SPAFACON2021

Papers from the SEAMEO SPAFA International Conference on

SOUTHEAST ASIAN ARCHAEOLOGY AND FINE ARTS

13 - 17 December 2021

Editor: Noel Hidalgo Tan

SPAFACON2021 is published by SEAMEO SPAFA, the Regional Centre for Archaeology and Fine Arts established by the Southeast Asian Ministers of Education Organization. SEAMEO SPAFA focusses on archaeology and fine arts in Southeast Asia, and promotes awareness and appreciation of the cultural heritage of the region. Its member-countries are Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor-Leste, and Vietnam; and its associate member-countries are Australia, Canada, France, Germany, the Netherlands, New Zealand, Spain and the United Kingdom.

SPAFACON2021

Papers from the SEAMEO SPAFA International Conference on

SOUTHEAST ASIAN ARCHAEOLOGY AND FINE ARTS

13 - 17 December 2021

2021 SEAMEO SPAFA
ISBN: 978-616-7961-55-2
ISBN (e-book): 978-616-7961-54-5
DOI 10.26721/spafa.pqcnu8815a

Publisher
SEAMEO SPAFA Regional Centre for Archaeology and Fine Arts
81/1 Sri Ayutthaya Road, Dusit
Bangkok 10300, Thailand
Tel: +66 (0) 2280 4022 to 9
Fax: +66 (0) 2280 4030

www.seameo-spafa.org

E-mail: spafa@seameo-spafa.org

Editor
Dr Noel Hidalgo Tan

Organizing Committee
Mrs Somlak Charoenpot
Ms Vassana Kerdsupap
Mr Kanal Khiev
Mr Ean Lee
Ms Gabrielle Anne Mangaser
Dr Hatthaya Siriphatthanakun
Ms Ratchaporn Tesjeeb
Mr Patrick Xia Linhao
Dr Noel Hidalgo Tan

CONTENT

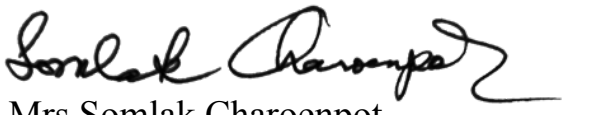
INTRODUCTION

This volume contains the extended abstracts from the papers presented at the SEAMEO SPAFA International Conference on Southeast Asian Archaeology and Fine Arts, which was held online from 13 to 17 December 2021. Also known as the SPAFACON2021, this conference was organised online due to the pandemic. Despite the disruption brought about by Covid-19 to our in-person events, training programmes and field research, it is heartening to see that archaeology and cultural heritage has continued under new modes of communication and collaboration.

This fourth iteration of the SPAFACON is also scheduled a year earlier than our usual triennial cycle to commemorate the 50th anniversary of SEAMEO initiating a centre dedicated towards archaeology and the fine arts. Over the past year, SPAFA has also been highlighting this legacy of international cooperation and capacity-building by sharing our photographic archives on our social media.

I am delighted by the high level of enthusiasm and intellectual curiosity brought by the participants to the conference. During our call for papers we received close to 90 submissions, but owing to the pressures of time and the online format, we were only able to accept 34 papers for the conference. The variety of papers present here, although a small set compared with our usual proceedings, reflects the breadth of the centre's ambit – covering not just archaeology, but also performing arts, visual arts, museum studies, and other aspects of Southeast Asian cultural heritage.

I would like to thank all the participants, without whom this conference would not be possible in its present form, in particular, our Governing Board members who represent every country in Southeast Asia, and to the Ministry of Culture, Thailand and the Ministry of Education, Thailand for their long-standing support of SEAMEO SPAFA and its activities.



