Archaeological Research in Asia xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Archaeological Research in Asia

journal homepage: www.elsevier.com/locate/ara

Glass ornament production and trade polities in the Upper-Thai Peninsula during the Early Iron Age

Laure Dussubieux[a,*], Bérénice Bellina[b]

[a] The Field Museum, 1400 South Lake Shore Drive, Chicago, IL 60605, USA
[b] Centre National de la Recherche Scientifique, Maison Archéologie Ethnologie, UMR 7055 Préhistoire et Technologie, 21 Allée de l'Université, 92023 Nanterre, Cedex, France

ARTICLE INFO

Keywords:
Thailand
Southeast Asia
Glass
Beads
Elemental composition

ABSTRACT

Khao Sek, a coastal settlement located in the Upper-Thai Peninsula and 80 km south of the early urbanized port of Khao Sam Kaeo in the Chumphon province, yielded an impressive quantity of glass waste and ornaments suggesting that glass bracelets and beads were manufactured at the site as early as the 4th c. BCE. This article discusses the glass material found at Khao Sek using typological observation but also elemental analysis with laser ablation – inductively coupled plasma – mass spectrometry. Beyond obvious morphological resemblance, compositional analyses of the glass confirm similarities between the glass industries at Khao Sam Kaeo and Khao Sek and the existence of a fairly standardized glass ornament production at an early period. This article provides new arguments to discuss the fashioning of a regional standardized craft system as early as the mid-first millennium BC and its role in participating in the production of a pan-regional style, the "Late Prehistoric South China Sea style". Finally, this study contributes to define the political developments that took place in the Upper-Thai Peninsula for the period 500 BCE–500 CE, hypothesizing the emergence of a ranked and complementary confederation of ports-of-trade.

1. Introduction

The Thai-Malay peninsula is at the intersection of the Bay of Bengal (Gupta, 2005; Bellina, in press a) and the South China Sea Interaction Spheres (Solheim, 2006; Hung et al., 2013; Blench, in press; Bellina, in press a). This unique geographical position partly accounts for the peculiar hybrid cultural developments that the upper part of the region witnesses as early as the mid-first millennium as reflected in the urban traits and industries of Khao Sam Kaeo (Bellina, in press a, 2017). As in the case of hard stones (Bellina, 2007, 2014) and possibly of copper-based industries (Pryce et al., 2017), the sudden appearance of complex skills necessary for the production of glass ornaments at Khao Sam Kaeo suggests a transfer of artisans, likely from India. Again, as for siliceous stones which were most likely imported from India (Carter and Dussubieux, 2016), raw glass found at Khao Sam Khao was imported from India through the Bay of Bengal Interaction Sphere to be locally transformed into ornaments with a style shared by communities of the South China Sea Interaction Sphere within which they were then "distributed" as far as the Philippines (Dussubieux and Bellina, 2017).

The excavation of the contemporaneous port-settlement of Khao Sek located 80 km south of Khao Sam Kaeo and at the end of a river system which is part of major ancient trans-peninsular route and the technological reconstruction and comparison of both sites' industries unraveled striking similarities between the two sites. Those are interpreted as the result of related, ranked and complementary ports-of-trade forming part of a confederation controlling the transpeninsular routes. Khao Sek may have acted as an outpost controlling the flux of the Langsuan river system to redistribute the goods to Khao Sam Kaeo acting as the international market place where foreign traders and artisans stayed (Bellina, this issue a,b). The settlement shows many similarities with that of Khao Sam Kaeo in terms of topography, modes of construction, internal organization of craft activities. At the same time, Khao Sek appears smaller and lacking monumental works evidenced at Khao Sam Kaeo such as the encircling walls, the monumental terraces, drainage and hydraulic system. Khao Sek does not appear as socially complex as Khao Sam Kaeo: it did not yield evidence for the presence of foreigners established at the site within socio-professional compounds such as at Khao Sam Kaeo. The smaller port did not provide imports such as Han materials or Indian Fine Ware for instance although Indian Fine ware and Dong Son drums are found in several transshipment and collecting sites along the River Langsuan system/transpeninsular route such as at Pangwan, Ban Na Hyan and wat Pathumtaram (see Map 2 in

* Corresponding author.
E-mail address: ldussubieux@fieldmuseum.org (L. Dussubieux).

http://dx.doi.org/10.1016/j.ara.2017.08.001
Received 16 January 2017; Received in revised form 18 July 2017; Accepted 28 August 2017

Bellina, this issue a). Exogenous traits appear in the shape of Indian-influenced ceramics such as kendi that A. Favereau interprets as produces made at Khao Sam Kaeo and exported to Khao Sek (Favereau, this issue). Khao Sek yielded fragments of one Don Son drum which turned up to be an ancient fake (Pryce and Bellina, this issue) as opposed to Khao Sam Kaeo which yielded several drums of various sizes. Finally, Khao Sam Kaeo furnished more than twenty seals (blanks or inscribed with brahmi inscriptions) whilst only two are reported at Khao Sek, and one of which containing a writing mistake showing the lack of expertise of the artisan. Despite these differences, the fact that the populations in both sites are related is shown by the production of the same domestic ceramics (the two technological groups are found and in similar proportions).

