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The Introduction to the Bronze Study of Cambodia

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Prohlašuji, že jsem diplomovou práci vypracoval samostatně, že jsem řádně citoval všechny použité prameny a literaturu, a že práce nebyla využita v rámci jiného vysokoškolského studia či k získání jiného nebo stejného titulu.

I declare that this thesis developed independently, that I have properly cited all the sources and literature, and that work was not used in other higher education or to obtain a different or the same title

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Anotace

Práce je věnována problematice studia doby bronzové na území Kambodže. Toto období je zde datováno od roku 4000. Studium doby bronzové v Kambodži, ležící v nížině v jihovýchodní Asii, bylo dlouho ovlivněno faktem, že země byla v letech 1865 – 1953 francouzskou kolonií. I přesto ale byly první archeologické výzkumy pravěkých lokalit provedeny v Kambodži dříve než v ostatních zemích východní a jihovýchodní Asie. Představitel francouzského protektorátu v Kambodži poručík Jean Moura, vedený zájmem o památky pravěku, získal výzkumem v roce 1864 kamenné nástroje na lokalitě Samrong Sen poblíž řeky Chinit. Nálezy byly později převezeny ke studiu do Francie a lokalita Samrong Sen byla opět zkoumána v letech 1878-1879. Tím bylo prakticky zahájeno studium doby bronzové v Kambodži. Předložená práce se zabývá také podrobnějším popisem geografických podmínek Kambodži, složením obyvatelstva, společností, jazykovými zvláštnostmi a náboženstvím. Základem práce je charakteristika hlavních archeologických lokalit doby bronzové, klasifikací a technickým rozbořem nálezů bronzových předmětů. Práci je možno považovat za první přehledovou studii o době bronzové na území Kambodže.

Klíčová slova: doba bronzová – jihovýchodní Asie – Kambodža – bronzová industrie

Annotation

The work is paid to the study of the Bronze Age in the territory of Cambodia. This period is dated from the year 4000. Study of the Bronze Age in Cambodia, located in the lowlands in Southeast Asia, has long been influenced by the fact that the country was in the years 1865 - 1953 French colony. And yet they were the first archaeological excavations of prehistoric lokalit made in Cambodia earlier than in other countries in East and Southeast Asia. Representative of the French protectorate in Cambodia Lieutenant Jean Moura, led by a focus on prehistoric monuments, won the research in 1864, stone tools at the site near the river Samrong Sen Chinita. The findings were later moved to study in France. Samrong Sen and the location was again examined in the years 1878-1879. This was practically initiated the study of the Bronze Age in Cambodia. The present study deals with a detailed description of the geography of Cambodia, the composition of the population, society, religion and language peculiarities. The basis of the work is characteristic of the major archaeological sites of the Bronze Age, classifications and technical analysis finds of bronze objects. The work can be seen as a first overview study of the Bronze Age in the territory of Cambodia.

Key words: Bronze Age – southeastern Asia – Cambodia – bronze industry

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Introduction

The Bronze Age refers to a periodical history that people had prosperity in managing of the society and understanding of doing metallurgy to get the metal, noted as an era when copper and bronze, which is an alloy derived from copper and tin. by the way bronze age in Asia was determined by approximately between 4000 BC continued to the Xia dynasty 2000 BC (Kimsreng.2009: 11), because of cultural artifact properties occurred. It was used extensively to make tools, weapons, and other decorative items of the furniture, jewelry, artifact tool, sculpture as well as valuable things in the architecture etc. Additionally, because of the rapid use of the tools made during this time period, commerce and trade grew tremendously.

In regard to the actual term, "Bronze Age in Asia ", it was also connected Bronze Age study of Cambodia which is in the small lowland of southeast Asia that were still limited in doing research of bronze study within the time of Cambodia had been under the French colonial during the 1865-1953 since the archeological site were found by them. The actually, to the first prehistoric archaeological research in Cambodia appeared even earlier, then in other countries of Eastern Asia and South-East Asia. Since Lieutenant Jean Moura was the Representative of French Protectorate to the Royal Court of Cambodia in 1864, he interested towards the find of the stone tools in Samrong Sen site, located (Chinit river). These finds he brought to France, where they were researched by J. B. Noulet, director of the Museum of Natural History of Toulouse. Samrong Sen site started in 1878-1879. So it was the first investigations and it might be the stage to the Bronze Age study of Cambodia. Though lately, the main attention of French scholars was researched to Angkor and extended mainly to conduct some prehistoric excavation sites in Cambodia, and also in Vietnam. Henri Mansuy excavated Samrong Sen and then Paul Levy excavated Mlu Prei sites, in the northern part of Cambodia (Prey Veng province). In 1968-1969 Roland and Cecile Mourer excavated Neolithic site in Laang Spean, they are most famous of them are early bronzes age with the comparison some artifact tools, like bronze axes in Non Nok Tha (western piedmont margin of the Khorate plateau), and Ban Chiang, found seals, glass beads, high tin bronze jewelry. Unfortunately the research field of archeology had stopped for a while because of the civil war reason, and financial budget and both of national and international experts. And at the beginning of 2006 the researched several Bronze-Early Iron Age sites was produced in Banteay

Meanchey, Oddar Meanchey Provinces (northwest of Cambodia), an enormous quantity of bronze, pottery, glass, gold, and carnelian beads etc. showed that Phum Snay was a large and rich cemetery near a settlement of Bronze-Early Iron Age period. And all the data of reasearching has been also doing yet in Siem Reap (Angkor) region and it is also planned together with APSARA Authority.

Despite of these Cambodian archaeological sites had previously worked in Cambodia since that time, and also think this territory that was occupied passed by the Neolithic of bronze stage which could be in Bronze Age or Early Iron Age, but all this data was still limited, the acknowledgement study of the bronze is still poor, but it also could be the additional sources to the introduction of bronze study research within other newly finds of bronze material in some prehistoric sites of Cambodia.

Within the study of prehistory of Cambodia in most of the extensive area has been recently developed in term of finding some material objects, or artifact tools, and the especially of bronze material such as the bronze earrings, bracelets, or bronze tools etc.

Thus these discoveries within these bronze artifact, it's a interring major and it can be more and more attractive objects for my first study to be introduced of the bronze study. because the throughout the bronze objects which were found since the stage of Bronze Age-Early Iron Age and bronze artifacts till the end of Angkor period (15th century), it was also considered the Khmer cultural greatness for the Khmer sculpture and architecture. The use of these bronze objects give use an important inside in to a wide range of activities, including the history, religions, economy, ornamentation, trade, metallurgical technology beside the providing evidence from the excavation site. This study explores the focus on placing the selected artifacts in a comparing them with other artifacts, and specific a role of bronze culture is well documented by inscriptions that list a bronze images or jewelries.

1.The General Geography of Cambodia

1.1 Location

Cambodia is a country located in southeastern Asia, called “Asian Countries” among 12 countries including East-Timor (new). It’s approximate geographical coordinates are 13°N 105°E 13°N 105°E 13 105 and there are 803 kilometers between natural border with Thailand on north and west, 541 kilometers border with Laos on north-eastern part, 1,228 kilometers border with Vietnam on eastern and southeastern part and the totally is around 181,035 square kilometers including the land (176,520 square kilometers) and water (4,520 square kilometers); (Map. 1).If we talked about the geographic line, there’re two different parts, one part is higherland area lies from the north-eastern toward north-western, and other one is the mainland area in a large basin like Tonle Sap, Tonle Mekong river and the coastal area. There are lot of forestry in higherland area surrounding the mainland. Kravanh mountain is called „Chour Phom Kravanh“, it is located in South-Western with an elevation of 1,772 meter (5,814 feet) it is called “Cardamoon Mountain“ are the longest in Cambodia. And the lowest rank Dang Rek “Chour Phnom Dang Rek“ which across to the north of country and it has an elevation of 488 meters (1,601 feet); (Dawn. 2002: 18) Kravanh mountain is along to the gulf coast, the maximum is around 1000 meter higher.

Between natural border Khmer-Thailand, in southern part of this area, there are Phoo-dek and also has Kulen mountain in some parts of higherland. and the middle part of this county, there is also Seal mountain, which is the location of people living for agricultural growing for their daily life because of good soil and larger area in Indo-china (Ghea. 1973: 2).

Mekong river is the big one feature of water way of Cambodia which flow passing from the northern part to the southern part, with a length of 5000 kilometers, from its northern source in Himalaya and flow southwards passing through China, Laos, Vietnam and in southeastern direction across Cambodia. From Kratie province lies to China sea. This river is shared into four rivers at Phnom Penh City in Tonle Bourn Mok (four river face) such as Tonle Toch, Tonle Sap, Tonle Basak and Tonle Krom. There’re 600 kilometers size and 2 kilometers river bank.

Tonle Sap (Great lake) is the most feature of Natural heritage in Asian country, it is located in the south Kulen hills. This plateau is drained by tributaries of Siem Reap river and intercepted by the hill of Phnom Bok, Phon Bakeng and Phnom Krom (Cultural heritage area of Angkor civilization); (Dawn. 2002: 17).

1.2 Populations and Societies

Cambodian society may be viewed as constituting a spectrum, with an elite group or upper class who worked for in the rank of high official government or other person whose are relatives in the royal families and other lower people. In this society, we called Khmer society that used to be strong country as a empire in South-Asia as well-known in history during Angkor period or before since Funan (Mountain empire), Chena empire and then its prosperities continued to Angkor period 9th-15th century),but after Angkor period, from 15th century, the power was fall down and social mobility was changed lots of stage. During the year of 1863-1953, Cambodia was put under the French colonial rule for 90 years and especially just at least 50 years from 1960-nowaday, this society has been changing for 5 regimes. In 1953-1970, Khmer was put under the power of Shihanouk, so it was called Kingdom of Cambodia regime, and then had one evolutionary society, so the social was changed to Khmer Republic, during 1970-1975. After that time was changed in the year of 1975-1979, Cambodia Democratic Society, “The Pol Pot regime”. In 1979 Cambodia started being a new evolution during the 1979-1993,” The People’s republic of Cambodia” and from 1993, the election form was made by UNTAC lead, and the social changed to the Kingdom of Cambodia has been establishing until now.

According now to the statistic had done in January 2010 (Khmer statistic.2010), the population of Cambodia, there is approximately 13,333,916 inhabitants a whole of country, and there are around two million inhabitants who live in the capital city of Phnom Penh, that 85 percent of Khmer, and out of these ,they are mostly Vietnamese, and also small numbers of Moslem ,Chinese, and other minorities who have been living on the highland tribal groups, most with their own local religious systems, probably number fewer than 100,000 persons, like Khmer Loeu (Upland Khmer), they’re Khmer people just living in highland or in neighboring country, and there are Jarai, Steang, Kreoung, Kouy minority etc., who are the minority communities group have also developed hierarchy of spirits with a supreme ruler in their societies.

1.3. Language and religious belief

The official Cambodian language is Khmer, it is one part of the Mon-Khmer family, enriched by the Indian Pali and Sanskrit languages (Gheza.1973:27). Khmer is related to the languages spoken by hill tribe people of Laos, Thai and even Malaysia. In making of Khmer words, like prefixes, infixes, and suffixes were also used in grammar. Out of this mother tongue there are now other languages such as English, French are also using at school program for Khmer children.

Today, almost 90 percent of the Khmer population, are Theravada-Buddhists. This Theravada Buddhism was introduced into Cambodia in the Angkor time during the 13th century by the King Jayavarman VII - in the whole country, it became state religion in the 15th century, and other 5 percent are Muslim (Cham), Christian, Taoist or Confucianism are practicing by Chinese group, and still there are animism (see photo), like Neak Ta (local spirits, there are variety spirits such as fire, rice, tree, water). These beliefs also have in a small social minorities group, like Jarai, Kouy, Kreung ..etc. living in northeast in country.

2. A brief of Cambodian archeological research

Before taking a part of Cambodian Bronze Age come to study, I would like to describe a brief prehistoric sites of researched work as below

In 1877 Mr J. Moura started collecting the Somrong Sen sites' artefacts and sent to the chief of Toulouse museum in France and he published one article about the Neolithic in Cambodia, two years later in 1879 Mr Cartailhac firstly interpreted the general site landscape to the researcher in Southeast-Asia. and in the year of 1881 Mr August Pavie found Kbal Romeas rock shelter site in Kom Pot Province (southern part of the country). In 1902-1923 Mr Henry Mansuy excavated in Anlong Pdv nearby Somrong Sen site. He found the artefacts and also did inventory. in 1932. Mr Paul Levy excavated in Mlu Prei archeological site and he found lots of artefacts, especially the bronze jewellery. In 1959 Mr Louis Malleret found two other sites, one is Phum Lvea (Lvea village) in Angkor area and other one in the red soil in Memot district, Kompong Cham province. Then Mr B. P Groslier also shown one prehistoric site of Iron Age in northern part of Bakeng Temple, Siem Reap province, which lies until the Bak sei Cham Krom foundation in the year of 1960. In 1963 Mr E. Saurin started researching of a pebble

culture in Sre Sbov village between Steung Treang and Snoul Kratie in eastern part of Mekong river. Mrs Mariam Stark started being study on the soil layer of prehistoric which under the Angkor borei historic site in Takeo, and he was also worked with Mrs Mourer in 1965. They excavated one archeological site in Treng area, southern Part of Battam Bang Province , Lea-ag Spean, it was the first in showing of Hoabinnien culture in Cambodia and also participeted with Cambodian archeology students. During the year of 1960-1970 Mr B.P Groslier and Mr Saurin found a big site in the red soil of Kompong province,they published a repport on the data of this site by given named Memotien “Memot civilize“ to notify the neolithic culture in 1966. And also during that time Mrs Mourer and including archeological students of the Royal university of fine arts in Phnom Penh started doing excavation at Lea-ang Spean site, is the rock sheltor, they fund aproximatelly 2000 artefacts, like stone tool, kitchen remains, animal bones ,human bones...etc.,and it was the fisrt time for Cambodia fund the rock sheltor site.out of this they also fund other sites such as, La-ang mountain and Kbal Romeas Site.In 1967 there were researcher, Mr J. P Carbonel and G. Delibrias (1968), they excavated one site in southern part of country, La-ang Phnom (La-ang spean) in Kompot province and did radiocarbone dating of charchaol pieces.

From the year of 1970, the archeological research was stopped, because of the war and until the decate of 90th, the filed of research is being started it again, and there were cooperations between other foreign organisations like American, Japanes, French etc.