Mrs Somlak Charoenpot
Centre Director
SEAMEO SPAFA

Khao San Dam: The Archaeological Evidence of Burnt Rice Festival in Southern Thailand

ข้าวสารดำ: หลักฐานทางโบราณคดีเกี่ยวกับประเพณีการเผาข้าวในภาคใต้ของประเทศไทย

10792/pqcnu8815a-08
Pakpadee Yukongdi (Ph.D.)
Fine Arts Department, Ministry of Culture
pakpadee1@hotmail.com

Abstract

Recently in 2021the 11th office of the Fine Arts Department, Songkhla has reported their annual excavations in Trang Province that archaeologists have found some set of rice while excavation in process namely,1) Khao Kurum Archaeological Site, Huai Yod District and 2) Napala Archaeological Site, Muang District. The artifacts which were found associated with the rice grains on the habitation layer consisted of potsherds, animal bones, grindstone, beads, etc. The grains of rice are short and brown in colour which is examined as carbonized since the beginning at its first left. The primary examination by archaeologists has classified the rice of Napala Archaeological Site as short grain of probably *Orysa sativa* (*Indica* or *Aus*) rice. AMS Radiocarbon dating by Beta Analytic Testing Laboratory shows the AMS standard results and calibration dating of charred material measured radiocarbon age:1440±30BP.

Because of their geographical location, both sites are incredibly located on one side of the hill slope, where they were suitable for habitat and plantation, especially tiny paddy fields and farms with sufficient water supply either small stream or well. The found rice, which now still grows uphill, probably called '***Khao rai***' needs less water or no marsh. Comparative study of ethnographic "*Atong*" 1 of 12 sub-tribes of the "*Garos*" Tibeto-Burman in Meghalaya, India which originated slash-and-burnt socio-groups, have shown an interest in growing rice activity. According to their ritual ceremony for planting of paddy, other grain, and seeds takes place. There are many ritualistic offerings of rice such as (1) flattened rice by asking for permission to cultivate the land from the first harvested paddy in May. (2) After the harvesting in September or October, the 1st ceremony of the agricultural year is a thanksgiving ceremony to mark the end of a period of toil in the fields and harvesting of bumper crops, which is probably the most important festival of the Garos locally called "*Maidan syla*" meant to celebrate the after-harvested festival or burnt rice festival. Their 2nd ceremony is to revive the monsoon clouds. People throw cooked

rice on the floor to symbolize hailstones. Noticing the rice, were probably the assemblage of "Khao San Dam" in many activities of these ceremonies, that is the archaeological evidence found in Khao Kurum and Napala Archaeological Sites.

In the Southern part of Thailand, once the crops have already cultivated, people celebrate to welcome their outcrops most probably at the end of September to October and mark their end of plantation before the monsoon come. People prepare 4 main rice desserts put together with other necessity stuffs in the "*hmrub*" special large containers and donate to the ancestors through Buddhist ceremony. Though archaeological evidence shows that southern peninsular was where the migrants from the west especially India origins, who shared same habitat of hillslope, might brought their different traditions through both land trans-peninsular and sea routes then settled down inner western or eastern coast since prehistoric times. The beliefs in animism might belong to some other western migrants and with having "*hmrub*" is one of their unique cultural characteristic material and tradition remain. Once they settled down then converged to Buddhism, the ritual ceremony may be changed due to religion, but tradition remains the same today, that is, Bun Duean Sib on the 10th of the lunar month or September-October.

สำนักศิลปากรที่ ๑๑ สงขลา ได้รายงานว่า ในคริสต์ศักราช ๒๐๒๑ นักโบราณคดีขุดค้นพบหลักฐานประเภทข้าวขณะทำการขุดค้นแหล่งโบราณคดีในจังหวัดตรัง ๒ แหล่ง คือ ๑) แหล่งโบราณคดีเขาคุรำ อำเภอห้วยยอด และ ๒) แหล่งโบราณคดีนาพละ อำเภอเมือง หลักฐานทางโบราณคดีที่มีความสัมพันธ์กับชั้นดินอยู่อาศัยพบร่วมกับเมล็ดข้าวนั้น ประกอบด้วย เศษภาชนะดินเผา กระดูกสัตว์ เศษหินลับ ลูกปัด เป็นต้น สำหรับเมล็ดข้าวเป็นข้าวเม็ดสั้น มีสีน้ำตาล ลักษณะคล้ายถูกเผาไฟตั้งแต่แรกทิ้งไว้ในแหล่ง นักโบราณคดีวิเคราะห์เมล็ดข้าวเหล่านี้ในเบื้องต้นคาดว่า อาจเป็นข้าวชนิด โอริสสา สัดติวา (กลุ่มอินดิกา หรือ ออส) (Orysa sativa :Indica or Aus) การหาค่าอายุด้วยวิธีคาร์บอน 14:AMS ด้วยเครื่องเร่งไอโซโทปคาร์บอนโดยห้องปฏิบัติการทางวิทยาศาสตร์ Beta Analytic Testing Laboratory ประเทศสหรัฐอเมริกา จากตัวอย่างถ่านได้ค่าอายุคือ 1440 ± 30 BP

