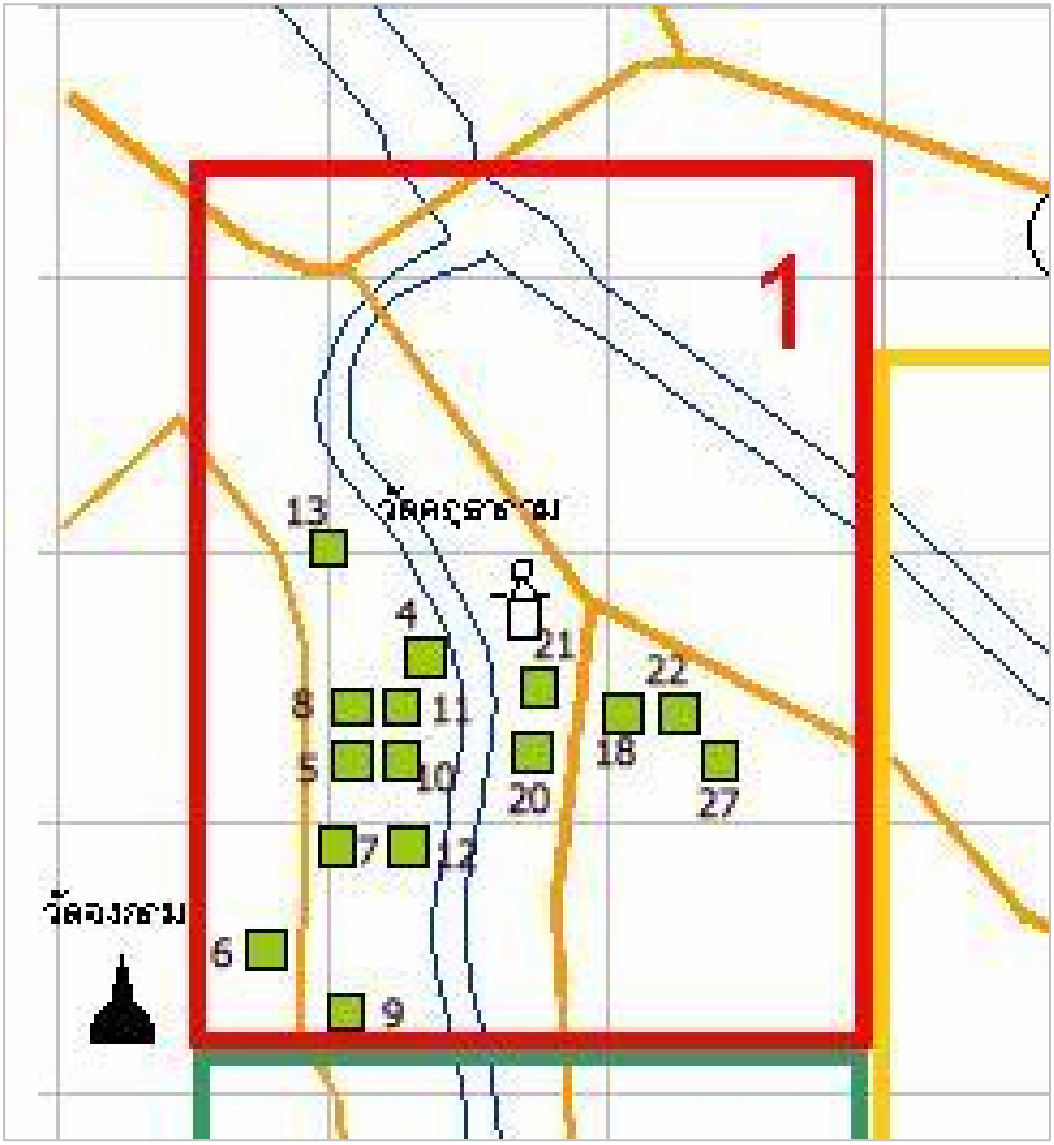

Fig. 8: Detailed map of area 1 showing excavation pits along both sides of Klong Sra Bua.

Area 3: the southern part beginning from Wat Bho Si to the end of Klong Sra Bua near Wat Na Phra-men. This area is also disturbed due to increasing of population. Though artifacts are less-densely found in this area, surface finds are shown the evidences of pottery production and also 3 small local earthen pot (locally called “Ta non”) factories are still active.

Area 4: the upper part of Klong Bang Kuad, starting from 100 meters below Klong Sra Bua – Klong Bang Kuad junction to south-west direction. The area is flat as part of alluvial plain of Lopburi River, where yearly flood is for many months and rare habitat is settled. Part of soil from both banks of Klong Bang Kuad was dug out to use as material for building constructions. This is caused this canal widen as huge deep pond and misshaped.

Area 5: the lower part of Klong Bang Kuad, starting from south of elephant trail to south of Wat Sam Vihara. The area is flat as part of alluvial plain of Lopburi River, where yearly flood is for many months and rare habitat is settled.

Area 6: the northeastern part of Klong Mueang where Klong Bang Kuad join Pasak River by a short-cut canal (and later become part of Klong Mueang). There is only Wat Mae Nang Pluem is located 200 meters away from Klong Mueang. This area is presently populated without any connection to the peoples in the earlier time.

Area 7: along Klong Mueang to Klong Sra Bua junction. Many temples are found on the northern bank, namely Wat Mae-nang Pleum, Wat Indraram, Wat Wong Khong, Wat Kudi Tong, Wat Bho, and Wat Mai Klong Sra Bua. Present-day houses are dense and no evidences of their historic settlement. By its concerning of temples, it can be assumed a crowded population in the past as well.

Sampling pits were done in every designed area for totally thirty pits. Primary investigation and excavations were shown that in the area 4, 5, 6 along Klong Bang Kuad appear less evidences of artifacts of human activities and by the historical record is concerned, it should be the official ground of the Royal Elephant Department (Krom Khachapan).There might not be other

personal activities in practice allowed. Area 7 is presently too crowded habitation and houses connecting many temples, which lack of pottery manufacturing feature. These 4 areas are assumed to have little coloration to ceramic making. The main study areas were focused on area 1 or uppermost part of Klong Sra Bua where there are appeared at least 2 main pottery manufactures. Nevertheless in area 2 and 3, a pottery manufacturer is still in practicing and many features of wasted pottery layers were discovered along the western bank of Klong Sra Bua, which can assumed as part of the pottery manufacturing area, but unfortunately the upper layer of soil with artifacts were dug out for constructing road and soil using to be infill construction materials.

Focusing on area 1, 11 pits were excavated on the west namely pit no. 1, 2, 3 4, 5, 6, 7, 8, 9, 10, 11, 12, 30 and 5 pits on the east namely no.19, 20, 21, 24 and 27. There are 2 different archaeological features found. Huge and complicated features were found on the western bank where a simple pottery firing features were on the east bank.

2.2.3 Excavation evidences

2.2.3.1 Soil Studies

- Soil Stratigraphy

On the western bank of Klong Sra Bua, soil stratigraphy from excavation pit no 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 30 can be noted. For useful understanding soil stratigraphy from pit no. 2 where located in the middle of Klong Sra Bua western bank is chosen for this examination. Within the depth of 8 meters from mean sea level it is generally classified to 2 cultural layers

Cutural Layer I : soil layer ii-iv, 7.70-7.40 to 4.50 meters from MSL, divided to 2 parts:
Lower part (soil layer iii-iv, 6.70 to 4.00 meters from MSL) soil is densely mixed by potsherds, earthen tiles.
Upper part (soil layer ii, 7.70 to 5.90 meters from MSL) soil is mixed by potsherds, baked earth fragments of kiln, earthen tiles for rolling and expanding the area.

Cutural Layer I : soil layer i, 8.00 to7.40 meters from MSL. It is present habitation floor. Potsherds, fragments of tiles are found scramble to modern plastic bags, fragments of bricks, etc. On the surface of its layer, a feature of broken kiln is found along with fragments of potteries and tiles. The kiln is made of brick appearing in a shot row with half cylindrical tiles lay upright underneath. Plenty of potsherds and tiles are also found very densely around kiln feature. It is meant that despite from being kilns this human habitation layer perform similar activity to the upper part. Other artifacts found during excavation associated to soil stratigraphy are chips making from earthenware fragments, bullet balls, stonewares from Ban Bang Pun, Si Sutchanalai – Sukothai Kiln sites, Vietnamese, Japanese and Chinese porcelains dated to about Ming to Qing Dynasty.

On the eastern bank of Klong Sra Bua, soil stratigraphy from excavation pit no. 19, 20, 21, 24 and 27can be noted. Soil profile of pit no.19 is sample to explain its one cultural layer

Cutural Layer I : soil layer ii - v, 0.34 to 3.40 meters from MSL, divided to 2 sub-layers

Lower layer (soil layer v, 30.0 to 3.40 from MSL) potsherds are scattered found to found the early settlement of the area.

Upper layer (soil layer ii-v, 1.00 to 3.20 meters from MSL) thickly and densely potsherds deposit in this layer which is assumed human activities in producing pottery in large scale.

Fig. 9 : Excavation in Pit no 2 showing feature of a kiln on the uppermost layer.

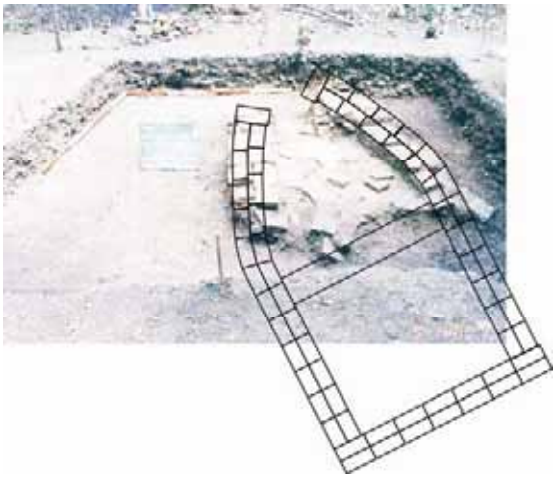

Fig.10 Overlaid feature of kiln

Fig. 11: Excavation in Pit no 2 showing soil profile.

Fig. 12-15:

Excavation in Pit no 5 and 4 showing evidences related to ceramic manufactures continuously found from upper *(lower left)* to lower layer *(upper right)*.

Fig.16 -17: Excavation in Pit no 8 extension from pit 4 and 5 showing ceramic manufacturing area and varieties of tile fragments.

Fig. 18-20: Excavation in Pit no 8 showing the continuity of ceramic manufacture and feature of a group of potteries.

Fig.21: Excavation in Pit no 11 showing evidences related to ceramic manufactures continuously found from upper to lower layer.

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Fig. 22-23: Excavation in Pit no 11 showing detailed baked clay floor on the lowest layer.

Typical type of pot is identified as “Lerng” by shards found but presumed different firing technique due to different of time, which is concerned by soil layer into 3

phases:

- Phases 1(soil layer v, 3.00 to 3.20 meters from MSL) shallow pit was dug to contain pots (and then covered with brushwood on top for firing.)
- Phases 2(soil layer iv, 1.60 to 3.00 meters from MSL) a platform was prepared on the living floor, potteries were laid on with firing over. This open bonfire was used repeatedly several times on the same platform.
- Phases 3(soil layer ii, 0.90 to 1.20 meters from MSL) a platform was re-arranged by using half cylindrical tiles lay upright to uplift from the living ground.

Cutural Layer II : soil layer i - ii, 0.34 to 3.40 meters from MSL. It is present habitation floor. Potsherds with stamped designs identified as large pots or “Lerng” are found densely widespread the entire layer. This floor is packed and higher leveled by the villagers to make use of the land.


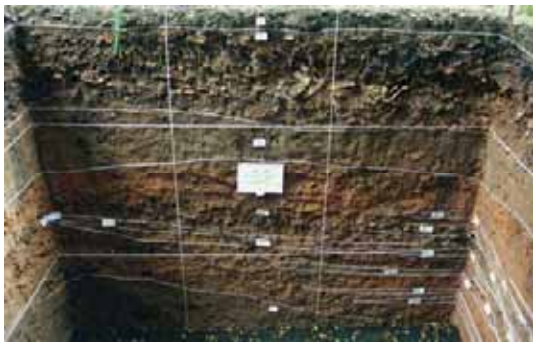

Fig. 24-25: Soil profiles of pit no 19 showing baked clay floors from the lowest.


Fig. 26-27: Soil profiles of pit no 19 showing baked clay floors to the upper floor.

Fig.28 : Rows of flat tiles serving as uplifting baked ground.

Fig. 29-32: Samples of shards found in the pit no 19

Fig.33-34: Samples of toys found in the pit no 19.

2.2.3.2 Artifacts

Artifacts found from area 1 consist of various types of pottery for daily life, roof tiles (e.g. rectangular flat, end pointed flat, half cylindrical, and antefix) and sculptures in many sizes of human and animal forms for using in ritual ceremony and toy. They are classified as follows:

1. Earthen artifacts

a) Potteries

1a) Earthenwares. Many complete and broken earthen potteries were found especially in the middle of western bank of Klong Sra Bua.

2a) Stonewares. Usually they are belonging to Ban Bang Pun Kiln Site, Noi River , Si Sutchanalai and Sukothai Kiln sites

- Ban Bang Pun Kiln Site, Suphanburi Province (dating about 13 - 14 century A.D.) Parts of rims, bodies and bottoms can be classified to various types of large thick vessels, such as pots, jars, mortars, etc. with wavy, comb, curving decoration or stamped with circular, lotus or Sema designed on their shoulders and some appliquéd. Their base bottoms are almost big in a form of elephant foot. They are found in the soil layer III-VII
- Noi River Kiln Site, Singhburi Province (dating about 15 -19 century A.D.) Parts of rims, bodies and bottoms can be classified to 2 groups of decoration: Unglazed plain potteries, they are classified as large pots; flare mouth jars with foot rim, mortars. They are decorated with multiple wavy incised and excised on their shoulders, and some appliqués.

  Glazed potteries, they are classified as large flare mouth pots, jars decorated with multiple wavy incised and excised on their shoulders and glazed.

  They are found in the soil layer VI-VII.

3a) Glazed wares. Potsherds of both Si Satchanalai - Sukhothai and foreign glazed wares are found. The foreign wares are imported from China, Vietnam and Japan.

Fig. 35-36: Samples of lids

Fig. 37-38: Samples of handles of pots and pans

Fig. 39-40: Samples of handles of pot or pan

Fig. 41: Samples of sprouts of kettle


Fig. 42 - 43: Samples of bowl and lamps


Fig. 44 – 45: Samples of footed tray and mortar


Fig. 46 – 47: Samples of steaming pot and bottle

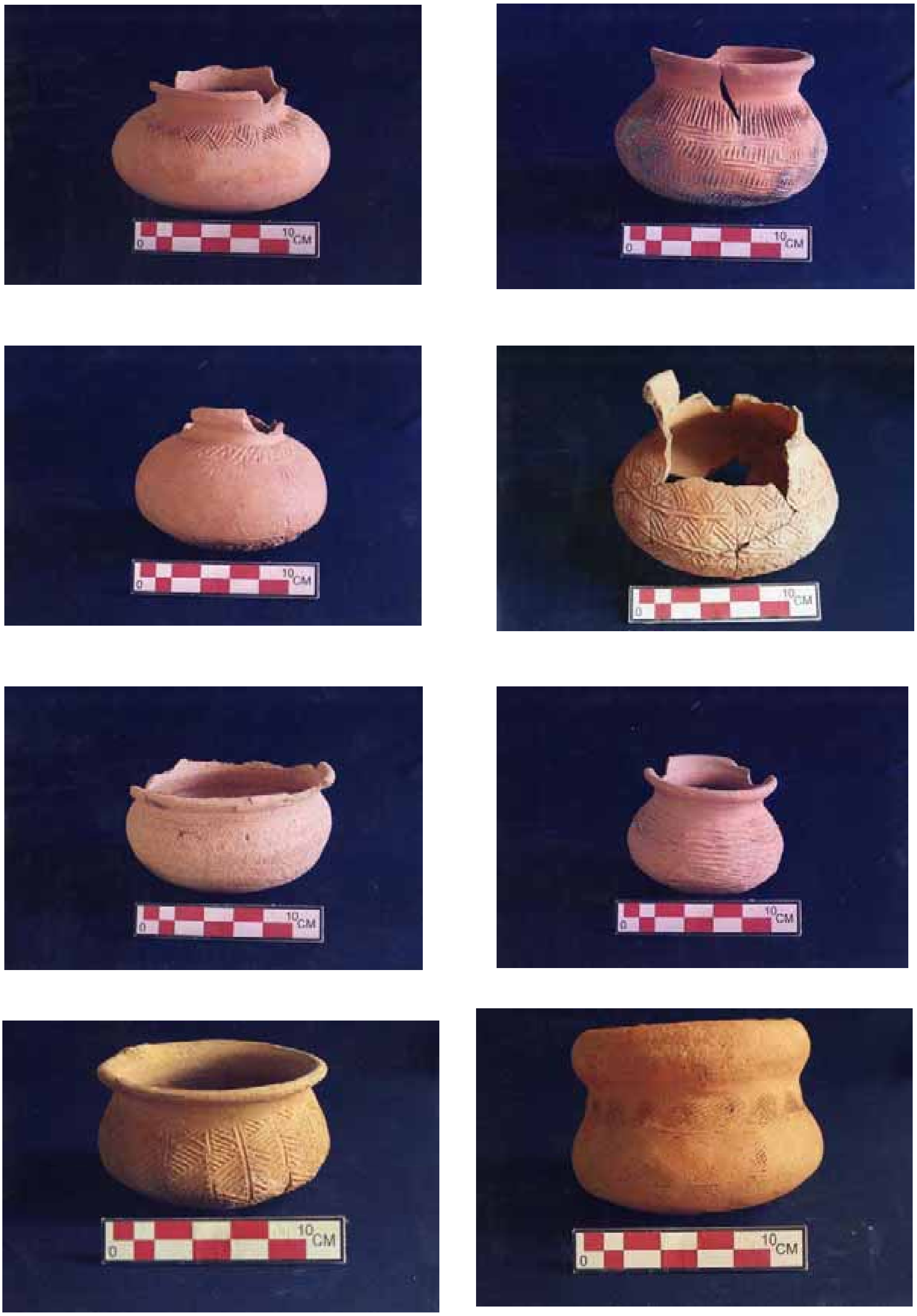

Fig. 48 – 55: Samples of pots

Fig. 56-57: Samples of stove

Fig. 58: Samples of water pipe

Fig. 59: Anvils

Fig. 60: Decorative object

- Sukhothai Kiln Site (dated about 15 -17 century A.D.) Parts of green glazed rims, bodies and bottoms are found in the layer III - VII
- Si Satchanalai Kiln Site (dated about 16 century A.D.) Large amount of potsherds of this kiln sites are found in layer III – VII which are classified to 4 groups:
  white glazed, black painted on white and glazed, dark brown and green glazed
- Lanna kiln sites (dated about 17-18 century A.D.) Few pieces of black painted unglazed stoneware are found in layer VII

Foreign wares

- Chinese wares
  - Ming Dynasty (1368 – 1644) red painted in floral design on glazed bowl and blue and white bowl are found in layer VI
- Vietnamese wares (15 -16 century A.D.)Green, Blue, Brown painted underglazed in floral design bowls are found in a few number in layer VI. Some pieces of their bottom is brown circular painted which indicate wares of Muc Dynasty (15 century)

4a) Porcelain

- Chinese wares
  -Southern Sung Dynasty wares (11- 13 century A.D.)

A few piece of small box Qing pai ware from Fujian are found in Layer I and II (where it may be considered as accidental find.

Ming Dynasty wares (1368 – 1644 / 15-17 century A.D).Large number of Ming potsherds are found in layer. There are 2 types: red painted in floral designs bowls on glazed and blue and white under-glazed bowls. Some of these blue and white bowls are kraak ware, a very fine body texture from Jingdezhern.

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Fig. 61 – 66: Samples of Chinese Blue and white and polychrome wares

- Qing Dynasty wares (18 – 20 century A.D.)

Qing potsherds are found together in layer I to VII, they are classified as blue and white bowls in floral designs

b) Anvils for pottery making

c) Round chips making from earthenware fragments

d) Bullet balls

e) Sculptures

1e) Baked clay toys in human or animal figurines

2e) Glazed toys

f) Infrastructure materials

1f) various kinds of roof tiles

2f) Antefix tiles

3f) others

2. Metal objects

3. Stone objects

4. Ecofacts such as animal bones and shells.

The most prominent artifacts and main discovery are all kinds of roof tiles as parts of infrastructure materials which are categorized from present to last as End pointed flat tiles with hook at headed end ("Kra Bueang Kho, กระเบื้องขอ" 15 cm. in width, 21 cm. in length, 1 cm. thickness and 340 gm weight each). They are mainly found in the upper layer up to surface associated to fragment of potteries. By interviewing the present-day villagers said that their ancestors' occupation was producing this type of tiles and potteries, which their raw material is clay. The production was depending on demand of market whenever housing material or daily utensils were needed. (Fig. 69)

Rectangular flat tiles with upright headed end ("Kra Bueang Chai phub, กระเบื้องชายพับ " 10 cm. in width, 24cm. in length, 1 cm. thickness and 350 gm weight each). This type of tiles is found in the layer of 2 - 4 meters

Half cylindrical tiles with hook at headed end (“Kra Bueang Kab Kluai, กระเบื้องกาบกล้วย and Kra Bu,กระบู ” 13 cm. in width, 27cm. in length, 1 cm. thickness and 600 gm

Fig. 67: Flat tile: visible view

Fig.68: Flat tile :rear view

Fig.69: End pointed flat tile: visible and rear view

weight each). These large and heavy tiles are found in lesser amount than rectangular flat tiles and mixed in the same layer. It is assumed that half cylindrical tiles were applied for the roofs of large buildings such as royal pavilions, ordination halls and preaching halls of great temples. It was probably occasionally made by order or command of the king. (Fig. 70-74)

Antefix tiles ("Kra Bueang Chaeng Chai",กระเบื้องเชิงชาย) 35 designs on the triangular end of antefix are found. (Fig. 75-93)

- Site Classification

Artifacts that consist of large amount of tile fragments, potsherds and a few of foreign ceramics, and stratigraphy proved that there were 2 main manufacturing areas: middle to upper western and upper eastern bank of Klong Sra Bua. Stratigraphy from pits showed layers of a dwelling which meant that the people lived and worked in the same area, as their houses where were not so far from the factory. House remains exist throughout the stratified deposit right up to the present day level associated with the present-day productive kiln.

Eastern bank of Klong Sra Bua

Excavation from pit no. 19, 24 and 27 can be identified that the eastern area near Khrut (Garuda) Temple was the production area of large earthen pots, jars or massive storage vessels. Soil stratigraphy in pit 19 as above mentioned is clearly shown this area was "Lerng" manufacture.(fig. 24-28) "Lerng" are large vessels for containing liquid or dry staffs. They are hand-mould round bottom with slow wheel rim, finishing by paddle stamped all over their bodies. The firing technique of "Lerng" were developed frequently from the earliest to more adaptive stage as

Stage 1- shallow pit fire. It was dug to contain pots and then covered with brushwood on top for firing.

Fig. 70: Half cylindrical tiles: upper -visible view

Fig. 71: Half cylindrical tiles: upper--rear view

Fig. 72: Half cylindrical tiles: lower -visible view

Fig. 73: Half cylindrical tiles: lower -rear view

Fig. 74: Visible view of half cylindrical tile samples in experiment

Fig.75 – 80: Antifix tiles samples from pit no.2

Fig. 81 – 85: Antifix tiles samples from pit no.2

Fig. 86 – 93: Antifix tiles samples from pit no. 2

Stage 2 – bonfire; flat packed ground was prepared.(The sun-dried pots would be stacked on top, usually upside down, and depending on the size, layer upon layer, then covered by brushwood of bamboo before firing.) This ground could be reused several times which its feature would appear as fired soil or earthen ground.
Stage 3 – bonfire on uplifted floor placed by earthen half-cylindrical tiles with 5 cm. gap to fill with small brushwood as fuel.

Western bank of Klong Sra Bua

From the middle part of Klong Sra Bua upwards opposite Khrut Temple was the production area for various kinds of earthen tiles, such as flat roof tiles, haft cylindrical tiles, various kinds of antefix tiles, thick square floor tiles and other decorative parts.