3. The new finding of archeological sites

During the research studies in a field of Cambodia archeological prosperities, from the year of 2000, there have been discovered the sites in many parts of the country such as central part, north western part and, especially in the southeastern part in the red soil of country (Fig. 2).

- Phum Snay site

At the first the research studies of Cambodia archeological prosperities but it was stalled, due to the collapsed in Khmer society since the decade of the seventeenth until the twenty first century by Khmer rouge and also because of the fall down of human relationship between the national researcher and international researcher institutions in

country. But now according to the new group of much social stabilities, the research of this fields has been doing better again because of international senior participation. So many archeological works has been discovered and start working. By the way, since the year of 2000, they fund many cultural properties containing the tangible and also intangibles, such as the archeological site in Pun Snay.

This sites was discovered by the one organization in Cambodia called World Food Program (WFP). This finding is by the road construction which started from the road Nr. 6 to Phum Po Pel (Po Pel village) with the length of about 3700 meters. Phum Snay is located in Ro Hal commune, Preah Neth Preah district, Banteay Mean Chey Province (north western of country). It is the most important for the archeological observation of Cambodia, during the construction they found so many antique objects, such as the potteries, whispers, jars, dish, and also the golden jewelries, silvers, irons, beads, human bones and animals, bronzes, and some kind of tool, etc.

Based on the material remain of artifacts which they found in this sites included the senior of the archeological researcher have been done, they concluded that this sites is a big field for the corpse holes and were presented in the latest iron age is about 300 BC until 500 AD because some kind of the artifacts were also fund and looked very similar to the sites of iron age in Noen Uloke and Muang Kao in Thailand (Somnang: 2003: 4). Out of this site, there are many sites has been finding by which is located in Svay Chek , Preah Neth Preah district and other districts also in Banteay Mean Chey Province, such as some sites as below:

- The Kiln site in Seam Village:

Last year, researchers of ancient site in Angkor area found 5 sites of ancient kilns which produced the pottery of green clay type and unglazed types, like the Anglong Tom kiln, Sor Sei, Ta Ny, Ba Kong and the last one is Khnar Po kiln. There were a lot of pottery fragments of the glazed on the site surfaces out of Angkor area, such as at the sites of Phum Snay (the north-western country) which they brought from the Angkor or city. They think like this because of there are still findings in the area.

By the way, according to the field of archeological research they also found the ancient kiln sites which produced the glazed potteries, and which located in Phum Top Seam (Siem military village) of Svay Chek district which far from the Banteay Mean Chey town(western country part) around 15 kilometers.

The northeastern part of this village, there is one basin, it has 1000 square meters sizes, it is one important water source for using of villager. The villagers said it has since the long time, and the western part of this water source, we found a lot of ancient, which found some fragments of glazed potteries including the red glaze burned. They think that this is an ancient kiln broken and still has only the foundation remaining included the fragments of potteries, and otherwise, in the eastern part of the residence village, there are some part of ancient kiln that we can see the form exactly, and other part it was broken by the farmer that they tried to deforest for land use. And far from this west site around 30 meter, we found the ruin of foundation site and still has a lot of glazed and also the ceramics.

All the pottery data acquisition that they collected from the sites are green colors of glazed and brown and yellow and dark is the unglazed pottery. These kiln sites are very important to understand of Khmer ceramic properties of Cambodia, but we are very sorry for this research stages because they're almost broken.

- Daun Noy Village:

In the same year of the research field, they are now have been interesting of Daun Noy village, because of finding and destroying by peoples who want to get the valuable things to sell on market place, and there are so many ancient sites has been destroyed by people in this Village,

Daun Noy village is also located in Svay Chek district, its far from Banteay Meanchey around 25 kilometers. It covers around 1200 meters from north to east of length and west to the east of around 1000 meter and there're so many ancient mound, such as ,Toul kok Samrong (Cheng kok temple), Kok srok (Kab Chol Templ), Sva kon (Preah But temple or Buddha temple), Snam Som (Long temple), Rong Kanh Chas (Kok Vihar) etc. (Ratha. 2003: 14).

All the mound has the temples, and they also found a lot of things, like the artifacts, bangle, bronze, gold etc in a tomb (see the 42nd page) almost these sites were broken by natural and peoples.

- **Bantort Boh village and Its surrounding.**

This is a new archeological finding. We were flinging by the road constructions and digging of the villager who wants to get some kinds of valuable things. This village is located in Ta Pho Commune, Svay Chek district, Banteay Mean Chey province (north western of country) on the road Nr. 69 around 20 kilometers and go then continuing by the red pebble road from Svay Chek village to Ta pho around 10 kilometers and after that we travel on the road in the village around 3 more kilometers, were we get to Ban Tot Boh village.

This village is on the circular location form in length of 500 meters and it surrounding the fields. There is approximately 1016 people living in this village, and they're all farmers and they have enough water sources to support their farm produce.

Research found this site in 2000, during the way were constructing they fund many tomb including some artifacts, potsherds, jewelry and some kind of tools which were made by iron, bronze and the gold. Out of this village, there are so many other ancient sites, such as the corpse hole contained with the material artifacts, and near the village around the 3 kilometers from the sites we saw the ancient mounds, temple mounds, ancient roads as well as the archeological material evidences that we have been now doing inventory for the cultural properties.

- **Ta Dong village,**

This site was discovered during the road construction, they found this sites in the year of 2000 and they found corpse holes and also the ancient artifacts only near the southern part and eastern part of mountain. And about the artifact ruins which they found, like the rosaries, some ceramics, iron tools and as well as the bronzes material product (see the pages). And they found also the stone tools around this village and on the other ancient mound. Through this discovery site, they also published one report on the researched result written by Mr. C. Pottier in the year of 2003. In the meaning of this article, he

supposed that the hole of corpses might be in as old as early AD similar to the age of Phum Snay (Ratha. 2003: 26); (see the 40th page)

And other one sites, by according to the reports of Khmer culture group of APSARA authority in August, 2001, they were interested of Tean Kam Village, which is located far from the north of Preah Neth Preah village around 10 kilometers that look at the same Phum Lea Vea village in Angkor area which supposed in the stage of prehistory site, and not occupied until now. There are three parts of Tean Kam village, the northern Taen Kam, southern Tean Kam and the western Tean Kam. The special thing of this village is its circular form and it has the special thing in the middle of village, Preah Phum, the villager called, it mean the god of village, they have just built a small wooden places for shrine of all the village to mark the ceremonies every year, ask for the rains.

There're approximately 180 residences in the village, almost all are farmers and fishers for their daily life. There are two ponds in the east and west which flows from Preah Neth Preah source. They always find the stone tools near their houses and they were also having the rice fields.

And about the eastern part of Cambodia which is located next to the border between Cambodia and Vietnam that used to be registered ready in the inventory by Mr. L. Malleret since the year of 1959 (17 sites), and until the year 2002, we found 28 sites. All these are archeological sites, they're named Beanteay Kou site (circular earthwork) which is found in the red soil of the country. The sites are complexly form because of the sizes and lied in Rattankiri, and Kom Pong Cham province and on the way to Vietnam border. And out of these, there're also some sites which has been found during the road constructions and also some found of the weapon fragments since the civil war time, such as Bit Meas site, Prek Pouy, and also Phum 10.8. In finding these artifact objects are more clearly to the additional interpretation for the art analysis, the typical cultures which related to Dong Son cultures in Vietnam territories, and also to understanding the social economic.

In the year of 2007, there were more discoveries in Prohear village, Chrey commune, Svay Antor district in Prey Veng province (western part of the country). The site was found by the villagers when digging the soil to deposit the house constructions. After that the villagers tried to find the valuable things and ancient materials. The formation of this

site has been destroyed by people. Based on the villagers, they found some kind of stone tools (adze stones, polishing stones) jewelry (gold rings, bangles), beads (some kind of black, red and the blue), iron kinds (bangles, sword and the spears) and also the bronze objects (spears, swords, drum bronzes, etc (see the 35th page). This site was attractive nationally and to the international researcher too and thus they started doing researches since 2007.

4. The beginning of Bronze Age in Asia

When we're talking about the prehistoric sites it means that we are not exactly dimensioned to a real period, because as well known, it had ready divided into four main periods such as Paleolithic, Neolithic, Bronze Age and the last one is Iron Age. So the prehistoric sites as above mentioned were passed ready in southeastern Asia, these depend on the difference of prosperities civilizations in each area that they have been finding some artefacts tools and also concerning analyzed within the geographical area, environmental, cultural diversities and weather factor. Through these objects they were mentioned to the interpretation by the material remains for a daily lives of doing agricultural participation in the past and could be also interested and think about Social changed by a different age and civilize section. we have notified that during the second half of the second millennium BC, most territories between the coast of Ghandong in southern China and valley Chindvin in Barma had also growing practiced and metallurgical original was occurred, which introduce divided no decisive break and supposed that gradually fall into the stage of prehistoric societies of the bronze age. It means that the a period had began making by the appearance of the first objects made of copper and printed practical and involves analogy with other regions where it could be used (Higham. 1996: 7). Locally these practices as are rooted in metallurgical effects in small communities still autonomous and mostly settled in the valley secondary river practicing for at least a millennium agriculture. The finally familiar properties of copper and tin. some of them started beginning to exploit deposits to their meger control and melting of the objects first, and then bronze mainly to meet their own need, but the networks of long distance trade soon began up and contribute to the movement of metals and objects from these early fonts. Despite of the metallurgical original bronze in southeast-Asia are not clearly established, but many archeological evidences suggest a insetuse came from China during Shang dynasty (Higham. 2004: 52); (the first century

above 1050 BC). The Bronze Age in southeastern Asia. some authors have long sought to push back the beginning of its development until the fourth millennium Bc. and by defending the idea of a purely original endogeny.

4.1 The Bronze Age's discoveries in China

The relationship of Bronze Age finding is different conditions between southeastern Asia and China, bronze in Asia notified that between 1500-1000 BC was appeared, it was still younger than China bronzes. They supposed that Chinese bronzes were occurred during the time of 4000 Bc., it is still in the Late Neolithic and it continued to the Xia dynasty is above 2000 Bc., based on the evidences of melting between the bronzes and tins to make the bronze. this technical process has been widespread to the end of Shang dynasty between 1000 Bc and then widespread to the Sangxiangdui culture, Sichun province, China (Hieda Sadromi, Al. 2008: 133).

Bronze culture in China may properties that always had appearances along the center local and middle of country and the Yellow river, like the Qujia culture, Erligang culture, Long Shan culture etc. (after the explanation of Professor Marsalek, consultations at the Faculty of Arts).

- Yang Zi and Yellow river in China

On the valley of the Yang Zi in China, the rice cultivating had begun during the 6500 Bc and they had exactly assumed that during the year of the 5000 Bc (Higham. 1999: 65). They had found the evidences of interactive metallurgy between bronze and tin in 3000 Bc on the Yellow river (Hung He).

During the 3000 Bc on the center of Yellow river, the present of bronze and longhin artefacts were very high quantity and they found some decline of bronze casting in the site during the period of 2000 Bc. and the third evolution it was occupied in Erlitou culture between 1700-1500 Bc (Chhun. 2008: 7).

In Yang Zi area has been documented on the Bronze Age 1300-1200Bc of Sanxian Dui, which is located in northern Cheng du, Sichun, it's the center of bronze production. This site has relationship to Asian by the way of Lang caung –Mekong, Xia China and the Red river.

Artefacts finding

- Ling Nan and Bac Bo

The first evidence of local bronze have been found between 1500-1000 Bc. and seemingly bronze pottery imported from the different kinds of characteristic decorative of Shang dynasty and found the ring and weapons etc. to the culture with Zong Yuan culture in Bronze Age period. By the way, we have seen the civilization of Bronze Age of illigator drum that was occured in Dong son culture.

This illigator drum bronze study is very important and attractively for chinese scholars because it was found in many archaeological sites in China such as Dian site and Wajiaba site

- Dian- Dian sie

Dian site is located in Yunan (Map. 3), nearby Dian river. The exacavation were made in 1965. All bronze artefacts were found and studied and strengly controlled and send to the muesum (Janse. 178,1938: 100-1010), like weapons and daily use tools, it has much decorations on shaps and the bronze culture in Eastern Yunan has also found of illigator drum which very similar to Diang culture , Mr Yasuda yoshinori suggeted that this culture is the impire (Yoshinori. 2008: 17).

- Wajiabao site

The illigator drum was also found, located in Yunan. According to the archeological excavated,tehy found the toup including the offering tool like pottery, iron and bronze tools (swords,arrowhead,and the knives) and the katledrum (Chiou-peng.2008:2). The tomb character was made by wood and they put the drum in sider with some offering tools.

4.2 The bronze immigration in southeastern Asia (Bronze Age in Thailand)

The kowledgement of Bronze Age research in southeastern Asia has largely central benefiet in archeological reasearch conducted on a large scale during the last thirty years on present territories in Thailand. These were also included dedicated to the study a

copper mining site, but it is the habite site where the metal came from various channels of trade, then was melted. The archeological sites well-kwons in Northeast, which provided remarkable documentations, including on spiritual concerns, economics and social organization of early metallurgists. The two mining sites have particularly studied,

- **Non Pa Wai:**

Located in the center of country, in the valley of Khao Vong Prachan (province Loburi) and Phu long, located in the Ubon Ratchan thari, (Map. 4); (Higham. 2002: 113). They're both involved in an intense phase of mining activity, contemporary the early development of bronze metallurgy that seen to further during the first millinium. Non Pa Wai, they had done radiocarbene dates reveals that copper smelting began in the period 1500-1000 Bc. (Higham. 2002: 115).

In Thailand they were much several time in researching of archeological sites, especially near the Meong valley river, such as Non Pa Klauy exvation during the year 1984-85 by Wilen. He expanded the knowledgements of prehistory of copper in Non Phong valley by undertaking a sites survey and excavation program. The results by radiocarbene determinations, indicate settled within the period 1300-975 Bc. In Non Praw site is located around 30 kilometer of Non Nok Tha, there were two definitions to be interpreted the earliest burial, were interested with ceramaic vassels .shell, bracelets, and other artefacts, but no bronzes were found. The second burials incorporated bronzes including braelets and axes all of these were based on the radiocarbene dated. It's considered likely that the sites belongs within the period 1000-500Bc (Higham. 2002: 131-132).

