

EDXRF ANALYSIS ON ANCIENT NUMISMATIC EVIDENCES; A CASE STUDY ON PINLE (MAINGMAW) COINS

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Abstract

There are different methodological approaches on ancient numismatic evidences in Myanmar archaeology literature. All of these research works usually emphasize on symbolic and typological analysis except for a few. Therefore, these studies intend to reveal ancient beliefs and religious customs through conceptual framework. There are, however, some approaches on numismatic evidences in terms of element analysis applications_ such as thermal neutron, lead based chemical analysis and proton- induced X-ray emission (PIXE) method_ to investigate the ancient metallurgy. Coins uncovered from Pinle can be grouped into three. Among them Heterogeneous coins are assumed to be the earliest one. The large variety of coin types in Myanmar suggest that they were produced by a number of different centuries, which had common auspicious symbols, local preferences for certain symbols and symbols combination and sufficient autonomy as well as silver resources to produce their own coins. The finding spots of silver coins indicate the existence of trading centers which may be connected by land and sea routes across the Mainland Southeast Asia or Bay of Bangal or Indian Ocean. Formerly some scholar assumed that Pyu coins were minted as symbol and some were used as ornaments. But as a result of thorough investigation, there is every reason to believe that Pyu coins were used as money for they have various standard weights and sizes. A controversial coin is more likely to be an amulet or insignia than to be used as money or medium of exchange. This paper is an attempt to review on different methodologies and their application. It also presents not only the result of metallurgical analysis from numismatic evidence of Pinle (Maingmaw) but also the evolutionary stages in the development of Pyu coin.

Keyword: *Energy Despersive X-ray Flouriscence, Pinle, Heterogeneous, Common Pyu coins and Controversial Pinle coins*

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Introduction

Pinle (Maingmaw) is located in the Kyaukse plain. This region is endowed with rich soil and watered by perennial rivers and streams. The city is circular in shape and similar to Beikthano and Sri Ksetra. At one and a half miles in diameter, enclosing 548.562 acres, Pinle is one of the largest ancient cities on the entire Kyaukse plains. It has two inner enclosure walls, the outer of which is square while the inner one is circular. The city is bisected by a canal, thought to be contemporary to the city, although no scientific dating has yet confirmed that Pinle has been tentatively dated to the first millennium B.C, based on its Pyu artifacts. It has also yielded distinctive silver coins which are identical to those found at Beikthano and Beinnaka. If the funerary urns at Beikthano represent a Pre-Buddhist period Pinle may have been contemporary with the former. Pinle's favourable geographical condition enabled it to evolve from village to a City State; in a process that commenced around 200 B.C. Silver coins have been found in Pinle. Such coins had wide dispersal and have been found in bulk at Dvaravati, Funan, Bangladesh, Rakhine, the Shan States and today Lower Myanmar. By studying the form and style of symbolic design numismatic evidences from Pinle can be grouped into three as Heterogeneous coins, Common Pyu coins and Controversial coins. Heterogeneous coins are assumed to be the earliest one. Common Pyu coins might have been derived from the so-called Heterogeneous coins of Pinle. And Controversial coins are the latest Pyu coins. The study of Heterogeneous, Common Pyu coins and Controversial Pinle coins reveal their belief, trade, production and utility.

Numismatic Evidences from Pinle (Maingmaw) Ancient City

Pinle (Maingmaw) is located in Myittha Township Kyaukse District. To the North of Pinle is Panlaung river and to the West is Samon river. Maingmaw also had good access to Yunnan in the past. The site is often assigned to the second century A.D. Systematic exploration on Pinle was first carried out by U Aung Myint in 1977. There are altogether 18 sites excavated in Pinle. The explorations and excavations in and around Pinle revealed structural remains, earthen ware, ornamental objects, metal ware and numismatic evidences. Among them numismatic evidences are of great interest.