According to archaeological stratigraphy in the excavation pits no.5 evidence has been found a kiln (kiln no.2) lying on the lowest living floor and smaller one on the upper layer. The approximate size of the early kiln is 3.5 x 4 meter with rectangular in shape which are set on the packed ground by tile fragments above the lowest layer or earliest living floor. It is made of brick of 4 walls which all upper parts of them have disappeared. One wall of shorter side is opened presumed to serve as air venerated. There are 4 dark grayish rolls of ash alternate to hard burnish earthen floor on its reddish ground. It is shown their continuity of tile manufacture. It is assumed that its wall would be 1-1.5 meters high. There is no evidence such as posthole to show any feature of any shade or roof to protect the entire kiln. Artifacts found around this kiln are mainly tile fragments which are able to prove this kiln is used for tile manufacture. (Fig.94-96)

Kiln type 1

Fig. 94-95: Feature of kiln in pit 5

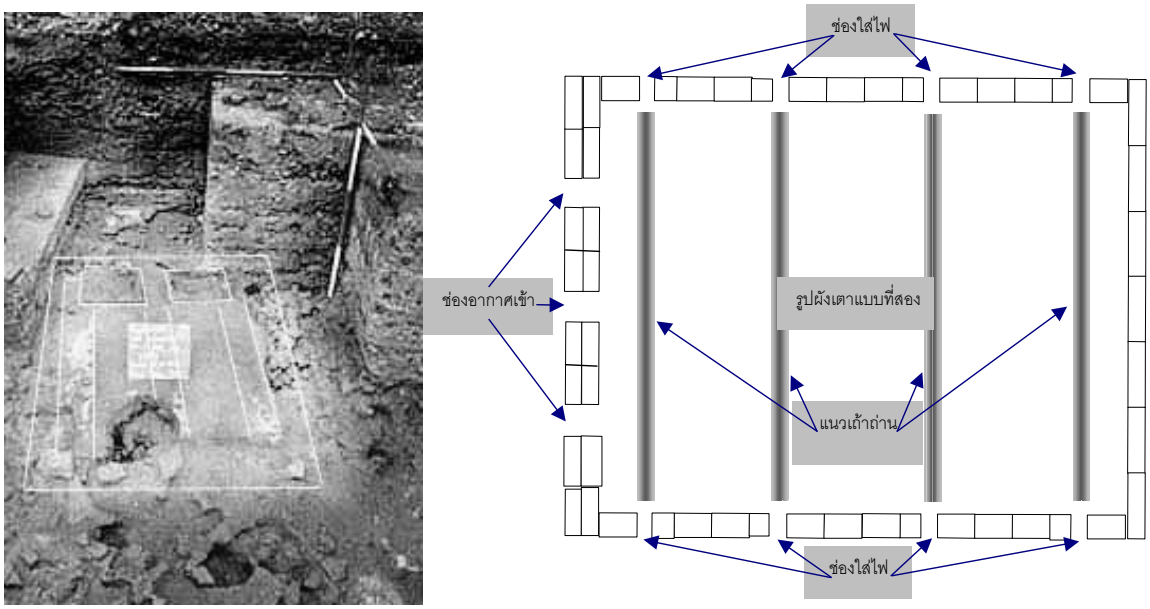

Fig. 96: Drawing of reconstruction plan of kiln type 1

On the upper floor kiln no.1 is uncovered which its size is 1.5 by 2 meters. Its ground that prepared by packing with 5-10 cm. thick clay is only prominent feature. This floor is as hard as baked brick with 3 rolls of ash appeared parallel along its length. Features of 2 square post-liked brick are appeared at one end on the width side. Though it is shown a posthole at the middle of kiln, it might not be any association to this kiln.

The extended excavation to pit no. 7, 8, 10, 11, and 12, evidences have been proved that the area towards the west of found kilns was working platform of tiles factories. Rectangular flat tiles with upright headed end are commonly found in with some half cylindrical tiles with hook at headed end that is clearly shown their main product in this area. End pointed flat tiles with hook at headed end are found on the upper layer to

surface which is meant their changing in different design of tiles. Antefix tiles are scattered found, that might be presumed their occasionally produced.

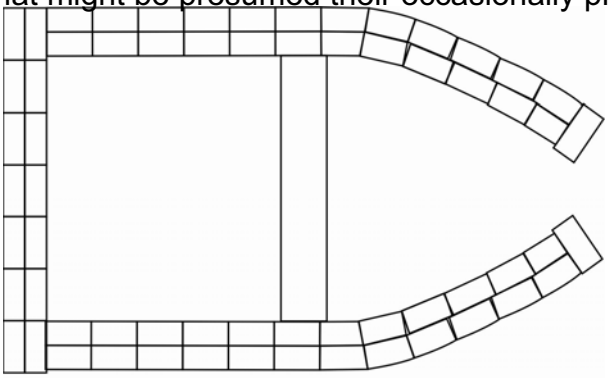

Fig.97: Drawing the feature of kiln type 2

By some mean, another kiln type is found in pit no.6, where is located about 30 meters away, comparatively on the upper layer of kiln no 2 and 1. Its plan appeared oval in shape with straight cut at one end. The features show that it consists of two parts, a firing chamber and a fire box. Firing chamber is square and built by bricks and small fire box was built adjoining the side of firing chamber. Many vested, slump and melt tile fragments were found in the beginning state of changing kiln type and firing technique. These evidences reveal that they were not able to control firing temperature higher than the old technique. After some times these expert fire controller were able to produce any kinds of baked-clay products, various types of tiles or pottery. These kiln type was used continuously for a long period of time.

It is primarily assumed whether this feature is an updraft kiln. However this is an unusual updraft kiln and unlike other primitive round updraft kiln that appeared in many parts of Thailand. This Ayutthaya kiln is seem to be more developed by adapting firing chamber from a square low firing kiln.

One question of concern is when this firing technique first appeared and how it suddenly changed. Comparing the firing technique in square kiln to updraft kiln, we come to the issue of time; the updraft kiln takes less time. Looking for answer, the comparisons of any kinds of ceramic

production are selected. The primitive and productive kilns in any local or ethnic groups should also be studied.

Chapter III

Ethnographical study of ceramic manufacture and production at Klong Sra Bua and Klong Bang Kuad kiln sites, Phra Nakhon Si Ayutthaya

It is generally noted that ethnography may be approached from the point of view of art and cultural preservation, as well as for archaeological reasons, which usually focus on the material remains of a society. Ethnoarchaeology aids in reconstructing ancient life ways by studying the material and non-material traditions of modern societies. Ethnoarchaoeloogical studies have longed served as a critical source of hypothesis, comparative data, and explanation of production[1]. Ethnological studies of ceramic production in Klong Sra Bua and Klong Bang Kuad areas can then be inferred that ancient Ayutthaya societies used the same techniques as their modern counterparts given a similar set of environmental circumstances.

Ethnographical survey in 2000 is shown that people in Klong Sra Bua and Klong Bang Kuad areas are ceramic manufacturers for more than 100 years. It has shown that there are 3 categories of ceramic productions in Klong Sra Bua, Klong Bang Kuad and Klong Mueang areas: tiles, potteries and bricks (Table no.1). Most of their productions include potteries, and half cylindrical and pointer flat tiles. More varieties of kitchen utensils, such as stoves, kettles, pans had been produced in the 60 years later, and only pointed flat tiles were still available while cylindrical one had already out of fashion. Increasing demand of bricks had caused an increase in production. However a number of household which rely on ceramic product tended to

[1] Cathy Lynne Costin, The Use of Ethnoarchaeology for the Archaeological Study of Ceramic Production, Journal of Archaeological Method and Theory, Vol. 7, No.4, 2000

decrease due to modern development that led to less preferable to use local or primitive utensils and its high production investment.

Table 1: Nos. of households of which produced ceramics before 2000

Types of ceramic making	Klong Sra Bua	Klong Bang Kuad
Tiles		7
Tiles, stoves	1	1
Tiles, stoves, pots, kettles, pans	7	3
Tiles, stoves, pots, kettles, pans, bricks	2	3
Tiles, stoves, bricks	2	1
Tiles, bricks	1	4
stoves, bricks		1
stoves, pots, bricks	1	
stoves, pans		1
pots, kettles, pans	20	2
pots, bricks	1	1
pots	20	1
bricks		11
	55	37

Table 2: Nos. of productive kilns in 2000

Area	Type of Ceramic	No. of kiln
Klong Sra Bua	Potteries	12
	Tiles	0
	Bricks	1
Klong Bang Kuad	Potteries	5
	Tiles	3
	Bricks	14
Klong Mueang	Potteries	0

Fig. 98: Soften clay by a hidden wood.

Fig. 99: Clay soaking in shallow well.

Fig. 100: Kneading clay with sand.

From table no.2, three kinds of ceramic are still produced; though the production of tiles are intended to reduce observe by less number of kilns. Ethnological observations have been shown details of potteries and tiles making manufactures are some procedures in common especially raw material. More differences can be seen in process to make items, which also slightly differ in firing process.

Generally, clay, the raw material, is bought from the land owners whose land contains good quality clay, whereas this area is almost clay sediment of Chao Phraya delta. Then coarse rock fragments or impurities are removed and beaten to be softened. Sieving sand and water is mixed by feet kneading on flat ground by men. The clay is turned slowly clock-wise to move the clay on the outside towards the centre of the mass whence its work out to the circumference again till smooth and plastic or in other hand to squeeze out all the air and thoroughly temper the clay. Smoothen surface of knead clay lump is done to stored and ready to be used. This clay can be used to make all kinds of earthen ceramic in this area. The only difference of preparing clay for pottery and tiles is the kneading ground is in the factory for pottery while in the open space for tile making. (Fig.98 - 100)

3.1 Pottery

3.1.1 Making Technique

Fig.101: Electronic wheel throwing

Wooden wheel throwing (45 centimeters in diameter) has been used to build the pot, and electric wheel throwing was recently replaced in 1972. Five sizes of earthen pots are produced by Klong Sra Bua/Klong Bang Kuad villagers; they are named by their sizes from large to small as Mor Ton, Hmor Klang, Hmor plai or Hmor Krachok, Mor Om, and Hmor Aum. They usually are simple plain round pots. Only stamped decoration on salt pot, called Hmor Tar, is also made to order. Other articles of kitchen wares are also produced: lids, kettles, pans and stoves. Stoves are built up with strips of clay coiling up to its length till the work proceeds. Handle of kettles and pans are built by coiling with strips of clay made in a wooden model, and then join them on the rim of its bodies. The detailed processes of forming each product are illustrated by pictures shown from Fig. 98 to 167

When prepared clay has been modeled in pots or any other desired forms, they are air-dried to proceed at a steady temperature and uniformly throughout the pot. Burnishing is now undertaken, beating by a wooden (teak) bat to shape up the body and flatten the bottom of the pot. Oval pebble (10.5 cm. in diameter for big pot and 8 cm. for small pot) and plastic sheet are applied to smooth the bodies. Then yellow clay is brushed to finish decoration of all products. Sizes of wooden bats applied for decoration is shown in table no.3 (Fig. 168 -173).

3.1.2 Pottery Factory Location

Most of the potters use the ground floor of their houses as a factory. A separate temporary factory may prefer in a few household, which is usually made of wood with thatch roof and protection walls. It can be divided into 4 functional areas (Fig.174)

- **Area of pot wheel throwing**, where the electric throwing machine is laying 45 cm. above the ground. The potter sits on wooden stool at the same level in front of machine, where pieces of wood are on both side to lock potter feet during working. Aside of the potter is a long sheet of wood for laying row of pots made. A water basin is put near the wheel thrower together with piece of cloth and thread for pot finishing. Here also a stored knead clay pit and kneading ground are set nearby for potter convenience. (Fig.175)

- **Area of pot decorating**. It is closet to the wall. The potter sits with her back leaning wall and straight legs where pot is beat and burnished by wooden beater. A water bowl for soaking beaters is on right of the potter.

- **Storage area.** It is closet to other side of wall where the finished pots are laying and waiting to kiln. In some household where vast space is provide, pots can be kept in separate stores.

- **Kiln.** A higher ground outside the house is selected to construct to avoid flood and moisture and neither obstructs other activities in process, where there should be a space to store wooden or fuel nearby.

3.1.3 Kiln Structure

The kiln applied in this area is updraft divided into 2 parts; the firing chamber - square horizontal in shape with opening on the upper end and combustion chamber– a long dome-shaped tunnel adjoining at one side to the firing chamber on a little lower slope. This is a purpose to allow heat flow easily to the combustion and pass upward to firing chamber.

To build up a kiln, the selected area is done by using a small round ball usually a lime roll on the surface to observe a suitable slope. Packed soil can be added in case the slope is less. Kiln basement is evenly filled by clay mixed to sand. Raw bricks are used to form the entire kiln and plaster with mud mixed with sand and husk. Ritual ceremony is practiced by sprinkling Buddhist holy water for good luck and admits to the Land goddess.

Lay-out of kiln and its size is set according to amount of uploading pots. The kiln which contains 500-1000 potteries uploading is considered as a large one. Meanwhile presently potter will produce only 100-500 potteries at one time; the small kiln is a selected size. Size of square firing chamber will be set by determining from how many rows and numbers of large pots in each row are able to be fit in square room normally 200 cm. in each size. At one side of firing chamber is selected to be opened a 40-50 cm. width, 100-120 cm height gateway called “Pra-tu-kaeo”. It is designed as the entrance of ceramic upload, which should be convenient for the carriers during work, especially from the drying ground or storage directly to the kiln.

Table no.3: Detail size of wooden bats

	body			handle		Pot size
	width	length	thickness	width	length	
Big beater for "La" or rough shaping	8.5	13	3	2.5	13.5	Big-medium
Beater for La	8	12	2	3	15	small
Flat Beater for "Laem" or fine burnishing	15.5-16.5-17.5	18	1.1	3	13	Big-medium
Beater for Laem	14-15-16	17	1	3	12	small

Table no. 4: Detail size of tiles

	Width cm.	length cm.	thickness cm.
End pointed tile -lower row end pointed tile "*kra bueang gret tao tua pu*"	12	21	0.7
End pointed tile -upper row end pointed tile "*kra bueang gret tao tua mea*"	11.5	17.5	0.7
Flat tile -ridge roofed tile "kra bueang din kho"	10	19	0.7
Flat tile -end roofed tile "*kra bueang chai nam*"	12	20	0.7

Fig. 102: Re-kneading before forming pot on wheel thrower.
Fig. 103: Starting by pulling clay upward.

Fig.104: Forming neck of pot.

Fig.105: Continuing down to body.

Fig. 106: Setting in a desirable size.
Fig. 107: Forming round bottom and cutting out by a thread.

Fig. 108: Drying pots before decorating.

Fig. 109: Starting decoration from bottom of pot.

Fig. 110: Smoothening surface of pot, pick out unexpected granules and repair.

Fig.111: First rough beating called “La”.

Fig. 112: “La” starting from side of pot.

Fig. 113: Pots after finishing “la” process.


Fig.114: “La” pot is smoothening by piece of cloth before “Lem” process.
Fig.115: “Lem” second beating start to flatten bottom.


Fig. 116: “Lem” in process to smoothen bottom and body.


Fig. 117: Clay patching.
Fig. 118: Beaten-decorated pots (La and Lem process) keeping under shelter.






Fig. 119 -124: Process of forming clay to pans on wheel thrower; starting by scooping clay upward then gesturing by fingers to form rim down to body and bottom and cutting out with string.

Fig.125-132: Process of fixing spout of kettle; coiling clay in conical tube to make spout, then using spoon to make a hole of pot, fixing spout at the hole cutting, binding adjoining surface with clay and decorating by yellow clay painting.

Fig. 133-137: Process of fixing handle of kettle; making a cylindrical piece in wooden mound, smoothen by rolling on surface , measuring to the centre line of spout and then binding.

Fig. 138: A baked kettle.

Fig. 139: Instrument s for fixing handles of pan.

Fig. 140: Coiling clay on wooden board.

Fig.141: Fixing coiled clay at pan rim.

Fig 142-143: Decorating by small wooden beater.


Fig. 144-145: Smoothening by convex disk

Fig.146: Burnishing by a smooth-touching object then Painting with yellow clay.


Fig. 147-148: Before and after baked pans.





Fig.148-152: Lid making in process.

Fig.153-160: Process of making stove; making strips of clay, new lengths have been attached and made in cylindrical tube shape.




Fig. 161-164: Cut 1/3 of the tube clay vertically to make an open mouth, fix 3 supported notches and make holes on its side.

Fig.165: Front view of stove after firing.

Fig.166: Rear view of stove after firing.

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Fig. 167: Stove in use

Fig. 168-169: Preparing yellow soil, painting material; refining and sieving.

Fig. 170: Painting.

Fig. 171: Burnishing by pebble.

Fig. 172: Re-burnishing by plastic sheet.

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Fig. 173: Keeping pots in shelter ready for firing.

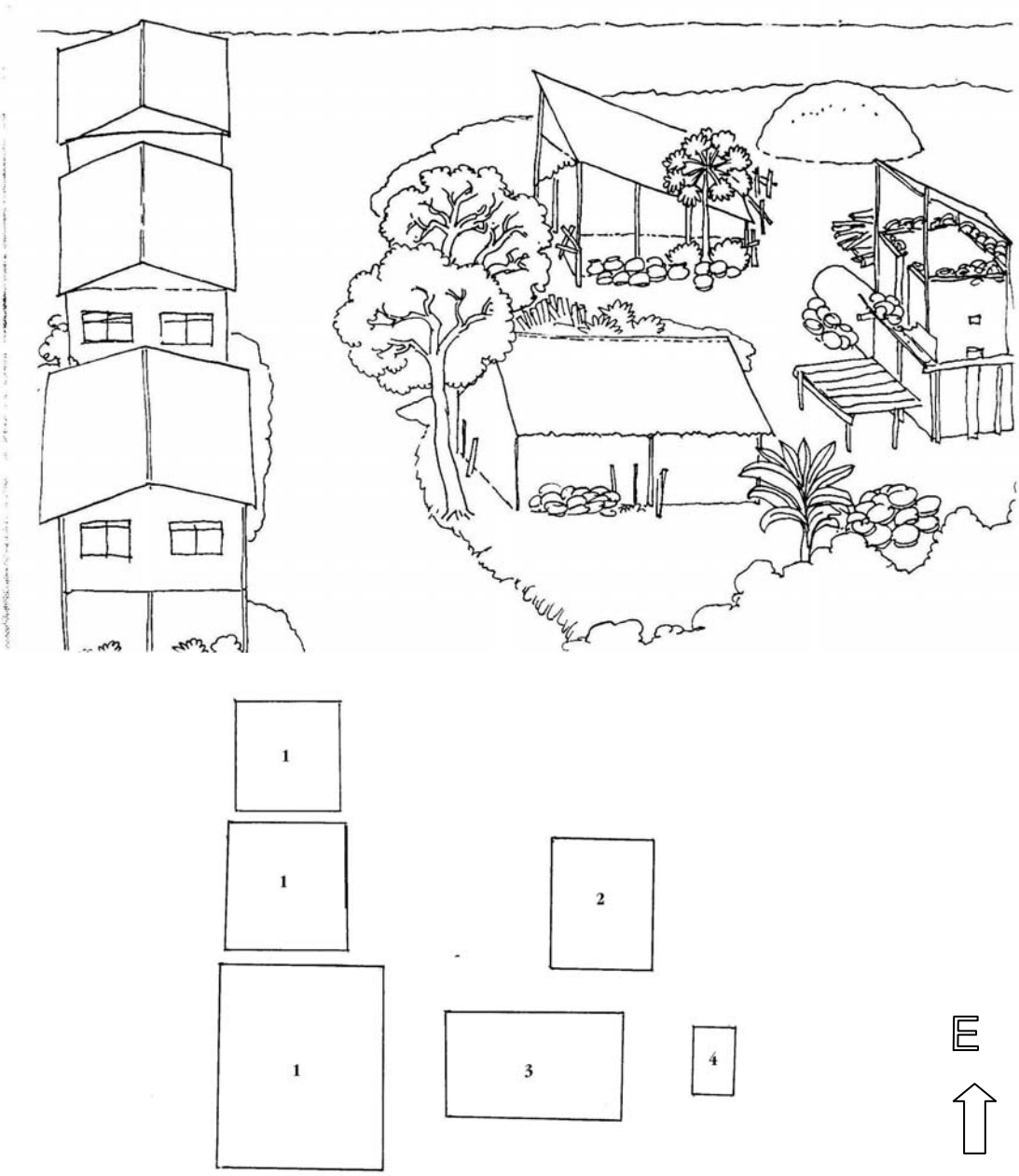

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Fig.174: Sketch drawing lay-out and plan of a pottery factory.
1= house 2 = pottery factory 3 = pottery storage 4 = kiln

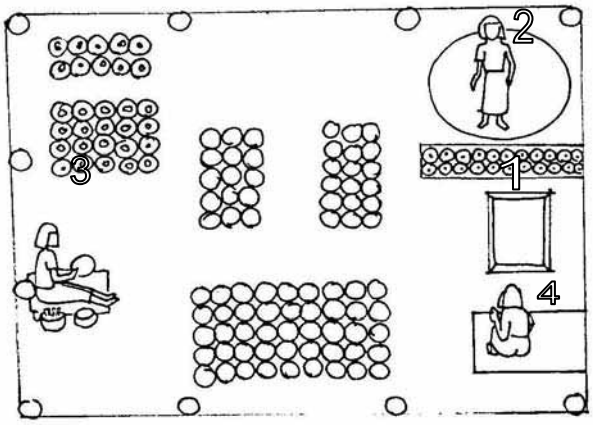


Fig.175: Sketch drawing lay-out inside the pottery factor.
1 = clay store 2 = kneading
3 = sitting area for decoration 4 = area for making clay in shape

The most important part of this kiln which the builder or user note is the support or “Sao hmo” located at the centre laying from the middle to almost at the inner part of the combustion chamber. This support is about 15 cm. thick, 60 cm. high and about 180 cm. long. For the large kiln, which contains 500-1000 potteries uploading, 2 supports are necessary. Lying cross to the support line are 7 rows of grates, each of which is 45-50 cm. long 10-12 cm. wide and thick. The grate bars are made of clay mixed with sand and husk ash in mould and then baked. Combustion domed tunnel (160 cm. long, 100 cm. high at its entrance and 140-150 cm. at its closet to kiln wall) is placed at one side of the outer part of square firing chamber on the lower ground and built attached to kiln wall. Two triangular fuel entrances are joined tunnel to the combustion room underneath the grates, where the pots will be lying to be fired on top. As for a large kiln with two supports, three fuel entrances will be modified. Preventing breakage of kiln, wooden beams are built to block the flame at four sides along with post for supporting thatch roof. Once the complete kiln is first built, it may be baked together with the first set of ceramic in firing. Some potters prefer to baked kiln before use therefore there is no moisture remains in the kiln to cause damage of their products. The kiln can be in use continuously for many times of firing ceramic. (Fig.176)

3.1.4 Firing Process

Fuels for firing process will be preserved in advance. Main fuel is dry firewood (ไม้สะแก) which is burnt to charcoal in combustion tunnel (called “fuen nok”) and turn into combustion chamber in the beginning to warm up pots heat. The other kind is brushwood, which is used for generating continual heat in the kiln. Bamboos and spine of coconut palm leaflets are inserted to add more fuel innermost of the chamber. During uploadind pots to the kiln, some firewood such as rain trees (*Samanea saman)*, Siamese rough brush *(Streblus asper)*,white popinac *(Leucaena leucocephala)* about 40 cm long (called “fuen nai”)is also filled alternately to pots and again brushwood is lied on top of the firing chamber called (“fuen roy chom”).

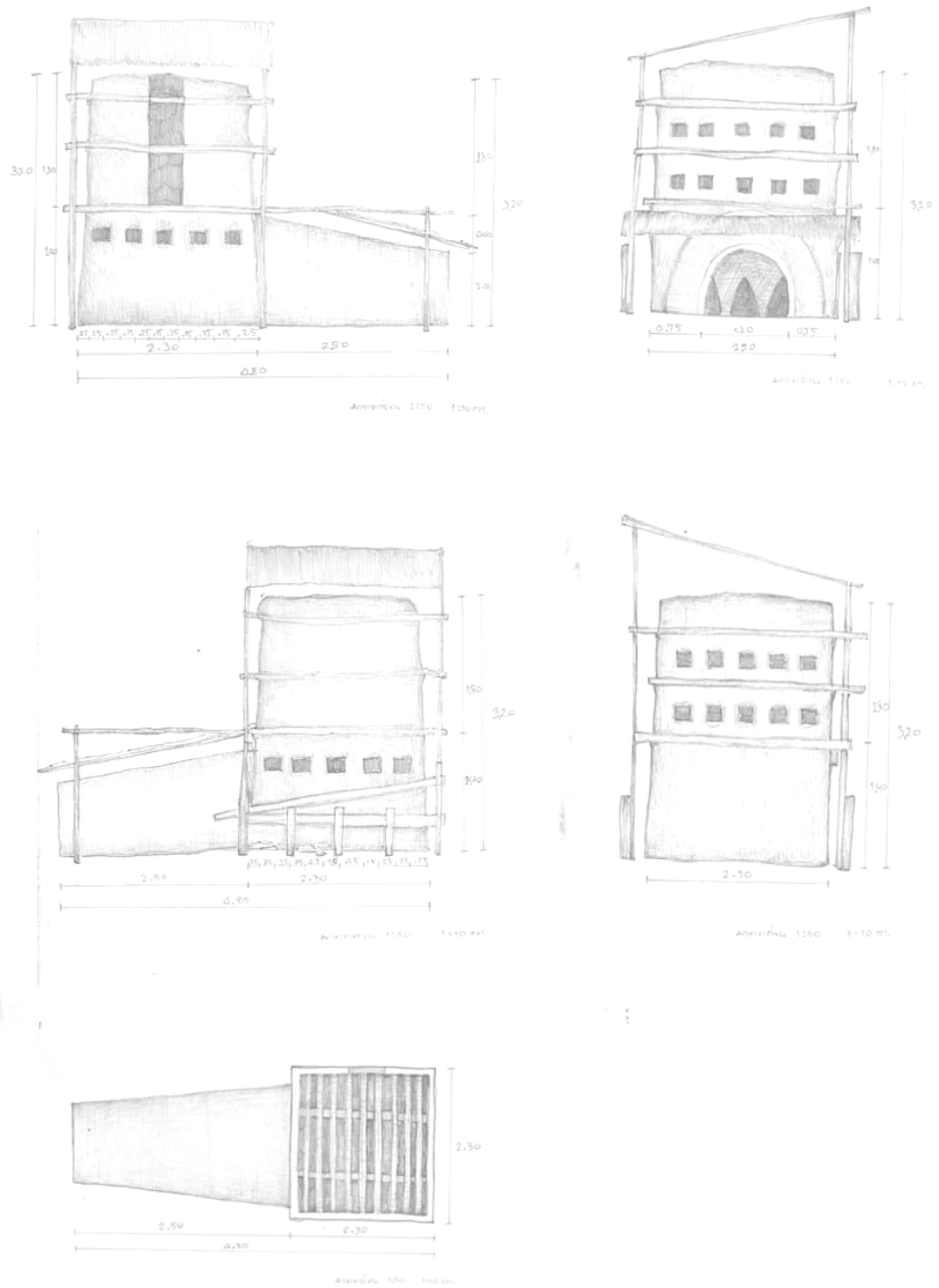


Fig. 176: Sketch drawing of kiln
a) side view showing open vertical gateway for putting tiles or pots,
b) front view showing combustion chamber,
c) side view,
d) rear view show horizontal rolls of square holes for fuel,
e) top view show grates lying above 2 supports .