- **Ban Chiang Site**

The research excavation in Ban Chiang was made since 1974, and reveals bronze age graves or neolithic cemetry. They were excavated two time ready during 1974-1975, and interpreted at exactly in 1975 on the site. This work they found laid out in cluster possibly rows, each containing the remains of men and women, children and infants. This finding had to be divided into two research sections, the first is the earliest bronze age grave (EP) and

continued to the second sections is the middle period (MP). According to the radiocarbon dating there were three period concentrations. First, involved the channel samples which took from the hearth, from 48 centimeters above the natural substances, and the results is 1115-874 Bc, Second, it is 1675-1430 Bc, and the last one is 930-805 Bc (Higham. 2002: 135). Out of these researched works, they had found the other area sites in Ban Na Di, which is located in Chhorat Plateau, province of Udong Tha Ni around 23 southeast of Ban Chiang, the site was identified since 1980 (Higham. 2002: 134), they found some fragments of crucibles were still presented remains of copper alloy containing about 10 percents tin. This type particular "bronzes" were used to produce of socketed axes, arrowheads, spears, rings, bracelets, pegs, or hooks, so many objects found during excavation.

Through finding the objects on the sites, they've also mentioned to be interpreted that the bronze melting was occurred between the middle of 2000 Bc. like Ban Na Di, Ban Chiang, and Non Pa Klauy (Chhun. 2008: 8)

5. A brief overview of bronze's historic study of Cambodia.

In the early 1920 when G. Coedes devotes the first great synthesis Khmer bronzes, the subject is "*almost entirely new*" (Coedes . 1923: 9). He was interested in ancient art of bronze made them to invest in the field of Khmer Studies. Thus, the same time, as part of his research into Cambodian, and Mr. G. Groslier researched on the art of bronze several pioneering works, and then he published in a series of articles. These two authors started doing preservations in old collections of bronze arts in Cambodia and Siam neighbor. They establish the first elements needed to understand the art of bronze in the ancient Cambodia. To capture the entire evolution of art in times of bronze

"Pre-Angkor" and "Angkor," the time of ancient Cambodia, it is necessary to adopt a time frame extended over nearly seven centuries between the seventh and the thirteenth century. This is the period most often used for the study of Khmer bronzes, and included the bronze images in early seventh century, only known by Chinese sources. The regionalization seems to have characterized the ancient Cambodia in the eighth century, succeeds installing a new power on the Angkor site, site copy established in the

plain

Cambodian between the Tonle Sap and Phnom Kulen plateau. Until the early fifteenth century, it is a capital city, seat of the Khmer monarchy and the center of a kingdom the boundaries of which often exceed the present boundaries of Country.

So the sources relevant to the knowledge of the art of bronze in Cambodia the archaeological documentation of the years 1870-1970, it brings together a body of work, they have some results from the research fields, which have described and understood the material evidences of old bronze study in Cambodia. In late nineteenth century, were originally of interest for the results of first stratigraphic excavations carried out on Cambodian soil from the beginning of the year 1950, they has focused on internal documentation and publications of the *École Française d'Extrême-Orient* (EFEO), which have the advantage of constitute a coherent set of documents, especially the Angkor site. Indeed, data from the Journals of excavations and Reports of the Angkor Conservation often complement those published in "Chronicles" of the Bulletin of the School.

The *École Française d'Extrême-Orient* (EFEO). Further information can be found in certain journals, or in catalogs with collections of museums while under the supervision of the *EFEO*: Albert Sarraut Museum in Phnom Penh, the Louis Finot Museum in Hanoi, and the Musée Blanchard de la Brosse in Saigon. Use of this archaeological evidence is certainly interesting to study the art of bronze in ancient Cambodia. Indeed, it is especially possible to propose, from the various data collected during the retrieval, analysis spatial and functional Khmer bronzes. This focuses, in particular, the various jobs and reuses they could be at different times. To better highlight the contributions of the plural of archaeological documentation years 1870-1970, a current state of research and knowledge on the art of bronzes.

Cambodia will be former first proposed on archeology as the history of arts. And about the acknowledgement of Bronze Age research history in Cambodia is still limited, because the evidences of the first bronze finding mentioned only three sites, Samrong Sen, Mlu Prei and Anlong Pdao site. They found some kinds of bronzes pieces contain iron tools and stone tool. In his article Mr.Charles Higham has written on the Bronze Age of Southeast Asia, he referred to a small statement of bronzes in Cambodia, he had also

written about the name of French researchers whom tried to describe on bronze artifacts or some other stone tools and the ancient materials which they were first started from Somrong Sen site, such as Mr. M. Noulet who was a director of the Natural History Museum in Toulouse. E. Fuch was a mining engineer and other two naval doctors, Corre and Roux. In 1879, Mr Noulet published for one important new material in his first number of publication, the *archives du musee d'histoire Naturelle de Toulouse* (Higham. 1996: 20). In 1984 Mr. L. Mourer wrote some articles that, the latest Neolithic had already used the bronze techniques (Ratha. 2003: 2).

6. First bronze material evidences in Cambodia's prehistoric sites

- Samrong Sen Site

Samrong Sen is located on the east river bank of Steung Chinit. It is a prehistoric archaeological site in the Kampong Chhnang Province, Cambodia at 12 20'N 14 50'E (Map. 4); (Chanthourn. 2002: 8).

Samrong Sen was a subject to archaeological excavation from the late 19th century through the end of the 19th century until the 20th century. The earliest artifacts were found by Lieutenant Jean Moura in 1876; he was the Representative of the French protectorate of Cambodia in 1864.

The site was first discovered and reported in the year of 1876 by M. Rouques, Director of the Fluvial Transportation Company (Sophady. 2007: 7).

In 1879 starts to be described of Samrong Sen made by Mr. Coorre, and Mr. Noulet published an article which analyzed on the bronze artifacts of the site at the same year. Mansuy started having a systematic excavation in 1902 and 1903 (Higham. 1989: 20-21) Three layers were identified, which revealed shell lenses up to 4.5 meters (15 ft) depth, he found the many artifacts and other daily use contained the human bones and other three finely potsherds. With findings of bronzes, arrow heads, hooks, bracelets, an axe, and a sandstone mould for axes, the excavations have also bridged the information gap between the Bronze Age with the excavations done at Angkor Borei (Keat. 2004: 876)

In 1914 Mr. H. Mansuy and Vitout, they had combined to study with other site of Anlong Pdao which is the nearest and found the stone artifacts, potsherds, many shells and bronzes artifacts (bracelets, fishhooks, arrowheads etc.; (Fig. 1)

The site was excavated again by Janse. He collected many artifacts, which were examined in 1986 by Robert E. Murowchick of Boston University. During these excavations, a crucible (with remnants of scoria) was also found along with bracelets, axes and a bell decorated with spirit motifs in height 19.7 centimeters (Fig. 2) . Chemical analysis of five antiquaries indicated 11.74 to 26.47% of lead which verifies that the technological techniques of casting and annealing were known during the period. However, the bronze items have been dated to late 200 BC (Higham . 1991: 172-73).

In recent archeological reports on the Samrong Sen, Ly reports that he identified nine cultural layers. During the test excavations ,he collected bivalve and univalves shell, fresh water turtle shell ,fishbone, animal bones, bangle of clay, stone and also bronzes...etc.;(Ly. 2002: 49-52)

In 1994, the radiocarbon dating was done by Roland Mourer, he suggested the prehistoric sequence for Samrong Sen as lying between 3400 BC and 500 AD.

Due to the geography of Samrong Sen which located in swampy and lowland area around the great lake retrieving good c14 samples in situ is difficult .Ly hesitated to link each pottery type to a specific time frame (Bong: 2003: 91)

Based on the result of the bronze artifact analysis, Higham suggested that the objects of Samrong Sen were cast sometime during in the iron age that began around 500 BC(Higham. 1989: 172). By following Jamme, Hanry and Mansuy, they argued that Samrong Sen site was first settled at the end of Neolithic period and Early Bronze Age. The date obtaining from the C14 samples indicated the early evidences of settlement began in 1280 (Carbonel, Delibrias. 1968: 1433).

- **Mlu Prei Site**

The information about Mlu Prei known by French scholar Mr.Paul Levy in the year of 1938, this site is located north Samrong Sen, near Steung Sen river, in Preah Vihar nowadays. It was excavated in 1939-40 by Mr.P. Levy. The consists of Mlu Prei concerned with other three different sites such as O Pie can, O Yak and O Nary.

During the archeological discovery, they fund bronze bracelets and some other artifact tools, Mr. Pellen reported to Mr.H. Parmentier, who is a director of the

archeological field of EFEO (*École Française d'Extrême-Orient*), and then Mr. G. Coedes who worked for this institute, he carefully ordered to study on these artifacts. The Radiocarbon samples (C14) of Mlu Prei no available because the work's P.Levy preceded the radiocarbon revolution that began in the year of 1950 and there was no archeologist reveal this site to study.

Based on the study and comparisons of artifacts, like the pottery comprised round-bottomed vessels and vessels with applied ornaments, spearheads, bronze ornaments, axes, and bracelets. Melt bronze of the stone. These closely to the Somrong Sen and are related to other prehistoric site in Don Nay valley (Mourer. 1986: 124 27, Higham. 1989: 69;1996: 208).;(Fig. 3)

- **Anlong Pdao Site**

This site was found by Mr. H. Mansuy in the year of 1902, it is far from Steung Chinit about 30 kilometers in southeastern part of Somrong Sen in Preah Vihar nowadays.

In 1902, Mr. H. Mansuy analyzed of all artifacts collected from the excavation sites, he supposed that, in the bronze age period, but there was no much information about this evidences like Samrong Sen, and there were no more articles written like Samrong Sen site.

6.1_ The technical study of bronze products in Asia

Before taking a statement on the technical study of bronze products in Asia, we should be first have look at typical bronze artifacts which found of much artifacts in the different sites. Based on the bronze research, the bronze cultures started to be used along Kong Kar river in India. The researcher suggest that the effectively bronzes perhaps started prospering in southeast Asia around the latest century 1st or the late 1st century (Sadaomi. 2008: 134) as they have been fund in some area as below:

Bac Bo area, they fund the evidences of melt bronzes, bronze casting. In Than Dan and Dong Dao which located in northern part of yellow sea and far from Phung Ngu Yen around 35 kilometers, which are the place for the bronze industry and which are also for the places of making printed bronzes. They saw the artifact material like the bronzes, melted in to the adzes, cold chisels, chisels, spears, fishhook, etc.

By analysis of the material fund of these artifacts in Dong Dao (Fig. 4), they show that the results of art comparatives are very similar to the artifacts in Thailand at the same period. There were a lot of artifacts which were also found in Samrong Sen site of Cambodia, such as the one adze, three bangles, one fishhook and other two spears. The analysis of the elements, it shows that there were zinc and leads of 48 percent of the spears, 4 percents of fishhook and 12 percent of bangles (Chrles. 1996: 21)

In 1902,1923, Mr. H. Mansuy had excavated at Sonrong Sen, he found 4 material bronze artifacts without the identification, and he make a report on the stone tools used to make the bronzes that they also found in Mlu Prei (Fig. 3)

Along Mekong river (Chunn. 2008: 12), they found the making artifact local in Phu Lon, there perhaps there were also product the metals for melting because zinc and leads were presented. Out of these they found some stones in the archeological excavation sites in Ban Chiang, Ban Na Di (Fig. 5), Ban Prasat, Non Pa Kluay,Han Gon,Doc Chua,O Pei can and Samrong Sen.

About the bronze techniques, they found in Ling Nan included the bronze plate for printing snail shell, clam, which have different character, allowing their tradition of southern part and cooperated with the technical staff from Zhong Yuang. The technical experts were not only referred to the printing but more than these they might be conscientiously in thinking to the melting techniques.

They give for one example of the technical sword product, they first have to melt the different metal and then think of its quantities to melt bronzes and apply on that sword to be cute and hard. As the same for this example in producing the bronze sword, there was one plate for printing which was found in Lang Ca area which they produced for a handle of a sword or to reserve the weapons to melt metal, and they also found it in Khorat but it was just smaller than then one from Lang Ca area. The use of plate for printing in Lang Car area, it was a traditional kinds of product like the shell shape or snail which were produced by clay, and there were two layer of clay to be dominated, unglazed was used outside the layer of plate and the layer of glaze was used inside the plates.

According to Mr. Murowchick 1989, he analyzed on the sipping characteristic of Atom in 7 bronze materials that found in Dong Son area by Mr. Janse. He has been finding

of the recruitment presently between the melting materials that concerned the 3 elements, zincs, leads and bronze and, some other elements contained (Arsenic). In using these elements to produce the bronzes, Mr. Diep Nho Ho was also notified for doing a spear, adze in Chua Can of China.

For one example in observing of several times in doing of bronze drums which concerned source from Guang Xi, Bali and Bac Bo, there were the same technical product (B. Kempers 1988, M. Connell, Glover 1988-89, Barnard 1996). The first step, would make a clay mold and could make the hole inside to be reproduced as well as its easy making (Fig. 6 a, b). and then they had to prepare other one of clay mold which had been pieces of round shape and corner shape to apply on the middle of that material mold. In these mold pieces had to decorate of animals, militaries or some other decorations, if they would need, and then they took a purified wax by heating in to the mold as they wanted (Fig. 6c, d) and the next progress, they took that wax to apply on the middle of mold (Fig. 6 e). in this stage they could be more created decorative or change it on the wax, if they wanted. In continue processing, they had to take a clay to apply on that wax mold to be attached together on the soil plate (Fig. 6 e, f) after that they could burn for melting the wax mold and used the metal instead of wax. Through this technical studied on this bronze drum product, we think seemly like the productions in Cambodia, and of course this technique still were used by Vietnamese until nowadays (Fig. 7).

6.2 The technical study of local bronze products

VI.2.1 The Origins of the Khmer bronze: Metals, Alloys and Sources of supply.

VI.2.1.1 The Composition of Alloy research.