Materials and Method

There are two kinds of studies for ancient silver coins such as typological analysis of the coins and metallurgical analyses by using Energy Dispersive X-ray Fluorescence (EDXRF). Numismatic evidences collected from Pinle have great archaeological value. Depending on their form and style of symbols and shape, these evidences can be grouped into three,

- Type 1 (a) Heterogeneous with Rising Sun and Srivatsa
 (b) Heterogeneous with Wheel (full sun) and Srivatsa¹
- Type 2 (a) Common Pyu coins with Badhapitha and Srivatsa
 (b) Common Pyu coins with Rising sun and Srivatsa
- Type 3 Controversial coin (Fantasy coin)²

Heterogeneous coins are also known as Pinle coins for most of them are uncovered from Pinle. According to Tampawaddy U Win Maung, many coins of this type were found in Beinnaka (Pyawbwe) and caches of 30 coins were accidentally dug out from Pinya Township.³ This type of coin is said to be found in the surrounding villages of Unepoke, Maingmaw, Taw Twin, Nyaung Pin Tha and Kan Swe near Maingmaw and Pindaya area. General distinctive characteristic feature of heterogeneous coin differs in the shape of srivatsa and fewer in number of minor symbols than common Pyu coin. The shape of srivatsa from heterogeneous coin is slenderer than that of common Pyu coin. In some cases one side of the coins is convex (puffy) while the other side, srivatsa is weakly struck. There are slight differences in their shape of both the rising sun and srivatsa motifs among the Heterogeneous with rising sun and srivatsa. But it can be said that early coins of Pinle are simple and beautiful. Generally at the top of the srivatsa symbol of common Pyu coin,

¹ (a), Dietrich Mahlo, *Early coins from Burma*, Thailand, White Lotus, 2012, Pp.44-45 (Hereafter cited as, Mahlo *Early coins from Burma*)

(b) Bob Hudson, "The origins of Bagan: "Ph.D Thesis, University of Sydney, 2004, Pg-140 (Hereafter cited as, Hudson, "The origins of Bagan")

² Than Tun (Dedaye), *Auspicious Symbols and Ancient coins of Myanmar*, Malaysia, Percetakan Sdn Bhd, 2007, Pg- 115 (Hereafter cited as, Than Tun (Dedaye), *Coins of Myanmar*)

³ Than Tun, (Dedaye), *Coins of Myanmar*, Pg - 115

there are symbol of sun and moon and is enclosed by swastika and Badhapitha. Unlike common Pyu Coin sun and moon symbols are not traceable on the obverse of Pinle Coin (Heterogeneous-coin). Within the srivatsa of heterogeneous coin there are one crescent like curved line on the top, two elongated dots and one bulb like symbol at the bottom. These symbols are probable to be the representation of Goddess of Sri and assumed to be the earliest and basic form in the evolutionary stages of the figure of Sri.⁴ Outside the bottom of srivatsa there are two dots in heterogeneous Pinle coins.⁵ For these reasons heterogeneous Pinle coins are assumed to be the earliest Pyu Coins. That means the common Pyu Coin might have been derived from the so-called heterogeneous coin of Pinle. Another significant coin also available at Pinle is Heterogeneous coin with wheel/srivatsa. Srivatsa and associated symbols of wheel/srivatsa Pinle coin are exactly similar to those of heterogeneous Pinle coins of rising sun/srivatsa. And on the obverse is a wheel or full sun with 16 rays or spokes. Rays or spokes are encircled by embossed line. Within the embossed lines are beads. Outside the beaded border there are parasols like symbol.⁶ In some cases, one side of the coin bearing the wheel is like that of Heterogeneous rising sun/srivatsa coin convex. Scientific study reveal that Heterogeneous Pinle coin of rising sun/srivatsa and that of wheel/srivatsa are almost identical to one another in their weight and sizes having 8.83 gm to 9.95 gm in weight and 29 to 32 mm in sizes. It is therefore obvious that the producers have intended and attempted to produce standardized money or coin with specific weight and sizes. But slight variation in their weight and sizes clearly indicate their technological defect. Thus no two heterogeneous Pinle coin are identical. Since rising sun/srivatsa and wheel/srivatsa of convex shape coins have been uncovered mostly from Pinle they are named by the collectors as Pinle coins⁷. Unlike other common Pyu coins, there were no smaller denominations of heterogeneous Pinle coin. There may be some reasons for the absence of smaller denomination among the so called heterogeneous coin from Pinle.