Pots are sun – dried for few hours before uploading to kiln, which is usually in the morning.(Fig.177-179) The potters firstly arrange large pots to be lined up in the kiln by side of the pots upward; mouths of each pot meet together alternately their bottoms in each row. Smaller pots will be lined up on the upper rows. Lids can be inserted between gaps of pots in each row to prevent an unexpected slide during fire process. Once lining up pots to reach stroke holes level, fire woods (“fuen nai”) are lied. When the uploading is finished, the gateway is closed by brick built up and clay plastered. Fuel is uploaded atop and stacked by broken shards. (Fig.180-182)

Firing pottery or ceramic need skillful male potters while potted shape making is woman work. Usually this process start early in the morning, a ceremony to worship Mother Goddess of the kiln is prepared by worship with flowers, candle and incensed sticks light up and pray to beg for good luck and success. (Fig.183-184)

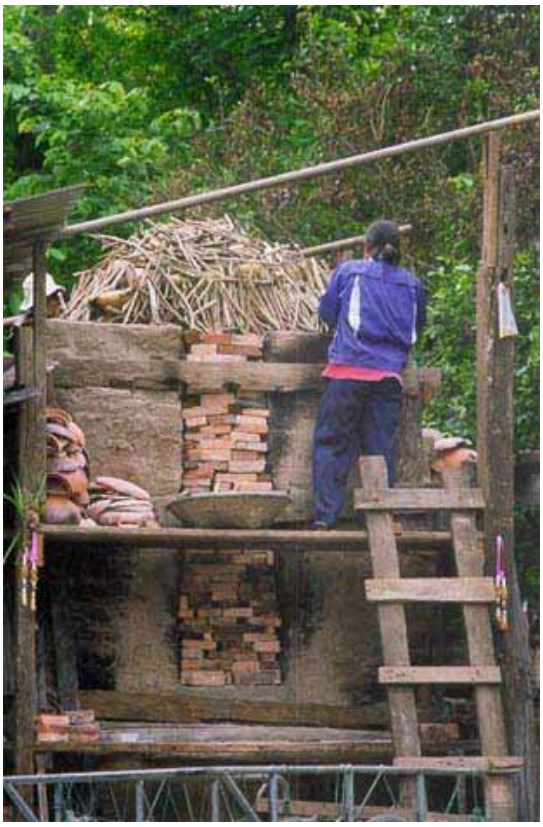
Firewood is lighting up in front of combustion tunnel until transforming to hot coal stage, then it is moved into the combustion chamber the inner part to preheat kiln and warm up the pots. The most important stage is to add brushwood and bamboo for continually rising heat and controlling high temperature by consequently add more brushwood till the potteries are done or transformed to hard stage which is about 6-7 hours for 400-500 pots or 4-5 hours in case of 200-300 pots uploading in kiln. Pottery will be left to cool down and kept in the kiln. Transferring potteries from the kiln is done in the morning by using bamboo basket to carry them and pass to a person waiting in front of open gateway. Some broken pots are accidently occurred and left to be used for the next firing. (Fig.185)

3.2 Tiles

Besides potteries, the evidences suggested tiles production has been a local occupation of people in this area before 1942. Earthen tiles have been used for roof tops of buildings of temples, such as ordination hall, preaching hall, monk dwellings

Fig. 177-179: Drying before uploading to kiln.

Fig.180: Laying row of pottery alternate to wood served as fuel in kiln, the smallest pots always on top.



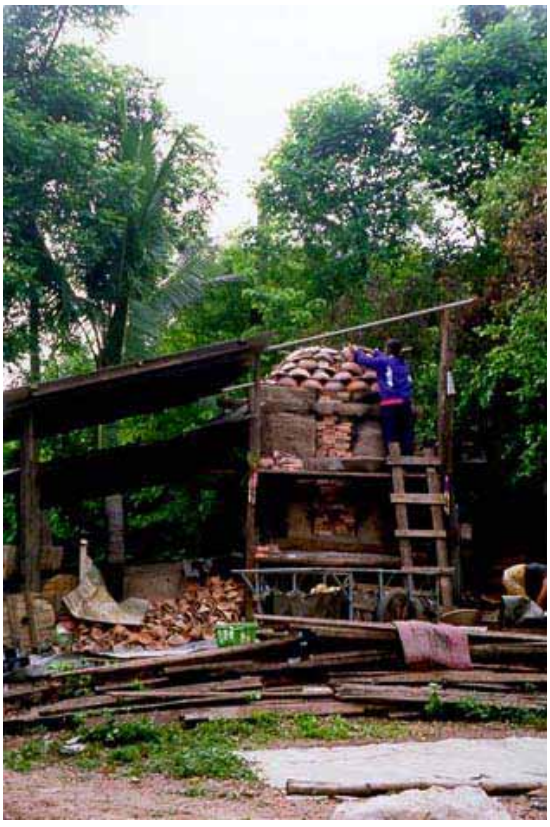


Fig.181-182: Closing gateway by bricks, stacking atop of pottery by brush woods for fuel and broken pots for protection


Fig.183-184: Worshiping Mother Goddess of the kiln.

Fig.185: Firing in process.


Fig.186: Burning wood to coal.
Fig.187: Turning coal in combustion chamber to preheat kiln.

Fig.188: Filling more fuel.

Fig.189-190: Filling more fuel to increasing more heat.

Fig.191-192: Adding brushwood coal inside the chamber by bamboo.

Fig.193: pots after firing in kiln.

Fig.194: 4 sizes of desirable pots

Fig.195: 4 sizes of desirable lids.

Fig.196: Salt pot.

Fig.197 : Pots are moved from kiln.

or other classical Thai houses. There are mainly 3 types of tiles and their sizes are given in table no.4

a) End pointed tiles or “kra bueang gret tao”. The name is given under the appearance of roofing, which looks like a turtle’s carapace feature. There are 2 types of this kind, one is applied to lie on the lower of row while roofing or “kra bueang gret tao tua pu”, the other is applied to lie on the upper of row while roofing or “kra bueang gret tao tua mia”

b) Fat tiles or “kra bueang din kho”. The name is given under the appearance of a hook-liked in cross-section, which is usually used for ridge roofing.

c) Flat tiles or “kra bueang chai nam”. The name is given under the appearance of its function at the end of the roof, as water or rain drainage.

3.2.1 Making Technique

In the production of tiles, an amount of “clay” is prepared by mixing with sand and soak in water over night in a well. Repeatedly feet kneading are done for 3-4 hours in circular form on floor from outer to centre and overturn 4-5 times. Sand is added by spreading on floor during being kneaded until it is mixed well and is slightly sticky with medium coarse touch. The lump of kneaded clay lump is then smoothened to maintain moisture by packing and covering with plastic sheet before proceeding to mould.

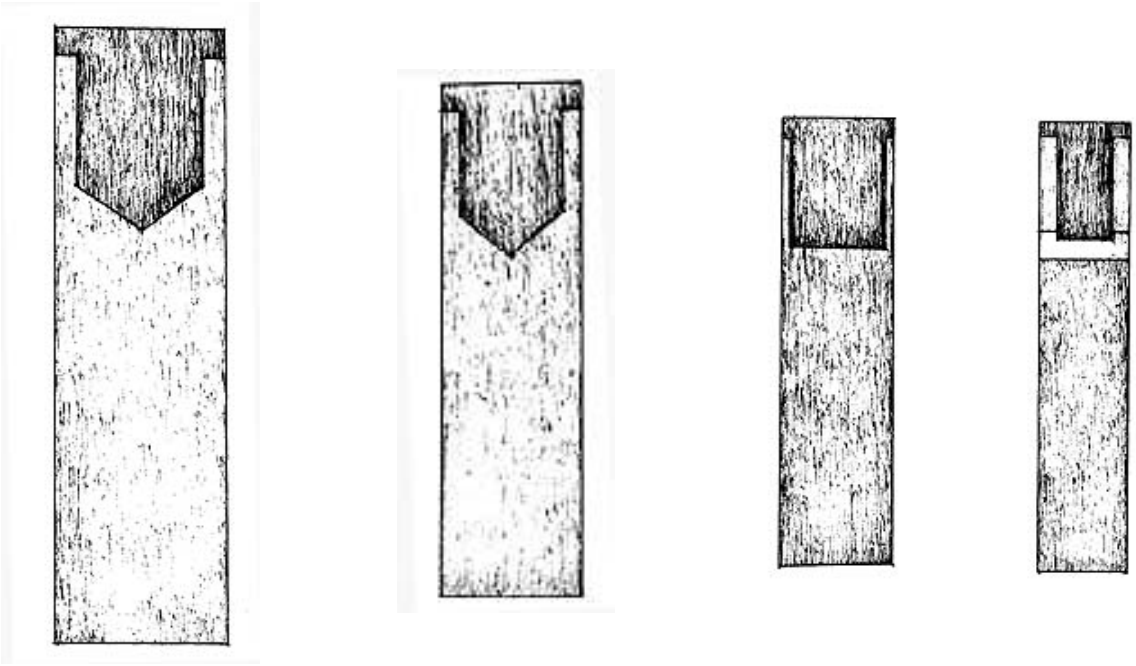
Wooden moulds are applied to produce tiles. There are 2 types of moulds for making each tile; one is for making a flat clay sheet and the other is for trimming to shape. They are usually made of teak cut into board, chip into tile shapes and polish to give finer surface. Details of tiles mould is described in the table no.5 (Fig.198)

Firstly, molding board for spreading clay sheet is lying along with sand, a water pail and a wooden cutter. Tile maker, generally female, sits at the lower end of board lying on the ground. She sprinkles water to clean up the board, then kneads small clay lump on the sand (served as a coat to prevent the clay from getting struck in the mould), put it on the board, spread the clay to fill up the entire mould and flatten it by using wooden blade or cutter. The next step is to pick up a flat clay sheet out of the mound and lay in

rows on the other side to dry. Then the turn clay sheets are kept and store for next step.

Table no.5 Detail sizes of tiles mould

	Width cm.	length cm.
Mould for spreading clay sheet of end pointed tile -lower row end pointed tile "*kra bueang gret tao tua pu*"	15	26
Mould for spreading clay sheet of end pointed tile -upper row end pointed tile "*kra bueang gret tao tuo mia*"	14	22.5
Mould for spreading clay sheet of flat tile -ridge roofed tile "*kra bueang din kho*"	11	20
Mould for spreading clay sheet of flat tile -end roofed tile "*kra bueang chai nam*"	15	25



(a) (b) (c) (d)

Fig.198: Drawing of wooden mould for (a) and (b) end-pointed tiles, (c) and (d) flat tiles.

Secondly, shape up clay sheets by trimming and making hooks. The maker sits on a plain board laying a clay sheet on one side atop with the model board (table no 6, Fig.199). Then, cut the outer rims with wooden blade to get an equal size of each tile model. A hook is fixed at the centre of its upper end. This is exceptional for ridge roof tiles, which clay sheet will be folded upright widthwise by helping of a bamboo straightedge. A complete tile is again lift to dry under sun. This process will repeat until it meets a required amount. Each maker will manage each type of tiles separately for an easy quantity counting. The tiles will be stored until be to the amount is fit in one kiln uploaded.

There are many styles in storing tiles that depends on duration of production and different types of tiles. Ridge roofing flat tiles are kept in a pile of 5 sheets in 2 rows alternate to another set. A technique is called “pa” which is to arrange the tiles vertically. “prom” is applied in cylindrical form (not higher than 50 layers) in order to make the tiles dry faster.

3.2.2 Tile Factory Location

The well-kneaded clay is simple placed outdoor for tile maker convenience. Tile making is required flat larger open space (Fig.200-201), especially for 3 different processes of drying as following;

1st stage- after spreading the clay from the mould, (Fig.203-210)

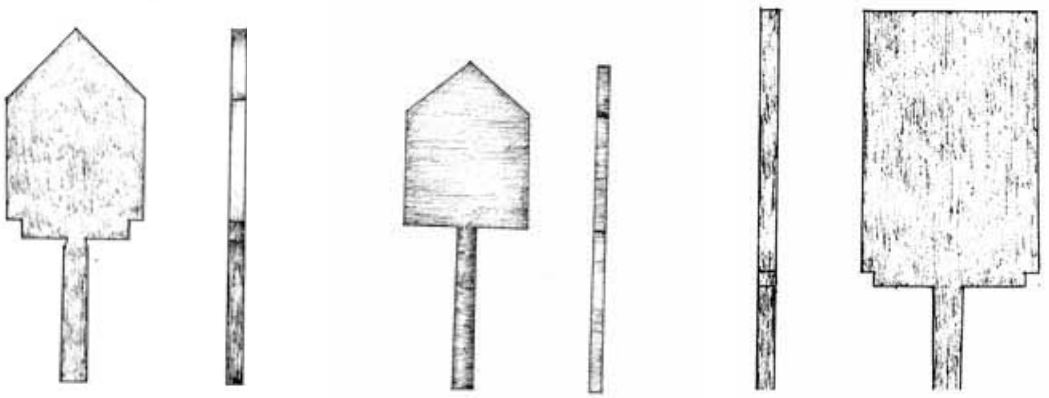
2nd stage- after trimming tile shape, (Fig.211-217) and

3rd stage - before firing in the kiln, (Fig.218-228)

Besides, storage is also necessary to keep the processed tiles to be ready to be fired. However, the tile makers have applied umbrella or palm leaf as a temporary shade to avoid direct sunlight. The preferable open air working space is under a large tree, especially tamarind *(Tamarindus indica)* which its shade provide sufficient light and wind flow. This points out that the tile makers have made use of natural environment while they are working since the past centuries.

Table no.6 Detail sizes of trimming board for tiles

	Width cm.	length cm.	Thick ness cm.	handle cm.
Model board for trimming shape of end pointed tile -lower row end pointed tile *"kra bueang gret tao tua pu*"	12.5	23	2	2.5x18x2
Model board for trimming shape of end pointed tile -upper row end pointed tile *"kra bueang gret tao mia"*	12	18.5	1.7	2.5x17x1.7
Model board for trimming shape of flat tile -ridge roofed tile *"kra bueang din kho"*	12.5	21	1.5	3x16x1.5



(a) (b) (c)

Fig.199: Drawing of wooden moulds for tile finishing by trimming or edge cutting
(a) and (b) end-pointed tiles, (c) flat tiles

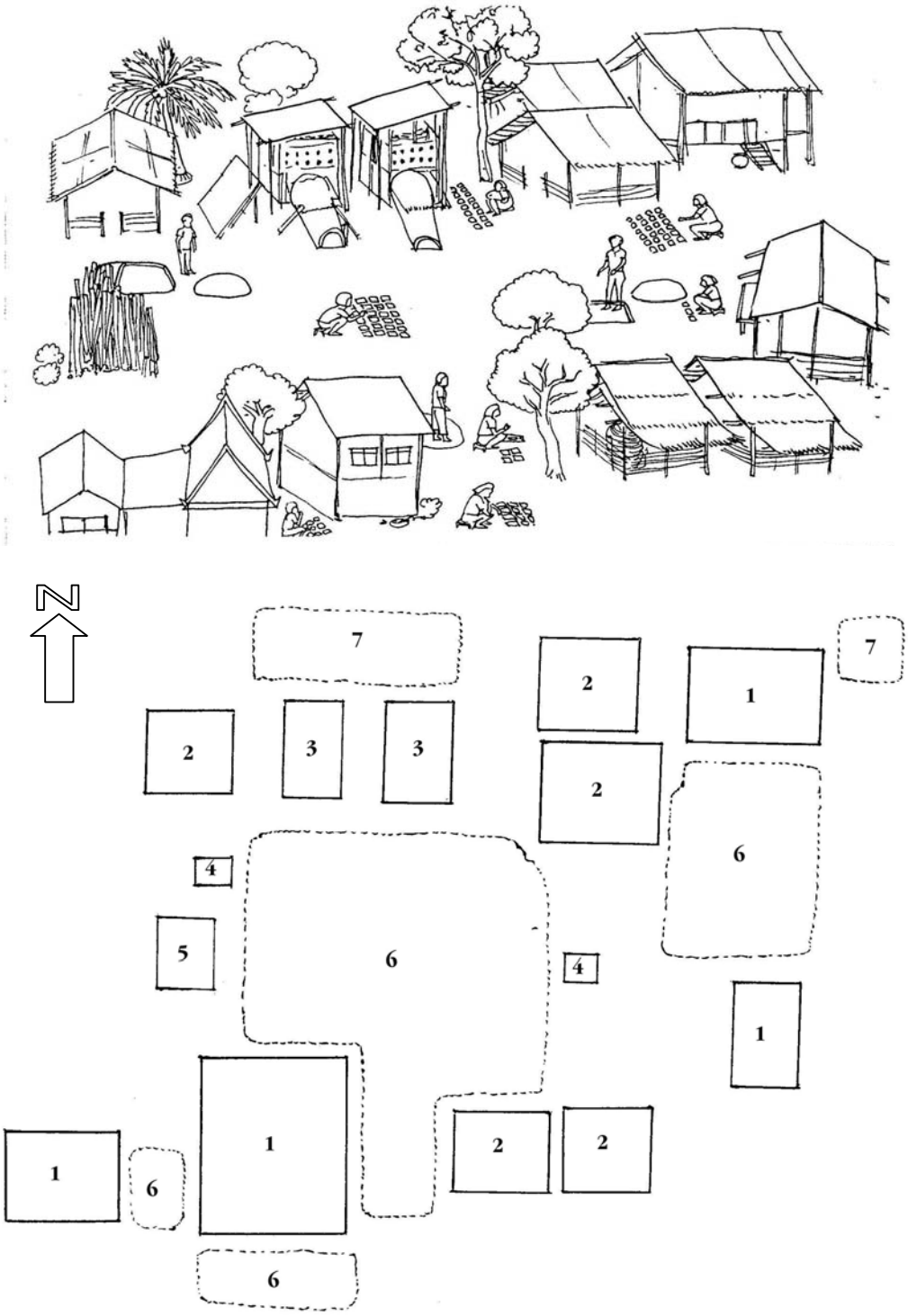


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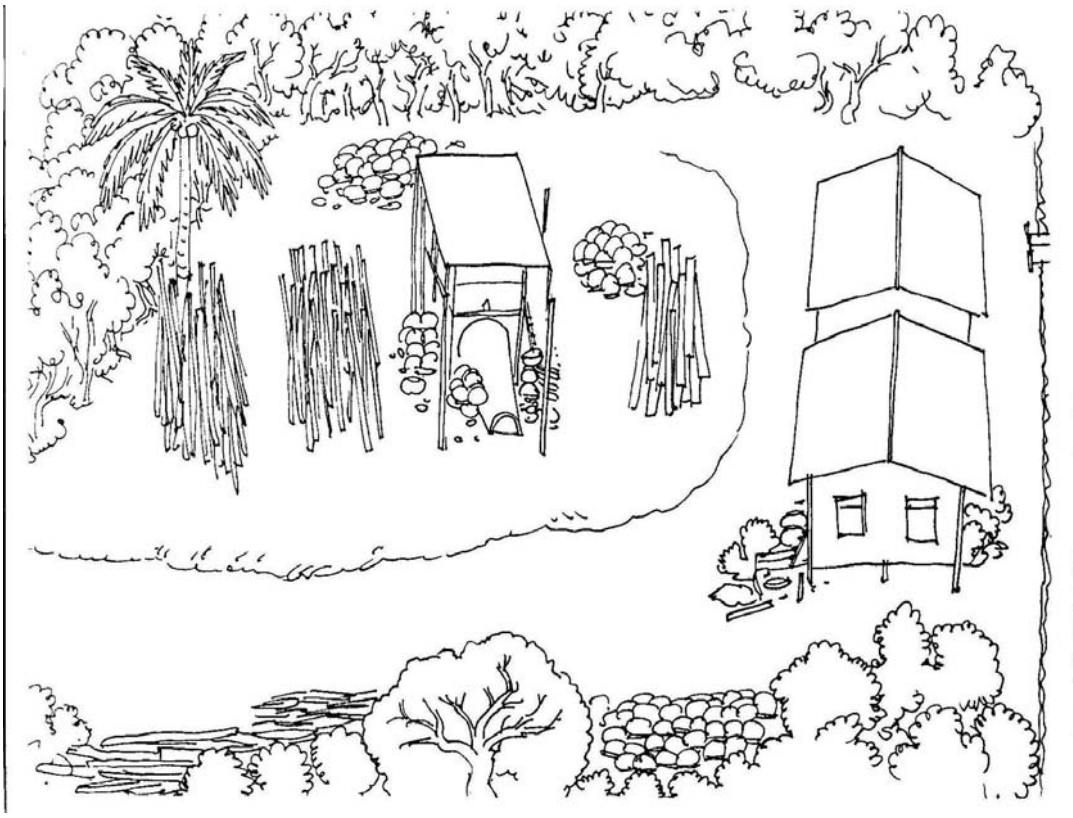
Fig.200: Sketch drawing lay-out and plan of tile factory model 1
1= house 2 = factory or storage 3 = kiln 4 = clay pond 5 = fuel storage
6 = producing ground 7 = drying ground



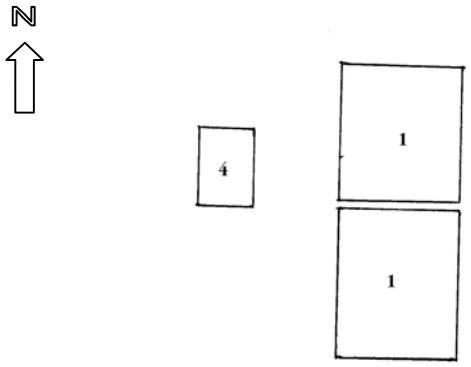


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Fig.201: Sketch drawing lay-out and plan of tile factory model 2
1= house 4 = kiln

Fig.202: Sieving sand, clay mixer as raw material.

Fig.203: “Kuak” mixing clay together with sand.
Fig.204: Circular feet kneading to the centre.

Fig.205: Covering the knead clay lump with sand to maintain its hardness.





Fig.206-210: Process of tile making; knead small lump of clay on sand, put the clay on tile mound wooden board, spreading clay to fill up the entire mound, equally flat shaping by wooden cutter, turning up side down the mound to get a flat tile sheet and laying in row to dry.





Fig.211-215: Making hook by putting tile sheet on cutting board atop by cutting mound, cutting both angles of the straight broad end and retain about 1” at the centre for upright bending to form hook.


Fig.216-217: Flat tile making: after remove from mound, folding one entire broadens end upright.

Fig.218 Collecting tiles after drying.


Fig.219-220: Storing unfinished tiles in “Lom” or laying in rows and cover with sag.


Fig.221-222: Storing end pointed tiles in “Prom” or cylindrical form.

Fig.223: Storing flat tiles in ‘Tang” or vertical form.

Fig.224: Storing flat tiles in “Pa” or vertical form.

Fig.225: Removing tiles from storage to dry before firing.

Fig.226-227: Drying tiles.

Fig.228: Collecting tiles for uploading to kiln firing.

3.2.3 Tile Kiln (Fig.229-234)

To determine the tile kiln location, it is similar to that of the pottery kiln. Its structure is also generally comparable to up-draft pottery kiln. The size is about 250 cm wide, 230 cm long and 320 cm high, which is capable to uploading 18,000 - 20,000 tiles. Upon one side of firing chamber are selected to be opened a 50 cm. width, 180 cm height gateway or “Pra-tu-kaeo”. At the same level of this gateway, there are two rows of five stroke holes at each side of walls and one row above the combustion chamber level purposely for filling fuel during firing. However, only one stroke hole is required in each row at each side. The other difference between potteries to tile kiln is the numbers of grates above the support in combustion chamber. The nine grates with two supports are lying in tiles kiln instead of seven grates with one support for potteries as compare to more loading in tiles than pottery accordingly.

3.2.4 Firing Process (Fig.234-243)

Tile firing process is somewhat similar to that of pottery, in that each type of tiles will be dried before uploading to the kiln. The difference is on the method of lying tiles in the kiln. In the beginning, the broken tile shards are leveled on the grates. The tiles are brought by few men passing 3 pieces[2] at a time through gateway of the kiln. Then, the long side tiles will be laid up alternately to the wide side one. In each layer, the same type of tiles should be laid up either end pointed-lower row tiles or end pointed-upper row tiles and from the inner side of the kiln to the centre. Space along stroke holes will be kept for inserting fuel during firing. However method of lying tiles should be done by experts who know how to arrange the tiles to allow the heat to reach thoroughly. Once the uploading done, the gateway is closed, fuel is uploaded

[2] It is noted that tile makers call a set of 6 pieces of tiles as 1”Uub” which is meant only half of 1 uub will be carried at one time, thus it is not to break the fragile unbaked tiles.

Fig.229: Front view of kiln of which containing approximately 18,000 tiles at a time.

Fig.230: Side view of kiln showing gateway for uploading tiles.

Fig.231: Earthen grate bars for replacement.

Fig.232: Horizontal roll of square stroke holes for fuel input.

Fig.233: Combustion chamber showing 2 supports under grate.

Fig.234: Perforated earthen grate.

atop and stacked by broken shards. Firewood is also inserting inside stroke holes before closing.

Fig.235: Uploading tiles to kiln by man passing tiles through gateway.

Fig.236-237: Laying first row of tiles in kiln.

Fig.238-239: Alternate lying on the next row and fixing gap by broken pieces of baked tiles.

Fig.240-241: Baked tiles are laying to prevent over heating from fuel channel in kiln.

Fig.242: Plastic sheet covering in case of unfinished uploading.

Fig.243: Placing tile shards atop the tiles stacking for protection.

Fig.244: Preheat the kiln in combustion chamber.

Fig.245: Filling fuel inside the firing chamber through fuel holes aside.

Fig. 246: Worshiping mother goddess of the kiln.