It has been pointed out that the Khmer founders have used hard alloys different, but still based on copper, to make objects in bronze. These differences between alloys, which result in a greater or lesser degree of any such metal in their composition, resulting perhaps the technical choices is Depending on the type or size of Khmer bronze pieces that had to be done. The early research were attached to know any metallurgical formulas than using them, and the technical literatures use as a chemical analysis. Mr. G. Coedès is the first scholar who studied of "matter" which are made Khmer bronzes, but may not offer specific recipe ancient Cambodia (Coedes. 1923: 13-15). So, if these metal forms

could be "received from the Khmer former" they all come from the textbooks of Siamese cast. Two treaties including, Tamra devarūp or Treatise on Hindu idols and another treatise on cast iron statues of Buddha, each offer two options for the development of Samrit (Bronzes). They define pañcaloha (that is to say five metals) and alloys, and sattaloha(seven metals) navaloha(nine metals) in which fall in widely varying proportions of silver, lead, copper, gold, zinc, mercury, iron, tin, or bismuth. However, it has consistently high gold content, which would conform to these Siamese formulas the "Khmer tradition". To better understand this metallurgical tradition, Mr. G. Groslier melted metal, meanwhile, fieldwork and chemical analysis (Groslier G. 1921-1923: 414-418). It can thus compare to the composition of the bronzes of the time as the "contemporary" And "classical", and the latter are divided into two main types: Firstly statues, bells and others gongs. Each of these types has at least two grades and a total of four different alloys based on copper can be distinguished. In parallel with alloys older, they seem witness the continuation of greater or less constant over the centuries, only some differences are to report (the appearance of zinc and the Meas sruoy(Groslier G. 1921-1923: 415). "disappearance of nickel). However, such a conclusion is based on the results of a limited number analysis of ancient bronzes and formulas was advanced by Groslier seem more only later adapted to the bronzes, otherwise contemporaries (Boisselier J. 1966: 324). Especially during the decades following that the chemical analysis of bronze artifacts is from archaeological sites Indochina. In particular, there Malleret resort for a few bronzes he discovered during his archaeological in the former of Transbassac (Malleret. 1960: 250-253, 358-367). The observations of contemporary fonts in Vietnam, also extended to the neighboring countries, it has indeed revealed metallurgical practices, it seems, the traditional tend to remove any probative value to these tests. It emphasizes the importance of reuse of objects metal old and very disparate in the cast of a statue. Through these offerings metal, which replace some of the tin of copper and ores and therefore show necessary for the casting of the alloys, each believer is to participate in this act of merit that is the realization of a new image of worship. But the diversity of these contributions contributes heavily to make the alloy very homogeneous. Changes constantly observed for different alloys analyzed, either in the same object or a cast the other would be so attributed "to the fixity of an ancient craft technique, which

respond to any form metallurgical established. As recalled by the same author, situation is however different for objects in bronze called "utilitarian" specialized in defined functions. Indeed, their casting is an act of merit much less than melting of an idol and in general. In practically only the function of these objects defines using of any metal used in the composition of their alloys. However, the little analysis has been performed on these derniers (Malleret. 1954: 306-307) . This research could not prove too much used by Khmer smelter of metallurgical formulas and proportions of metals defined utilitarian objects made of bronze apparently constituting a special case. It is still necessary verify this conclusion with regard to the first results of new techniques analysis offered by the Archaeometry. Mr L. Malleret already called his wishes that "the investigative methods and chemical physics that science is increasingly at the available to the archaeologist occupy more space in its concerns (Malleret. 1960: 251).

6.2.1.2 The sources of metal test

At present, there're different in variable proportions in Khmer bronzes and respond to three distinct origins, which are also not incompatible: reuse, local sources and importing. Reuse already mentioned various objects metal has probably provided a substantial amount Khmer bronze metal necessary to melt. However, besides these, there should probably add number images and objects of worship in shrines made of a conquered country, and then remelted. These "Spoils of victory" would have been, according to J. Boisselier, the chief source supply of metals, the proportions of which would have only very little change over centuries in Southeast Asia Indianized, with more "transfers of land to country "that" a genuine policy of exploration and extraction minerais(Boisselier. 1967: 279). This review remains is to be qualified, since it seems that the Khmer bronze have completed these reuses of contributions of minerals, including tin and copper . Modalities of supply, both regionally and locally, must be recalled here. It first be sure to emphasize the "deprivation" as evidenced by Cambodianbasemen (Bronson. 1992: 97-98). There is only a few exploitable mineralization occur because of the various territory. Deposits of cassiterite, or tin oxide, have been particularly identified in southern Cambodia in the province of Kompong Speu. But they remain very modest and "traces of ancient farms" they have retained is to imprecise less (Dottin. 1971: 30, 47-50). The fact is that, here in Southeast Asia, tin has the appearance of alluvial deposits, has probably been extracted

by the method of the pan. In other sites, evidence of the same metal, but copper form of malachite, also attracted attention, but that further studies There are extensive conducted (Malleret. 1960: 253-254). Other local sources are better known. Exploitation former, more assured, would have provided metals involved, nearly or in the development of Khmer bronzes. In the province of Preah Vihear particular, the rich iron deposits of Phnom Dek (literally "iron mountain") been exploited in the twentieth century by the mountain people of Kuy, probably constituted

the Angkor period the main source of iron oxide at very high levels of metals (Levy .1943:43). It is located near the old provincial capital of Preah Khan - the "Preah Khan Kompong Svay "in the archaeological literature, where important remnants of transformation iron have been recently day. Furthermore, an inscription (K. 180), from sanctuary north of Prasat Pram, still within the province of Preah Vihear, seems to referring to the same period to another holding mines (Pottier. 1997: 196-197, Coedes . 1913: 24-25). Written in Sanskrit and dated Saka 869 (947-948 AD), she recounts the recognition of several pictures of deities and the organization of their assigned area. Especially, it describes this area as a land "rich in treasures, precious stones, silver, metals, container land grown and, village, that there were serveants on the rice fields ", in his final report, he said it was the "earth mines" (Pou. 2004: 356). In the real notion of "local procurement" should be extended to spaces an ancient Cambodia and their fringes. In particular, this area of supply extended deposits of chalcopryrite and cassiterite known in the Middle Laos (Malleret. 1960: 194-195, 253, 266-267) and Mr. B. P. Groslier preferred to see them, rather than in the mineral veins - a little known - Cambodian territory, the source of tin copper and khmer tins (Pottier. 1997: 197). Several arguments can also be developed to support this hypothesis. First, traces old farms were located in the tin basin of the Nam Pathene, located about 60 km north of Thakhek (Khammouane province). However, knowledge to High time these rich resources of tin does not seem to leave any doubt. In would demonstrate the development of these deposits, according to conventional methods, by Banhar the Vietnamese province of Kon Tum, but also the prestige that have long pewter ornaments benefited from some mountain people trays central Indochina (Malleret. 1960: 195.). Moreover, the route of the Mekong has certainly made to date former a direct outlet to supply the territories further south. History of Liang and recalls

that in the first half of the sixth century, the kingdom of Funan produced, among other things, the tins (Pelliot. 1903: 263). However, this metal is probably not produced locally, in the Mekong Delta region, but would instead be originating from deposits in Middle Laos, rich enough to provide a craft tin then open essor (Malleret .1960: 266-267). Despite the existence of rich deposits of copper and tin especially, do not however, excluding the more distant sources. These have probably contributed at different times, to fill gaps in local supply and power applications in specific metals. In the particular case of tin, the assumption of maritime relations with the Malay Peninsula should not be discounted. Recent would have occurred under the old trade routes between countries bordering the Gulf of Siam. Thus, the very rich tin deposits located on the west coast of the peninsula Malaysia, and could also had some of the tin product within Funan (Pelliot. 1903:263). It is also highly possible that these imports have continued over the following centuries, not only for the tin, which would explain its "hegemony" in the various alloys tested, but also for copper. Peninsular Malaysia has indeed very special copper ores, which naturally contain a high proportion of gold, estimated property probably of Khmer bronze. The high grade gold that have number of Khmer bronzes could be explained by the use of these minerals copper of Malay origin, rather than a deliberate addition of gold at developing their alliages (Bourgait, al. 2003: 112., Baptiste, Zephir. 2004: 183) .The recent tests conducted by the composition C2RMF also tend to show that the copper used by the founders come from a Khmer approvisionnement (Bourgait., al. 2003: 117) single source. and Further analysis will probably confirm or refute this hypothesis importing copper from the peninsula Malaise. Apart from the tin and copper, zinc would too partly imported. Fast proportion in some alloys (0.6%), it seems to respond to two original distinctions: first, the recasting of metal objects containing zinc, on the other hand, the use of copper ores or lead with a high content of that metal. Such a lead-zinc ore is found especially in rich deposits - and possible

source - located in Burma, at the current border between latter Thailand voisine(Bronson. 1992: 78-81., Bourgait, al. 2003: 117).. It is worth noting that all these metals, imported from traded locally or distant deposits and regionally, have probably been in the form of ingots or "salmon", a practice attested in Bronze Age and later confirmed both by the archeologiacl epigraphy. This distinction between the origins of various metals useful in the development of bronze Khmer evaluated both the mineral possibilities of exchanges with the circuits existed in ancient dated. However, in the absence of

systematic research in the field and further analysis in the laboratory, identification of a particular ore deposit as a source of supposedly is a mere hypothesis research. The data is however best known regarding the work itself - once the metals needed together the Khmer bronze.

6.2.2 The technical repertoire of Khmer bronzes.

6.2.2.1 A document study and indirect

Between the seventh and thirteenth century khmer bronzes show a remarkable technical mastery, as evidenced by the quality of implementation of most parts preserved. They were all carried out in two stages: first melted under different techniques, and they then received successive treatments finish. These steps are appeal to a wide range of traditional practices can be understood through documentations.

Several references to images or bronze objects are found in Khmer epigraphy. The inscriptions, however, that rarely evoke the actual cast of the latter and while no details are given on technical uses (Pou 2004: 494, 709). The Chinese annals

offer little more information: indeed, if history of the Liang mentions realization of "bronze images" in Funan the first half of the sixth century, no technical information is made (Pelliot. 1903: 269). It is the same for the testimony of Zhou Daguan, who noted simply that the late thirteenth century, the "Buddha of the towers, "that is to say, those of large religious foundations of the Angkor capital - by opposed to images of Buddhist pagodas"are all fused into bronze (Pelliot. 1951: 14). Thus, knowledge of traditional techniques of processing and melting used in the Ancient Cambodia relies in a large part on the studies - still incomplete - of India's abundant technical literature, which has certainly influenced the whole Asia Southeast indianized. No technical treatise Khmer now metallurgy being known, if it existed, it is indeed assuming that the bronze Khmer will be simply referred to Indian treaties, but to develop practices propres (Boisselier. 1974: 50) to them. This directory is also traditional technical apprehended since several decades through ethnographic observation of metallurgical practices contemporary, both Cambodian

territory in neighboring countries (Thailand, Laos, Vietnam). Many of these practices adapt and reflect in fact uses more former, which are partly preserved over the centuries and now form a fund more or less common to the entire regions.

6.2.2.2 The casting techniques.

They still in use today, the process of melting "lost wax" was very widely favored by the Khmer bronze, as well as for various objects for images even larger. Only a few containers and other devotional materials had face techniques of embossing. If casting techniques adopted in ancient Cambodia, and more widely in Southeast Asia and India society, is similar to known methods from China or the West, but they would differ in their complexity and their empiricism. Another peculiarity of these techniques just mentioned here, is the close association of manual operations and rites religious (Boisselier. 1974: 50). Two major methods of casting "lost wax" bronze Khmer are known: the hollow casting and solid casting. They both use the same materials, but latter requires more complex manipulations. Logically, it is dimensions of parts to melt that largely determine the choice of either: if smaller pieces that can be filled, require a larger

hollow casting, both for the sake of saving metal by technical necessity (problems weight, casting and cooling of the metal). Rarely, however, that these images are fully rendered hollow and their extremities (feet and hand) are almost always solids. hollow casting and Solid casting use both at a wax model: a positive where specified in the tool the lowdown, and is used only once, being necessarily destroyed by melting. This wax is actually a mixture gently, beeswax and gum-laque (Pelliot. 1951: 26-27). While the wax is solid to solid casting, he made for casting hollow core of a land that covers a layer of wax. This core is formed by successive layers: each said slowly forms part to produce and the finest is in direct contact with the wax. The latter, cut into strips, is Applied by hand. The success of melting depends largely on the maintenance of the thickness. In both methods, then comes the realization of a clay mold refractory still in one piece, which is wrapping the model previously developed. Earth who is is a preparation of fine clay. Various products acting as

"degreaser" are also added, depending on the destination of the piece to melt (brick pottery and crushed or organic matter). The mold generally consists of three successive layers of clay, but provided in different locations suitably chosen, tirecure, cast channels and other vents that pass through the thickness of the chape (Grosslier. 1921-1923: 419-420). The first layer, the thinnest, directly overlies the wax with a brush. After drying, a second thicker layer is applied by hand. Finally, even thicker, the outer layer comprises protrusions to strengthen weaknesses. For large rooms, iron frames, increasing in complexity with the size of the image are also drowning in the outer cap (Fig. 8). But such reinforcement can also be provided for objects "utilitarian" plus size Guests, especially designed to work force (Grosselier. 1965: 94). On the other hand, these same pieces of large dimensions are generally cast in several parts, then met (Grosselier. 1921-1923: 419-420). More advantages to this: a realization and modeling of the molds more simple manipulation being cast also facilitated, and finally, the use of smaller quantities of metal. Despite these obvious interests, others still remain large bronzes cast in a single room, which can probably be explained by differences in technical developments or by the weight of tradition and local practices. Once dry, the mold is heated on a fire and heated to allow the cooking the flow of wax, which is not "lost", but carefully recovered. Then, once the proper temperature is reached, can begin casting the molten metal, which preparation was done in parallel to that of the mold. To avoid missed casting a amount of metal still higher than is necessary provided (Griswold. 1952: 637, 639). In addition, the mold is always "repaired" before casting the soft earth to fill cracks and drain holes in the wax. Finally, after slow cooling and complete, the mold is broken carefully. Besides these two processes related to melting called "direct", it should discuss the practice of casting "indirect", which also makes the melting "lost wax". His "rediscovery" is due late first, by developing new analytical criteria for identification purposes, but also by the fact that she had been far overshadowed by the practice of direct melting, very large majority. Indeed, it is interesting to recall that on forty-five bronzes analyzed, only nine of them are melting indirect (Bourgarit., *al.*2003: 108-110, 118). In the same way as for direct smelting, this method involves performing a mold, but starting this time from an original pattern. Fashioned in the ground, it envelopes the model and then receives a layer of wax applied by hand on its inner wall. The mold can also be completely filled with wax, a part of it is then removed before it not be fixed. In addition, an earth core is made to fill the cavity. Then same methods as those described above are

involved to achieve the melting and molded piece. The choice of indirect cast is still difficult to interpret, even if it is already possible to exclude any concerning reproductive, since even parts "major", and certainly unique, can be melted by this method. Again, it can be put forward as explanations of technical capacity, more or less developed of bronze and perhaps even more the weight of traditions.