⁴ (a) Fig - 4

(b) Interview with U Win Maung (Tampawaddy) on (5-8- 2013), The Coins of Pinle Old City.

⁵ Fig- 1 (a)

⁶ Fig- 1 (b)

⁷ Interview with Than Tun (Dedaye) on (2 - 10 - 2009), The Coins of Pinle Old City.

Since, these types of coins are considered to be the earliest one; they might not have been used as money. But on the other hand there was no trace of string holes to be used as amulet or insignia or charm. But because of the presence of auspicious symbols on the surface of heterogeneous coins it is thought to be used as ceremonial object. Type 2 (a) has the symbol of conch in srivatsa on the obverse and baddhapitha on the reverse. Apart from Pinle (Maingmaw) this type of coins have been reported from Hmawza (Old Prome), Halin and Saigon (Ho Chi Min City). These coins occur in $\frac{1}{4}$ unit (17-18 mm, 1.9-2.1 gm), $\frac{1}{2}$ unit (23-24 mm, 4.7-5.5 gm) and full unit (26-27 mm, 10.1-11.3 gm) denominations.⁸

Common Pyu Coins with rising sun/srivatsa coins are also discovered from Pinle. They are almost similar in their weight having 9 gm to 7.4 gm and 9.7 gm to 10 gm respectively. But unfortunately there were no small rising sun coins reported from Pinle. Since most of the flat shaped rising sun/srivatsa coins were unearthed or discovered from Halin, they are named as Halin coins by the scholars.⁹

Rising sun/srivatsa coins were unearthed from the excavation at MM-17 by U Myo Nyunt of Archaeology Department in December 2009¹⁰. The excavation at MM-17 uncovered square on brick structure together with burial urns. Burial structure and urns as well as rising sun/srivatsa coins are exactly similar to those found at Halin¹¹. Brick sizes and finger marks are also identical in both sides. Therefore it is possible that Pinle and Halin were to some extent contemporary. This type bears srivatsa flanked by swastika and baddhapitha symbol on the obverse and the symbol of rising sun on the reverse. Coins are typically struck to a weight of approximately 9.2 - 9.4 gm on a flat 30-33 mm flan. A number of small rising sun weighing between 2.2 - 2.3 gm are known and probably represent the one quarter unit companion to the larger class coins. Even smaller specimen, perhaps a fractional one-eight unit have also been reported. Another class of rising sun/srivatsa weighing

⁸ Fig- 2 (a)

⁹ Tha Tun Maung, *Material Culture of Halin*, Ph.D (Dissertation), Department of Archaeology, Yangon University, Pg-75(Hereafter cited as Tha Tun Maung, *Halin*)

¹⁰ Fig- 5

¹¹ Fig - 2 (b)

between 5.4 and 8.9 gm are concentrated in central Thailand and Cambodia, offering a possible geographical division of Rising sun coins. Rising sun symbol, the most Common Pyu coin found ranging from Shwebo in the north to Minbu and Taungdwingyi in the south, often called the Halin coin, were probably minted from silver from the Shan Hills¹². Coins with a rising sun symbol are also found at Sriksetra, Wadi, Beikthano and Halin. These coins were also reported almost a century ago at the east of Pyawbwe.¹³ Mahlo does not consider that this coin to be common at Sriksetra, although it is represented with one excavated specimen. They have been found on the Malay peninsular,¹⁴ across the Dvarawati sites such as U Hton and a deposit of several hundred formed at Nakon Si Thammart, 420 km South of Tanathayi. This coin is seen in Vietnam and was copied by local in the Dvarawati centers of Thailand. It has been described as the most widespread of all ancient coinage from Southeast Asia, but with an origin in Upper Myanmar¹⁵. The range of their coin type might suggest a stable long-term relationship between Beikthano, Pinle and Halin, over a timescale that also allowed the coin to spread to Thai sites and to pre 6th century A.D Oc-Eo¹⁶. A number of ancient coins including rising sun coins were collected from Bangladesh. Considering all the different sources from the past and present, we can confidently say that thousands of rising sun coins had been found from Halin and its environs and find spots were quite widespread stretching up to Oc-Eo of South Vietnam to the east and Camilla district (Jeff-Col) of present day Bangladesh to the west. But surprisingly there is no rising sun coin uncovered from Rakhine State except srivatsa/ baddhapitha. It is therefore believed that thorough investigation may reveal rising sun coin from Rakhine State. The find spots of rising sun/srivatsa coins were quite widespread