Fig.247: Various types of baked tiles.

The ceremony to worship Mother Goddess of the kiln and God of tiles protection is then prepared by worship with flowers, lit up candle and incensed sticks and pray to beg for unbroken and complete perfected tiles.(Fig.245-246) The heating of firewood in front of combustion tunnel until transforming into hot coal stage are taken. After that, the coal is proceedingly moved into the combustion chamber until it reach the inner part, thus to preheat kiln and warm up the tiles.(Fig.244) It is about 4-5 hours at this stage before adding brushwood and bamboo for continually rising heat. The method of controlling temperature by constantly adding more brushwood till the tiles are done or transformed to hard stage takes about 1-2 hours more. Then the tiles will be left to cool down in the kiln for at least 2-3 days and will be removed from the kiln by opening on the top. Six pieces or ore “Uub” at a time will be carried passing to a person who waits in front of the open gateway. The broken tiles will be thrown away in the lower land.

Chapter IV

Comparative archaeological and ethnographical study of ceramic manufacture and kiln

4.1 Archaeological study

This study of archaeological focusing on ceramic manufacture in Ayutthaya, a comparison of the same category of artifacts in the Central plain should be observed. As far as an archaeological survey and excavation evidence is concerned, there are 4 well-known sites which are related by their duration and associated location.

Fig.248 Map of Thailand showing kiln sites in Ayutthaya and Rattanakosin period

4.1.1 Ban Bang Pun kiln site. (Fig.249-255)

This site is located in present-day Suphanburi province, latitude at 14°30'8"north,longitude at 100°6'58"east (UTM 47 620346 E 1605160 N) and about 70 kilometers westward of Ayutthaya. This site is geographically situated on the western bank of Suphanburi (or Tha Chin) River, a western tributary of Chao Phraya in alluvial plain of central Thailand. Its position is related to ancient Suphanburi where people settled down and played strong social role in this area.

Archaeological evidence shows an influence of an earlier Dvaravati community which approximately dates 5th- 11th century, where their main city centre was “U-thong”, 30 kilometers westward of ancient Suphanburi. Also, there were many other small communities along Supanburi’s tributaries, such as Tha-wa, Charakhe Samphan, and “Khu-Muang” or moat and rampart town. A smaller community along Suphanburi River is Dem Bang Nang Buod District, Suphanburi Province which continues in present-day. Many ancient Buddhist temples in this area show strong influences of Dvaravati style especially stupas on octagonal bases and also show so-called “U-Thong” style in later period or after 13th century. The first Thai inscription which is dated at the 15th century mentions “Suphanbhum” with other place names located in Sukhothai southern region which are clearly identified as Suphanburi. [1] This evidence shows that this area has been long occupied since early historic “Dvaravati” or prehistoric period to later times. This is a basic background of community development in the early Ayutthaya period.

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[1] กรมศิลปากร, แหล่งเตาเผาบ้านบางปูน, เอกสารกองโบราณคดีหมายเลข 9/2531 (กรุงเทพฯ: โรงพิมพ์ชุมนุมสหกรณ์ 2531), 8.

Excavations have been carried out in 1987 and 1999[2] The kiln site approximately covers about 1000 square meters on both sides of Suphanburi River. At least 10 kilns were found in the 10x10 meter excavated pit in 1987.They were identified as horizontal or cross draft kiln type with oval in shape. They were found with 6 layers of kiln's floor built on top of each other. This means that new kilns were re-built at the same place of the previous ones, at least 5 times. Other kilns were built although separated aside or above other kilns in the main group. It can be assumed the continuity of ceramic manufacture for a long period. The kilns were made of fired-harden clay 15-20 centimeters thick. The size is approximately 2 meters wide 5-6 meters long and attached with the 1x1 meter square at the end which served as a chimney. The biggest chimney is about 3 x 8 meters. The front of their oval chamber is stepped about 60 centimeters below to serve as firing pit. The middle part is a ware chamber. Products of this kiln group are high-fired earthen bowls, round bottom pots with incised, stamped decoration under reddish brown slip and some stoneware vessels. The attribute of the ceramic products from this kiln is the high temperature of 1000° to 1200° Celsius. Archaeologists assume the kiln's date when first made to be early 11th century and continuously to 12th to 13th century[3]. This assumption matches to carbon dating done by the 1999 excavation. The sampling from the earliest human activity layer given was measured at a radiocarbon age at 760±50 BP. / calibrated age at 1205-1300 AD. It is confirmed that their well known cross draft kiln technology of this ancient communities was before 11th-13th century.

ศุภมาศ ดวงสกุล , แหล่งเตาเผาบ้านบางปูน, เอกสารประกอบการสัมมนาประวัติศาสตร์โบราณคดีสุพรรณบุรี16-17 กันยายน พ.ศ. 2542 ณ โรงแรมคุ้มสุพรรณ อำเภอเมือง จังหวัดสุพรรณบุรี,(อัดสำเนา)

[3] กรมศิลปากร,Ibid., 55

Fig. 249: Feature evidence of Ban Bang Pun kiln

Fig. 250-251: Stamped decoration on potteries of Ban Bang Pun

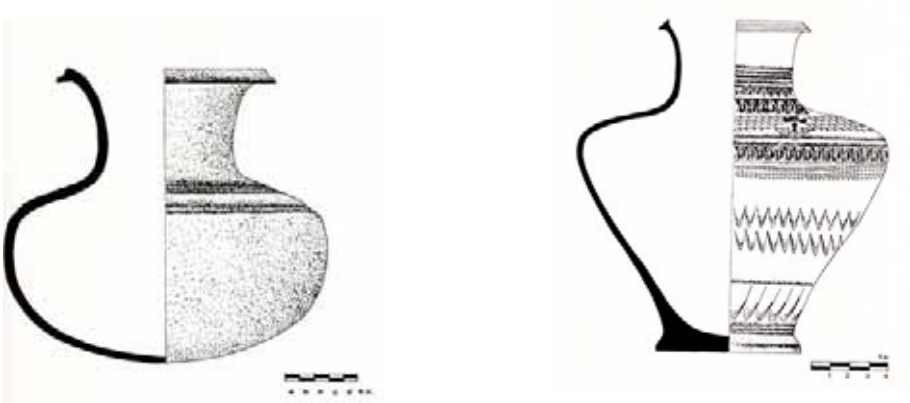

Fig. 252: Drawing of Ban Bang Pun potteries.

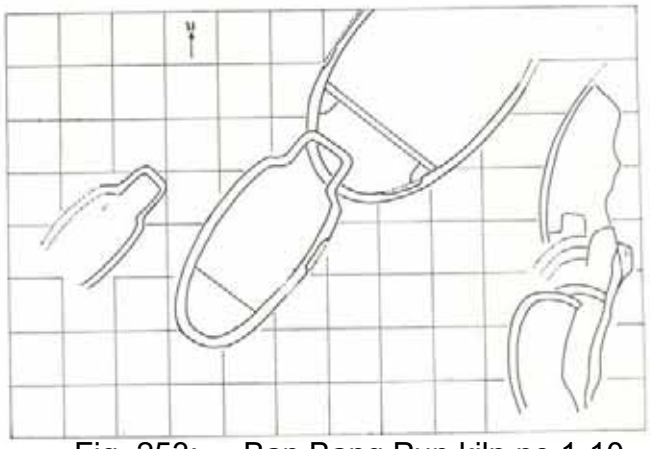

Fig. 253: Ban Bang Pun kiln no 1-10.

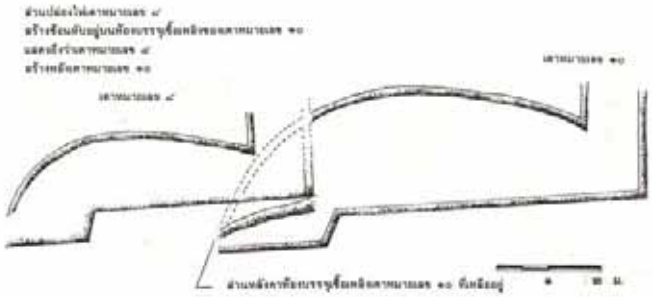

Fig. 254: Reconstruction of Ban Bang Pun kiln no 8 and 10.

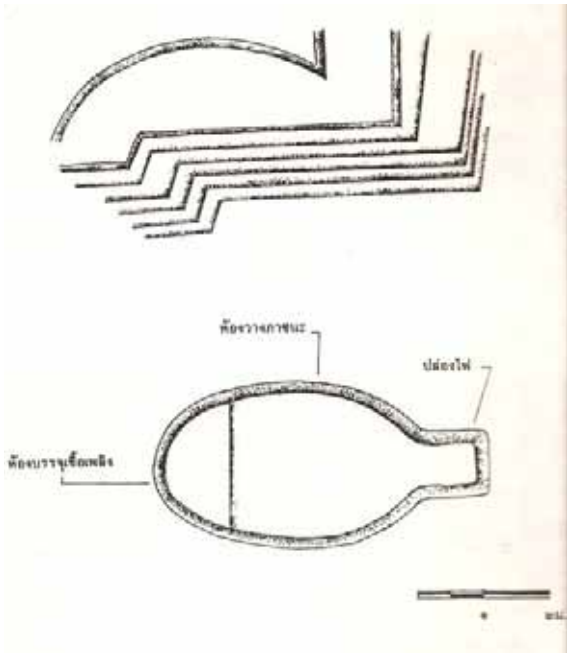

Fig. 255: Reconstruction of Ban Bang Pun kiln no 1-6.

4.1.2 Noi River kiln site. (Fig.256-261)

This site is located in present-day at Singhburi province, latitude at 14°55'0"north, longitude at 100°16'0"east and about 100 kilometers north of Ayutthaya. It's geographically situated on the western bank of Noi River, a northern tributary of Chao Phraya River. Its location is related to ancient Singh which is a satellite town under Ayutthaya capital

Evidence of ceramic manufacture is found 2 kilometers along the river bank. After excavation in 1988-1989[4],at least 4 kilns were recovered. Each kiln has a brick construction with clay-plastered in oval shape and a cylindrical chimney at the end. There is about a 2 meter step below at the front with a fire hole which serves as an entrance. They are definitely horizontal cross draft kiln with the size at about 5-6 meters wide and10-11 meters long. It is assumed an arch ceiling of cross draft kilns. Soil profile is shown with packed debris of wasted or distorted shards which served as an artificial uplift kiln floor. This is also in accordance with the kilns of the later period of Sukhothai-Sichatchanalai. Main pottery products of this kiln site were dark brown glazed and unglazed stoneware jars, large bowls or basins, mortars, bottles, pots, lids and some of kendi or kettles, steamer, small bowls and bowls with stand together with unglazed high fired earthenware in the same type of vessels. Some architectural accessories are also found as its production, which include tiles, water pipes, decorated articles, etc. Comparative dating of potteries found especially in ship wrecks can date this kiln site from 16th -17th century. However the exact date of samples from kiln no.2 shows its continuity from 17th-18th century[5].

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[4] กรมศิลปากร, เตาแม่น้ำน้อย 2,เอกสารกองโบราณคดีหมายเลข 4/2533,โครงการโบราณคดีประเทศไทย,(กรุงเทพฯ:โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย, พิมพ์ครั้งที่ 3 , 2533)

กรมศิลปากร, เตาแม่น้ำน้อย, (กรุงเทพฯ : โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย จำกัด, 2531)

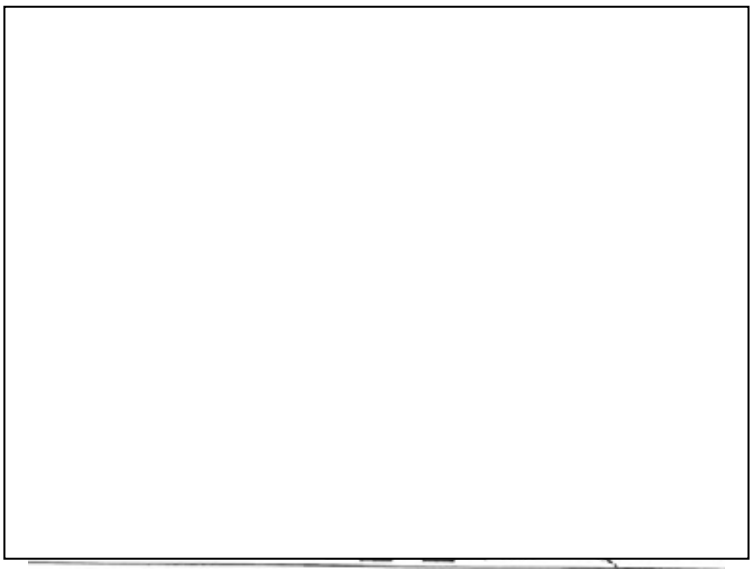


Fig. 256: Location of Noi River kiln site.

Fig. 257-258: Features of Noi River kilns.

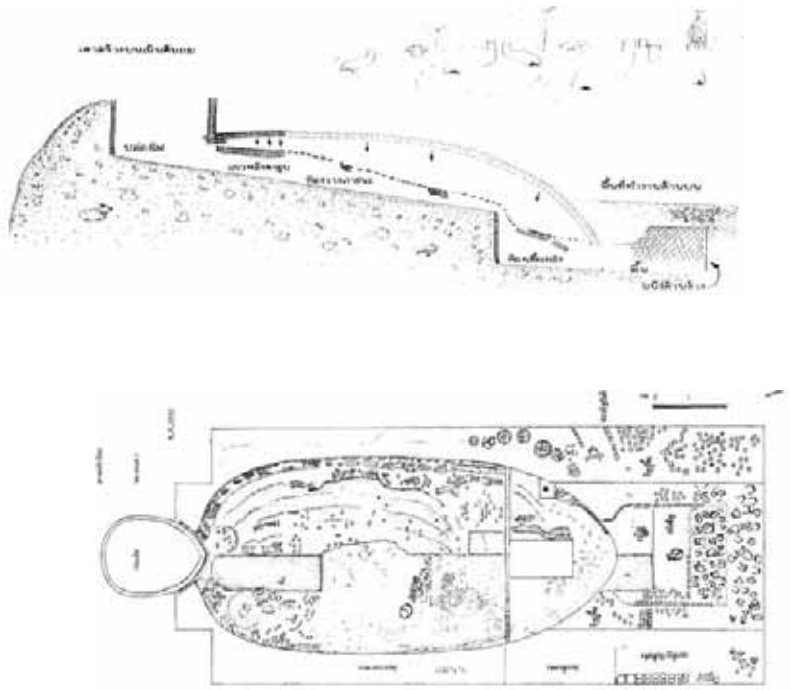


Fig. 259: Reconstruction of Noi River kiln.

Fig. 260: Some potteries of Noi River kiln.

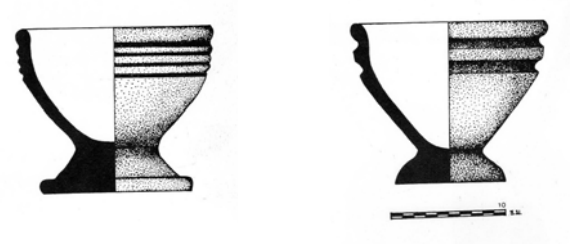
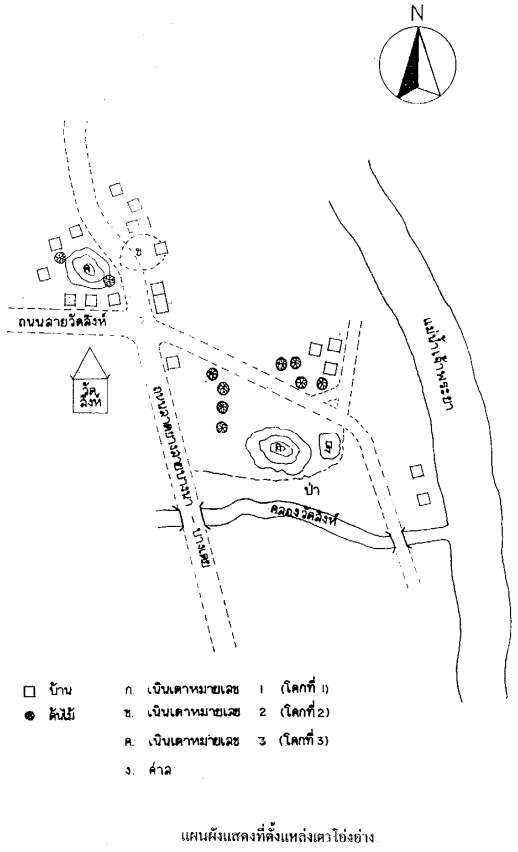


Fig. 261: Drawing of Mortars, Noi River kiln production.

4.1.3. **Ong Ang or Sam Khok kiln site**. (Fig.262-273)

This is located in present-day Pathumthani province. It is about 50 kilometers southward from Ayutthaya. It's geographically situated on the western bank of Chao Phraya River. Its location is in ancient Sam Khok village. Historical records show that Mon immigrant settled down here by an order of King Narai of Ayutthaya. The earlier Mon immigrants had already exhibited on the eastern bank of the river and they expanded their community across the river bank. These Mon groups maintained their community through the early Bangkok or Ratanakosin period. King Rama II changed this area's name to be Pathumthani as for its place and provincial name till this day.



แผนผังแสดงที่ตั้งแหล่งเตาโอ่งอ่าง

Fig. 262: Location plan of Ong Ang or Sam Khok kiln site.

Three kiln moulds are located in Wat Singh area which is 100 meters away from the river bank. The first and less-damaged kiln mould was excavated in 2000[6] and 4 single chamber cross draft kilns were uncovered. They are oval in shape with the size at 17 meters long, 4.5 meters wide and made of brick. They have an artificial uplift platform to avoid high water level during flood. One appears to be rebuilt (kiln no.3) over the ruins of previous one (kiln no.2) with the same axis.

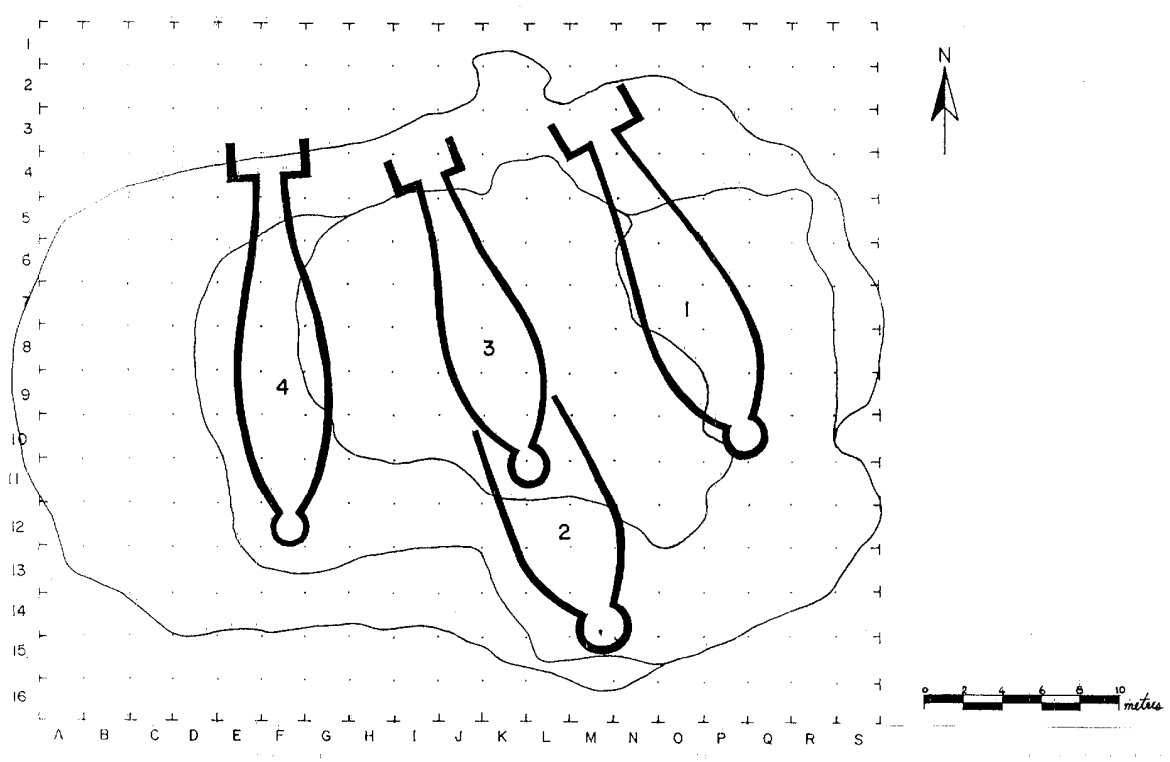


Fig. 263: Plan of Ong Ang or Sam Khok kiln.

[6] สำนักงานโบราณคดีและพิพิธภัณฑสถานแห่งชาติที่ 2 สุพรรณบุรี, รายงานเบื้องต้นการขุดค้นศึกษาทางโบราณคดีแหล่งเตาโอ่งอ่าง ตำบลสามโคก อำเภอสามโคก จังหวัดปทุมธานี. (อัดสำเนา), 2543.

Their structure consists of 3 parts; fire box with fire hole and an entrance on packed clay mix with sand and ground brick floor located on the lowest part of the front mould; a ware chamber with 60 cm of 2 steps beneath the fire box with slightly concave packed floor in the middle, and 1.1 meters cylindrical chimney attached at the end. Its wall is doubled-layer with clay and ground brick filling. The surface is covered with clay plastic in order to form arch vault. The products found from this kiln site are distorted or over fired. They are identified as big jars or “Lerng”, basins, mortars, kendi or kettles, bottles, steamers, bowls, plates, oil-lamps, lids, stoves, etc. They are mainly plain vessels and are rarely stamped with decoration in Thai classical floral designs. Some architectural supplements are also produced; they include water pipes, small roof tiles with hook, floor tiles, human and animal figures. According to Chinese ceramics of Qing Dynasty (1644-1911),this manufacturing can be dated in during the middle of 17^{th} -19^{th} century.

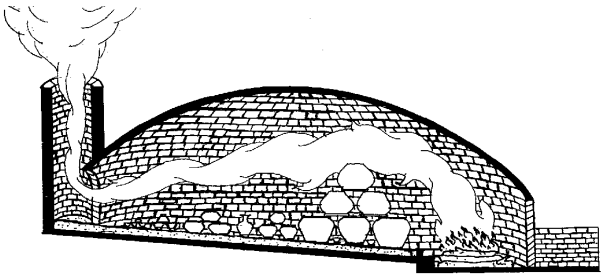
Fig. 264: Ong Ang or Sam Khok cross draft kiln.


Fig. 265-266: Firing chamber of Ong Ang or Sam Khok cross draft kiln.

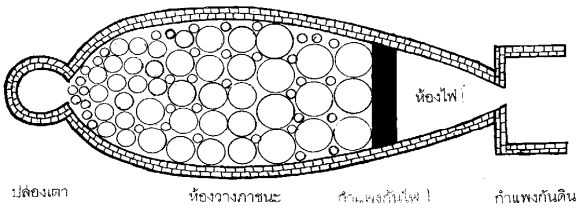

Fig. 267-268: Chimney of Ong Ang or Sam Khok cross draft kiln.




Fig. 269-272: Ceramic products of Ong Ang or Sam Khok kiln.



ภาพสันนิฐานแสดงด้านตัดตามแนวยาว
เตาโอ่งอ่าง อ. สามโคก จ. ปทุมธานี



ภาพสันนิฐานแสดงรูปแปลน
เตาโอ่งอ่าง อ.สามโคก จ. ปทุมธานี

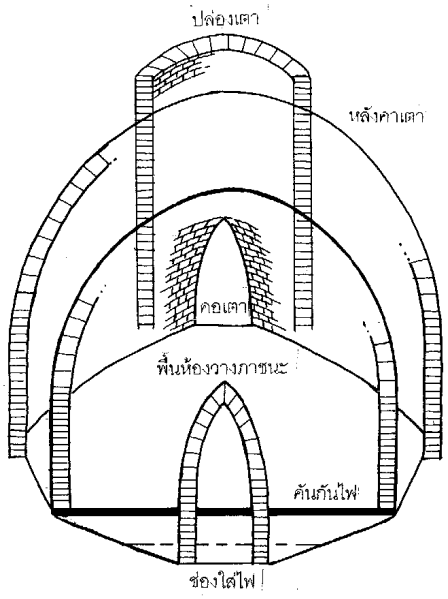


Fig. 273: Reconstruction of Ong Ang or Sam Khok kiln

4.1.4 Khok Hmo kiln site. (Fig. 274-280)

This site is located at present-day in Ratchburi province and is about 270 kilometers south-west of Ayutthaya. It is geographically situated on the eastern bank of Mae Klong River. Its location is in ancient Ratchburi, another Ayutthayan satellite town.

Archaeological excavation has not yet been done, a lot of evidence during many surveys found fragments of kiln structures such as broken pieces of arch vault, thick baked-clay sheets with holes as part of grates, etc. Archaeologists assume at least 2 types of kiln were applied in Khok Hmo manufacturing, which were cross draft and up draft kilns[7]. Production from this kiln was mostly earthen pots with stamped decoration. 3 main sizes of round-base pots were found; large, medium and small and some other items such as bowls, mortars, oval-base pot-stand and cylindrical tiles. Many collective potteries in 3 private museums along Mae Klong River, namely Wat Khok Hmo near the kiln site, a small island of Wat Ko 3 kilometers Mae Klong downstream of the kiln and House of Tang Siam Ha, Bang Khon-thi District, Samut Songkhram displayed those three sizes of Khok Hmo potteries and categorized as Mho Tha-non, Mho Tan and Mho Puon respectively. These are considered according to their purpose in use for water container, sugar and lime packages. However there are some medium round pots that served as cooking utensils as well.

. The objects found in other sites along Mae Klong River especially on the opposite of Khok Hmo kiln site, where the outer end of ancient Ratchburi city wall is located, are of Ayutthaya period. It is assumed the kiln is as the same period as the city. It has long survived through Ratanakosin by their government that controlled sugar pot producing during reign of King Rama V[8].