ด้วยเหตุที่แหล่งโบราณคดีทั้ง ๒ แห่งตั้งอยู่เคียงกับลาดเชิงเขาซึ่งเหมาะกับเป็นที่อยู่อาศัยและเพาะปลูกในเวลาเดียวกัน โดยเฉพาะอย่างยิ่งแปลงนาขนาดเล็กและขนัดสวนที่มีแหล่งน้ำเอื้ออำนวยหรือมีบ่อน้ำตื้นอยู่ไม่ไกล เมล็ดข้าวที่พบนี้เมื่อเทียบกับที่ยังคงปลูกอยู่ในที่ดอนหรือบนเขา เรียกโดยทั่วไปว่า"ข้าวไร่" เป็นข้าวที่ต้องการน้ำน้อยหรือข้าวนาดอน ในการศึกษาชาติพันธุ์วิทยาเปรียบเทียบกลุ่มชนที่มีต้นกำเนิดทางสังคมด้วยวิถีการดำรงชีวิตแบบทำไร่หมุนเวียน (Slash and burnt) พบว่า เผ่าอตอง (Atong) ๑ ใน ๑๒ ชนเผ่ากาโร (Garos) ซึ่งเป็นชาติพันธุ์ทิเบโต-เบอร์มัน ในรัฐมัคคาลายา

(Meghalaya) ประเทศอินเดีย มีกิจกรรมการปลูกข้าวที่น่าสนใจ โดยเฉพาะอย่างยิ่ง การปลูกข้าวรวมถึงเมล็ดธัญพืชอื่น ๆ ในแปลงนา นอกจากนี้ยังมีพิธีกรรมต่าง ๆ ที่ใช้ข้าวเพื่อการบูชา เช่น ๑. การใช้ข้าวแผ่นเพื่อขออนุญาตทำการเพาะปลูกครั้งแรกลงบนผืนดินในเดือนพฤษภาคม หรือ ๒. การเฉลิมฉลองครั้งแรกของฤดูกาลเก็บเกี่ยว โดยทำภายหลังการเก็บเกี่ยวพืชผลช่วงเดือนกันยายน-ตุลาคม เป็นพิธีขอบคุณที่กำหนดว่าการทำงานหนักในท้องทุ่งจบลงและการเก็บผลผลิตจำนวนมากทวียิ่งขึ้นกว่าเดิมได้สิ้นสุดแล้ว ซึ่งถือเป็นประเพณีที่สำคัญที่สุดของชนเผ่ากาโร มีชื่อเรียกในภาษาถิ่นว่า “ไหม้ดานสิละ” (Maidan syla) หมายถึง เทศกาลฉลองหลังฤดูเก็บเกี่ยวหรือเทศกาลข้าวสารดำ สำหรับงานฉลองครั้งที่ ๒ คือการฟื้นคืนขึ้นของกลุ่มเมฆฝน ซึ่งผู้คนจะโยนข้าวสุกลงบนพื้นดินเป็นสัญลักษณ์เปรียบเสมือนลูกเห็บ ที่น่าสังเกตคือ ข้าว ในวัฒนธรรมของชนเผ่าอตองอาจหมายถึง “ข้าวสารดำ” ในหลาย ๆ กิจกรรมของพิธีการเหล่านี้ และอาจเทียบได้กับหลักฐานทางโบราณคดีที่พบในแหล่งทั้งที่เขาคุรำและนาพละ