¹² (a) Mahlo, *Early Coins from Burma*, Pp.40-44

(b) Tha Tun Maung, *Halin*, Pg- 76

¹³ Tha Tun Maung, *Halin*, Pp. 76-77

¹⁴ (a) Win Maung (Tampawady), *Some Symbolical Designs on Early Silver Coins*, 2002 Unpublished. (Hereafter cited as, Wing Maung (Tampawady), *Early Silver Coins*)

(b) Tha Tun Maung, *Halin*, Pg. 75

¹⁵ (a), Robert S Wick, *Money Market and Trade in Early Southeast Asia*, , New York, Cornell University, 1992 Pp. 116-119, 159-162 (Hereafter cited as, Wick, *Trade in Early Southeast Asia*)

(b) Tha Tun Maung, *Halin*, Pg. 75

¹⁶ Oc-Eo = Sea port of Funan

stretching from Myitkyina to the north and Nakhon Si Thammarat to the south at Malay Peninsula and from Camilla district of present day Bangladesh to Oc-Eo of South Vietnam to the east. The recovery of a large quantity of rising sun coins from such a wide-ranging area would point to the existence of a trading centre which may be connected by sea route or land route.¹⁷

Controversial Coins uncovered from Pinle area have rather complex auspicious symbols but basic forms are similar to other Pyu coins. Controversial coins are made of both silver and gold as well as some kind of alloy, they don't have standard weight and sizes, the smallest one having 22 mm in sizes and 1.88 gm in weight. And the largest coins have 45 mm in sizes and 13.8 gm in weight. They are hardly identical in their weight and sizes to be used as money or medium of exchange. Similarly the symbols represented by each coin is also different from one to another except specimen one F and 7 F of Soe Moe Naing¹⁸. According to the result of statistic analysis it is found that only 2% of so called controversial coins are exactly similar in their symbolical style. Generally, this type of coins can be grouped into three classes depending on their sizes, the smallest denomination are ranging from 22 mm to 27 mm the medium denomination are from 31 mm to 33 mm and the largest one are 39 mm to 45 mm in their diameter. Therefore, this type of controversial coins uncovered from Pinle have different weight and sizes. That means they don't have standardization of weight, sizes and symbol as well to be used as money.

On the other hand, almost all the so called controversial (Pinle coin) has two string holes at the top of the symbol of baddhapitha, therefore, it is possible that the user of this coin might have considered or believed baddhapitha as auspicious symbol. On the other word, baddhapitha is clear to be one of the most influential symbols among the user. By finding two holes at the edges of almost all the coins of this type, it is also considered to be used as amulet or insignia or charm.

The auspicious symbols depicted on this type of coin are rather complex but basic form are similar to other Pyu coins. The baddhapitha (harmony) and srivatsa symbols are adorned with wave-like lines, circles and

¹⁷ Tha Tun Maung, *Halin*, Pg.75

¹⁸ Fig - 3 (a), (b)

semi-circles as well as dots. Therefore they look more beautiful than the rest of Pyu coins. In some cases symbolical design bore on the auspicious symbols are likely to be a scroll-work with floral motif. According to the indigenous people, Pinle was once ruled by Shan princes. And beautifully arranged auspicious symbolical coins are also assumed to be used as amulet or charm by the indigenous Shan. Some coins were obtained from Pinle, some from Pindaya, Yaksauk, Inlay and Loikaw areas¹⁹. It is also learnt that exact location of the source of this type of coin is difficult to pinpoint. Some collectors assumed that these coins were brought to different part of Shan State from its original mint, Pinle²⁰. Unfortunately, no evidences for the production of coin have not been recovered so far to be assumed Pinle was once a production site of coin.