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[7] พยุง วงษ์น้อย , แหล่งผลิตภาชนะดินเผาในลุ่มน้ำแม่กลอง (เมืองราชบุรี) ,(อัดสำเนา), 2540 ไม่ปรากฏเลขหน้า

[8] Ibid


Fig.274 – 275: Location of Khok Hmo kiln site.



Fig. 276 – 277: Evidences found on the surface of kiln mould.



Fig. 278 – 280: Collection of potteries from Khok Hmo kiln site.

By these 4 prominent kiln sites in the central plain around Ayutthaya there is no doubt in the knowledge of ceramic making and their

expertise in cross draft kiln technology. Nevertheless very well known Sukhothai and Si-Satchanalai kilns in the northern region are shown to have evidence of their specification in same kiln type and that had passed to the central region which is shown clearly at the Noi River kilns. Thus Ayutthayan potters would have been able to know the usage of cross draft firing as well. Contrary to the evidence found in the excavation pits at Klong Sra Bua, hence, ethnographic study should be considered in vaster areas.

4.2 Ethnographical study

Throughout the country, various types of ceramic production are widely spread especially in bricks and tiles where many factories are found in Phra Nakhon Si Ayutthaya, Ang-Thong, Saraburi,etc. Dome shape kilns are being used where they were most likely introduced in 20th century A.D. [9]

Fig. 281: Modern downdraft dome shaped kiln, Ang-thong.

Only the earthen products should be considered for closer determination. These earthen products include construction materials such as

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[9] สุขุมาล เล็กสวัสดิ์, เครื่องปั้นดินเผา พื้นฐานการออกแบบและปฏิบัติงาน, (กรุงเทพฯ : สำนักพิมพ์แห่งจุฬาลงกรณ์มหาวิทยาลัย, 2548) , 57

bricks, roof and floor tiles, and also potteries. Most of the bricks were produced by bonfire technique of firing either with or without earthen heated protection walls. This is observed in the central region such as in Phra Nakhon Si Ayutthaya, Ang-Thong, Nakhon-sawan, Kampaeng-petch[10] provinces (Fig.282). However the feature of this bonfire technique for baking bricks is not able to be matched to any kiln features found in excavated pits.

Fig. 282: Brick producing in modern clump kiln, Kampaeng-petch.

Tiles and potteries were mainly produced in kilns. There are two traditional techniques in firing potteries. The more common one is open bonfire which is still practiced in some local groups but rarely found in the central plain. It appears that potteries are almost baked in cross draft kilns which follow traditional methods. The prominent examples are the Mon peoples at Ko Gret in Nonthaburi, Bang Gang in Nakhon Sawan pottery making groups.

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[10]อายุวัฒน์ สว่างผล,การศึกษา สำรวจอาชีพช่างปั้นดินเผาประเภทต่างๆ ในจังหวัดกำแพงเพชร และจังหวัดตาก, ม.ป.ท. 2547

4.2.1 Ko Gret / Ban Gang pottery making. (Fig. 283-288)

Ko Gret is located in Pak Gret District, Nonthaburi Province. The oral history mentions the villagers' origin to be Mon ethnic from Ban Arman (meant "village of potters") in Maulmein or Mawlamyine in present Myanmar. Mon migration to the Central plain of Chao Phraya River occurred about 9 times from 1539 to 1814 especially for the majority of them to escape from the Burmese invaders in 1757 or few years before the declining of Ayutthaya Kingdom. The last Mon migrants were allowed to settle down in Sam Kok (Pathumthani), Pak Gret (Nonthaburi) and Phra Pra Daeng (Samut Prakarn) in the reign of King Rama II. The Mon who lived along the river sustained life by selling potteries and in return trade firewoods, palm leaf thatches from Mon living near the sea. Connection of Mon groups was widespread and new villages settled in many parts of the country. One of well described group is in Ban Gang village of Nakorn Sawan Province. They migrated from Pak gred 60 years ago and continued pottery making as one of their occupations.[11]

In general the process to produce Pak Gret or Ban Gang pottery is similar to Klong Sra Bua/Klong Bang Kuad villagers. Basic materials are firstly prepared thus; clay for making pots, sand for mixture and firewood for firing process. Damp clay is well stored for 6-7 days then sand mixed in proportions of 3: 1and machine kneaded. Wheel throwing has been used to build the pot by electric wheel thrower. After shaping up pots, the decoration of engraving technique proceeds. This rich engraved decoration in floral designs on potteries' body is specific of Mon potteries of Pak Gret or Ban Gang. The decorated pots are kept under shed for 3 days then uploaded to kilns which are a cross draft. Firing then takes place in a firing chamber at the front with frequently added firewood for 3 days.

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[11] องค์ บรรจุน. "มอญ เกาะเกร็ด." วารสารเสียงรามัญ ฉบับที่ 9 พฤษภาคม-มิถุนายน 2550, 3-4.

Fig. 283 – 284: Modern pottery production of Ban Gang, Nakorn Sawan.

Fig. 285: Oval cross draft kiln of Ban Gang, Nakorn Sawan.

Fig. 286 – 288: Oval cross draft kiln of Ban Gang, Nakorn Sawan.

It thus establishes that Klong Sra Bua either updraft kiln pottery making or half-oval kiln features do not relate to above mentioned groups.

Further searching for other ceramic producers in other parts of Thailand, it appears that there are at least two areas where the people still produce bricks and tiles in kilns. Both sites are located in the south. One is located in Ko yor, and Tha Nang Horm villages, Songkhla province and the other is in Du-Song-Yor village in Pattani province.

4.2.2 Ko Yor / Tha Nang Hom construction material products.

(Fig. 289 – 302)

Ko Yor is a small island located at the southernmost part of the Songkhla lagoon, where the city of Songkhla is situated. Towards the north along the eastern shore of this lagoon is lower plain where Tha Nang Hom village is settled by the expansion of people from Songkhla to Hat Yai district. A hundred years ago or more, there were more than 100 houses that produced earthen tiles which spread out to Saiburi district, Pattani province. Most of the villagers were Chinese whose ancestors migrated from South China in early Rattanakosin period. These Chinese immigrants settled in Songkhla and sustained their life in ceramic manufacture especially tiles.[12] But later local Thais got more involved in this manufacture and a few families are still involved in tiles producing activities.

. The main products of Ko Yor / Tha Nang Hom villages are tiles and bricks. 4 types of roof tiles are: end pointed flat tiles, ridge tiles, eave tiles and half cylindrical tiles, which their sizes are described in table no.7

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[12] มหาวิทยาลัยศรีนครินทรวิโรฒ สงขลา, สถาบันทักษิณคดีศึกษา,"จีน: ผู้คนและวัฒนธรรมในภาคใต้," ใน สารานุกรมวัฒนธรรมภาคใต้ พ.ศ. 2529, เล่ม 2 (กรุงเทพฯ: อมรินทร์การพิมพ์,2529), 829

Table no.7: Detail sizes of Ko Yor / Tha Nang Hom tiles

	Width cm.	length cm.	thickness cm.
End pointed flat tile	15	20	1
Flat tile -end roofed tile or "*kra bueang chai* "	13.2	24	0.5
Flat tile -ridge roofed tile or "kra bueang hlop"	15	29	0.9
Half cylindrical tile "*kra bueang kap klouy* "	19.5	22	0.8

Their typical characteristic of flat tiles of Ko Yor / Tha Nang Hom villages is the upper end of tile sheet. This is folded about 2-3 cm upright to serve as hook for locking on roof batten. Besides roof tiles 4 types of floor tiles which sometimes are called bricks are also produced. They are square in 15, 20, 25, 30 and 35 cm. in size. Rectangular bricks are made for constructions of buildings in either houses or temples. Half circular bricks are specially produced for forming round pole bases or pillars and trapeziums for the wall of water well.

Due to the location in the southern region, this site is in tropical area where rain is always a main obstacle for any process outdoors. A thatch-roofed workshop is built, where it is also used for storage and also a comfortable place at all times of working. The process of making is begun by preparing clay kept in a shallow well to the ground and chopped by string cutter while repeatedly being feet kneaded till it is mixed well. Small granules are taken away. The well kneaded clay is stored by covering it with a plastic sheet before proceeding to mould it.

Wooden moulds are applied to produce tiles. Molding boards for spreading clay sheet lies along with ash then they spread clay to fill up the entire mould by foot and equally shape it flat by a string cutter. Next step is to pick up the flat clay sheet out of the mound by lightly striking the mould and laying it on cloth or wooden board to dry. Next turn is again starting repeatedly. Clay sheets are kept and stored for next step. The hook is formed

by applying a flat bamboo straight edge by the length of tiles at a width of 15 cm to 2 cm. wide then overlay by both hands on the upper end widthwise of the clay sheet and fold upright. A complete tile is again placed to dry under the sun; this process will turn up again until it meets a required amount. 5 pieces of dried clay sheets are comfortable for carrying (called “hnueng mue” or one handed hold), counting and storing. Each set is then alternately laid in row for many layers waiting to kiln[13].

The process of making various kinds of bricks follow the same step as tiles but more time is taken for drying under the sun. These products are baked in dome-shaped with tiles covering the kiln where a gateway is at one side towards workshop hut, while 3 small chimneys are fixed on the opposite side. Through gateway, bricks or tiles are uploaded and set in piles alternate in long gaps for the purpose of the flames that enter from the front near the bottom corner of the kiln. The flames pass over a baffle and reach the tiles at the top. They are then drawn down through opening gap in the floor into a flue connected to chimneys behind. This is normally known as down draft kiln. It is said that in their passage through the kiln the flames come in direct contact with everything in it.[14]

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[13] ประเวศน์ วิริยานุวัฒน์. การทำกระเบื้องดินเผาในภาคใต้ฝั่งตะวันออก, สถาบันทักษิณคดีศึกษา มหาวิทยาลัยศรีนครินทรวิโรฒ วิทยาเขตสงขลา, (อัดสำเนา)ม.ป.ท.,2539

[14] F.E.Kidder, Building Construction And Superintendence
http:// chestbooks.com Free Books/ Building Construction And Superintendence

Fig. 289: Tile factory at Tha Nang Hom village, Songkhla

Fig.290: Knead clay ready to mould.

Fig.291: Floor tile wooden moulds.

Fig.292: Ash is applied for separator

Fig.293: Place of tile making.

Fig. 294: Tha Nang Hom kiln.

Fig. 295: Kiln entrance.

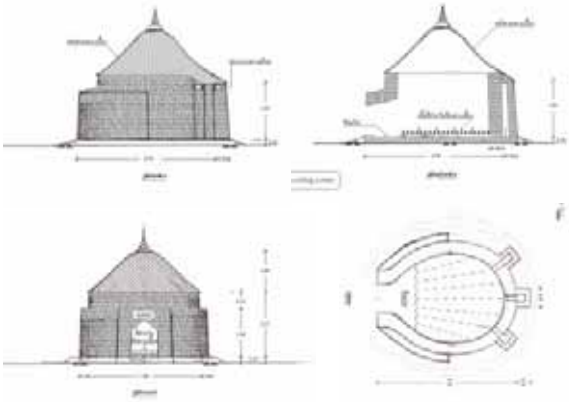

Fig. 296: Drawing of Tha Nang Hom kiln.

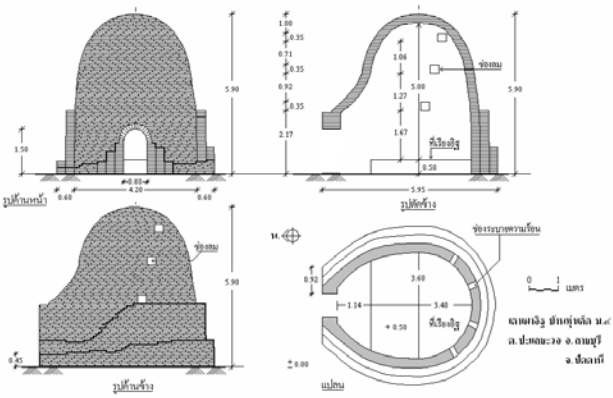

Fig. 297: Drawing of Saiburi kiln.

Fig. 298-300: Saiburi kiln, Pattani.

Fig. 301 – 302: Map of Songkhla
Ko Yor kiln site.

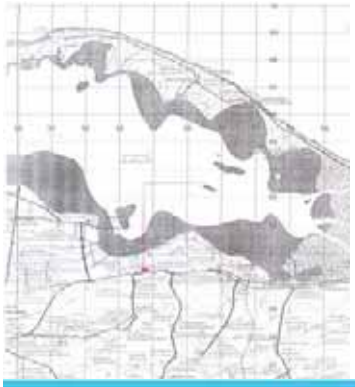

Fig. 303 – 304: Map of Pattani
Du - Song -Yor kiln site

4.2.3 Pattani construction material products (Fig. 303-315)

Du-Song-Yor is a village located south of the present-day Pattani, The city of Pattani was one of important prathesaraj (tributaryship) of Ayutthaya between the sixteenth and seventeenth century A.D. The city was relocated on the bank of one tributary of Pattani river at Ja-Bang-Ti-Kor by following the residential of the counsellorship in the reign of King Rama III[15] (Some scholars comment this matter was in 1816[16]). After his royal command of Rama II to separate into 7 towns, Prince Dumrongrachanubhap commented that its duration was between 1788-1791.The city was in the formal location at Krue-Se. This modern Pattani is further; about 5 kilometers towards the west from its origin. There are Muslims whose ancestors settled and lived to the south not far from the city centre where Mosques and the house of counselor is located. There used to be more than 20 or more families that produced tiles and bricks. New production areas were distributed to other districts especially to Ban Don, a small village located in Panare district of Pattani.

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[15] พงศาวดารเมืองปัตตานี ใน ประชุมพงศาวดาร ฉบับกาญจนาภิเษก เล่ม 6,(กรุงเทพฯ: กรมศิลปากร ,2545),354

[16] คณะกรรมการฝ่ายประมวลเอกสารและจดหมายเหตุ ในคณะกรรมการอำนวยการจัดงานเฉลิมพระเกียรติพระบาทสมเด็จพระเจ้าอยู่หัว ,วัฒนธรรม พัฒนาการทางประวัติศาสตร์ เอกลักษณ์ และภูมิปัญญา จังหวัดปัตตานี, พิมพ์เนื่องในวโรกาสพระราชพิธีมหามงคลเฉลิมพระชนมพรรษา รอบ, 5 ธันวาคม 2542 (กรุงเทพฯ : โรงพิมพ์คุรุสภา, 2542)

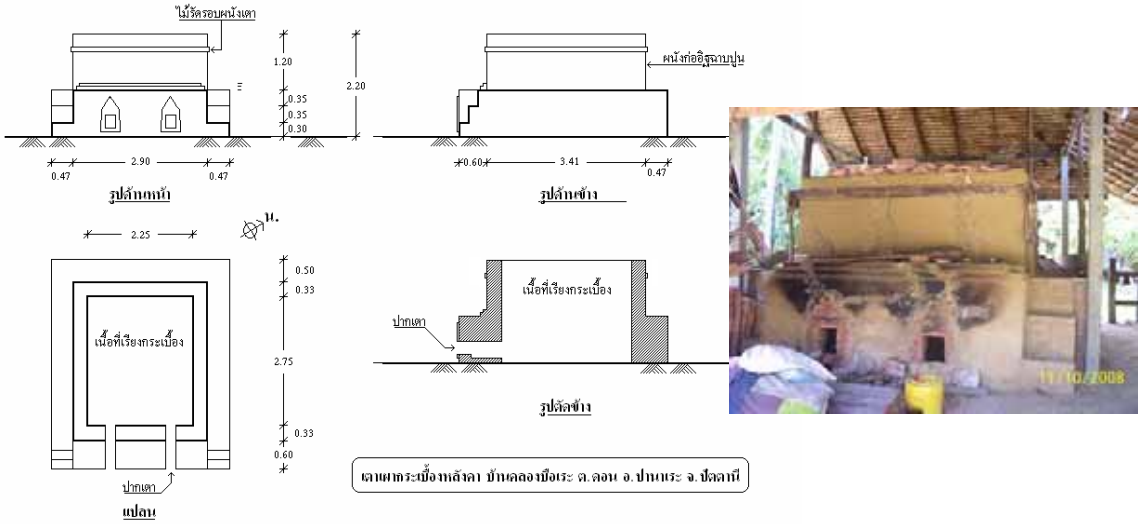

Fig. 305-306 Ban Don kiln, Pattani

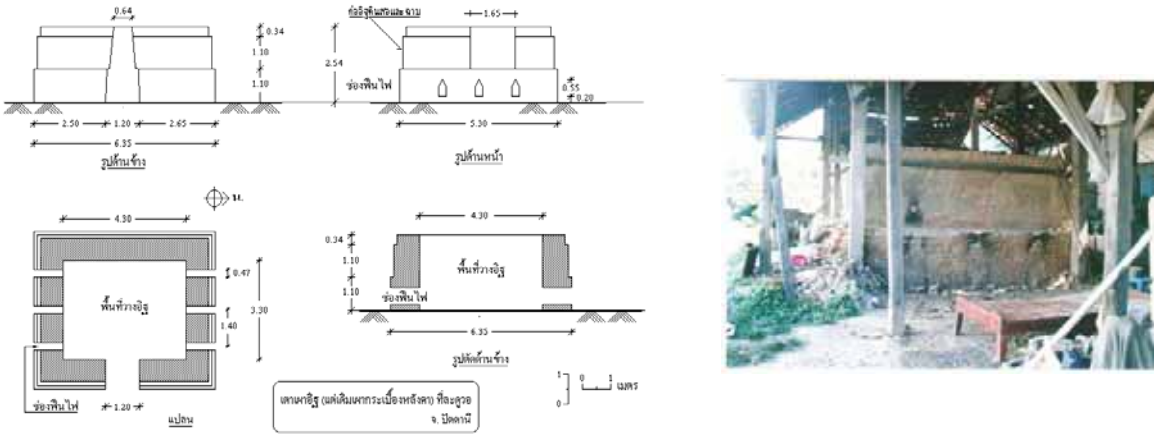

Fig. 307-308 Du-Song-Yor kiln, Pattani

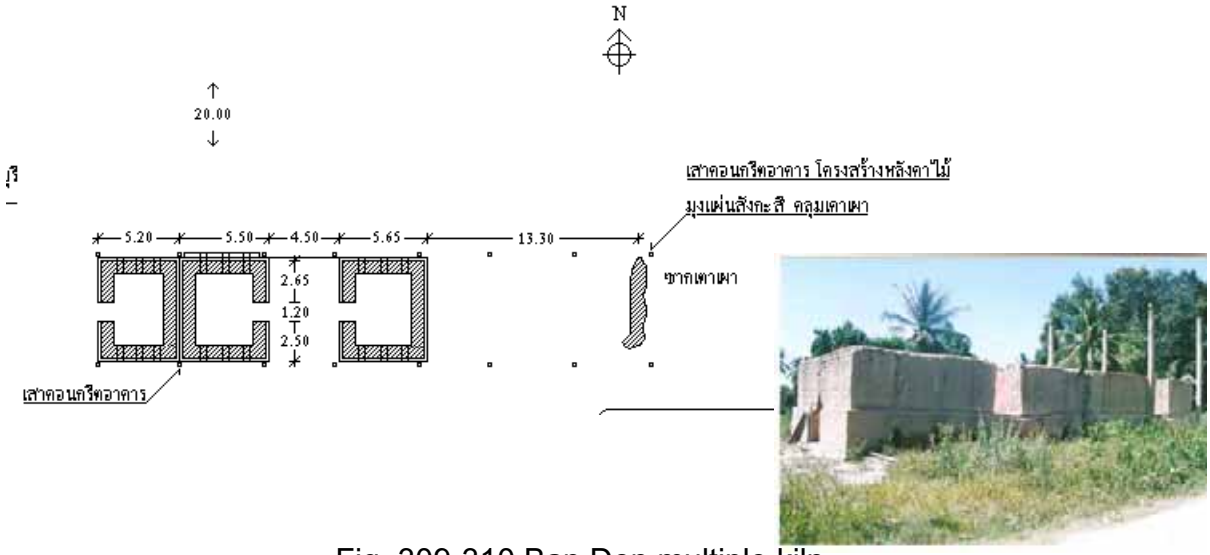

Fig. 309-310 Ban Don multiple kiln

Du-Song-Yor / Ban Don villagers mainly produce flat roof tiles (occasionally constructional bricks) which normally are end pointed flat tiles, ridge tiles and eave tiles. The flat tiles of Du-Song-Yor / Ban Don villages are thes same category as Ko Yor / Tha Nang Hom. Despite the difference in its size, which is bigger and thinner than Songkhla's, the whole producing process is alike. Their workshop is a thatch-roof building with simple palm leaf fence where is served as a pre-baked tiles storage. Its thickness is 10 pieces of dried clay sheets which is set as comfortable for each carrying, counting and storing. They are laid alternately in rows in the same manner of Songkhla producers. (Fig.318 & 321).

The kiln is built separately from the workshop apart from houses which normally are kept away from the smoke. It is made of bricks in an oblong shape. Kiln in both places (Du-Song-Yor and Ban Don) are of little different but definitely classified as updraft type. Du-Song-Yor kiln is built with the size of 5.3 x 6.3 x2.5 meters and about 1 meter of wall thickness. Its gateway is opened on one of elongated sides and 3 fuel entrances correspondence at both the breadth side to be served as combustion trails (Fig.307-308).Ban don is a smaller one with the size of 3 x 3.5 x 2.2 meters and about 50 cm. of wall thickness and has 2 fuel entrances at one side for the combustion. There is no gateway at any side but it opens on the upper chamber for enough convenience for uploading firing objects with built-in steps in thick kiln wall (Fig.305-306). However after finishing uploading the materials in both kiln types, the upper open part is covered with broken tiles and wasted bricks. Also the whole kilns of both sites are well protected by thatch-roof on post supports. By the time of the survey, many abandoned kilns could be approachable. A modified twin Du-Song-Yor kiln is also observed. Its lay-out is attached on the back side of each kiln together while the gate ways are at the opposite direction. The fuel entrances are now on the kiln length, where the fuel materials are easily placed (Fig.307).

Fig.311: Ban Don tile factory.

Fig. 312: Ban Don tile kiln, Pattani.

Fig. 313-314: Detail construction of Ban Don kiln.

Fig.315: Baked tiles in kiln.

Fig.316: Combustion fuel.

Fig.317: Tile storage and workshop.

Fig.318: Inside the workshop.

Fig.319: Ash using as separator.

Fig.320: Tile wooden moulds.

Fig.321: Tiles waiting to kiln

4.3 Analysis and Interpretations

Two major archaeological pieces of evidence are categorized in the field of ceramic manufacture study. The most prominent feature is the appearance of kiln structures and associated objects related to ceramic manufactures. This should be in consideration. So discussion will be focused on kiln structure less but not least on ceramic manufactures for maximum identification.

4.3.1 Identification Archaeological Evidences

Determination of archaeological evidence found in kiln sites in central region gives some interesting remarks about knowledge of kiln technology. Kiln sites found in this region which date from about 15th-18th century A.D. or during the rise of Ayutthaya as mentioned above,(except an unexcavated Kok Mor kiln), either Ban Bang Pun, Noi River or Sam Khok (Ong Ang). These kiln sites are shown to be very prominent kiln type and clearly identified as oval cross-draft kiln, though they showed some changes in shape and size (Fig.322). It had a tapering domed profile with a recessed firing-box, a single ascending firing chamber and a tall round chimney at the back. Many archaeologists have studied Noi river kilns and assuredly traced the evolution of this kiln from above-ground cross-draft of later Si-Satchanalai/Sukhothai kilns which dated from late 14th century onwards.[17] The later and existence of cross-draft kiln in Ko Gret / Ban Gang kiln, which is very closed related to Sam Khok (Ong Ang) kiln can be assumed to be the proper dimension of late Ayutthaya cross-draft kiln in central region, whereas none of Si-Satchanalai/Sukhothai kiln were abandoned.

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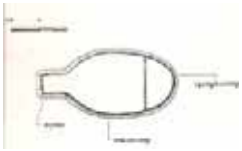
[17] Joseph Needham, Science & Civilisation in China Volume 5 Chemistry and Chemical Technology part XII: Ceramic Technology, (Cambridge: Cambridge University Press,2004), 727

Ban Bang Pun Kiln site



Noi River Kiln site

Sam Khok (Ong Ang) kiln sites

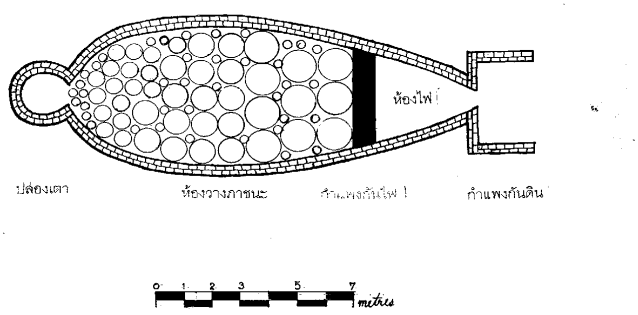


Fig. 322: Size comparison in cross draft kiln of Central Thailand.

Both artifacts found from ground survey, ship wrecks and the excavations showed significant potteries. This was the main product of these kiln sites. These potteries are earthen wares and only glazed or unglazed stone wares, mainly big jars for storage. The techniques of forming is slow wheel throwing, though no evidence of thrower has appeared in the area of excavations, it is assumed from every present potter that it used to be a wooden thrower which is easily disintegrated. It has already been replaced by an electric one in recent times. Only in Noi River kilns also produced architectural products. It is not clear to say that the ceramic makers who applied cross draft kiln for their manufacture in central region produced only potteries, but their skill was basically focused on potteries. Whereas architectural products (water pipes) are contemporary found *in situ* in kilns which might be made by order of royal constructors for using in royal palace of Ayutthaya and second palace of King Narai in Lopburi.