ในภาคใต้ของประเทศไทย เมื่อฤดูการเก็บเกี่ยวเสร็จสิ้น ชาวบ้านจะฉลองพืชผลของตนในช่วงปลายเดือนกันยายน-ตุลาคมเป็นการจบของปีปลูกพืชพันธุ์ก่อนที่ฤดูมรสุมจะมาเยือน ทั้งนี้ชาวใต้จะจัดขนมที่ทำจากข้าว ๔ อย่างพร้อมด้วยสิ่งของจำเป็นอื่น ๆ บรรจุลงใน“หมรับ” ซึ่งเป็นภาชนะขนาดใหญ่เตรียมให้กับบรรพบุรุษที่ล่วงลับผ่านพิธีกรรมทางศาสนา จากหลักฐานทางโบราณคดี เชื่อได้ว่าบนคาบสมุทรภาคใต้ของประเทศไทยเป็นที่ซึ่งผู้คนโยกย้ายเข้ามาอยู่อาศัย โดยมาทั้งทางบกข้ามคาบสมุทรหรือทางเรือเดินชายฝั่งและลงหลักปักฐานภายในแผ่นดินด้านตะวันตกหรือชายฝั่งทะเลตะวันออกมาตั้งแต่สมัยก่อนประวัติศาสตร์ โดยเฉพาะอย่างยิ่งชาวอินเดียหรือกลุ่มชนจากทิศตะวันตกซึ่งอาจมีลักษณะการอยู่อาศัยบนภูมิสัณฐานเชิงเขาแบบเดียวกับแถบเชิงเขาหิมาลัย แต่มีประเพณีที่แตกต่างกัน มีความเชื่อในเรื่องวิญญาณนิยม และการใช้ภาชนะ“หมรับ”ซึ่งเป็นวัตถุทางวัฒนธรรมที่มีลักษณะเฉพาะตัวยังคงใช้อยู่ในกลุ่มชนเหล่านี้ ต่อเมื่อได้ตั้งหลักปักฐานมั่นคงและยอมรับนับถือพระพุทธศาสนาแล้ว พิธีกรรมทางศาสนาได้เปลี่ยนแปลงไป แต่ประเพณีความเชื่อยังคงอยู่ นั่นก็คือ ประเพณีบุญเดือนสิบ ในเดือนที่ ๑๐ ทางจันทรคติซึ่งตรงกับเดือนกันยายน-ตุลาคมของทุกปี

Keywords
burnt rice; paddy; ritual ceremony; tradition
เผาข้าว; ทุ่งนา; พิธีกรรม; ประเพณี

In 2021, the 11th Regional Office of Fine Art, Songkhla has reported their important excavations in Trang Province that archaeologists have found some rice during the excavation process at Khao Kurum Archaeological Site, Huai Yod District (Figure 1), Napala Archaeological Site, Muang District, Trang Province located at 7.583099954810659, 99.66354905970341 (Plengmetha Koawnoona 2020). The artifacts which were found associated with the rice grains on the habitation layer consisted of potsherds, animal bones, grindstone, beads, etc. The grains of rice are short and brown in color which is examined as carbonized since the beginning at its firstly left. The primary examination by archaeologists has classified the rice of Napala Archaeological Site as short grain of probably *Orysa sativa* (*Indica* or *Aus*) rice.