Excavations and Explorations conducted in and around Pinle revealed variety of archaeological evidences, structural remains, earthen ware, ornamental objects, metal tools and weapons, numismatic evidences and etc. Among them numismatic evidences are of great interest and valuable. By the study of numismatic evidences it is learnt that there were variety of Beikthano, Sriksetra and Halin. Type 2 might be a contemporary Pyu coin and the last one might have been later than Pyu period. Their symbols are rather controversial to be termed. But it is clear that one side of that Controversial coin represent the symbol of harmony and symbol on another side is supposed to be sriavatsa. Both Badhapitha and sriavatsa symbols depicted on the so called Controversial coin. Pinle coins are varying in their form from those of Common Pyu coins. And minor symbols like sun, moon, thunderbolt, moving sun (swastika), and conch, Badhapitha are not traceable on controversial Pinle coins. Instead some floral like design and lines of wavy zigzag and dots are adorned with thinner line. Thus style of the design represented by controversial Pinle coins looks more beautiful and fantastic than those of Heterogeneous and Common Pyu Coins. These controversial coins are adorned with dots, curved lines, circles and semicircle. Thus, the representation depicted looks more beautiful and artistic than the former ones.

¹⁹ Than Tun (Dedaye), *Coins of Myanmar*, P - 116

²⁰ Ibid, P - 117

But since they don't have specific weight and sizes they are more likely to be used as amulet, insignia or charm than money or medium of exchange.

Result and Conclusion

According to this EDXRF results, following major content rate of metals are found in an Pinle (Maingmaw) silver coin; silver (Ag), iron (Fe), copper (Cu), and lead (Pb). Furthermore, other minor cases of metals are silicon (Si), iridium. Pinle (Maingmaw) contains high amount of silver percentage (98.12%). Depending on their form and style of symbols. Type-I (a) Heterogeneous with Rising sun and srivatsa (b) Heterogeneous with Wheel (full sun) and srivatsa. Type II (a) Common Pyu coin with Badhapitha and srivatsa (b) Common Pyu coin with Rising sun and srivatsa. Type III Controversial Coin. The shape of srivatsa from Heterogeneous coin is slenderer than that of common Pyu coin. One side of this coin is convex (puffy) while the other side, srivatsa is weakly struck. Some scholars assumed that Heterogeneous Pinle coins are earlier than those of common Pyu coins. The common Pyu coin might have been derived from the so-called Heterogeneous coin of Pinle. Pinle (Maingmaw) is likely to be earlier than the rest of Pyu city states. Pinle coins are varying in their form from those of common Pyu coins. And minor symbols like sun, moon, thunderbolt, moving sun (swastika) and conch, Badhapitha are not traceable on controversial Pinle coins. Instead some floral like design and lines of wavy zigzag and dots one adorned with thinner 42 lines. Thus style of the design represented by controversial Pinle coins looks more beautiful and fantastic than those of Heterogeneous and common Pyu coins. Among the silver sources available in Myanmar Pindaya, Bawsaing and Yomethin are very close to Pinle, therefore these three areas might have been used for providing raw material in the production of Heterogeneous (Pinle), Common Pyu coins and controversial coins by the Pyu from Pinle (Maingmaw). But thorough investigation is needed. Different scholar has different interpretation on the symbol or coins. In general these symbols represent the concept of both Buddhism and Brahmanism, which many have been flourished in Pinle and other Pyu sites. On the other word these symbols show the influence of Indian culture. Although the symbols one ideologically influenced by the Indian,

these styles of the symbols depicted on the coins are arranged in typical manner of Pyu.