These pieces of evidence confirmed that high technology in cross draft kiln was very much developed and well known among ceramic makers in central plain including Ayutthaya which was the capital or centre for all aspects at that time. Evidence found in Klong Sra Bua / Klong Bang Kuad shows traces of nothing concerning oval cross draft kiln, nevertheless the eastern Klong Sra Bua / Klong Bang Kuad ceramic makers also produced potteries by simply bonfire technique. Therefore the kiln technology chosen for potteries might not be a concern rather than quality output. More or less pottery production from any other kilns around Ayutthaya could be traded to the city and people could use products from any factory per their choice. So the western Klong Sra Bua / Klong Bang Kuad ceramic makers would be able to produce supporting the city's necessity (sometimes also potteries). The artifacts found from this area are shown in huge numbers of bricks, roof tiles or decorative objects. Thus they would have mainly concentrated in making construction or architectural materials.

4.3.2 Historical circumstance

Historical background is clear that Ayutthaya expanded its sphere of influence over Malay Peninsula ranging from Nakorn Si Thammarat, Songkhla and Pattani, one of tributary states but archaeological evidence of kiln focusing on this period is has not really been discovered. Ethnological studies in Songkhla indicate the ceramic manufactures especially architectural productions clearly showed their introduction by Hakka in the Rattanakosin period which almost dates around the middle 19th century onwards. So correlations of Songkhla ceramic manufacture may not be in consideration at this moment especially kiln types. However evidence from ethnological studies in Ko Yor / Tha Nang Hom show 2 prominent remarks; one is the unchanged style of tile fashion, which still remains the making of flat roof tiles with folding of about a 2 cm. width at one end to serve as a hook strip, and second is the applying of ash as a separator during brick or tile molding and cut off by a string cutting bow. These are unique or personal methods of the makers who follow their ancestors' technique from China.

Though Pattani's population have resettled in the present-day, Pattnai since early 19th century, the Muslims conservatively spend their lives corresponding to their religion and following their occupation according to their ancestors. No doubt this is how they spent their lives in earlier time at least in late 18th century or late Ayutthaya period. Results of interviews give information of ceramic producers following their mother practice unchanged either up draft kiln type or the making procedures of tiles and bricks.

4.3.3 Ethno-archaeological comparison

4.3.3.1 Figure (shape and size)

Ethnological data collected in ceramic manufacture from Pattani and present Klong Sra Bua has given a clear view of firing techniques particularly by using an updraft kiln. Comparing kilns of Pattani (Ban Don) to present Klong Sra Bua tile makers, it is shown some characteristics are similar (Fig.323), especially its oblong shape with thatched–roof protection. The difference of Pattani's seem to be simpler with a low and tiny combustion

flues by applying a layer of bricks to a little uplift firing chamber, while Klong Sra Bua's show to be more adaptive by uplifting the combustion chamber with graters and protecting the fire place by building a solid vault. However, they give the same production results. More differences are noticed in tile figure, though both factories produce pointed flat roof tiles but bigger and thinner in size than in the southern region, either Songkhla or Pattnai and both of them making flat roof tiles with widthwise edge folding as hook strip as well. The Klong Sra Bua tiles have nail-liked hook that serves as batten hanger. Another remark is ash separator which is very familiar in southern region while

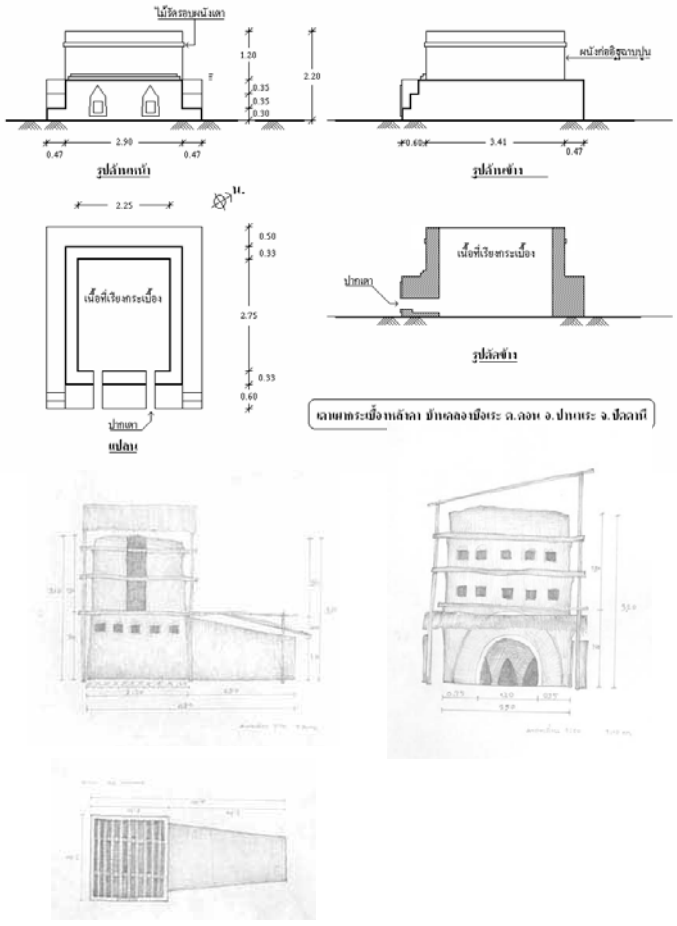


Fig. 323: Comparative Pattani's kiln to Klong Sra Bua's.

fine sand is used in the Klong Sra Bua. Thus, there is no doubt the southern ceramic producers follow their ancestors techniques, so applying ash separator tend to be more conservative or less recent.

One of the very prominent features in the lowest archaeological layer in pit no.5 is a four dark grayish lane of ash alternate to hard burnish earthen floor on its reddish ground. This is surrounded by brick wall is 3.5 x 4 meter rectangular room above wasted tile compacted floor. It is a pended feature of kilns, tile fragments are its associated artifacts which is definitely identified as kiln for tiles or other massive products. Comparative pictures and drawings of archaeological features of the appearance of the Pattani (Du Song Yor) prove that those are combustion trails of updraft kiln and their shape is probably identical. (Fig.324-327)

It has been pursued as to what was the reason of a small kiln/newer which was built overlaid on the bigger one/older. This may mean that the size of kiln more or less depends upon builders or users demands of materials using at a particular time or economic sufficiency. The clear answer approach by Ban Don tile makers when he built the smaller kiln after the previous bigger one was cracked and broken, therefore, to fit his economic situation.

4.3.3.2 Kiln constructor

Soils demonstrate the first kiln feature was made on the tile fragments packed platform. It is clear that the kiln was very well adopted and built by an experienced builder, well acquainted at the time of building. But this does not mean that this updraft kiln type was built by Malays or Malays' influence that had a very close connection to Ayutthaya at that time. One of ancient maps of Ayutthaya points to that the Malays settled at Pla-Tha Khu-Cham along Ta-Kian Canal further south of the island. One possibility probably concerns the Malays influence or interchanging knowledge of two groups of people. However this kiln technology was already well developed in Ayutthaya period and used for a long time before introduction of new kiln type.

Fig.324-326: Comparison of feature found and combustion fuel of Du-Song-Yor kiln

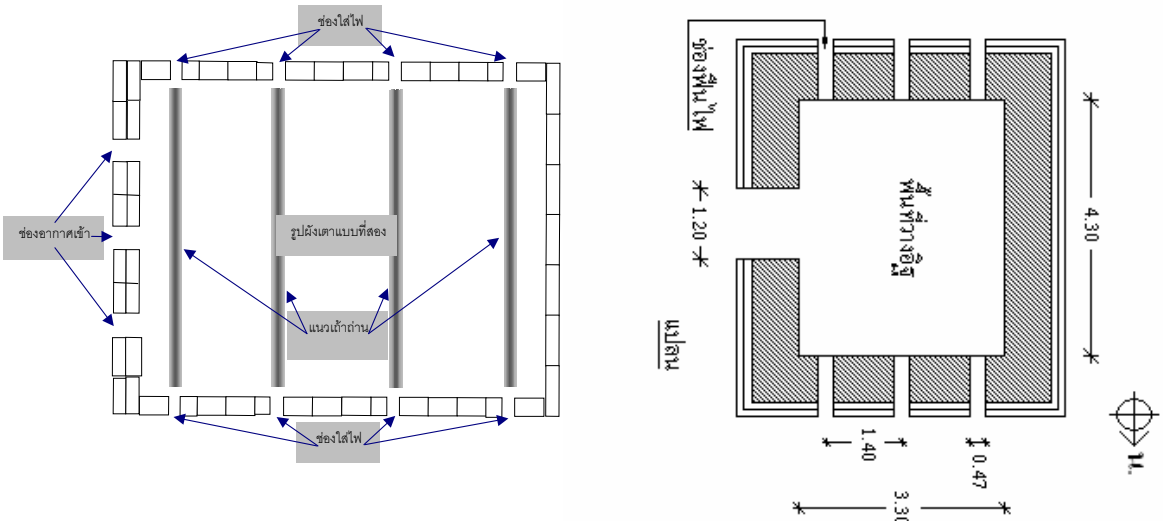


Fig. 327: Comparative details in plan of reconstructed kiln feature to Du-Song-Yor kiln

The second kiln type found by traces of half oval in shape with closed straight-cut at the back and narrow entrance. Interiorly it is divided into 2 parts, a fire box and a little uplifting firing chamber in the inner part. Reconstruction of this kiln type by identification of kiln slag especially fused bricks of kiln materials found in its associated layer, confirmed a vault roof. Its reconstructed model is drawn as shown in Fig.328. It is assorted with vested melt clump of tile fragments in its lower soil layer reveal uncontrollable firing temperature at the first stage of using this new kiln. By comparison the predominant updraft kiln used in the area to the drawn model is incredibly same type. Determination of the later kiln feature in primary report may be inaccurate by misidentification of slag of the kiln vault to the combustion vault tunnel. The possibility of which is identified as down draft or cross draft kiln. However either they are down or cross draft, when they were in function, the fire is lit at the entrance or bottom. The heat rises up and turns down passing out the flue at the opposite end in the same manner of cross draft where the heat flows to the firing chamber, pass the chimney behind. These 2 kilns' technology is more advanced to apply higher firing which is consistent with the evidence of over fired fragment of kiln or kiln slag.

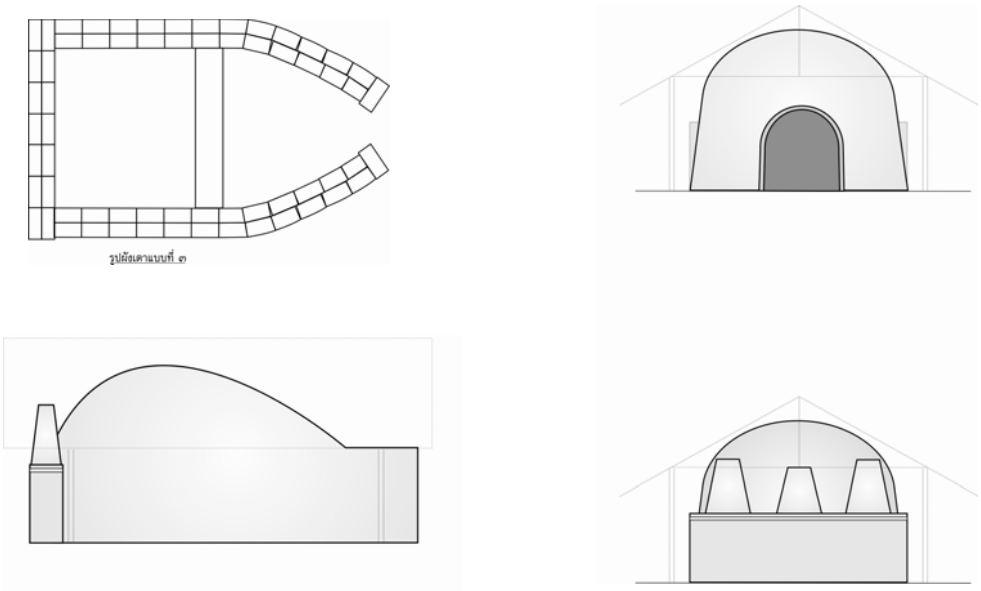


Fig.328: reconstructed model of kiln type 2

Thus, vault of combustion tunnel of present updraft kiln does not show any evidence of kiln slag or sweat. This vault is probably created by applying such vault to fit the need to prevent fire processing during wet climate or rain. (Fig.329)

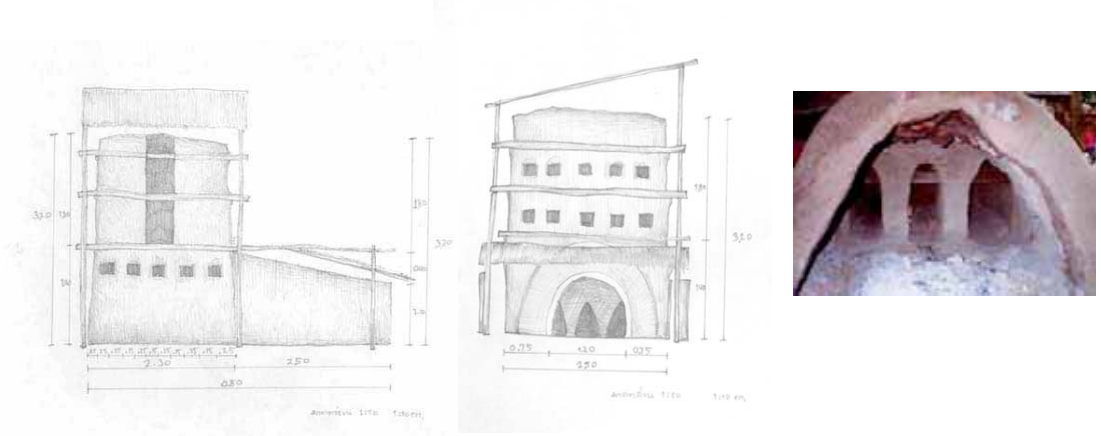


Fig. 329: Detailed vault of present-day Klong Sra Bua updraft kiln.

Appearance showed an emergence of new kiln technology which was set by other kiln builders or new advisers in changing to more modern innovation of kiln technology. However less kiln slag is found in the later stage and only vested fragments are found in the latest stage. This is assumed for their earning having more experience in higher fire controlling after practicing for some time. Questions come over for the reason of changing the technique of firing in a newer kiln type. There is inability to clarify the firing technique which was totally changed from updraft to down draft or cross draft. Throughout the excavations around these 3 canal areas, the evidence of updraft kilns still existed and practiced in the same time of Phaniad. Here was rebuilt with some buildings to round-up the elephants and the ritual participation on the frontal bank of Klong Bang Kuad during King Rama III (1824-1851), where 2 royal updraft kilns were found.

4.3.3.3 Influences

General information of kilns and its evolution should be mentioned to understand. Open bonfires are the simplest technique to produce ceramics. Updrafts are simple kilns which have been used all over the world. Archaeological evidence found the early pottery updraft kilns in

many parts of the world, especially in the western regions and also in the eastern region, which date back to 5000 B.C. or more or even the prehistoric period. More developed updraft kilns are found around Mediterranean Sea and across the Middle East to North Africa and into Spain. It is also spread to Iran (through Baluchistan), Pakistan to India where some of it is still in use for low-fire glazed pottery by Mansimran Singh, a Muslim potter in New Delhi.[18] More developed kilns are also found in Multan, Hala, Pakistan, which is a round kiln for glazed potteries[19]. It is quite clear that the updraft kiln technique has been dominated in western regions since prehistoric to modern time.

Also it should be noted that tiles and bricks production has been long been developing in central region of Thailand for many centuries. Bricks are found in temples building but without any evidence of brick kilns. These are found since Dvaravati period or as earlier as 7th century. Archaeologists suggest that bricks probably were made on site and baked in clumps where there is any evidence of kilns. Scholars identify Dvaravati was influenced by Indians who introduced their knowledge, religion, and so on including construction technology. Though bricks and tiles were long used in later centuries during the Khmer influence especially in Lopburi and Suphanburi and through to the Lopburi period, a few centuries before Ayutthaya's establishment in mid 13th century. There has not been any evidence of kiln construction materials so far. Further evidence of a small round bee-hive (Fig. 330-331) and a square firing chamber with a firing vault tunnel updraft kiln (Fig.332)

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[18] Frederick L.Olsen, The Kiln Book, (Radnor,Pennsylvania: Chilton Book Company,1983), 136-138

[19] Owen S.Rye and Clifford Evans, Traditional Pottery Techniques of Pakistan,(Islamabad: Lok Virsa, reprinted with the permission of the: Smithsonian Institution, Washington D.C. , 1990),110.

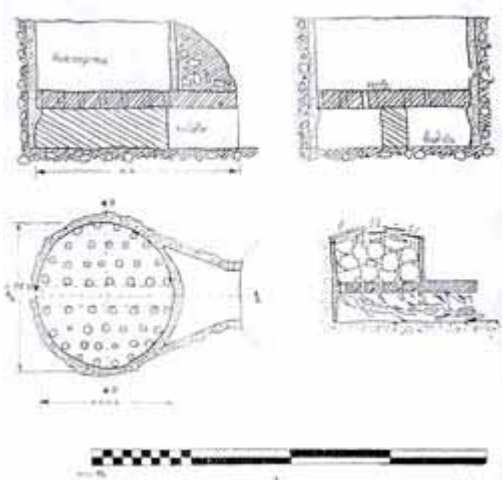

Fig. 330: Si Satchanalai kiln group no 47 shown round bee-hive updraft.

Fig. 331: Reconstruction Drawing of Si Satchanalai updraft kiln group no 47.

Fig.332: Si Satchanalai kiln no.177 shown square with grate underneath and firing tunnel vault updraft comparing to present Klong Sra Bua's.

is found in Si-Satchanalai excavation associated to popular cross drafts which dated to 14th – 17th centuries.[20] Closer determination in Si-Satchanalai's firing vault tunnel with the vault of present-day kiln at Klong Sra Bua, it can be compared alike. Hence, with the close historical relation of these 2 regions, they might have shared some knowledge of kiln technology. It can be determined the use of updraft kiln had existed in the central region with or without either people from the south (through the southern settlers at Klong Ta-kien) or local people from Sukhothai influences. Ceramic makers probably knew this kiln technique very well, though no evidence has been found at earlier archaeological time scale. However evidences found in Sukhothai, Si-Satchanalai and any other towns in many regions around Ayutthaya show that local ceramic tiles were served for architectural buildings (Fig 333-335).[21]

A new innovation of kiln technology might have been developed in this region in later periods by earning more knowledge from any foreigner or different groups of people who came in contact to Ayutthayan. If the reconstruction drawing of the latest kiln feature is correct, physical appearance of the kiln would be similar to kilns found and still in use in Vietnam. A brief survey was done and at least 2 villagers are still practicing. The first one is Huoung Canh village, Vinh Canh Province, 47 kilometers north of Hanoi. This village formally made glazed terra cotta articles (glasses, jars, small coffins), but now it is more specialized in the production of tiles and other kinds of construction materials(Fig.336-340 & 347), Some of abandoned kilns at Huoung Canh with clear side view of its shape and over-fired wasted earthen coffins are placed aside as shown production of kiln.

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[20] โครงการอุทยานประวัติศาสตร์ศรีสัชนาลัย,รายงานการขุดค้นทางโบราณคดีเตาเผาสังค-โลกหมายเลข 61, (อัดสำเนา) 2530, 124

[21] Asian Art Museum of san Francisco, Thai Ceramics, (Kuala Lumpur: Oxford University press,1993),140-142

Fig. 333-334 Antefix tile sample found in Si Satchanalai.

Fig. 335 Roof tile sample found in Si Satchanalai.

According to local documents It is said that the ceramic craft has existed for more than 200 years accompanied with the temple in the centre of the village, which the inscription on the wooden roof-bean described the restoration under King Canh Hung's reign (1740-1786) and thus it must have been built hundreds of years earlier and the village must have existed earlier as well.[22]

[22] Nguyen Vinh Phuc, Historical and Cultural Sites around Hanoi, (Hanoi:The Gioi Publishers,2000), 35-36

Fig. 336-340: Huoung Canh kiln, near Hanoi, Vietnam.

Fig. 341-347: Huoung Canh kiln, near Hanoi, Vietnam.

The second village is Thanh Ha, 5 kilometers west of Hoi An, an ancient town. Hội An was founded as a trading port by the Nguyễn Lord Nguyễn Hoàng sometime around 1595[23] and used to be an international trade center by sea on the east west area in the 16th and 17th centuries. It was the busiest trading port in Dang Trong region of Vietnam under the reign of Nguyen as merchants from Japan, China, Portugal, Spain, Holland often landed for exchanging and purchasing commodities. In the historical progress of establishment and development, Hoi An was known by foreign merchants as Faifo, Haisfo, Hoai pho, Ketchem, Cotam. Based on archeological relics and architecture documents, Hoi An was not only a place of convergence and exchanging of many cultures such as: Champa, Vietnamese, Portuguese, Japanese and Chinese, but also impacted mostly by Vietnamese and Chinese civilizations which mainly shows architecture of communal houses, Buddhist temples, funeral monuments, graves, meeting halls, family chapels, houses, wells, etc. The ceramic crafts of this village show the trace of Chinese relations especially in pottery manufacturing by foot wheel throwing. Besides pottery work, Thanh Ha Village is also famous for bricks and tiles(Fig. 348-352). So far it has supplied double, zigzag and tubular tiles for the old architectural constructions in Hoi An. The Kiln used in this ceramic village is small half oval in plan with vault firing chamber adjoining to a row of three stroke holes behind, which the local Vietnamese called “frog kiln” as its shape resembles a squatting frog, which is not at all different to Huoung Canh village near Hanoi.

[23] Hoi An Wikipedia the free encyclopedia Accessed 16 January 2010. Available from http:// www Wikipedia.org





Fig. 348-352: Thanh Ha Pottery, Hoi An, Vietnam.

It is clear that the Vietnamese were under Chinese domination in the first millennium of the Christian era, and by Thang Long and Van Don of the Ly-Tran-Le period in the 11th-15th centuries though Hoi An was set up late in the 16th century[24]. Main culture has shown strong influences of the Chinese and the two ceramic makers are one of historic-ethnological appearances which confirm the frog kiln was introduced to the Vietnamese by the Chinese. The Chinese frog kiln is mentioned as a small kiln used in Xiaoman Street, Jingdezhen, for firing daily wares in late Ming (1368-1644) and early Qing period (1644-1911)[25]or about 16-17th century.

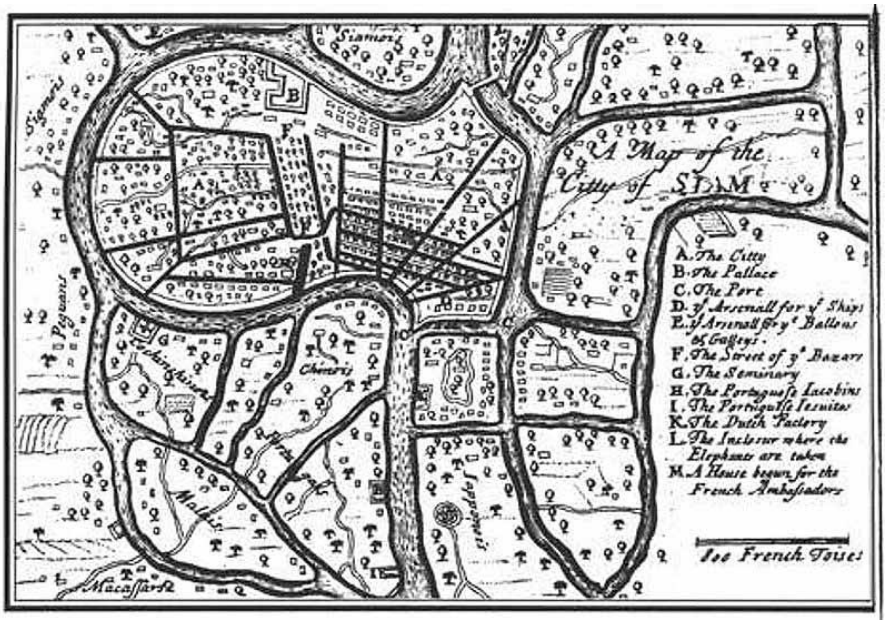

Fig. 353 Map of Ayutthaya in 17th century, shown ethnic group settlements.

Though evidence was marked on the map during King Narai which shows the Vietnamese communities were scattered around the French

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[24]Prof. Phan Huy Le, “Hoi An (Faifo)-Past And Present” , in The National Committee for the International Symposium on the Ancient Town of Hoi An, Ancient Town of Hoi An, (Hanoi: Thê Glől Publishers, 2006), 24-31.

[25] Wang Qingzheng, A Dictionary of Chinese Ceramics, (Singapore: Sun Tree Publishing Limited, 200), 138.

quarter outside the island city to the south and Vietnamese migrations, they must have migrated to Ayutthaya as early as in the reign of King Song Tham and continued into the reign of King Narai[26]. It does not mean that Ayutthaya learned this kiln technology directly from Vietnamese. This ethnological comparison can only confirm this kiln type and its knowledge had widely spread from China to Vietnam and also Siam or Ayutthaya at that time.

There is no doubt that Ayutthaya had also a close connection to China. There is evidence of diplomatic missions being sent to China about 70 years before Ayutthaya was founded. Not only is it a testimony to diplomatic and trade relations, but it also indicates that Chinese junks must have sailed to this region. As a result, Chinese communities were found.[27] Many Chinese migrated and settled in Ayutthaya living on the island city .They featured in court and commerce and had strong relations to the local community to be able to teach or give new information. One of these would be new technology in mass production of ceramic and construction materials that local producers tried and learned till being experts. With this evidence again clarified the hypothesis in its technology and transferring from China.