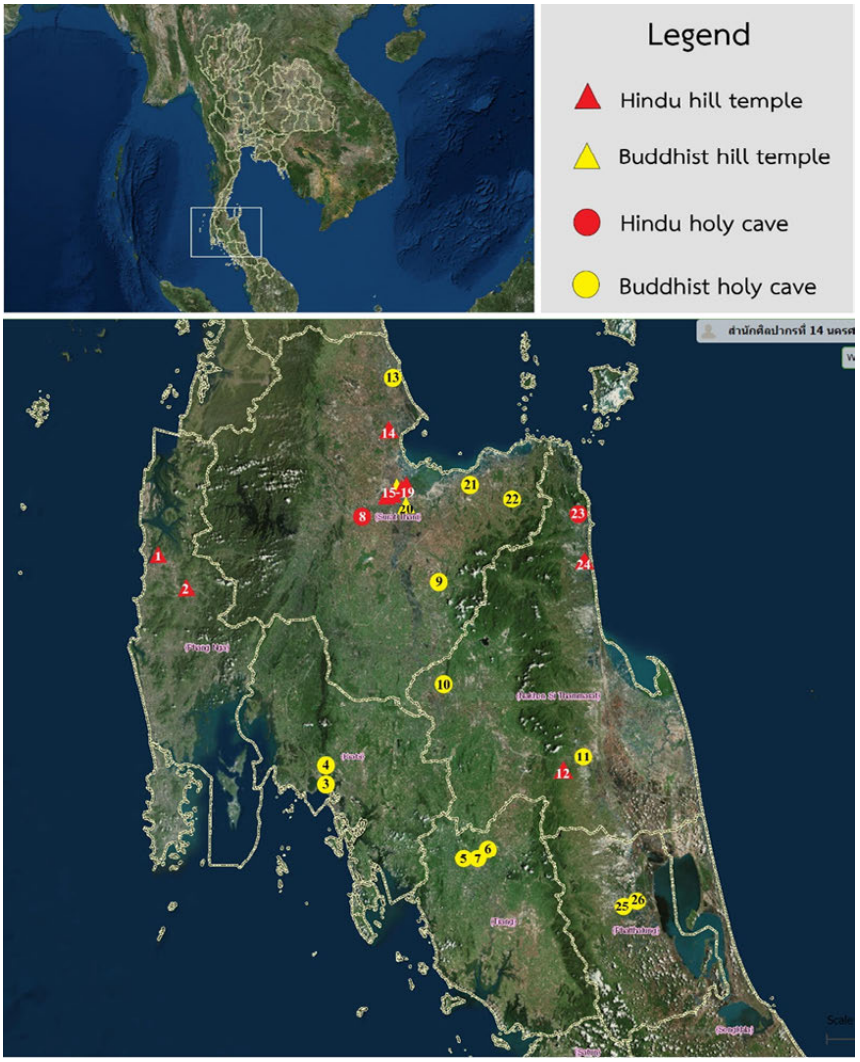


Fig 1: Map show the 26 sites of ancient hill temples and holy caves in the upper southern Thailand. No. 7 is Khao Nui, and the Khao Kurum Archaeological Site is nearby. Photo: Phanuwat Ueasaman, 2017

Fig. 2 Napala Archaeological Site.