These two sites show evidence for hybrid industries producing similar objects of the "Late Prehistoric South China Sea style" that is found in various sites along the coast of the South China Sea (Bellina, in press a, 2017) and their "chaîne opératoire techniques" is the same (see Bellina, this issue a). This is the case for the glass industry too which is the focus of this study. Like Khao Sam Kaeo, Khao Sek yielded an impressive quantity of comparable glass material including glass wastes suggesting the presence of an active glass workshop at this site. The study of this material presented here includes a general description of the type of artifacts and compositional analysis obtained using laser ablation – inductively coupled plasma – mass spectrometry (LA-ICP-MS) and a comparison with that of Khao Sam Kaeo. This study provides data on the elaboration of a regional craft system and how it contributes to what can be labeled a "South China Sea style" (Bellina, in press a) in the context of emergent maritime silk roads trading polities. More broadly, along other analysis of these port-cities industries, this study of the early glass shed light on aspects of the still poorly known emergent maritime polities in Southeast Asia.

2. Site and glass artifacts

2.1. The glass material at Khao Sek

Khao Sek is an industrial port situated at the mouth of the River Langsuan that emerged during the 4th c. BCE (Fig. 1). It was excavated by the Thai-French Mission in 2013 and 2014; however, most of the glass material was found along a small branch of the river, on the western part of the site which was excavated by the land's owner. Consequently very little contextual information is available for most of the artifacts discussed below and it has not been possible to catalogue all the artifacts individually. Despite these caveats, we are able to provide a general description of the glass corpus found at Khao Sek and to place it in a chronological framework thanks to the small quantity of glass beads and bracelets fragments that were found in-situ by the French-Thai mission and the data obtained through compositional analysis. The material is now kept at the National Museum of Chumphon.

Although we were unable to determine precisely the quantity of glass found at Khao Sek, it is safe to say that several thousand glass artifacts were recovered at the site. A large number of unshaped glass fragments were collected; most of them present evidence of knapping. Unshaped glass fragments with evidence of hot working are available too but in much smaller number. Other glass artifact types recovered at the site includes: refuses of bracelet manufacturing, finished bracelets and beads (Fig. 2).

Pieces of unshaped glass or raw glass are turquoise blue, green, black, red and dark blue. There are two shades of turquoise blue, one being of a more intense color than the other one. The turquoise blue glass is translucent, the green and the dark blue glasses are transparent and the red glass is opaque. In a sample of 162 pieces of unshaped glass artifacts, the proportion of the turquoise blue pieces is 47.5%, transparent green, 44% and black 2.4%. Red glass and dark blue glass represent each 1.8% of the total. The color of a few artifacts could not be identified.

Glass beads were manufactured by the drawn, the wound or the lapidary techniques. Drawn beads are mostly opaque red and transparent dark blue. They are by far the most abundant type of beads at the site. No evidence of drawn bead manufacturing is available as no tubular pieces of glass were visible and red and dark blue waste glass fragments were not very abundant. Based on the lack of local manufacturing evidence, drawn beads might have been imported from elsewhere.

A fairly large number of lapidary glass beads, estimated to more than a hundred, were recovered at Khao Sek. They are transparent green, translucent dark blue, colorless or amber and are available in a variety of shapes. Broken or whole specimens are visible. It is impossible to say whether the broken specimens were production wastes or broken after they were manufactured. A local production is possible as testified by the large quantities of knapped wastes that could have been generated by lapidary glass bead manufacturing. Pelegrin (2000), a specialist in stone-knapping technologies was able to identify flake scars on knapped waste from Khao Sam Khaeo characterizing indirect percussion by the counter-blow technique, a traditional Indian technique also called the "Cambay technique", used since the Harappan period. This technique was used within the same workshop to work siliceous stone ornaments (Bellina and Silapanth, 2006; Dussubieux and Bellina, 2017). At Khao Sek, as at Khao Sam Kaeo, the glass production involves similar Indian techniques for siliceous stones.

Wound beads are fairly rare. A few spherical opaque green beads were manufactured using this technique. Other beads were manufactured using technique that could not be identified.

Some beads were certainly imported as in the case of the orange beads with an annular shape that are present by the hundreds and red disc-shaped beads although found in much smaller number. Both types of beads are abundant at South and Southeast Asian sites although the red disc-shaped beads seem more common in South India and Sri Lanka (Dussubieux, 2001, 103) and the orange annular beads in Thailand (e.g. Higham and Kijngam, 2012; White, 1982) and Vietnam (Dussubieux, 2001, 103). The place of production for these beads is still unknown.

At least, one gold-foiled bead was recovered at Khao Sek and possibly a second one. Both specimens are collar beads. One of the beads is tabular and the other one is cylindrical. They can only have two origins: the Mediterranean area or Pakistan where a number of locally-manufactured gold-foiled beads were found (Dussubieux and Gratuze, 2003).

Another type of glass artifacts present at the site is bracelets. They come in a variety of shapes and colors. They are mostly transparent green (~80%), black (~14%) and turquoise blue (~5%). Other colors are orange, opaque green, opaque red and transparent dark blue but they are extremely rare and only a specimen or two is available in each of those colors. A large proportion of the bracelets has a semi-circular section (A or B type as defined at Khao Sam Kaeo, see Fig. 3) and are transparent green. Other sections include triangular, house-shaped, D or C sections. Different artifacts are distorted pieces of bracelets (Fig. 2). They would indicate that glass bracelets were manufactured at Khao Sek.

2.2. Comparison with Khao Sam Kaeo

Khao Sam Kaeo is a unique site in Southeast Asia as it yielded evidence of ornament production dating as early as the 4th c. BCE. This discovery changed the long and well-established view that glass ornaments in Southeast Asia at that time were exclusively imported from South Asia (Dussubieux and Bellina, 2017). The presence of a second glass working site 80 km away from Khao Sam Kaeo raises a range of new questions related to the chronology of the two sites, their roles and relationships.

Both sites have in common the presence of an important quantity of glass wastes and more especially of knapped glass fragments. Transparent green glass objects dominated the Khao Sam Kaeo glass