In the field of ceramic studies, it is agreed that in the Far East-primarily China, Korea, and Japan, these are the earliest innovations in virtually all stages of the potter's art that can be found. Main topics focus on history of technical developments and types of porcelain wares but hardly in details of kiln technology or the production of construction materials. Though there are some of Chinese references, it became a difficult to identify Chinese transference in kiln technology by a general references. This study would only identify through available information of Chinese pottery.

The best-known early Chinese pottery in the late prehistoric come from Yangshao culture in The Yellow River Valley, between 4800 and 4200 B.C. Potters at Banpo and other Yangshao villages produced varieties

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[26] Charnvit Kasetsiri and Michael Wright, Discovering Ayutthya, (Bangkok:Toyota Thailand Foundation, 2007), 143.

[27] Ibid.,147.

of decorated wares which were fired in small, subterranean horizontal and vertical updrafts on the outskirts of the villages. These were so skillfully made that they showed the knowledge in kiln technology had already begun. Moreover Chinese ceramic history is marked by numerous technical achievements of lasting compact, particularly in the field of high-fired bodies and in glazes. Stonewares were being produced in kilns capable of reaching 1200°C by the Middle Shang period, between the fifteenth and thirteenth centuries B.C. At about the same time, glazed were also produced. One of the most beautiful Chinese glazed wares is celadon, of which the most famous were produced in Lonquan District of Southern Song Dynasty (A.D. 1127-79). Celadon were widely popular throughout Asia including Thailand which is the prototype of Sukhothai and Si-Satchanalai glazed wares in later period. The Chinese kiln technology was higher developed by using dragon cross draft kiln but by local small oval cross draft one in Thai wares. The most enduring legacy of Chinese potters is porcelain which is most closely identified with the "imperial kilns" at Jingdezhen established in 1004[28]. Innovation in ceramic manufacture was well done in Ming Dynasty. Kilns used new techniques in design and shape especially the use of kaolin mixed in pottery stone and experience in observation of variation in temperature of large egg-shaped kilns which potters could adjust potteries at the proper place inside the kiln to reach a required temperature at each stage of firing for body pottery stone, kaolin paste or glazed. The late Ming period underwent a dramatic shift towards a market economy, exporting porcelain around the world on an unprecedented scale including Ayutthaya. In the reverse, the high supplies of good quality of potteries from China impacted Sukhothai and Si-Satchanalai manufactures to a decline. Only local low firing products which were necessary for cooking or storing still remained. Moreover to serve the main necessity of Ayutthaya capital construction at all times, construction supplies would have been under possible consideration while the eastern side of Klong

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[28] Wikipedia, Chinese Ceramics [online], Accessed 16 January 2010. Available from http:// www Wikipedia.org

Sra Bua was already produced and served “Lerng” potteries for daily usage accompanied to Bang Bang Pun wares, Noi River wares, etc These were provided in general markets where evidence of their fragments found with approval of their usage in every habitation layer inside and around the island city.

More description could be revealing in construction supplies or architectural ceramics. In China, the pioneering technique of using baked clay tiles as roofing materials appears to have started in the Western Chou dynasty (c.-9th to 7th centuries)[29]. In almost the same time the true cross draft kiln for brick appeared as found in excavation at Lo-yang, Honan Province. It was built above ground with rammed earth walls. This has a relatively small firing chamber (about 1.3 metres square) but has radical arrangement of firebox, chamber and exit flue on the same horizontal plane, with a square exit flue at floor-level in the centre of the kiln’s back wall. This arrangement would have been an improvement on the standard up-draught design.[30] Later in the Han period the kilns show larger chambers, longer fire tunnels and more efficient chimneys (Fig.354). Similar kilns to those used at Lo-yang also operated in Szechuan province in the Thang dynasty, (Fig. 355-356) where one example has been excavated three kilometers to the east of His-chhang city. This too was one of a series dug into an earth bank, and the kiln examined in detail had a firing chamber of about two metres cube, with five exit flues at floor level in its back wall. Like the Lo-yang kilns, the main

[29] Needham,Joseph, Science and Civilisation in China Volume V:12 (Cambridge: Cambridge University Press,2004), 407.

[30] Ibid,302.

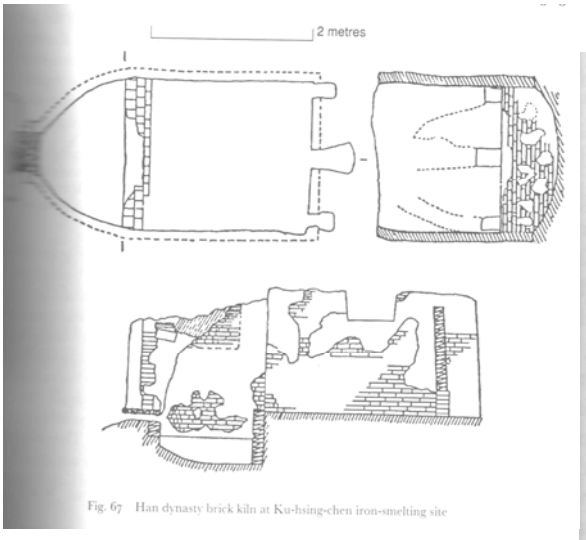

Fig. 67 Han dynasty brick kiln at Ku-hsing-chen iron-smelting site

Fig.354: Han dynasty brick kiln at Ku-hsing-chen iron-sineking site.

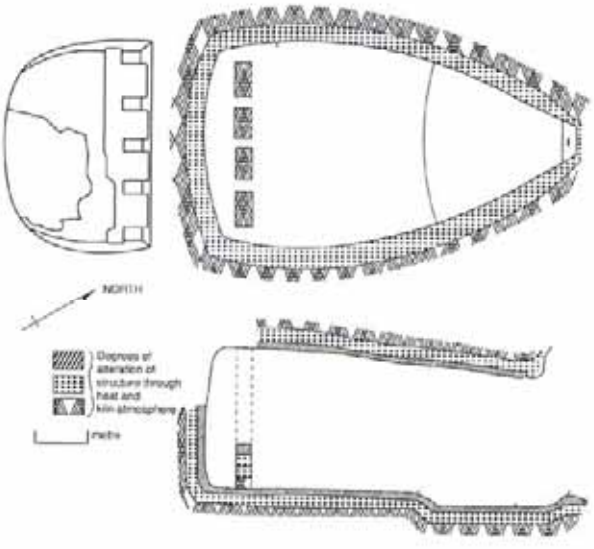

Fig. 70 Thang dynasty tile kiln from Szechuan province

Fig.355: Thang dynasty tile kiln from Szechuan province.

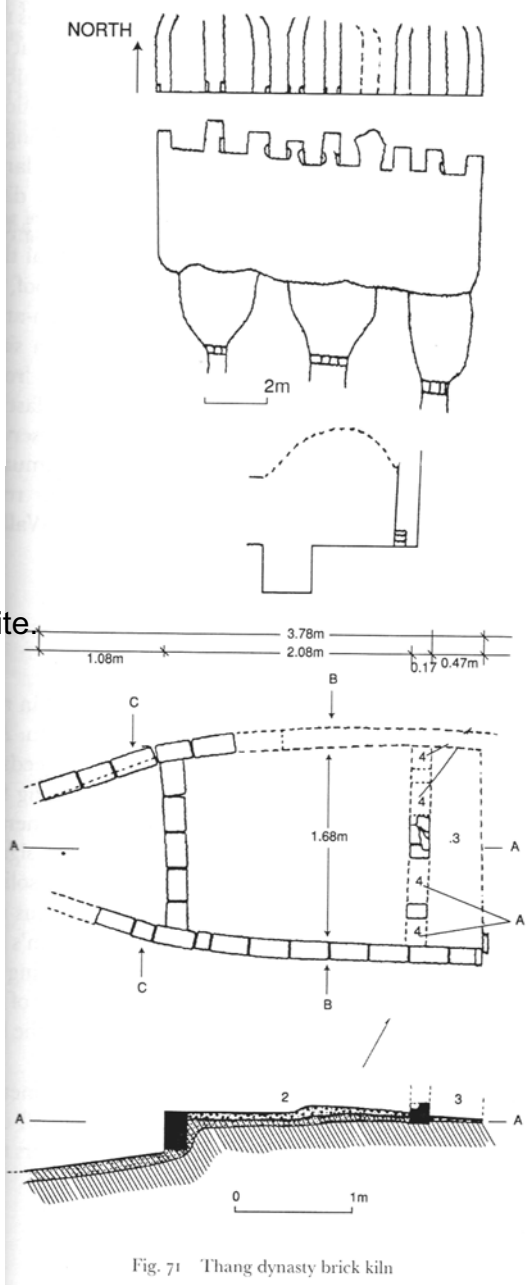

Fig. 71 Thang dynasty brick kiln

Fig.356: Thang dynasty brick kiln.

products from this Szechuan kiln were flat tiles, together with some eaves-tiles and end-tiles. The authors give comment about the size of kiln[31]

"*The relatively small size (2-3 metres cubed) of Han Dynasty northern brick kiln probably dictated to some extent by the fall-off of heat that occur from firebox to exit flues in cross-draught kiln designs. Kiln deeper than this might be badly under-fired at the back… Building the kiln of the same length, but wider, does not seem to have been attempted by earlier Chinese brick-makers*…"

Thus the brick kilns in China tend to occur are most usually small but multiples until Ming dynasty rather than as single giant structures. This comment confirms about brick/tiles kilns in Ming Dynasty were small and remained as almost same as used in its long past history of Chinese brick cross draft. It is also compatible to the evidence found on kiln features on the upper layer of Klong Sra Bua which was in the same period, though they have not been found multiples as the limited area of excavation, or it depend on their different preference to brick/tiles makers at different place and times. Hence, it is very much possible to mark that the later stage of ceramic manufacture of Ayutthaya which used the firing technique by cross draft kiln from Chinese people, who had long relation to Ayutthaya and settled in the city as part of its population.

[31] Ibid., 308

Chapter V

The development of ancient Ayutthaya ceramic manufacture and production of Klong Sra Bua and Klong Bang Kuad sites, Phra Nakhon Si Ayutthaya

5.1 The beginning of ceramic production of Klong Sra Bua

Results of the excavation mentioned in Chapter II confirm that there were 2 main areas of ceramic manufacture; one was on the eastern bank of Klong Sra Bua and other was on the western bank. Evidence from the excavation shows the scattered human settlement without any ceramic activity and production in the lowest habited floor or the earliest stage of its settlement. After a short time, the ceramic manufacture began. According to Chinese shreds, it gives a wide range of dates. Most of them are blue-and-white Chinese porcelain of Ming Dynasty. Two issues are involved for the beginning. The first one is concerned with the topic of the time (also by whom) to conduct a canal which definitely gives an approximation of earliest time of every activity along the canal. The second one focuses on the purpose or reasons why it had been dug out

Certainly, the canal was not dug at the beginning of Ayutthaya. This canal was found by King U-Thong in 1351.It should have been done sometimes after permanent and successful settlement on the island city. The first historical document mentioned about this Klong is the Chronicle of Ayutthaya edited by King Rama IV. It mentioned that Khun Worawongsa was dethroned by the officials loyal to the late King Chairacha (1534-1547), Thao Si Sudachan. Their baby daughter escaped on boat which passed through this canal. Thus the canal would already have been used as communication route before at least 1547 A.D. or the above period.

It would be noted that waterways, rivers and canals were the main and most important transportation during Ayutthaya period. Many

waterways were ordered to be dug by the King in order to provide a short-cut for more rapid communication. The first short-cut ever mentioned was a Bangkok short-cut of Chao Phraya River in 1534-1537 by King Chairacha. The purpose of this short-cut was to promote trade and communication by sea. There were many other short-cuts in later time. There were many man-made canals and short-cut were dug both on the island and around the city which we can be observed through aerial maps. There were canals that never mentioned this in the chronicles such as Klong Tho, Klong Makam Riang, Klong Kao Mao, Klong Kao San, etc and also Klong Sra Bua, a short cut of Lopburi River or Bho Sam Ton River. Klong Sra Bua canal would probably have been used as a prior promoting communication by land to the north in order to expand the kingdom to Chiangmai and Sukhothai. To confirm this critical incident, it is argued by many prominent records, Khunluang Pha-ngua who engaged in battles to carry out expansion of Ayutthaya's rule to the northern principalities especially Phitsanulok, Kamphaengphet, and Chiangmai. Also the next kings Ramesuan, Boromaracha II (Chau Sam Phraya, 1424-1448) were in the course of a campaign against Chiangmai. Towards the end of Boromaracha II's reign, he attacked Chiang Mai twice. After the attack they took many prisoners to the capital to gain more population of the city. These Chiangmai prisoners were allowed to settle around northern part of the city island. Evidence is confirmed by observing prominent evidence of Buddhist's temples, the centre for faith and belief of Buddhist's communities. The temple of Laan Na shows influence of the north. It was at Wat Kae (Fig 358), is located on the western bank of Klong Bang Kuad in triangular islands towards the east of Klong Sra Bua, This meant there were a large number of people from northern regions who settled in this area. This supported their close relation, connection and communication. The canal might have been dug either in reign of king Boromaracha II or King Boromatrailokanat (1448-1488). Again in the reign of King Boromatrailokanat, who was the heir of both the Ayutthayan and Sukhothai lines, played a leading role in the annexation of Sukhothai to Ayutthaya. When King Mahathammaracha IV of the Sukhothai family died in 1438, he was installed

as viceroy of Phitsanulok, a city in the north also halfway from Ayatthaya to Chiangmai[1].

Fig. 357: Main stupa of Wat Kae assemble to Laan na style of Haripunchai, Lampun.

He also reorganized the government by setting up the system of Sakdi Na, which granted land ownership to princes, noblemen and soldiers, regulating the administration and issuing new legislation. Government was reorganized in order to strengthen the bureaucratic administration to an extent more fitting for a greater and more complex kingdom which Ayutthaya had become. The bureaucracy was divided into two main system: - the military and civil, and sub-divided into four departments: - the Capital, Palace, treasury and Agriculture. This would bring order to be constructed for many official houses and other infrastructure. For his palace, he granted the palace

[1] See details in, พระจักรพรรดิพงศ์ (จาด) พระราชพงศาวดารกรุงศรีอยุธยา เล่ม 1,(กรุงเทพฯ: องค์การค้าคุรุสภา, พิมพ์ครั้งที่ 4 ,2532) , 6-16

to be the royal chapel named Wat Phra Si Sanphet in 1488. He then moved all the palace buildings to the neighboring area to the north, adjacent to the Lopburi River. One of the most important halls built in his reign was Sanphet Maha Prasat, which was used for royal purposes such as receiving envoys from foreign countries, coronations of kings, etc. Many more buildings in the palace were constructed.

Demand for bricks and tiles as major construction materials would certainly raise leading to an increase in production of these supplements. Bricks and tiles manufacturing for new houses, of course, would meet the royal satisfaction. It also was easier for suppliers in carrying materials to their work station for a shorter distance. On the other hand settling a new supplementary house at a near location or at Klong Sra Bua could have been more convenient than any other place around the island city as it is only 1.5 kilometres from the royal palace.

Of course, brick and tile makers were experts by the time. They set an acquainted kiln, a large oblong updraft one. This kiln type has been familiar to Ayutthayan people, even it would borrow kiln technology from other nations especially Malays. There was also a possibility to say the Malays who lived in Klong Ta-kian, south of the island city, were the producers. Logically, we should note that by water transportation, it is easier to transfer materials downstream than upstream. In case of any formal supplementary area or kilns those were down to the southern part or Klong Ta-kian area. Heavy loads in boats and facing strong currents upstream would be done under difficulty. Hence, the most convenient way was settling a new and nearer location to the working station.

However some changes occurred through a long period of time during applying oblong kilns. Changing of kiln to smaller size was shown in the later period. This might due to economic and political problems, also wars. Nevertheless ceramic manufacturing along with oblong updraft kilns at Klong Sra Bua was continually activated for a number of times till new technology was introduced to the ceramic producers.

5.2 Changing Kiln technique - an innovation

Stratigraphical evidence shows that a new kiln type, semi dome-shaped cross draft kilns were set in use instead of the old oblong one. Along with its newer preparing platform, an ash pot is found lying together with other potteries to perform a kind of ceremony. The information from interviewing a kiln builder at Klong Sra Bua indicates nothing concerning a ceremony in the beginning of kiln building. The information is totally different from the evidence found from the excavation. They definitely confirm a new different ethnic group of ceramic producers who were introduced to teach other techniques of firing to the previous ceramic producer group. With no doubt, the advisers were Chinese or the local ceramic makers who learned this new technique of kiln firing from Chinese. The Chinese probably used to priory practice in their homeland.

It is come to question as to when or which period this kiln technique was firstly built in Klong Sra Bua pottery village. As already mentioned in Chapter IV concerning in the typical Chinese half oval (in plan) cross draft kilns that were used for brick/tiles making from Western Chuo through Tang till Ming Dynasty down to the south of the China and to Vietnam. Moreover evidence of small cross draft ones which were considered as “frog kiln” featuring similar, is also dated in the late Ming to early Qing Dynasty or as earlier as16th century A.D. The only time when Ayutthaya could have expanded her development was after a long period of war under the Burma conflict or from the reign of King Song Tham (1610-1628) onwards.

When the city was almost in peace with flourishing trade connections and commerce with foreign countries both from the west by Muslim merchants who came from India and further West and the east by Chinese traders with their large and versatile junks, they had the most regular and sustained contact. These had brought up foreign communities elsewhere on and outside of the city. The major group was the Chinese, formed by Fujians, Indochina or Annamese, Malays, Indian, Persian and Europeans. Though there is no direct documentary record mentioned about the introduction of Chinese technology in Ayutthaya history, although we can

presume that the interactions between local and Chinese might give an idea to local tiles/bricks makers in improving a higher technique of ceramic production at that time. The only reason to increase these supplements was in order to meet the demand in a specific time or how it would have been to produce the required numbers of materials in time. By managing to construct kilns that could produce more frequently, this would have been one priority. Then the kiln that could provide products in shorter time should have been desirable, thus brought to experiment a new kiln with special technique.

Upper habitation floors with the association to half-oval kiln features show the same and unique characteristic features in excavation pits. Blue-and-white porcelain of late Ming and early Qing Dynasty are very much prominent. Hence it could confirm the approximate date of kiln. Determination for a closer date of this innovation may be interpreted by applying comparison to historical incidents. The Chronicle of Ayutthaya [2] mentions that after King Song Tham, during King Prasat Thong's reign (1629-1656), he instructed in nourishing many temples and also the palaces. He gave an order to build a palace at a place on the way to Phra Bata (Buddha's footprint) named Phra Nakorn hluang as a replica of Ankor Thom in Combodia in 1630, build a royal hall named "Sirisothorn Mahabhimanbanyong" in 1631, restore the summit of the main prang of Wat Maha That collapsed in the reign of King Song Tham in 1633, build a temple on his mother's homeland named Wat Chaiwatanaram in 1635, expand the palace wall, and construct royal halls and Brahmin shrines in 1636. It is in no doubt for the high demand in infrastructural materials that would have been required and how the producers must have been in expedition. So, the possibility for the dating of the introduction of semi dome shaped kiln would have been in the first half of 17th century or closer dated to the reign of King Prasat Thong (Table no 8)

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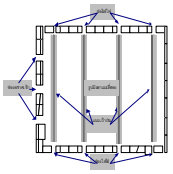
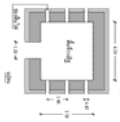
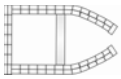
[2] พระจักรพรรดิพงศ์ (จาด), พระราชพงศาวดารกรุงศรีอยุธยา เล่ม 2,(กรุงเทพฯ: องค์การค้าคุรุสภา, พิมพ์ครั้งที่ 4 ,2532), 342-361.

Table No.8 Approximate dating of Klong Sra Bua Kiln

Period	Cultural Layer	kiln type	Re construction	Comparative kiln	Comparative Estimate dating
Early	I			 Du Song Yor,Pattani	**King Boromatrailokanat (1448-1488)** ***Ca 2nd half of 15th century***
Late	II			  Huoung Canh, Vietnam	**King Prasat Thong (1629-1656)** ***Ca 1st half of 17th century***

Prominent evidence to support this interpretation is the water pipe, a row of which were cylinders made one end narrowed down for insertion into the next. This was found in lower part of cultural layer I the excavation pit no. 3 or about in the beginning of late period. Though they are smaller in size as comparing to other ones found in the royal palaces both in Ayutthaya and Lopburi, although they were believed to be well produced in the reign of King Narai (1656-1688) or earlier in reign of Prasat Thong or King Ekathotsarot (1605-1610). By accompany to absolute palaeomagnetic dating of Kiln no 2 of Noi River kiln site, where the water pipes found *in situ* attached to the kiln which were given the latest date of the reign of King Narai and could probably have been used in earlier times as in the reign King Prasat Thong[3].

[3] กรมศิลปากร, เตาแม่น้ำน้อย 2: เซระมิคส์ในประเทศไทย ชุดที่ 5 เอกสารกองโบราณคดี หมายเลข 4/2533, (กรุงเทพฯ: โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย,2533), 68

Fig. 358: A row of water pipes found in pit no 3

5.3 Ceramic Production of Klong Sra Bua

Categorizing artifacts found in excavation associate to kiln features confirm the correction of "Record of Ancient Architecture in Ancient Phra Nakhon Si Ayutthaya" and can be classified into 2 periods

5.3.1 Western Bank of Klong Sra Bua (Table no. 9 -13)

5.3.1.1 Early Period (layer 22 - 6)

Main productions of an earlier stage in this area were tiles and bricks. Typically they were straight-cut end flat tiles with upper end folded upright to serve as hook for locking on roof batten. Its size is about 12 cm wide 1 cm thick. Though unfortunately no complete sample was found to examine the proper length, it might have been approximately about double of the width or more.

Cylindrical tiles are found from the early stage of their production and found in the earlier period than straight-cut end flat tiles. The discovered amounts of cylindrical tiles tended to be less in number by comparing. Thus, it might be considered a rare or special architectural material as mentioned by many scholars that they were used for roofing temples and royal halls. The antefixes appear of course in association to the cylindrical tiles as parts of

corrugated roof form along with its decorated eaves. “Thepanom” (representative deity with hand pressed together) were produced accompanying a floral design in lesser quantity.

Anvils for pottery making also confirm the pottery making activities on this part of Klong Sra Bua. Usually many sizes of pots with less stamped decoration are commonly produced including kettles (as found in the spouted fragment), lids, stoves or cooking pot stands. All were as per required in daily cooking wares, and some of which are “Lerng” from opposite neighbors. Toys in animal and human figures were also produced on some occasions.

5.3.1.2 Late Period (layer 6 ~ 5- 1)

Straight-cut end flat tiles seemed not much in fashion in this stage with few pointed end flat tiles that were introduced especially in Layer v. Both types of flat tiles were found to mingle and later increasing in a large number of pointed end flat tiles which predominated the entire factory area. Cylindrical tiles were also produced but more different designs of antefix were made especially “Kala” (representative Asura of without its lower jaw) and floral designs while “Thepanom” dominated at all times. Co-ordination of antefix samples to which found in various sites especially temples in Ayutthaya long period can be classified and chronologically dated as shown in table no. 14.

Potteries were continuously produced along with tiles and there was a number in shape, design or decorations but varied in sizes. However “Lerng” potteries were also preferable to be used which showed close relation to eastern area.

5.3.2 Eastern Bank of Klong Sra bua

“Lerng” eartherwares predominated on the eastern bank of Klong Sra Bua in upper layer or late period. They mostly are pots with stamped decoration on their shoulders, also over their bodies, made by hand-mould round bottom with slow wheel rim in shape, finishing by paddle stamped. The firing technique of “lerng” was developed frequently in 3 stages:

1) shallow pit fire 2) bonfire; flat packed ground was prepared. This ground could be reused several times which its feature would appear as fired soil or earthen ground. 3) Bonfire was on an uplifted floor placed by earthen half-cylindrical tiles with 5 cm. gap to fill with small brushwood as fuel. The sun-dried pots usually upside down, and depending on the size, overlaid on each pot layer then covered by brushwood of bamboo lying and then covered with brushwood on top for firing.

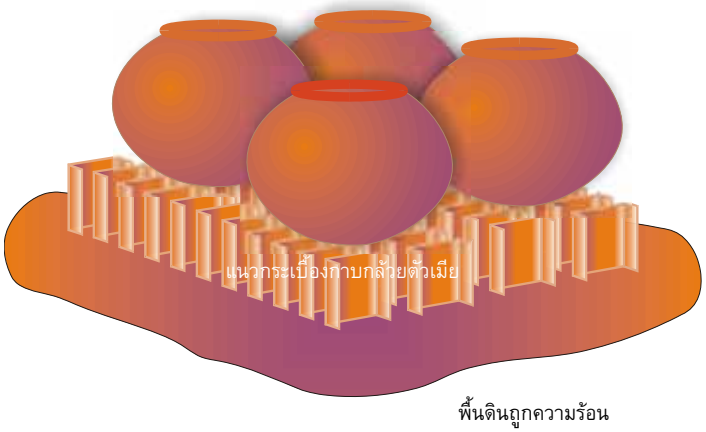


Fig. 359 Reconstruction of 3rd stage of bonfire technique

5.4 Ceramic manufacture of Klong Sra Bua

Because of some objects which were made of organic materials had naturally disintegrated, ethnological observation and study of present-day potteries and tiles making can provide some knowledge in reforming the process of ceramic making from artifacts found in the excavation.

5.4.1 Tiles

Determination of tile making procedure of present-day Klong Sra Bua villagers shows a large flat ground is required for drying under the sun within every process. Without doubt, ceramic factories in the excavation pit of the western part of Klong Sra Bua showed continuity in quite vast area of further than 100 metres from the bank of the canal, where the semi-domed

kilns featured laid deep upland with small wells which can be found scattered in between the bank of Klong Sra Bua and kiln location.