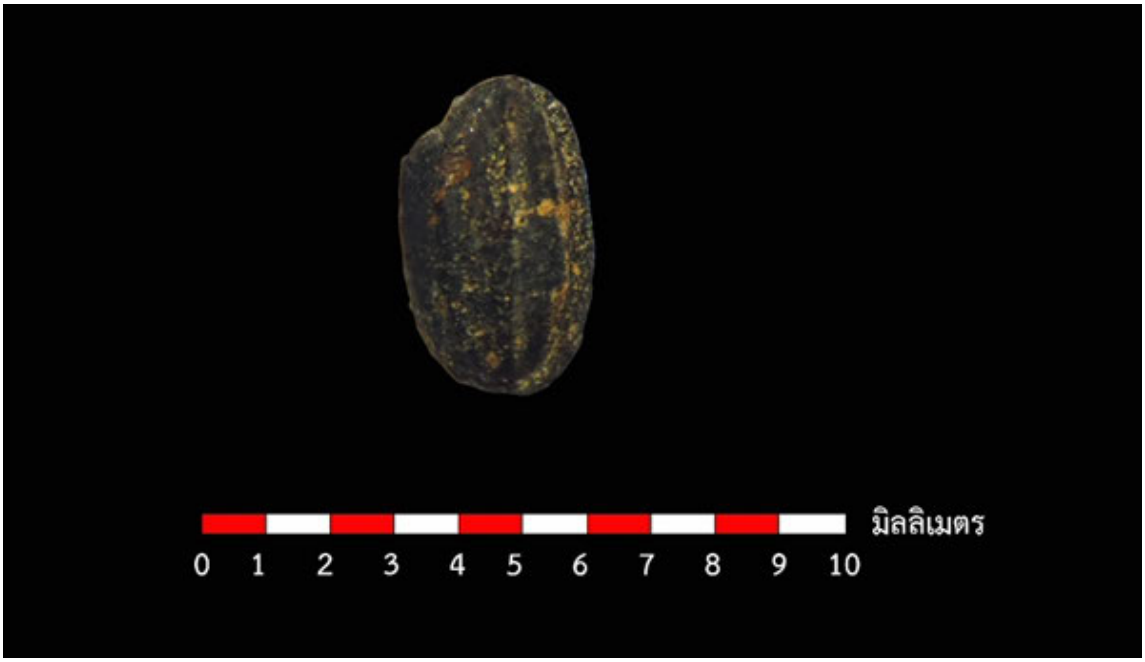


Fig. 3 Burnt rice found at Napala Archaeological Site.

Both sites are located on one side of a hill slope, which were suitable for habitat and agriculture especially tiny paddy fields and farms with sufficient water supply either small stream or well. (Figure 4)

Fig. 4 General view of Napala, Muang District, Trang Province. Photo by Plengmetha Koawnoona.

The AMS standard results and calibration dating of rice grain measured radiocarbon age:1440±30 BP[1]. Especially at Napala Archaeological Site, its location is associated with a small monument previously found nearby, which is indicated to be a Buddhist monastery (Figure 5).

Fig. 5 The fragments of stupika found at the small monument of Khao Kurum near the Napala Archaeological site. Photo by Plengmetha Koawnoona.

The found rice, which now still probably grows uphill, is called in Thai '*Khao rai*' and needs less water or no marsh. The AMS standard results and calibration dating of charred material measured radiocarbon age:1640±30 BP[2] or about 15th -16th century BP (Figure 6).

1 Beta 543316

2 Beta 543314

Fig. 6 The examples of carbonized rice grains found in the excavational pit of Khao Kurum Archaeological Site. Photo by Plengmetha Koawnoona.

Comparative study of ethnographic the Atong, one of twelve sub-tribes of the Garos, a Tibeto-Burman group in Meghalaya, India which was originally a slash-and-burn agriculture socio-group, have shown an interesting feature of growing rice activity. According to their ritual ceremony for planting of paddy, other grain, and seeds takes place. There are many ritualistic offerings of rice such as (1) flattened rice to ask for permission to cultivate the land from the first harvested paddy in May, and (2) after the harvesting in September or October, the first ceremony of the agricultural year is a thanksgiving ceremony to mark the end of a period of toil in the fields and harvesting of bumper crops, which is probably the most important festival of the Garos locally called *Maidan syla* meant to celebrate after-harvest festival or burnt rice festival (Seino van Breugel 2021: 587). Their second ceremony is to revive the monsoon clouds. People throw cooked rice on the floor to symbolize hailstones. Noticing the rice, were probably the assemblage of Khao San Dam in many activities of these ceremonies, that is the archaeological evidence found in Khao Kurum and Napala Archaeological Sites.

In the Southern part of Thailand, once the crops have already cultivated, people celebrate to welcome their outcrops most probably at the end of September to October and mark their end of plantation before the monsoon come. People prepare four main rice desserts put together with other necessary items in the *hmrub* (special large containers) and donate to the ancestors through a Buddhist ceremony. Archaeological evidence shows that the

southern peninsular was where the migrants from the west especially those of Indian origin, who shared the same hillslope habitat, might brought their different traditions through both the land trans-peninsular and sea routes and then settled down in the inner western or eastern coasts since prehistoric times. The beliefs in animism might belong to some other western migrants and with having "*hmrub*" is one of their unique cultural characteristic material and tradition remains. Once they settled down then converged to Buddhism, the ritual ceremony may be changed due to religion, but tradition remains the same that is Bun Duean Sib on the 10th of the lunar month or September-October yearly until today.

Moreover, from the evidence found at the ancient hill temples of Khao Nui where Khao Kurum and Napala are associated to, it is clearly that local people conservatively still play the common role of rice cultivation particularly at Napala which means "rice ploughing specifically for monks or temple". However, the tradition had been changed since the early Bangkok Period, so the place name remains.