6.2.2.3 Processing techniques

When the stripping is completed, the piece then receives the raw number of treatments. First, the metal rods corresponding to the old lag wax runners and other vents are removed and the holes they have left are blocked by welding. No trace of porosity of metal and very few missed castings are always visible, even for parts "minor", indicating that the fonts are generally good quality. In addition, for hollow castings, their core anthrax is not always removed, it can help to strengthen particularly for those whose thickness is limited to a single sheet of bronze. Finally, the shape of coarse part is polished, these are the last operation to finish work,

However for large parts, their melted parts separately must still be met, according to techniques that the same analysis Radiographic help to reveal. For the statues, the separation is the most common the arms and two assembly techniques are then used: the arm can be inserted in the shoulder and then welded, unless an extension of the shoulder did come fit therein, where a hole has been specially equipped to receive a pin (Bourgarit, *al.* 2003: 110) (Fig. 9-10) In addition, other types of assemblies are bronze individuals who routinely use mortise and tenon joints, fasteners being provided by dowels or pins. Thus, the famous bronze Buddha on Naga, who have their equivalent in sculpture pithy, always consist of three distinct parts, regardless of their size: the Buddha himself and the body of Naga into two parts assemblies, with its turns serving as seats and cap polycéphale (Grosselier. 1921-1923c: 420, Boisselier .1967: 281., 1974: 51-52.) (Fig. 11).

But should also be made of triads and sets architected Buddhist bronze, which several examples have been preserved and the assembly of parts is always a simple interlocking provided by ankless (Grosselier. 1921-1923a, 1921-1923c: 420); (Fig. 12-13). On the other hand, the Khmer bronze still resorted to other techniques

treatment to complete their work finished. B. P. Groslier recalls in particular that "all Khmer bronzes were gilded," this was a statement which is found in other more nuances. Scattered traces of gilding are visible effect on the number of bronzes preserved. Furthermore, an inscription in ancient Khmer (K. 504), discovered in Peninsula Unese, Chaiya (Surat Thani Province), seems to testify to this ancient practice of gilding, probably common throughout the region. Engraved on the pedestal of the famous "Grah Buddha" and probably dates from 1105 Saka (1183 AD), it gives the weight of the bronze was needed to cast the statue, but also that of gold which had serve his dorure⁶⁶. Finally, several inscriptions mention images of worship and other various objects in gold, in which he should probably recognize some of them, golden (Grosselier. 1965: 92) bronzes. Three different techniques were used to gild these derniers (Grosselier G .1921-1923c: 419, Grosselier B.P., 1965: 94, Bunker . Latchford. 2004: 434-435).The first is to apply gold leaf on a resin support black or vermilion. The second technical uses, for its part, the mercury is amalgamated with gold and applied to the surface bronze, before it is heated and polished. Finally, a third technique accompanied by a cladding hammered gold leaf, embossed on the shape of bronze Brown and maintained by crimp. It should be noted that two of the products needed for these techniques, vermilion and mercury, are likely of Chinese origin. Zhou Dagan makes them also among the various goods imported from China Angkor to the late thirteenth century (Pelliot. 1951: 27-28).

At the execution quality of most preserved Khmer bronzes meets a know how developed technique, which seems to have been more or less constant over the centuries and and would define a true "school of Khmer bronze. Although the latter have never used alloys "standardized", but this lack of control does would actually be apparent, responding to more concerns that ritual proper techniques. In addition, the function of objects seems to have ordered the development of special alloys. Beyond these issues of composition, the bronze Khmer demonstrate mastery of a wide range of metallurgical practices, as well regarding the cast (hollow or solid, single or separated, direct or indirect) that the treatment of bronze coins to make (various finishes, assembly, stamping, inlay). Doubtless this explains technical mastery does the variety of bronzes produced in ancient Cambodia.

7. Bronze arts study and its developmental stages

7.1. The study of Bronze's art material found in some prehistoric sites

7.1.1 Circular earthwork

- Krek 52/62 Site

What is a Circular Earthwork? It's an earthen circular structure in the red soil area southeast of the Mekong River in Cambodia and the southern region of Vietnam. They consist of an outer wall, an inner ditch and an inner platform. According to the article of Cambuja, 16 June.1996, said the diameter of the outer walls is more than 200 meters (Chanthourn. 2003: 7) and they now found between 150 and 300 meters, the structure contains rarely one and mainly two entrances (Fig. 14)

In 1959, Mr. Louis Malleret described circular earthworks with outer walls and inner ditches as a new category of prehistoric sites in Cambodia. He listed 17 earthworks of this type in the red soil region east of the Mekong in the Kampong Cham Province and adjacent Vietnam (Map. 2).

In 1962, Bernard Philippe Groslier excavated in a circular earthwork near Memot, later called Groslier site, and named this civilization "Mimotien". Research on these earthwork sites resumed only in 1996, with an examination of later named Krek 52/62 site by Yasushi Kojo and students of the Royal University of Fine Arts, Phnom Penh. Now there're more than 30 site are researched. The artifacts like, fragments of pottery, stone pieces (flake), atone adzes, and some other were fund, and some other metals were not presented because of the oxidization by red soil, but according to the research of Mr.Dega 1999, 2001., Carbonel 1979., Grolier 1966, Maleret 1969, Manh 1996, and Mr.Kojo Pheng 1997), they think that it was in the Neolithic period (Samnang. 2003: 7) but nowadays they have been finding some evidences of bangle glass, which are very similar to the sites in Thailand dated in the latest of the 4BC (Glover, Henderson 1995:148) and some other like, iron pieces, lithopone are dated not less than 1000 Bc.

In 1999, Mr. Ngyuen Trung Do tried to compare the objects between Cambodia-Vietnam artifacts, and he make a conclusion that they might be in 1550-550 Bc, on the

other hand, they found a piece of bronze drum in which are decorated in 18 village far from 52/62 site area only around 2 kilometers and half.

- **18 village site**

18 villages located in northern of Mekong river in the red soil of Kompong Cham Province in the same circular earthwork (Map. 2). This site was discovered by a rubber plantation company while they took out the red pebbles in 2000, and it was researched by a group of archeological student who lead by Memot cemetery for Archeology in 2001. They had a site survey and they had collected the pottery fragments on the surface and decorated pieces of bronze drum. This was the first time of discovery which they had never found on the sites.

Based on the decorated shape pieces, Mrs. Michael Piratsoly, a bronze metal expert from China, she first concluded that this shape decorative was used between the third century and the first century BC.

Since we have the excavation we've never found a bronze drum pieces like this, we found only the material like, the bronze bracelets, iron bangles, stone beads, some weapons of swords, and a different sizes of potteries, etc in a tomb.

Through these bronze drum pieces, we could not notify to study on its civilization, date, the use relatives or some kind of beliefs, because we had just found it on surface, were not exactly from or might be from the other site near this 18 village. But based on the C14 result, it was during the time of 400-50 BC (Kimsreang. 2003: 34).

VII.1.2 Phum Snay site

As I wrote in an overview in finding of Phum Snay archeological site in the 8th page, in year of 2000 when road construction occurred by the organization in Cambodia called World Food Program (WFP) while they were constructing on way number 6 road to Phum Po Pel (Po Pel village) with the length of about 3700 meters.

Phum Snay is located in Ro Hal Commune, Preah Neth Preah district, Banteay Mean Chey Province (north western of Cambodia, Map.1). It is the most important for the archeological observation of Cambodia, this site is located on the big mound with the

diameter of 3 kilometers, and it was destroyed by the people who live in 2002, during the short term of the human destroyed, we found so many holes and much of ruins on the surface, the villagers said they found some fragments of pottery, beads, iron tools, bronzes, and some other of jewelry etc. and they were found the helmet in the corpse holes. After that there were some institutes which are concerned in the cultural field to explain on the value of the cultural properties within the village which participated by UNESCO, APSARA Authority, EFEO (Ecole Française d'Extrême Orient), Mémorial Center for Archaeology, University of Otago of New Zealand, and also by the staff of the Ministry of Culture and Fine Arts...etc (Samnag. 2003: 1).

In 2001, there was an excavation which led to Mr. Pheng Sitha from the Ministry of Culture of Fine Arts, and Mr. Daugaul Oreillie from Otago University of New Zealand supported by UNESCO.

Throughout the result of the first excavation in the sizes of 15 by 5 meters, they found the different fourth of the cultural stratigraphies contained the corpse holes and the artifacts.

There were 9 corpse holes found in the site, some human bones had only the head within the small pieces of artifacts, excepted the only 3 corpses and there was only one corpse hole which was attractive, because of the potteries, iron knives, earrings, bracelets, bronze ring, ivory and contained the beads are to appear near the corpse.

Material artifacts amount 36 spindle whorls were found, while they were digging. But they called these buttons "the villagers said", because of the similar form and otherwise found them on the chest of corpse, it looks the same kind of the sites in iron age in Southeast Asia (Ratha. 2003: 6) and the beads in amount of 168 were also found during the excavations in the sizes 1 by 3 millimeter (yellow kind, blue and the oranges), and about the pottery, they found some kinds of glazed which applied with a clay water, but the pottery which they are attractive was the black one which was the same kind in Phi Mai.

In 2002, they excavated again to be analyzed much more data, but contrastly they were not found anything within this site. Until the year of 2003, January, they continued it in the third time, this project leads by Mr. Thuy Chanthourn and Mr. Daugaul Oriellie,

they opened in the sizes of 100 square meters. They found the 12 corpse holes and much of metal artifacts such as the material burned of clay (potsherds), iron tools (swords, knives, rings, adzes, and some kinds of tools without the notifications), Beads (red kinds, blues, yellows, it was the first time which found some kind of beads made from Agate), stone tools (bracelets, adzes etc.) and other the metal artifacts of bronzes such as the rings, bracelets, bangles, rings, plates...etc.(Fig. 15)

So throughout some data collections, it is the most important archeological site and also the only source comprehensive to understanding of human civilization in the prehistory of Cambodia and the most important to be compared with some other sites which are discovered nearby. Despite of many data lost by human destroyed, but anyway according to Dr. Dougald O'reilly and Mr. Pheng Sitha, they suggested that it could be in iron age (300 BC- 500 AD); (Ratha. 2003: 4)

7.1.3_ Ta Dong Mountain

They discovered the site during the road construction occurred, which found in the year of 2000 far from Banteat Boh Village which is the new corpse field. Tadon Village is located in Banbeat Boh village, Ta Pho Commune, Svay Chek District, Banteay Mean Chey Province. There were some material artifacts like ceramics, iron tools and as well as the bronzes material product were found by the villager who living around, and also found the stone tool on the other ancient mound. Out of this there are three more temples are located in Eastern part, Northern and the western part of Ta dong which are almost destroyed.

This site more interesting by researcher because of much metal evidences found in site, and more attractively to understanding of metal useful in the past of Khmer society and also in Asia. Especially with the bronzes artifacts found:

Bronze material artifacts:

some kinds bronze artifacts were to appeared by jewelry such as bangles, bracelets, rings, earrings, and for the daily use like, the plates, bowls etc.

They found the jewelry like the bracelets and also the bangles 162 pieces. They could divide into 6 different types.

- **The first type** (Fig. 16): it had decorated in the vertical rule shape which are designed by many short rule and arranged it in to the string. This decoration are used to practice on the shape of prehistoric ceramics (Bunthoeun. 1995: 7).its diameter of 6 centimeters, and the length of 0.5 centimeter and 0.5 centimeter thick.
- **The second type** (Fig. 17): the diameter are like the first kind, excepted the length and thick are more thicker than the first kind without decorative.
- **The third type** (Fig. 18): the decoration likes the gable of a house which are hollowed inner side and have a swell outside, the normally width of 0.7 by 0.9 centimeters. And the most thickness in 3 millimeters, and the diameters are 9 centimeters.
- **The fourth type** (Fig. 19): the decorated likes a layer of banana petal shape without decoration outside, are swell and round shape.
- **The fifth type** (Fig.20): the decorated likes the triangular shape. 3 by 0.9 centimeters thick, the diameter of around 6 centimeter.
- **The sixth type** (Fig. 21): the decorated with a round shape and smoothness in the length of 1 centimeter and the diameter of 7 centimeters.

Out of these bronze jewelries, they had also collected like the bronze rings, gold ring, and iron. They found also the small bell of bronzes near the corpse holes ,they would be dedicated to the corpses "*The villager said*". And there was one scoop looks like the scoop of rice nowadays, looks on the outer shape, Dr. Gerd Albrecht Said, he supposed it in Angkor period?, and there were some other supplemental things like the, iron tool (spears, knife, hoc?, swords etc.)

Through this discovery site as I have written ready in the 11th page, in the year of 2003, they also published one report and had written by Mr. C Pottier, based the the hole of corpses, he supposed in as ol as early AD similar to the age of Phum Snay (Ratha. 2003: 4); (see the page 40)

7.1.4 Daun Noy Village

Daun Noy village is also located in Svay Chek district, its far from Banteay Meanchey around 25 kilometers. There were many ancient mounds and temples and, ancient sites has been destroyed by people in the Village. That were only for amount 6 months, Daun Noy was destroyed of 20 percents in a month. Everything which is attractive to research is the corpse holes.

In each of corpse holes were buried by a different positions, some burial corpses are characterized group, there were a different depth and sited corpse, but the most interesting are prepared the bricks as a coffin surrounded in the length of 2 meters and width of 1 meter, and in higher 0.5 meter. Burials are mostly faced to the west in depth of 2-3 meter, some other burials faced to the east in depth of 1.5 meter "*the villager said*".

On the burial, they fund so many artifacts, like the beads, swords, potteries, spears, adzes, bracelets, bangles, bronzes etc.

The bronze material were also typical fund such as the jewelry (earrings, bracelets, bangles, rings etc., contained the some typical of beads (Carnelian and Agate type).

7.1.5 Prohear site

Prohear site is the newly site discovered in the year of 2007 by the villagers, who dug the soil for house constructing. During digging, they found some burials and some artifacts such as stone tools, beads, potteries, iron and bronze artifacts, and the gold, etc. After that almost the whole site had been destroyed by the local and non-local villagers to find the valuable things in order to sell to middle traders.