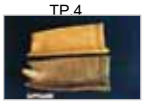
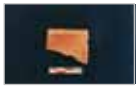
The process of tile making would probably have been as same as present-day making activities as observed ethnologically. All flat and cylindrical tiles were made by wooden mould with hand folding and a formed small band served as hook at one end. Flat tiles in earlier period would have been in the same process as Pattani's and Songkhla's, while later period still being produced at Klong Sra Bua itself.

The antefix tiles were also made by 2 types of mould; first the cylindrical mould for the clay body and an engraved mould plate to make a decorated triangular part then fix them together while in damp conditions. "Krachang", decorated objects were made in wooden moulds and fixed in a small notch at the centre of the obverse side. This was to fix on any desired wall of the building. Also some decorative pieces were hand formed especially for toys in human and animal figures. Other architectural objects, such as water pipes, floor tiles, etc were produced occasionally, probably made by order.

5.4.2 Pottery

Potteries also played an important product. During early period western Klong Sra Bua peoples also produced potteries by using wooden wheel throwing. Round base pots with quite long flared neck were their basic use for storage. Cooking pots were wider mould with 2 handles, kettles; lids in various sizes were made. Cooking pot stands or stoves are very unique at all times throughout Ayutthaya period or later, more in early Rattanakosin. More varieties of cooking wares were also made, such as pan, bowl with stand, rice cake tray, etc.

Table no 9 showing types of roof tiles found in klong Sra bua

Period	Cultural Layer	Soil Layer	straight-cut end flat tiles	End pointed flat tile	Cylindrical tile	others
Early	II	Layer 14-16				
		Layer 13			 TP.8	
		Layer 12			  TP.5	
		Layer 11	 TP.5			
		Layer 10				
		Layer 9			 TP.4	
		Layer 8				 TP.3
		Layer 7	 TP.4			
		Layer 6				
		Layer 5	 TP.1  TP.4	 TP.17		
Late	I	Layer 4		 TP.17	 TP.4  TP.8	
		Layer 3	 TP.18			
		Layer 2				
		Layer 1		 TP.2		

P.

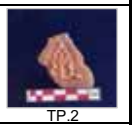
Period	Archaeological Layer	Soil Layer	decorated design					
			Debhanom	Goddess	Floral	Kala	Cloud	Lotus
Early Period	Cultural Layer I	Layer 16						 TP.2
		Layer15 -13						
		Layer 12	   TP.2					
		Layer 11			 TP.2			
		Layer 10						 TP.2
		Layer 9	 TP.3					 TP.2
		Layer 8						 TP.2
		Layer 7	 TP.3		 TP.3			  TP.8
		Layer 6	 TP.3					
		Layer 5	 TP.2		 TP.2			 TP.1

Table no 10 showing types of antefix tiles found in Klong Sra Bua (cont.)

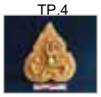
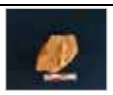
Period	Archaeological Layer	Soil Layer	decorated design					
			Debhanom	Goddess	Floral	Kala	Cloud	Lotus
Late Period	Cultural Layer II	Layer 4				 TP.4   TP.11		
		Layer 3	  TP.4			  TP.4  TP.8		 TP.8
		Layer 2	 TP.4		 TP.3		 TP.11	
		Layer 1	 TP.1  TP.2	 TP.2				

Table no 11 showing types of architectural objects found in Klong Sra Bua

Period	Archaeological Layer	Soil Layer	Boundary sheet	Decoration motifs "Krajang"	Decoration motifs	Floor tiles	others
Early Period	Cultural Layer I	Layer 22	 TP.2				
		Layer 22 -9					
		Layer 8		   TP.2	 TP.3		 TP.3
		Layer 7					
		Layer 6			  TP.2		
Late Period	Cultural Layer II	Layer 5	 TP.4		  TP.2  TP.8	 TP.3	
		Layer 4	  TP.4		 TP.4  TP.8		   TP.4
		Layer 3			 TP.8		 TP.4
		Layer 2	 TP.2			 TP.4	

Table no. 12 showing types of potteries found in Klong Sra bua (cont.)

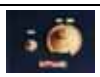
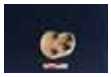
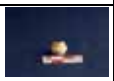
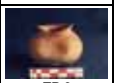
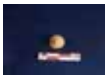
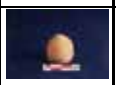
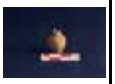
Period	Cultural Layer	Soil Layer	pot	lid	Small lantern	stove	bottle	Handle of pot	Bowl with foot
Early Period	Cultural Layer I	Layer 11	 TP.3						
		Layer 10	 TP.1 TP.2 TP.3 TP.4	 TP.2		 TP.19	 TP.5		
		Layer 9	 TP.2	 TP.1	 TP.1  TP.4		 TP.19	 TP.3	
		Layer 8	 TP.1	 TP.2		 TP.1  TP.4		 TP.3	
		Layer 7	 TP.3	 TP.4				 TP.1	
		Layer 6	 TP.1  TP.2    TP.3	 TP.2   TP.4	 TP.6	 TP.2	 TP.1  TP.6	 TP.2	

Table no. 12 showing types of potteries found in Klong Sra bua

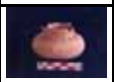
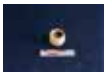
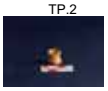
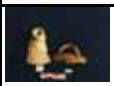
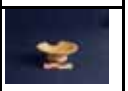
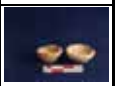
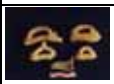
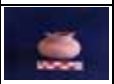
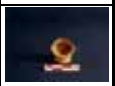
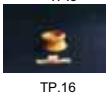
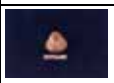
Period	Cultural Layer	Soil Layer	pot	lid	Small lantern	stove	bottle	Handle of pot	Bowl with foot
Late Period	Cultural Layer II	Layer 5	   TP.2  TP.4  TP.19	 TP.4	 TP.4	 TP.4		 TP.17	 TP.3
		Layer 4	  TP.2    TP.3	 TP.4  TP.8	 TP.1   TP.4	 TP.3		 TP.1	
		Layer 3	 TP.2   TP.3	 TP.4			 TP.3		
		Layer 2	 TP.2  TP.3  TP.16	 TP.1  TP.4					
		Layer 1	 TP.1  TP.3					 TP.1	

Table no 13 showing types of toys found in Klong Sra Bua

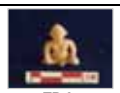
Period	Archaeological Layer	Soil Layer	human figures	animal figures	others
Early Period	Cultural Layer I	Layer 22	 TP.11		
		Layer 21-17			
		Layer 16			 TP.4
		Layer15			
		Layer 14		 TP.8	
		Layer 13-12			
		Layer 11	 TP.3		
		Layer 10	 TP.4		
		Layer 9	 TP.3	  TP.3  TP.17	
		Layer 8			
		Layer 7			
		Layer 6	  TP.3	 TP.3	
Late Period	Cultural Layer II	Layer 5	 TP.3	 TP.3	
		Layer 4		 TP.19	 TP.16
		Layer 3	 TP.19	 TP.19	
		Layer 2-1			

Table no 14 Comparing types of antefix tiles found in Klong Sra Bua to other sites in Ayutthaya

Period	Archaeo-logical Layer	Klong Sra Bua						Other sites					
		Thephanom	Goddess	Floral	Kala	Cloud	Lotus	Thephanom	Goddess	Floral	Kala	Cloud	Lotus
Early Period ca second half of 15th century to wards 16th century	Cultural Layer I						 TP.2						 Wat Suwanawat
		   TP.2						 Wat Thammikarat  Wat Khunsaen  Wat Worachet  Wihan Klap					
				 TP.2						 Banyon Pavillion  Object's Museum			
							 TP.2						 Wat Tritrueng
		 TP.3					 TP.2	 Wat ChaoPrap					 Wat Viharn Thong  Wat Mondop
		 TP.2					 TP.2	 Wat Khunsaen					 Wat Suwannawat  Wat Phrasi Sanpetch
		 TP.3		 TP.3			 TP.8	 Wat Nakhon Kosa, Lobburi					 Royal palace
		 TP.3						 Wat Nakhon Kosa, Lobburi					
		 TP.2		 TP.2			 TP.1	 Wat Thammikarat		 Wat Kae  Banyonrattanat Pavillion			 Royal Palace

Table no 14 Comparing types of antefix tiles found in Klong Sra Bua to other sites in Ayutthaya (cont.)

Period	Archaeo-logical Layer	Klong Sra Bua						Other sites					
		Thephanom	Goddess	Floral	Kala	Cloud	Lotus	Thephanom	Goddess	Floral	Kala	Cloud	Lotus
Late Period ca first half of 17th century on wards		TP.4 TP.11									Wat Khunsaen Wat Suwanchedi		
		TP.4			TP.4 TP.8		TP.8				Wat Khunsaen		
		TP.4		TP.3		TP.11						Wat Ubosot	
		TP.1 TP.2	TP.2										

Chapter VI

Summary

Archaeological evidence has proved that the historical record in early the Rattanakosin period is certainly. This says that on the western bank of Klong Sra Bua or Thung Khaon, it used to be architectural material production area where mainly flat and cylindrical tiles were made. Firstly, the ceramic makers as experts in oblong updraft kiln firing techniques settled their factories and played their acquainted role of ceramic makers probably due to the command of the royal court. The most probability of this act would be that after Klong Sra Bua short-cuts were dug to serve the northern communication and with high demand for construction material of the royal court during reign of King Boromatrailokanat (1448-1488). This kiln and their productions played a main construction role of the city for more than a hundred years. Then more requirements for architectural materials brought them to change to a new kiln technology. The beginnings of semi dome cross draft kilns were then built. There was advancement in technology by comparing the study of kilns in China and Vietnam. It would be the introduction of Chinese who were one of the main ethnic groups who settled in Ayutthaya. The Chinese also featured prominently in court and commerce. Again, probably to meet high demand of royal court in the reign of Prasat Thong's reign (1629-1656), would have been the reason for new innovation would arise. This technique was applied throughout in later period of Ayutthaya. Though the absolute dating is not applied in this research, but by following Ayutthaya chronology it would have dated from first half of 17th century till 18th century or the declining of the Ayutthaya kingdom.

Not only architectural materials but also various earthen potteries were also produced. On the eastern bank of Klong Sra Bua, another ethnic group, whose open bonfire technique were typically practiced, settled and made mainly storage vessels and pots, named locally with Mon dialect as "Lerng", to serve as kitchen wares. Archaeological evidence shows that

they perform pottery making in the later period. By the historical evidence mentioned first, the Mon migration to Ayutthaya was in 1539. It might be said that “Lerng” pottery making would have been introduced to Ayutthaya during mid of 16th century.

Because of clay materials available in Ayutthaya may not give a good quality of product. Also, Ayutthaya was an important trade centre where goods and products from many places were collected and exchanged. Best high quality of ceramics, such as blue and white and polychrome porcelains, were common in market and easy to purchase for use in daily life even among commoners. So, there was unnecessary to gain higher quality for infrastructural materials that hardly to renovate within their life time .In archaeological point of view, ceramic making tradition is one of culture identity that can apply for study human development and can bring out the understand their civilization in many aspect.

Study by ethnological observation of ceramic in many local groups that relate to specific location can give a clearer understanding into its manufacture and help to clearly identify archaeological evidence. The process of various type of tile making is shown by their making and firing in closer dimension to perform better reference. During the early period, flat tiles with long banded hooks were common in use for roofs, not only among Thais but also Muslim from southern Thailand. This type of tile has been continuously used in southern Thailand through Rattanakosin period up to present day, but in Ayutthaya, it showed a newer trend for its shape that looked more decorative, once these tiles were used for roofing, it would look like the scales of mythical animals, such as a serpent “Magara’s” body which adjoined to the roof final, “Chor fa” an ornamental roof points shaped as the head.

Observation in ceramic making in many ethnic groups can provide clearer view for reconstruction of pottery making process. Generally, they are made by slow wheel throwing and anvils which are applied with a wood paddle for decoration. Some of the paddles were engraved to give decorative effect on the shoulder or body of pots. There was not a special kiln for pottery. Potters could apply available kilns for firing with any kind of clay

objects, thus a tile kiln is able to fire pots and certainly bricks. All these practices can be seen both among Klong Sra Bua, Songkhla and Pattani ceramic makers.

It is concluded here also that the similarity of ceramic manufacture in South-east Asian regions occur by the intercultural change among neighbors either through trade or commerce or a relationship through marriage or migration to settle. Ayutthaya flourished in all aspect especially in 17th century, without doubt increasing the population, gaining economic growth and trade and also more modern technology to support the rising of Ayutthaya.

Bibliograghy

- English

Asian Art Museum of Mexico. Thai Ceramics. Kuala Lumpur : Oxford University Press,1993.

Babetti, M. and Hein, D. Palaeomegnetism and High-Resolution Dating of Ceramic Kilns in Thailand. Vol. XXI, June, 1989.

Baker, Christopher John and Pasuk Phongpaichit. A History of Thailand. New York : Cambridge University Press, 2005.

Bougas W.A.L. Islamic Cemeteries in Patani. The Malaysian Historical Socieity, 1988.

Charnvit Kasetsiri. Discovering Ayutthaya. **:** Bangkok, 2007.

Charnvit Kasetsiri. From Japan to Arabia: Ayutthaya's Maritime Relations with Asia. The Foundation for the Promotion of Social Sciences and Humanities Textbooks Project, Bangkok, 1999.

Charnvit Kasetsiri. The Rise of Ayudhaya. Kuala Lumpur : Oxford University Press, 1976.

Costin, Cathy Lynne. The Use Of Ethno archaeology for Archaeological Study of Ceramic Production**.** *Journal of Archaeological Method and Theory, Vol.7, No.4, 2000*.

Chuimei, Ho. Ancient Ceramic Kiln Technology in Asia. Hong Kong : University of Hong Kong, 1990.

Chuimei, Ho., Minnan. Blue and White Wares ; An Archaeological survey of kiln sites of the 16th -19th centuries in southern Fujian, China. BAR International Series 428, 1988.

Curtain, Philip D. Cross-Cultural Trade in the World History. New York : Cambridge University Press, 1984.

Cooper, Ilay and Barry Dawson. Traditional Buildings of India. London : Thames and Hudson Ltd, 1998.

Farooq, Mohammad Khalid, Dr. Engr. Technology Manual on clays bricks in Pakistan. Lahore : The Pakistan Council of Scientific and Industrial Research, 1944.

Olsen Frederick L.The Kiln Book. Rodner : Chaton Book Company, 1983.

Lamb, P.Y.K. and others. A Ceramic Legacy of Asia's Maritime Trade. Kuala Lumpur : Oxford University press,1985.

Leach,Bernard. A Potter's Book. London : Faber and Faber, 1976.

Needham, Joseph. Science & Civilisation in China : Volume 12. UK : Cambridge University Press, 2004.

Kajit Jittasevi, Dr. (editor). Ayudhya and Asia. Proceedings for the International workshop 18 – 20 December 1995. Bangkok : Printing House of Thammasat University,1995.

Rice, Prudence M. Pottery Analysis. Chicago : The University of Chicago Press, 1987.

Rhodes, Daniel. Kilns : Design, Construction, and Operation. Pennsylvania : Chilton Book Compant, 1968.

Sarasin Virapol. Tribute and Profit : Sino-Siamese Trade, 1652-1853. Cambridge : Harvard University Press, 1977.

Smith, George Vinal. The Dutch in Seventeenth-Century Thailand. Northern Illinois: Northern Illinois University, 1977.

Shepard, Anna O. Ceramics for Archaeologists. Washington D.C. : Carnegie Institution of Washington, 1971.

The Office of the National Cultural Commission. Ancient Trades and Cultural Contacts in Southeast Asia. Bangkok : n.p., 1996.

The Trusties of the British Museum. Pottery in Making. London : British Museum press, 1997.

Gilquin, Michel, translated by Smithies, Michael. The Muslims of Thailand. Chiang Mai : Silkworn Books, 2005.

Vainker, S.J. Chinese Pottery and Porcelain From Prehistory to the Present. London : British Museum Press, 1991.

Wikipedia. Chinese Ceramics. [online], Accessed 16 January 2010. Available from http:// www Wikipedia.org

Wikipedia. Hoi An. [online], Accessed 16 January 2010. Available from http:// chestbooks.com

Thai (**ภาษาไทย**)

กรมศิลปากร. เตาแม่น้ำน้อย. กรุงเทพฯ : โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย จำกัด , ๒๕๓๑.

กรมศิลปากร. บันทึกเรื่องสัมพันธไมตรีระหว่างประเทศไทยกับนานาประเทศในศตวรรษที่ ๑๗ เล่ม ๑, กรุงเทพฯ: โรงพิมพ์คุรุสภาลาดพร้าว, ๒๕๑๓.

กรมศิลปากร. กองโบราณคดี. รายงานการขุดค้นทางโบราณคดีเตาเผาสังคโลก หมายเลข ๖๑ ในบริเวณแหล่งเตาเผาโบราณเมืองศรีสัชนาลัย หมู่บ้านเกาะน้อย ตำบลหนองอ้อ อำเภอศรีสัชนาลัย จังหวัดสุโขทัย. สุโขทัย : งานโบราณคดี โครงการอุทยานประวัติศาสตร์ศรีสัชนาลัย, ๒๕๒๙-๒๕๓๐.

กรมศิลปากร. รายงานการสำรวจขุดค้นทางโบราณคดีแหล่งผลิตเครื่องปั้นดินเผา กลุ่มคลองสระบัวคลองบางขวด และคลองเมือง จังหวัดพระนครศรีอยุธยา. พระนครศรีอยุธยา : สำนักงานโบราณคดีและพิพิธภัณฑสถานแห่งชาติที่ ๓, ๒๕๔๔.

กรมศิลปากร. กองโบราณคดี. แหล่งเตาเผาบ้านบางปูน. กรุงเทพฯ: โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย จำกัด, ๒๕๓๑.

กรมศิลปากร. กองโบราณคดี. เซระมิคส์ในประเทศไทย ชุดที่ ๕: เตาแม่น้ำน้อย. กรุงเทพฯ : โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย จำกัด, ๒๕๓๓.

กาโตะ วาย. เตาเผาไทย. (เอกสารทางวิชาการในงานสัมมนาเรื่องเครื่องปั้นดินเผา ครั้งที่ ๑ วันที่ ๑ - ๓ ธันวาคม ๒๕๑๔ โครงการพัฒนาอุตสาหกรรมผลิตภัณฑ์เครื่องปั้นดินเผา กรมวิทยาศาสตร์ กระทรวงอุตสาหกรรม), ๒๕๑๔. (อัดสำเนา)

จอร์ห ซอร์. เครื่องปั้นดินเผาไทย. (เอกสารวิชาการชุดเครื่องปั้นดินเผา ลำดับที่ ๑ โครงการศึกษาเครื่องปั้นดินเผา ศูนย์ส่งเสริมวัฒนธรรม มหาวิทยาลัยเชียงใหม่ แปลโดย สมพร วาร์นาโด,เอมอร ตรูวิเชียร และ อุษณีย์ ธงไชย). กรุงเทพฯ : โรงพิมพ์กราฟท์แมน, ม.ป.ท.

กรมศิลปากร. เซระมิคส์ในประเทศไทย ชุดที่ ๕ : เตาแม่น้ำน้อย ๒. กรุงเทพฯ : โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย จำกัด, ๒๕๓๓.

จุฬิศพงศ์ จุฬารัตน์. ขุนนางกรมท่าขวา การศึกษาบทบาทและหน้าที่ในสมัยอยุธยาถึงสมัยรัตนโกสินทร์ พ.ศ. ๒๑๕๓ – ๒๔๓๕. กรุงเทพฯ : โครงการเผยแพร่ผลงานวิชาการ คณะอักษรศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, ๒๕๔๖.

ชนิดา ศักดิ์ศิริสัมพันธ์. หน้าต่างสู่โลกกว้าง ประเทศจีน. กรุงเทพฯ : บริษัท สำนักพิมพ์หน้าต่างสู่โลกกว้าง จำกัด, ม.ป.ป.

ประพิศ พงศ์มาศ และคณะ. มรดกไทย มรดกชาติ. กรุงเทพฯ : บริษัท รุ่งศิลป์การพิมพ์ จำกัด, ๒๕๕๒.

ประเวศน์ วิริยานุวัฒน์. การทำกระเบื้องดินเผาในภาคใต้ฝั่งตะวันออก. (อัดสำเนา)

พรรณี ฉัตรพลรักษ์ และคณะ. สังคมจีนในไทย, กรุงเทพฯ : ม.ป.ท., ๒๕๒๙.

พยุง วงศ์น้อย. แหล่งผลิตภาชนะดินเผาในลุ่มแม่น้ำเพชรบุรี. (อัดสำเนา).

พยุง วงศ์น้อย. แหล่งผลิตภาชนะดินเผาในลุ่มแม่น้ำแม่กลอง(เมืองราชบุรี). (อัดสำเนา).

พระยาโบราณราชธานินทร์. ประชุมพงศาวดาร ภาคที่ ๖๓ เรื่องกรุงเก่า. (พิมพ์เป็นอนุสรณ์เนื่องในงานพระราชทานเพลิงศพนายพิมล บุญอาภา ณ เมรุวัดเทพศิรินทราวาส วันที่ ๒๓ มิถุนายน พ.ศ. ๒๕๑๑). กรุงเทพฯ : โรงพิมพ์การศาสนา, ๒๕๑๑.

พระยาโบราณราชธานินทร์. รวมเรื่องกรุงเก่า. (พิมพ์ในงานพระราชทานเพลิงศพนางสาวเพ็ญ เดชะคุปต์ เป็นกรณีพิเศษ). กรุงเทพฯ : ม.ป.ท., ๒๕๔๑. (อัดสำเนา)

ภรดี พันธุภากร. เซรามิกส์เบื้องต้น. ชลบุรี : มหาวิทยาลัยบูรพา, ๒๕๒๔.

ภัคพดี อยู่คงดี และพรทิพย์ พันธุโกวิท. การศึกษามัสยิดและอาคารประกอบศาสนกิจในศาสนาอิสลามก่อน พ.ศ. ๒๔๗๕. ม.ป.ท., ๒๕๔๔. (อัดสำเนา)

ภัทรพงษ์ เก่าเงิน. แหล่งผลิตภาชนะดินเผาสามโคก. (อัดสำเนา)

ภัทรพงษ์ เก่าเงิน. เตาโอ่งอ่าง, (อัดสำเนา)

สุขุมาล เล็กสวัสดิ์. เครื่องปั้นดินเผา พื้นฐานการออกแบบและปฏิบัติงาน. กรุงเทพฯ : สำนักพิมพ์แห่งจุฬาลงกรณ์มหาวิทยาลัย, ๒๕๔๘.

สุชาติ ปลดเปลื้อง. กระเบื้องมุงหลังคาไทย. เอกสารทางวิชาการ ในงานสัมมนาเรื่องเครื่องปั้นดินเผา ครั้งที่ ๒ วันที่ ๑๔ – ๑๖ พฤศจิกายน ๒๕๑๔ โครงการพัฒนาอุตสาหกรรมผลิตภัณฑ์เครื่องปั้นดินเผา กรมวิทยาศาสตร์ กระทรวงอุตสาหกรรม. (อัดสำเนา)

สารสิน วีระผล.จิ้มก้องและกำไร : การค้าไทย-จีน ๒๑๙๔ – ๒๓๙๖. ม.ป.ท., ๒๕๔๘.

กรมศิลปากร. เซรามิคส์ในประเทศไทย ชุดที่ ๔: เตาบ้านกรวดบุรีรัมย์. กรุงเทพฯ :โรงพิมพ์ชุมนุมสหกรณ์การเกษตรแห่งประเทศไทย จำกัด, ๒๕๓๒.

.....วารสาร เสียงรามัญ. ปีที่ ๒ ฉบับที่ ๙ พฤษภาคม – มิถุนายน ๒๕๕๐.กรุงเทพฯ : บริษัท วีซี เพรส จำกัด, ๒๕๔๐.

.....พระราชพงศาวดาร ฉบับพระราชหัตถเลขา เล่ม ๑. กรุงเทพฯ : อมรการพิมพ์, ๒๕๑๖.

.....พระราชพงศาวดาร ฉบับพระราชหัตถเลขา เล่ม ๒. กรุงเทพฯ : โรงพิมพ์เจริญธรรม, ๒๕๑๖.

.....พระราชพงศาวดารกรุงศรีอยุธยาฉบับพระจักรพรรดิพงศ์ (จาด) เล่ม ๑, กรุงเทพฯ : โรงพิมพ์คุรุสภาลาดพร้าว, ๒๕๐๔.

.....พระราชพงศาวดารกรุงเก่า ฉบับหลวงประเสริฐอักษรนิติ์, กรุงเทพฯ : สำนักพิมพ์แสงดาว, ๒๕๔๔.

อนันต์ วัฒนานิกร. แลหลังเมืองตานี, กรุงเทพฯ : ห้างหุ้นส่วนจำกัด ศิริวัฒนาการพิมพ์, ๒๕๒๘.

อายุวัฒน์ สว่างผล. การศึกษา สำรวจอาชีพช่างปั้นดินเผาประเภทต่างๆ ในจังหวัดกำแพงเพชรและจังหวัดตาก. ม.ป.ท., ๒๕๔๗. (อัดสำเนา)

อิบรอฮิม ชุกรี. ประวัติราชอาณาจักรมลายูปะตานี. ปัตตานี : โครงการจัดตั้งสถาบันสมุทรรัฐเอเชียตะวันออกเฉียงใต้ศึกษา มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตปัตตานี, ๒๕๔๑.

โรงเรียนนวมินทราชูทิศ มัชฌิม. วิถีชุมชนบ้านแก่ง บลบ้านแก่ง อำเภอเมือง จังหวัดนครสวรรค์. [online], Accessed 16 January 2010. Available from www.chaiwbi.com

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