The traditional of the after-harvest festival or burnt rice festival might have spread to mainland Southeast Asia, where the archaeological evidence of "Khao San Dam" or carbonized rice grains have been found at prehistoric Non Ban Jak (15° 15'.30.89", 102° 10'14") in the upper Mun Valley, Northeast of Thailand and historic Ban Wai and Ban Huai Pong, Lom Sak District, Phetchabun Province, while Indica or Aus? burnt rice of Khao Kurum and Napala Archaeological Sites had already dominated during early historic period or AD 1000-1100. One of the special burnt rice ceremonies, so-called a "Royal Pao Khao Ceremony" held in the third lunar month in the central plain of Thailand was also mentioned in the book of Royal Ceremonies of the Twelve Months authored by King Chulalongkorn in 1888. I would claim that southern Thailand is a transitional path of rice cultivation from the west (Indian subcontinent) to east.

References

Seino van Breugel (2021) *A Dictionary of Atong: A Tibeto-Burman Language of Northeast India and Bangladesh*. Berlin, Boston: De Gruyter Mouton.

The Fine Arts Department (2020) *The Origins of The Civilization of Angkor. Volume VII. The Excavation of Non Ban Jak*. Bangkok: The Fine Art Department 2020.

Meghalaya. (2021) Wikipedia, Wikimedia Foundation. Available at: https://en.wikipedia.org/wiki/Meghalaya [accessed 22 October 2021].

The Primarily Report of Khao Kurum Archaeological Site, Huai Yod District, Trang Province [In Thai] (2021) Songkhla: The 11th Regional Office of the Fine Arts Department.

The Primarily Report of Napala Archaeological Site, Muang District, Trang Province [In Thai] (2020) Songkhla: The 11th Regional Office of the Fine Arts Department.

Ueasaman, P (2019) Clay Votive Tablets in Southeast Asia: Distribution and Relationship. In: *Ancient Maritime Cross-Cultural Exchanges: Archaeological Research in Thailand*. Bangkok: The Fine Art Department.

Beta Analytic
TESTING LABORATORY

Beta Analytic Inc
4985 SW 74 Court
Miami, Florida 33155
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

ISO/IEC 17025:2005-Accredited Testing Laboratory

REPORT OF RADIOCARBON DATING ANALYSES

Parichat Saengsirikulchai — Report Date: December 02, 2019

Feature One Limited Partnership — Material Received: November 11, 2019

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes Calendar Calibrated Results: 95.4 % Probability High Probability Density Range Method (HPD)	
Beta - 543314	**#6**	**1640 +/- 30 BP**	IRMS δ13C: -24.9 o/oo
(75.6%)	**336 - 436 cal AD**	**(1614 - 1514 cal BP)**	
(16.0%)	**486 - 534 cal AD**	**(1464 - 1416 cal BP)**	
(3.8%)	**446 - 472 cal AD**	**(1504 - 1478 cal BP)**	

Submitter Material: Seeds
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 81.53 +/- 0.30 pMC
Fraction Modern Carbon: 0.8153 +/- 0.0030
D14C: -184.67 +/- 3.04 o/oo
Δ14C: -191.44 +/- 3.04 o/oo (1950:2019)
Measured Radiocarbon Age: (without d13C correction): 1640 +/- 30 BP
Calibration: BetaCal3.21: HPD method: INTCAL13

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

BetaCal 3.21

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL13)

(Variables: d13C = -24.9 o/oo)

Laboratory number **Beta-543314**

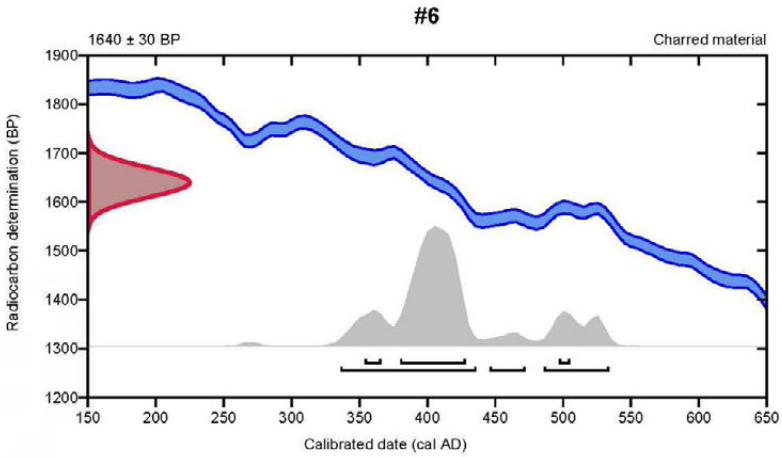
Conventional radiocarbon age **1640 ± 30 BP**