This site locates in Prohear Village, Chhrey Commune, Svay Antor District, Prey Veng Province and about 120 km of Phnom Penh city. The history of this site research had done the excavation ready by Memot Center for Archaeology and the students from Faculty of Archaeology. As the result, we have found 59 graves and some artifacts like: potsherds, stone tools, iron tools (spade, knife, bangles), beads (blue, black, red, green) and the bronze tool such as sword, bell, mirror?.

The bell type:

They found in the road of Nr. 27 in 39 centimeters from the surface, the bell size is 11.7 by 5.5 centimeters, they found in the corpse hole of child ,it perhaps for the child while he had a live. They put it in a tomb for a child, they might be believes that for the happiness, because bronzes in Khmer belief is a cool material, but nowadays they use it for decoration on the cow, horses, and also for the pagoda at Khmer countryside, but it just not make by bronze objects, etc.(Fig. 22)

Mirror (Fig.23) ?:

They found it in deep of 150 centimeter from the surface and diameter of 14 centimeter, a round shape, but the function, they do not know exactly, why they produced it.

Bracelets

They found it in deep of 150 from surface, a round shape, it was nearly broken all, they saw a skull inside this bronze contained the beads (blue and black), it might be have some beliefs concerned to deadness as they put in the jar. Out of the bronze tool, they fund also the bronze jewelries such as the bracelet which have three different kinds and different decorated on it.

First type (Fig.24): They found 6 tombs, 160 centimeters deep with diameter of 8.5 centimeter without decoration.

The second type: They found 8 tombs, in depth of 168 centimeters. The diameter was 9 centimeter without decoration, decoration in leaves in the middle shape(Fig. 25).

The third type: They found 2 tombs of 175 centimeter deep. The diameter was 8.5 centimeter, is a circular form without decoration.

Earring jewelry:(Fig. 26)

They found 20 tombs of 138 centimeter deep. The diameter was 5.5 centimeter. The earring was found also in Phum Snay Village, it is the same kind.

Sword: sword is a sample weapons for a researcher which always found during they excavated, they use it for the war or for cutting the thing in daily life. The swords were also found in this site by digging of the villagers, and there different types. They could not notify of source. They have difference kind of length, 33.2 centimeter, 38 centimeter, 37 centimeter, 33 centimeter, 38.5 centimeter.

Bronze drums:

They found 6 tombs of 169 centimeter deep from surface. The diameter is 45 centimeter by 30 centimeter , this bronze drum is decorated by 10 stars in center shape and perhaps there are decorations of a frog in eider like other drum which used to be found. There are 8 circle form decorations around the star which decorated by the animal and other 6 birds (Fig. 27) Inside the drum they found a skull contained the teeth, earring and the golden dish, through this evidence, we believe that they used this drum to cover the corpses because the death may have been covered by the leather or tree leaves. And other might be related to the belief of the prosperity because bronze is a kind of cold metal, and otherwise might be related to the raining ceremony because of the water animal such as frog, or crocodile were presented in center of drum and the cemetery or sun which appeared (Kempert. 1988: 135). Furthermore, through studying these artifacts we could conclude that this site was an ancient, and the chemical analysis (C14) has shown that this site dated to 2000BC (Komnet. 2009: 57).

7.2. The stages of development of bronze arts and Khmer's art styles

In the absence of further absolute dating, some vagueness hangs over the chronology Khmers bronzes. While the "styles" (Mr. P. Stern) developed for statuary Stone has often served as useful frameworks for a more or less precise dating of these last. These relatively flexible joints, particularly defined by the evolution of clothing, ornaments, hair or the shape and technology, offer Indeed, with some degree of certainty, a very fine chronology for the period between the seventh and thirteenth century (Boisselier. 1966: 41). However, this division did stylistic and chronological not always been adapted to the original formulas that were developed in the art of bronze. It is clear that in some cases, similarities of dress and

adornment are even more between images in bronze and stone, which tends to make them contemporary.

However, developments in the art of bronze and lapidary art have rarely been parallel. Statuary bronze, especially, has many characteristics, most often result technical possibilities offered by the modeling. Thus, adornment of statues and statuettes bronze often show greater richness of detail, they can be specified directly on the wax model, or even made by chasing after the melting. As for their clothing, he rarely obeys the known rules for statuary lapidary. Again, the use of modeling, or assembly by welding, allows the achieving draped over complicated, only known in the bas-relief or, conversely, paradigms. But the garment can also adapt older models or simply copy them. Alongside these images "how to", are in addition to other bronzes, whose stylistic features seem rather "advanced" on the chronological sequence defined for the lapidary art. Statuary and more generally the art of bronze would thus tend, not to comply, but rather to overlap, styles Khmer Art, a division which can be used with caution.

This is particularly why other remedies were considered, always in the interests of Khmer bronzes dating. Some authors have advocated the comparison of statues and statuettes bronze bas-reliefs, whose technique makes it possible to achieve sculptured works that are more like those of bronze. Others preferred stylistic criteria intended to be a stronger evidence base of dating, such as invoice, the contours, or facial expressions. However, these studies have detailed the more often allowed a approximate date, while leaving some problems unresolved. It is sometimes difficult, for example, to distinguish copies of exhibits "old" among the many late bronzes made several centuries after the end of the period Angkor. In addition, the problem of dating is even more complex objects Worship and domestic bronze, which frequently beyond the stylistic frame and time set for the lapidary statuary. On the other hand, even using different styles of Khmer art, a new problem is emerging, that of a profound imbalance in the representation of the latter. Indeed, the bronzes Khmer are kept very far from corresponding to continuous

development and number of periods are hardly known. This is especially the works of the Bayon style (1177-1230 AD approximately) which are very widely prevalent, as well as for statuary, worship and household objects. In the course of the 1960, with an inventory Statistics of all then known bronzes, BP Groslier has shown that "ninety percent of them belong to the latest styles of Khmer art, that of Bayon (Groslier. 1965: 93).

Thus, all the bronzes prior to the late twelfth century are represented by corpus reduced, the study of stylistics can not have the same degree of relevance. Two trends, the superposition and concentration, thus define reports the art of bronze with styles made for the lapidary art. Therefore, any analysis works produced by the Khmer bronze between the seventh and thirteenth century must stress for each step, albeit variously represented, this production continues, both their commonalities than their differences with stone works relatives. To facilitate this analysis, the bronzes studied will be distributed so between classical bronzes "pre-angkor " and bronzes "Angkor", followed by the partition long passed for the history of ancient Cambodia.

7.2.1 Bronze in Pre-Angkor period .

7.2.1.1 The study on the bronze images of Funan:

From historical sources and archaeological data.

In Funan period a bronze statue developed in the first half of the sixth century, prior to the oldest known images in Southeast Asia. which would show the history of Liang dynasty with a short statement: "Their custom is to worship the spirits of heaven. Of these geniuses of the sky, they make bronze images; those two faces have four arms, those four faces have eight arms. Each hand holds something, sometimes a child, sometimes a bird or a quadruped, or the sun, lune Pelliot. 1903: 269). Admittedly, these geniuses of heaven "are not identifiable to any deity Brahmanic or Buddhist bronze images and their well described do not appear respond to known iconographic types. The fact is that the information given, despite their obvious limitations, evidenced at that time a point of working with bronze, material already privileged, it seems, to produce works developed, both in their forms in their iconographie (Jessup., Zephir. 1997: 130-131).

However, no archaeological evidence to prove these are clearly unique Chinese source. Early research conducted by Mr. L. Malleret in the former territory of Funan, especially in the plain of Oc Eo (current Vietnamese province of An Giang) have indeed delivered a bronze material very limited - particularly in comparison to Many objects of gold and tin unearthed - and among the bronzes discovered not one, even in fragments, could be attached to a bronze sculpture produced localement (Jessup., Zephir. 1997: 130-131). Several reasons could explain the scarcity of bronze: first, the natural data specific to the region of the Mekong Delta, are not conducive to conservation objects based on copper, so the use for several centuries to an abundant tin smelting, which would have prevented the development of bronze metallurgy or In any case, this alloy limited to specific uses, and finally, the practice of reform already mentioned (Malleret. 1960: 193-194) several times. It should be noted, moreover, that the archaeological research which have recently been taken in the same plain of Oc Eo, have not delivered more examples of a local sculptor bronze. However, establishing the different sites studied a long sequence chronological (first to twelfth century), divided into several major phases of occupation, these Research has helped clarify the likely conditions for its appearance. The initial findings indeed tend to show that both the mounds located in the floodplain on the flanks of Mount Ba Thê which dominates religious monuments Buddhist and were built between the fourth and seventh century. Exchanges with India, Southeast Asia, but also with China, are also backed up by evidence material from the fifth century. However, chronologically, these archaeological data do not contradict the History of the Liang dynasty. It is thus highly likely that the various cultural borrowings made by Funan to India, including a religion (or Brahmanic Buddhist) and monumental architecture, will also be accompanied by adoption, then the local production of a statuary bronze. In the current research, however, no link can be established between this statuary and the earliest examples of bronzes have been unearthed on the territory Cambodia.

The first Khmer bronzes

The early khmer bronzes is reasonable to assign an identity properly "Khmer", are attested only from the seventh-eighth century, or only the end of the pre-Angkor period,

when several successive political entities in Zhenli regional. Extremely limited in number, they are almost entirely composed of statuettes of reduced dimensions, with the notable exception of the few witnesses was already mentioned a monumental sculpture. Most of them address iconography Buddhist, mostly Mahayana Bodhisattva images (especially Avalokitesvara, but Maitreya) are indeed very large majority, with only a few representations of the Buddha and Hindu images very rare. No conclusion can however, be drawn, given the gaps in the literature. It remains very difficult to integrate these bronzes pre-angkoriens the stylistic frame and time set for the lapidary art. Thus, among the documents produced at that time, only the whole Buddhist bronzes found at Prasat Ak Yum, in the Angkor region, seems clearly attributable to the style of Prei Kmeng is about 635-700 AD . The statuettes made the day, Maitreya and Avalokitesvara five, are in fact wearing a simple cloth wrapped around the hips and held by a cord that serves as a belt, but wearing āmuku decorated roving falling in coves, many peculiarities of this style. But because of specific details (length of the garment, fit the bun, or still differences of modeling), they would have been different variants (Dupont. 1955: 157,163-164) (Fig. 28-29). If this set is indeed isolated, other bronzes, however, show some nearby lapidary style with statuary. This is particularly true of a statuette Visnu discovered in a town near Eo Oc. With four arms and three of its characteristic attributes (club, ball and shell), the god wears a miter flared slightly upward (Fig.30). The statues has been linked to the family stylistic Visnu mitred, well known by many examples scutures. It have also been made from a model made of stone, probably an idol installed in a sanctuary, it would have been twice as portative idols. It is clear however that most of the bronzes pre-angkor beyond any allocation not only because of their stylistic peculiarities, but also various "Influences" Foreign (southern India, Dvaravati, Champa, or "Indonesia") much more sensitive than the statues pierre (Boisselier .1955: 279-280 ., 1966: 326). Moreover, several of them, considered "Khmer", have certainly made that imports. This is particularly applicable to the statue of Avalokitesvara of Kompong Luong (Takeo province), which may be purely a work of Cham, or for both statues of the bodhisattva found at Phnom Ta Kream (Battambang province), which Originally the 'Indonesian' (Malay Peninsula and Sumatra) seems the most probable. Other parts would have made more copies of foreign models very loyal, while issues of "workshops" Khmer bronze. Finally, always a stylistic point of view, should be

studied separately statuary monumental bronze Angkor era and the few elements that were

preserved. It should be noted first of all, about large feet discovered Phnom Bayang, only their high heels, prominent feature common to all Pre-Angkor works, let's connect this period. In addition, it is highly probable that he received a mobile ornament, probably necklace bronze or silver, a practice there too Angkorian. From these characteristics, but also several historical data supplied by other finds made at Tuol Kuhea, Lan S. proposes, with some caution, to date the work of the late seventh or early eighth century. The bull Tuol Kuhea, bronze high silver content, and could join the statues of precious metal or more known less on the same date by the inscription k 124. This brief stylistic analysis of the first Khmer bronzes has identified Several trends are suitable for production of the Angkor era. However, it does not be complete without the study of other works in bronze finds on the plateau Korat, which are also inscribed in the context of pre-Angkor art, but remain difficult to classify as Khmer bronzes. For this reason, these parts will be treated in a separate part.

7.2.2 Bronzes in Angkor time

Among the bronzes in Angkor time, they carefully tried to refer on art, its decoration and its technical product. In latest century they fund some the artifacts like, The Maitreya at Wat Ampil Teuk located in the province of Kompong Chhnang. It also represents an excellent indicator that shows the super position the art of bronze compared to the styles of the lapidary art. The belated nature of his costume, Sampot a non-pleated effect recalls the style of Preah Ko and the late ninth century (875-893 AD approximately).

Rather, the appearance of his aberrant jatāmukuta, made of braided strands and covered

coves adorned with curls, hairstyles clearly announces the eleventh century. Mixing both reminiscent of past styles with specific traits that appear only later, the room was reasonably dated from the half of the tenth century. The bronze products in the following century reflect, in turn, greater loyalty lapidary and statuary have been studied as works of Baphuon style.

Whether its Sampot or Sarong, it is a garment heavily indented on the front and up high enough above the kidneys. The Sampot presents also a post link that allows you to attach the tail to the belt. Such an adjustment is reflected, for example, a male bronze deity statue found in Phnom Bayang (Mauger 1936: 626, Boisselier. 1955: 281). But beyond these similarities, the several innovations appeared at the same time, in particular to represent the dress and adornment. It should be noted first that the only Sampot present any draped in hand, however, often an adjustment in the statuary lapidary the time of Baphuon style, but is however already surrounded by a border. The belt, in turn, often embellished with an anchor as reported, its form differs from much more elaborate that known for images of stone.

Finally, the small bronze sculpture fields are distinguished by a greater richness iconographic, with both Buddhist statuettes as Brahman, but also with first witnesses of wildlife art. Note also that the workmanship of some of these parts, broadly comparable to the works of larger dimensions.

The bronzes of the style of Angkor Wat (1100-1175 AD approximately), the transition between the styles of Baphuon style and Angkor Wat style is in fact "almost gradually (Giteau. 1965: 138)" where a certain difficulty to distinguish what belongs to the past of what is the Angkor Wat style. For example, the costume of most statues and bronze statues produced during this period is characterized, of course, by the same board, top folded down, but nothing prevent and the oldest adjustments added to it.