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Type 1



Figure 1 (a) Heterogeneous Coins

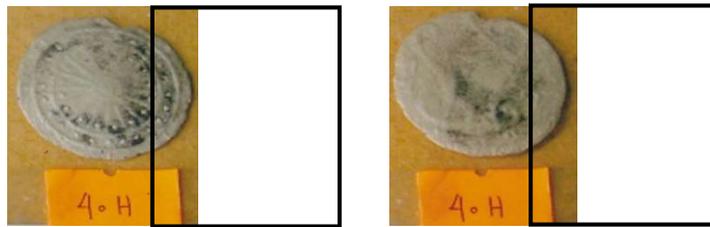


Figure 1 (b) Heterogeneous Coins

Type 2



Figure 2 (a) Common Pyu Coins

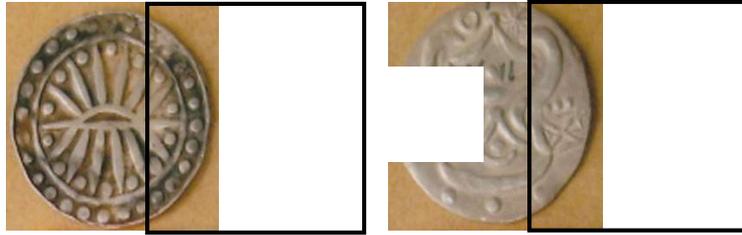


Figure 2 (b) Common Pyu Coins

Type 3



Figure 3 (a) Controversial Pinle Coins



Figure 3 (b) Controversial Pinle Coins

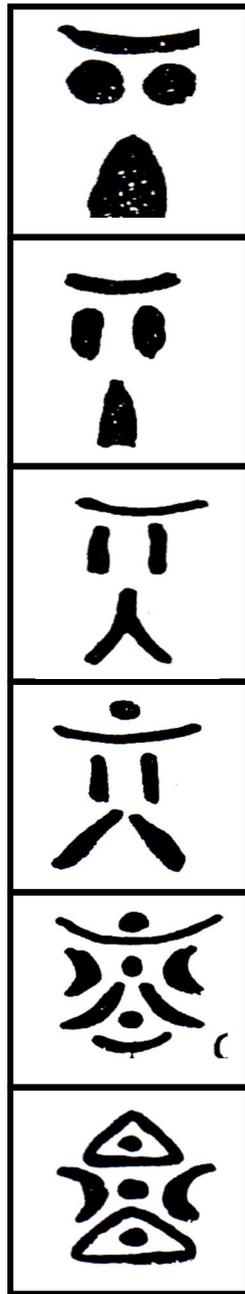


Figure 4: A probable evolutionary pattern of the figure of Goddess Sri
(Adapted from Win Maung (Tampawady))



Figure 5: MM - 17

EDXRF Result of Pinle (Maingmaw) Coins

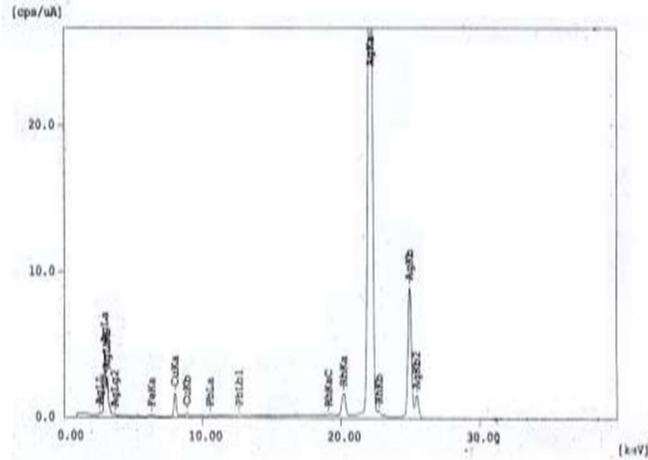
Sample : MM 1
 Operator : CW+OMO
 Comment : Coin
 Group : Solid Air
 Date : 2014-09-23 12:37:02



Measurement Condition

Instrument: EDX-720 Atmosphere: Air Collimator: 10(mm) Sample: Solid Air

Analyte	TG	kV	uA	FI	Acq. (keV)	Anal. (keV)	Time (sec)	DT (%)
Si-U	Rh	50	15-Auto	----	0 - 40	0.02-39.98	Live- 100	39



Quantitative Result

Analyte	Result	(3-sigma)	Proc.-Calc.	Line	Int. (cps/uA)
Ag	98.127 %	(0.280)	Quan-PP	AgKa	693.7350
Cu	1.420 %	(0.028)	Quan-PP	CuKa	14.8716
Fe	0.292 %	(0.014)	Quan-PP	FeKa	1.6206
Pb	0.161 %	(0.014)	Quan-PP	PbLb1	1.8282