95.4% probability

(75.6%)	336 - 436 cal AD	(1614 - 1514 cal BP)
(16%)	486 - 534 cal AD	(1464 - 1416 cal BP)
(3.8%)	446 - 472 cal AD	(1504 - 1478 cal BP)

68.2% probability

(59%)	380 - 428 cal AD	(1570 - 1522 cal BP)
(5.6%)	354 - 366 cal AD	(1596 - 1584 cal BP)
(3.7%)	497 - 505 cal AD	(1453 - 1445 cal BP)



Database used

INTCAL13

References

References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337-360.

References to Database INTCAL13

Reimer, et al., 2013, Radiocarbon55(4)

Beta Analytic
TESTING LABORATORY

Beta Analytic Inc
4985 SW 74 Court
Miami, Florida 33155
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

ISO/IEC 17025:2005-Accredited Testing Laboratory

REPORT OF RADIOCARBON DATING ANALYSES

Parichat Saengsirikulchai — Report Date: December 02, 2019

Feature One Limited Partnership — Material Received: November 11, 2019

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes Calendar Calibrated Results: 95.4 % Probability High Probability Density Range Method (HPD)	
Beta - 543316	**#8**	**1440 +/- 30 BP**	IRMS δ13C: -25.5 o/oo
(95.4%)	**566 - 654 cal AD**	**(1384 - 1296 cal BP)**	

Submitter Material: Seeds
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 83.59 +/- 0.31 pMC
Fraction Modern Carbon: 0.8359 +/- 0.0031
D14C: -164.11 +/- 3.12 o/oo
Δ14C: -171.06 +/- 3.12 o/oo (1950:2019)
Measured Radiocarbon Age: (without d13C correction): 1450 +/- 30 BP
Calibration: BetaCal3.21: HPD method: INTCAL13

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

BetaCal 3.21

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL13)

(Variables: d13C = -25.5 o/oo)

Laboratory number **Beta-543316**

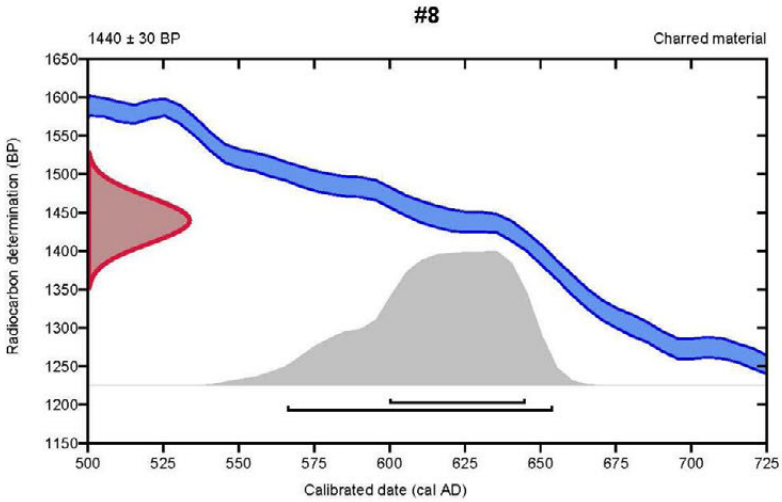
Conventional radiocarbon age **1440 ± 30 BP**

95.4% probability

(95.4%) 566 - 654 cal AD (1384 - 1296 cal BP)

68.2% probability

(68.2%) 600 - 645 cal AD (1350 - 1305 cal BP)



Database used

INTCAL13

References

References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337-360.

References to Database INTCAL13

Reimer, et al., 2013, Radiocarbon55(4)