A statue of Harihara, taken from Pursat province and dated the first half of twelfth century, and is a Sampot indented, which directly recalls the style of Baphuon but with an upper edge folded around his tail (Boisseleir. 1955:281, Giteau. 1965: 144)

In addition, all clothing now are adorned with an anchor, often very complicated and more attached to the belt. Similarly, for the hairstyle, the tiara and chignon cone spreading. The tiara, which is no longer tied behind the head, is the type "crown" and most often embellished with finials, a decorative motif that appears rather late in the lapidary sculpture. Finally, a rich goldsmith adornment continues be used to adorn the statues and bronze statuettes, while the beginning to be also represented in stone arts. On the other hand, the style of Angkor Wat, Buddhist statuary and diversified types

iconographic "new" bloom both in the stone in bronze. The type of Buddha adorned in particular, certainly known from the eleventh century, was frequently represented standing or sitting in the posture of meditation on the Naga Mucilinda. This iconographic, more specifically Khmer is very representative of the style of Angkor Wat.

And in early twelfth century, the production of bronzes seems to be characterized by a very net diversification. At that time and during the following decades, the Khmer bronze would indeed cast a large number of domestic and ritual objects. Again, the quality of execution in these parts is second in any of the works of major dimensions. This diversification of production still continues till the end of the century. These are indeed held by many idols of the Bayon style. Again, the differences between styles are much less clear in the art of bronze in lapidary art. The bronzes of the Bayon style (1177-1230 AD approximately), the several bronze images in Bayon can be reasonably allocated, due to peculiarities of dress and adornment that reach those of the stone status produced at the same time. The costume of most of the idols women and takes a type well attested: a Sarong adorned with flowers, with free pan triangular, often richly decorated and maintained by a wide belt with pendants. However, among male idols, only a few images are represented with Sampot are very short style, the anterior anchor pan that also maintains a single large belt. Such a suit is found, for example, a statue of Avalokitesvara in Khleang, the north of Angkor Thom and so due to the late twelfth or early thirteenth century (Jessup, Zephire. 1997: 312-313.); (Fig. 31).

So the Buddhism is developing an important Mahayana iconography. Images of the Buddha sitting on the Naga dominated, along with representations of the Bodhisattva Avalokitesvara and Prajnaparamita. These three deities are represented in isolation or conversely, grouped in Triads, the most popular type showing the Buddha in the center, with its Avalokitesvara , right and the Prajnaparamita its gauche (Coedes. 1947-1950: 100-101) .

Besides the style of Angkor Wat, one of Bayon style is the most widely represented in the furniture and let them easily identify, the scene using a rule of the themes of architectural decoration, the same indices of time relatively safe. It also stands out by a "taste of virtuosity (Giteau. 1965: 156) ", with bronzes often loaded with decorative elements - at the end of style above. They also found in the region of Mongkol Borei in

the Province of Banteay Mean Chey, whose decor reflects extremely complicated. Each element is indeed the support of a particular setting: praying figures, Garuda, an attitude of flight, or head of Naga.

Finally, it should be noted that the production of bronzes is still going after the style of Bayon.. These bronzes remain generally adjustments related to those styles of Baphuon, Angkor Wat and the Bayon, but simplifications - new or details - they have demonstrated their lateness. On the other hand, when implanted in Cambodia Theravada Buddhism in the thirteenth and fourteenth centuries - and perhaps even as early as the late twelfth century, the Buddhist image enjoys a revival.

So the research on the art of bronze in the Ancient Cambodia has, among others, identified several innovative policies that participate in the renewal of the study of Khmer bronzes. First, the use of more frequent of the new analytical techniques has helped to improve knowledge of various metals used in them. Several hypotheses on the various sources of metal used to date former can thus be advanced.

8. The Role of bronze arts and its functions

8.1. In statuary

8.1.1 Architectural decorations: bronze medal in architectures

While the bronze coins in connection with architecture, evidenced at the times Pre-Angkor and Angkor are poorly represented, which could leave Assuming a restricted use of them. Do not forget as long as they have no may have been the first elements of the sanctuaries, with deposits sacred, to have been looted. Some examples, however, retained the advantage of having been found in situ. In addition, using the archaeological record, it seems possible to identify within the sanctuary the original location of certain parts. Among the bronzes are used in construction, are first spikes, used for chaining blocks of the same seat. Double-T, they are generally plomb 42 sealed. It appears that iron anchors, certainly easier to acquire, have most often been used. Center plates of bronze were also found in several temples, and Angkor, pre-angkor. Very thick and form hemispherical, they were destined to receive the pins for gates wooden doors. They and were housed in cavities formed in the slab of the threshold. Their fixation was

done two ways: by the studs, which were embedded in holes specially equipped, or even by a lead seal. These systems have no may have been used concurrently, as indicated by the discovery of strainers responding to both types of fixation on the same site Bassac (Marchal. 1939: 144-145); (Svay Rieng province). Other examples are also documented in the Angkor region. Thus, in the north gopura of the sanctuary of Chau Say Tevoda, was unearthed a pair of center plates at each of its entrances, north and south. Different size from one gate to another, they were in both cases inserted into the slab cut inside and sealed with lead. In addition, one center plates of the southern gate, was still in place the pivot of the gate, whose decomposed woody debris were caught in a bush round bronze (Mauger. 1936: 627 ., *JF*. 1924s, 1926:184-185 (Fig. 32-33).

Regarding the architectural decoration, it should first mention elements crowning bronze, best known for the sanctuaries of the time Angkor.). About a pattern in bronze was also found in the immediate vicinity of another gate of Angkor Thom, the Door of the Dead. Probably belonged there, too, the ground terminal which had crowned the tour (*JF*. 1924-1926: 142) (Fig. 34). It is therefore possible that each of the five gates of the capital, built under the Jayavarman VII, has received a terminal pattern in bronze, or other Trisuli. Other types of caps, shaped vajra of triratna, or stupa reduced, are effect evidenced by the bas-reliefs of the Bayon and Banteay Chmar at that time. By Moreover, other examples of Trisuli were discovered during work release of several shrines. According to J. Boisselier, however, they would size too small to have been used as parts of coronation. It proposes to considered as potential attributes of mobile statues, including giving the example Trisuli a bronze, about 25 centimeters, found at Preah Khan Angkor. However, the post that this seems to confer a greater role in compared with architecture (Boisselier. 1966: 185); (Fig. 35) and other two types of bronze coins are also involved in architectural decoration sanctuaries: the liner plates and decorative inlay. The former are first documented in some pedestals. In the region of Angkor, the temple-mountain of Ta Keo, begun under the reign of Jayavarman V (968-1000), presents several examples sanctuaries in its corners. Although the setting of these metal pedestals has disappeared, but it still exists for sealing the holes to receive, regularly spaced, with some remnants of the sealing plomb (Parmentier.1935b: 277, Boisselier. 1966: 215).

However, these plates coated seem mostly to have played an important role in the major foundations of the reign of Jayavarman VII (Banteay Kdei, Ta Prohm, Preah Khan, Bayon), whose sanctuaries main have certainly been covered with golden bronze . Reflected in their walls internal and external, which are, again, holes drilled on a regular basis, for receiving such a coating. Some fragments of gilded bronze plaques, about 1.5 cm thick, were also uncovered during the work release of Preah Khan. Most were twisted and torn, which shows clearly they had been torn from their anchors. Moreover, it is interesting to note the discovery of one of these fragments of plates at the base of the building round columns located between the second and third speaker of the sanctuary. The mass of this base is indeed made of sandstone blocks or molded uncut: it would be very possible that he, too, received a metal decorative.

Finally, decorative inlay in bronze, for carpentry, have holes allowing their fixation in spikes. They would, in particular, adorned the doors wood doors. An image in the stone is supplied by the false door that possess many of sanctuaries Angkor. In addition, a whole suite of rooms decorative gilt bronze, found at Tep Pranam Angkor Thom, lets get a idea of the composition of such a setting metals. It includes major square plates richly decorated, without doubt destined to beat the dice, and Quatre, which were attached to the panels (Fig. 36). Other reasons bronze always using the same attachment techniques are also known. And were found in Bassac sconces shaped lanceolate, whose cells have received vitreous (Marchal. 1939: 120-121) inlay material. We should also remember the discovery in Phnom Bakheng. Many patches in the shape of a flower rosettes reproducing blossomed. These, which have the distinction of being devoid of any fixation might have been inserted insets stuccoes . The study of bronze coins in connection with the architecture thus allows better understand the original state of various shrines, especially for their decoration architecture. Within these, some bronzes or sets of bronzes found and their locations and functions first. This analysis of both spatial and functional still needs to be extended to images and other bronze objects that meet the needs of worship celebrated in these sanctuaries. Only a limited number of bronzes, precisely localized or grouped in assemblages consistent, however, will be studied.

8.1.2 The needs of worship: furniture and bronze images

- Study of bronze images of monumental character.

It is clear that many of the major cult images produced by the bronze Khmer were found in the same sanctuary where they had been spent. Indeed, their often considerable weight has preserved the repeated motion at early date, and in some cases, prevented the raiders to recover their full metal. It was so particular Visnu Anantaśāyin of Western Mebon whose original provision in the sanctuary appears to be partially restored, although number of questions continue to arise. It should first be recalled that the bust and various fragments of the idol was found in a well laid out within the median Central sanctuaire. However, the well and the statue seems clear correspond to two distinct phases of his construction (Dumarcay, Royer. 2001: 23 , Dagens. 2003: 120).

At the beginning of the eleventh century, parallel to the realization of the Western Baray, the Western Mebon was apparently first developed as a kind of "temple- Nilometer, with a well-shaped li nga inverted which was linked to the large tank and indicated the level of its water (Fig. 37). Then, in the second half of the eleventh century, the median of the sanctuary would have had a profound redevelopment, including the translation would have been a religious passage of Saiva worship original to a new cult visnu. the sanctuary is still operating at that time as "Temple- Nilometer". Certainly, Zhou Dagan described at the end of the thirteenth century, in the middle of "Lake East "- often considered an indication of orientation error on his part between Eastern and Western Baray, a sanctuary where the statue of worship is "a lying Buddha bronze, navel leaves continuously flow from the water (Pelliot. 195: 12). This testimony immediately been linked to the discovery of the well and Visnu Anantaśāyin "Nilometer" that is supplemented with a small pit square 60. According to a "traditional" interpretation, water from Mother baray would have sprung from the body of god, before being collected in the pit located close (Pelliot. 1951: 142) .According to Mr. J. Dumarçay and P. Royer, the redevelopment occurred in the second half of the eleventh century. Zhou Dagan had indeed seen the statue of Visnu Anantaśāyin, but his description would have

made of it does not may not be followed to the letter and would not perhaps at the suggestion of a ritual observed in the sanctuary and misinterpreted.

Furthermore, other data, provided in particular by the archaeological record, could still bring new elements related to the original layout of the statue. First, it is interesting to note that a very large quantity of glazed tiles butt and other roofing terracotta have been excavated in the immediate vicinity of the central islet. Thus, light structures might have protected the idol, unless they have previously covered the well "Nilometer". On the other hand, two hands in bronze have also been found in one place. Also larger than life, However, they are smaller in size than those of Visnu Anantaśāyīn and could belong to the same statue). The hypothesis presence beside Visnu Anantaśāyīn another bronze statue of great size, Laksmī perhaps, can not be completely rejected . Apart from the Angkor region, some examples of provisions worship provided for bronze images of monumental character are also known. Thus, it should again mention the case of large feet discovered in Phnom Bayang. These have been unearthed in the hall of a shrine annex, located immediately south-east of the preliminary Prasat central body. They were still sealed lead to a large sandstone slab at the corners arrondis (Mauger. 1937: 257) (Fig. 38). instead of their discovery does not correspond to their original location. Based on the most old inscription found on the site (K. 13), dated Saka 546 (AD 624-625) H. Mauger has therefore proposed to replace the colossal bronze idol, identified a Siva, in within the central prasat, which in its first state, was specially designed to serve as frame. A brick base was built there would be particular to receive the slab on which was fixed the statue (Barth, Bergaigne. 1885-1889: 36,38) His interpretation of the inclusion would however considered with the greatest precaution.

Finally, even if large images of bronze or precious metals (gold and silver) were not retained, the traces they have left in the stone are sometimes visible. An example is provided for the sanctuary of Preah Vihear, which overlooks the plain Cambodian from the heights Dangrek (province of Preah Vihear). H. Parmentier there indeed recognized by its north porch a rectangular pedestal which, because of the groove that this parallel to its edge and square, would have been the edge of a plinth

metal. Given the shape of the pedestal and the Saiva destination of the monument, it was probably a metal image of Siva.

Admittedly, these bronze images of monumental character, very limited in number, do that are special cases. Often found in situ, however, they allow better understanding of certain provisions of worship practiced in the Khmer sanctuary. Furthermore, other data relating to this time of bronze images of dimensions smaller, often associated with a cultic furniture more or less complete, may yet be obtained through a review of the archaeological record.

- **Study of assemblages of worship use.**

There are only a few examples will be presented to illustrate different types furniture used in worship sanctuaries. It must be remembered however that, their dimensions, these objects of worship have always been used easily transportable. It is therefore extremely difficult to precisely place within a sanctuary. Often found with other objects of the same destination, but they seem to be assemblages of relatively consistent. That is the case, in particular, several provincial bronzes from the site of Bassac. Nestled beside a river, a few miles south-east of Svay Rieng, this site has been the subject of archaeological work in the early twentieth century. Three brick shrines, completely ruined, were then released. However, only the largest of them, located one hundred meters south of the river, would have delivered bronze objects. These were found in the central shrine Prasat, inside a rectangular wells bricks laid in the center of its (Commaillie. 1902: 264). The furniture uncovered consists primarily of several elements of statuary Brahmanic large despite their condition fragmentary: a statue of Shiva, another statue of deity and a male torso and fragment corresponding likely face two other statues (Marchal. 1939: 87-90). These bronzes attributed to the style of Baphuon date from the eleventh century (Fig. 39-40). In these cult images, add more statues, also in a fragmentary state. This is the case including two representations of the god caturbhuja Visnu, which remains the only torso (Marchal. 1939: 104-105, 114). Other items that have completed this set of furniture used

in worship, we must mention a pedestal bowl for ablutions, another pedestal fragmentary decorated frieze, a foot support quadrangular shaped, another foot of "lamp" or still cymbals (Marchal. 1939: 115-117, 124-125, 137). However, much remains unclear whether this whole furniture was used within the sanctuary where he was discovered. Indeed, some objects could also come from two other shrines known Bassac, or a sanctuary

neighbor. Furthermore, it should also integrate the study certain sets of bronzes Worship uncovered by accident. Even if they can most often be traced to a Sanctuary precise, they indeed provide examples of furniture worship more or less complete. in the region of Mongkol Borei (Banteay Mean Chey), have been found in various earth objects in bronze, which would initially concentrated on a single Buddhist altar. This set of furniture use indeed worship consisted of two statues of deities, and doubtless Avalokitesvara Prajnaparamita, a shell fragment in holy water, a ritual bell, two vajra, two tripods with feet and a naga relic ring, perhaps a fragment of a lustrale (Grosselier. 1921-1923b: 226-228, Jessup., Zephir. 1997: 322-324)vase water (Fig. 41).

Based in part on data from the archaeological record, the study of uses and functions of the bronze in the Khmer sanctuary can provide some shade made the observation that G. Coedès on the origin of Khmer bronzes. In a number of cases, bronze or bronze sets can indeed be reasonably placed in defined areas of the sanctuary where they had originally been used. Thus, their primary function is frequently clarified or confirmed. After presenting several examples of furniture made of bronze in their original context especially religious, he now needs to look at different displacements and reuses they could be at different times.

8.1.3 In a ritual foundation: bronze sacred and deposits

The importance of ritual ancient of Cambodia imposes the new sanctuary receive "foundation" which help to impart a sacred character. Objects widespread looting, however, are rare deposits remained inviolate. The epigraphy or traditions also do not refer to them. The provisions of worship which led to their realization, however, have been revealed as and when the advancing work of clearing the old shrines, mostly those in the region of Angkor. More than seventy foundation deposits have been discovered by Conservation, but

only two thirds were found in situ. It should also be noted that other examples are certified to provincial sites. He is not here to detail all the provisions of worship known to the sanctuaries of the Angkor period, but only to understand in which specific cases

Bronze was used to meet the needs of specific facilities that were the foundation deposits. Under this functional analysis, it will necessary to take into account all types of known deposits, which vary depending their position within the sanctuary. J. Boisselier distinguishes' deposits essential "secondary" (Boisselier. 1966: 205-210) deposits. The former, which are still in the central axis of the sanctuary include first the foundation deposits themselves, prepared at the original soil. Very rarely preserved, it seems impossible to establish a typical composition. According to Boisselier, However, more deposits have included at the bottom of a single cavity, a main depot boxed, often bronze, and various gemstones and metals. At the same axis as the foundation deposit is usually a series of other sacred deposits, directly under the idol of the shrine. Thus, the pavement where fits the pedestal of the idol in the center often has a cavity, whose shapes and sizes are specially designed to accommodate a stone deposit. In Furthermore, the bottom of the cavity itself is dug five wells arranged in staggered rows, which receive a deposit of nature rather variable. Such a device is certified for the XI century the sanctuary north of Prasat Trapeang Run³⁴ (Siem Reap). Yet its pedestal in place was drilled from top to bottom with a square vertical channel, which had a stone block deposit cubic seventeen alveoli (Pottier. 1997: 402) . As for the cavity which receives it contained in its five subjects with different cells, next to the bronze, quartz, silver, iron, or more gold. But other devices are also certified foundation. Thus, within group Angkor Prasat, Prasat North Bay would Kaek presented by BP Groslier "One of the most curious devices known far foundation." Still observable despite several disturbances, organized around a vertical tube made of bronze, strictly axial and welded to the center of a square plate of silver, which itself was based on plates Bronze assembled together. This tube passed through a brick Pintail, which was to support the depositing the stone idol. site. A final type of "key deposit" is made by depositing slabs above, inserted in the top of Prasat, within a cavity in the foundation beneath the capstone. Prasat Kok Po, also located in the Angkor region, has delivered a unique example in bronze (Marchal. 1937: 376). Admittedly, this slab was not

found in situ butrested on the brick paving of the hall long before one of his prasat. Available, reminiscent of the many stone slabs deposit known, however, attests clearly his position. Square in shape and measuring 15 centimeters to one side, it is pierced twenty-two holes, too square. Bronze cubes, hollow and small dimensions were fixed below each hole, presumably to receive valuable deposits of which no trace has been found, however. Although this is a without such other equivalent, it should probably assume the existence of other slabs deposit

Graduate bronze, but who would not resist the looting. With these tiles to deposit always placed in the central axis of the sanctuary, ends the materialization of the latter. According to G. Coed, they have also helped to "establish a correspondence between the world from below and to the world (Coedes. 1940: 332-333).

Finally, "secondary deposits are often placed in cavities more or less important, as a rule of simple cells, formed at the upper surface Assize, or lintels pediments. Such deposits were demonstrated, in particular, several monuments from the time of Jayavarman VII. This is particularly true of the Bayon temple-mountain set in the center of Angkor Thom, where a number of deposits have sacred been uncovered during work anastylosis towers faces set on the terrace Superior sanctuaire. They were found in the upper parts of the face towers at the eyes, forehead, or the crown, and is often on their face. Deposits sacred then rested in cavities hemispherical, more or less deep, and possibly blocked by a plug stoneware cylindrical. Always the same type, they presented in the form of a small bronze cup a few inches of diameter, containing particles of gold, small fragments of quartz, stones, or even metal, all embedded in pure sand. These few examples show relatively well-documented use of bronze in the different types of foundation deposits, such as container, or even contained the sacred deposit, or as the core foundation of devices more or less complex. No doubt the technical properties to the metal, but also its quality material "noble", they explain these functions. They would also determined its use in construction and architectural decoration of the sanctuary Khmer.

8.2. For the furniture and home worships

8.2.1 The use of bronze worship

The needs of Brahmin and Buddhist religions, whether celebrated in shrines or on domestic altars, there were several types of objects have been developed and then melted by the Khmer bronze.

Frequently, the images of worship erected on a pedestal in bronze. They are in order general image of the great stone pedestals, but because of their size often smaller, can only take them simplified their provisions. Thus, some of these pedestals, associated with the Saiva cult, breeding in a bronze vessel *snānadroī* and receive a *linga*, always carved in a different material. Other support one or more deities, grouped into triads Hindu or Buddhist. Bronze frames can also be added to these pedestals to house a *idole*. They are inspired more or less direct forms of architecture, especially pilasters and pediments, and sometimes take on the appearance of a sanctuary in miniature.

Other bronzes are still intended to carry out certain rituals. Such is the case in the Brahmanical cult of the conch, which reproduces the shape of the stylized a triton shell. During the ceremonies, it is used to draw the container or pure water lustral or wind instrument for generating a special sound, they shouted Oh for a congratulaion. It is placed horizontally on a tripod, also in bronze, which is specially elongated to cover its part venture (Grosseleir. 1921-1923b: 224-225: 225). It should be noted that several examples of shells in the ground cotta are also known.

The type reproducing the three points of *Trisuli*. There is also another form of bell ritual she probably also larger, with a loop instead of *vajra* handle. These ritual objects are accompanied by various media, finally, the most common are tripods circular. *Naga*-filled feet supporting a conical crown flared, they are intended to receive an object to be *dished*. Other carriers are still quad, with them as foot-*Naga*, and present in their upper part a circular plate pierced at its center. These could be bases "chandeliers¹⁰⁴. Besides the furniture associated with Buddhist and Brahmanic cults still exist many bronzes whose destination is less assured. For convenience, they will

classified within the same "household furniture". Only a few types of objects well evidenced by the bas-reliefs, however, will be presented.

VIII.2.2_The use of bronze household.

A first category of this section it can be a specially designed the thing whether the palanquin,, medic's litter, bulwark...etc. Several of these pieces are strong analogies between them can hardly be assigned to a particular type of household. It is thus preferable to study according to their form and their destination pieces about one side, hooks and rings suspended other. The first consists of a socket, which allows the socket to a pole, and a ground terminal, usually in the form of Naga. In some cases, however, figures in a round may be associated with this pattern. In addition, several pieces by their same scene seem to have a clearly purpose on the religion, this is the case of particular parts about representing the Buddha sitting protected by the naga (Jessup. 1997: 273-274). For brackets and suspension rings, there are few examples found complete. The hook includes a socket type of ring is also attached to a pole and hook suspension itself. If this socket is often very ornate, the ring, because of its function itself, which has a composition less charged. Parts butt, hooks and rings suspension are subject to numerous representations in the bas-reliefs and have even been described more or less accurate by Zhou Dagan, who observed including palanquins during his stay in the capital Angkor (Pelliot. 1951: 31); (Fig.42).

Moreover, the same category of bronzes includes the support legs of chairs, likely thrones, and hooks elephant saddles. Again, it remains difficult to define what belongs to any category of seats. Both types objects are indeed very similar, with the upper part usually adorned with a head Monster and a foot ending in a cap naga to one or more heads. If these parts from various vehicles and seats are relatively well documented, other types of bronze objects are attested only by rare examples or only known by the bas-reliefs. To complete the typological study, it should just mention the use of bronze weapons (signboards particular), in the adornment (seals, rings, signet of different types, rings, bracelets and earrings), but also as sound equipment (bells, cymbals).

Finally, mention must be still other movable objects, whose role is primarily utilitarian and

whose forms would have little changed over the centuries like footless bowls in form to modern phitel, circular plates, pots, sometimes large dimensional boxes, or media-shaped cut.

In the words of J. Boisselier, the art of bronze in ancient Cambodia thus constituted a "complete art", which was accompanied by the production of idols, monumental or smaller dimensions, but also a furniture meets specific needs of religion or having a destination strictly utilitarian. After presented metallurgical techniques for achieving the Khmer bronzes and various types of objects produced, it should also put this production in the time of ancient Cambodia. It is thus the problem of dating Khmer bronzes and recall the main results of stylistic studies which are devoted to this complex issue.

Conclusions

In China local bronze production seems to have begun as 4000 Bc, it is still in the late Neolithic. It continued to the Xia dynasty (above 2000 Bc.). The object were mentioned to the interpretation by the material remains for a daily life of doing agricultural participation .Locally metallurgical effects in small communities still autoumous settled in the valley secondary river practicing for at least a millennium agriculture. we have notified that during the second half of the second millennium BC, most territories Between the coast of Ghandong in southern China, valley Chind Vin in Burma had growing practiced and metallurgy was occurred,. it mean that the a period had began making by the appearance of the first objects made of copper and printed practical and involves analogy with other regions were it could be used (Higham. 1996: 7)

And the rich bronze objects finds from the evidences of melt techniques between Cu and tin, some of them started beginning to exploit deposits to their merger control and melting of the objects first ,and then bronze mainly to meet their own need and then widespread to the end of Shang dynasty between 1000 Bc and then to the Sang xiang dui culture, Suchun province, China (Hieda sadromi, Al.2008:133), the contains of archeological evidences appeared in yang Zi, yellow river which fund a high quantity of

bronze artifacts, bronze casting and had evolutionary in Erlitou culture for 1700-1500 Bc (Chhun. 2008: 7). All bronze evidences emerged of alligator drum in many site, from Ling Nan, Bac Bo, and in Yunan province, like the Dian site, Wajiabao which found the offering tools with swords, arrowhead, and the knives..etc.

Bronze Age findings in Southeast-Asia were still younger than China bronzes, notified that only between 1500-1000 BC by bronze casting. After this dates, we observe that there is available association with early copper mining at other site, such as Ban Na Di, Non Pa Klauy, Chiang Hian will be obtained during this date, and there would be connected to the artifacts of wearing jewelry, of which bracelet and bracelets and shell beads in the form of waistbands were most common involving of coastal communities. We also the stone bracelet were also obtained from exotic source. Among the bronze offering, bracelet dominate the sample. Bronze were never abundant within a given area across a cemetery as a whole. One more thing we could be observed that the reveal evidences from the excavations site at Kok Phnom Di, a coastal site in Central Thailand, pottery vessels, shellfishes, bracelets...etc. were found, there are also closely similar to the evidences from Samrong Sen site, along Chinit river of Cambodia which both sites were located on the coastal Gulf Siam, about the 400 km from the west. Based on the result of this collection of artifacts contained also the bronze melt, it was the first conclusion of the beginning of late bronze age and early iron age. One of the first investigation concerned chronology, based on bronze items from the local villager, bronze bells, arrowheads, unidentified pieces, Samrong Sen was probably occupied a few centuries before the Christian era, apart from rare case where late prehistoric site included Chinese imports of known age (Higham.1996: 23), though these results, there were also emerged at other local, Mlu Prey site, Anlong Pdao, La Ang Spean...etc. which they supposed ready in item of late bronze age- to early iron age, with containing the little evidence known from excavations.

Despite of the bronzes age was occupied lately, but the process of bronze casting were had never abundant, it was still occupied until the prosperity of iron age, much of bronze artifacts were found, like bronze weapons (adzes, arrowheads, spears etc), bronze jewelry (earrings, bracelets, bangles etc), bronze tools (drums, mirror?, bells, rings...etc.) in many sites of the Iron Age as they have been found in the area of the red soil, circular earthwork

(southeast Cambodia-western part of Vietnam), 52/62 sites, 18 village site ...etc., or also the golden age (Prehear sites), and other more sites of northwest of Country.

Thus the evidences of bronze material, we could see the article of bronze study research, bronze immigrations, source technology by scholars, China were really effected in South east-Asia, including the produced tools, a typical of doing agriculture, especially in Vietnam, Thailand, Cambodia, But in the contrast, it was also considered that the Khmer society has already the cultural greatness in using of these bronze objects, despite of bronze age in this territory little known, and it was emerged lately than China, but it give use an really important inside the range of activities, including the history, economy, religions, ornamentation, trade, metallurgical technology beside the providing evidence from the excavation, there would seen the relationship of the civilization between Cambodia, Southeast Asia and China .

However the use of bronze were still passed longer and practically emerged to the history stage which remaining a bronze benefits for the first in the Khmer sanctuary, which remains the best documented, some or sets of bronzes can be placed in a more or less accurate in its different parts, which found in Angkor period through bronze uses and its functions of what they had originally been used, and many cases of the role of bronzes it was the spiritual field in an architecture of foundation building and decorations, and also for worship in the operation of Angkor period .

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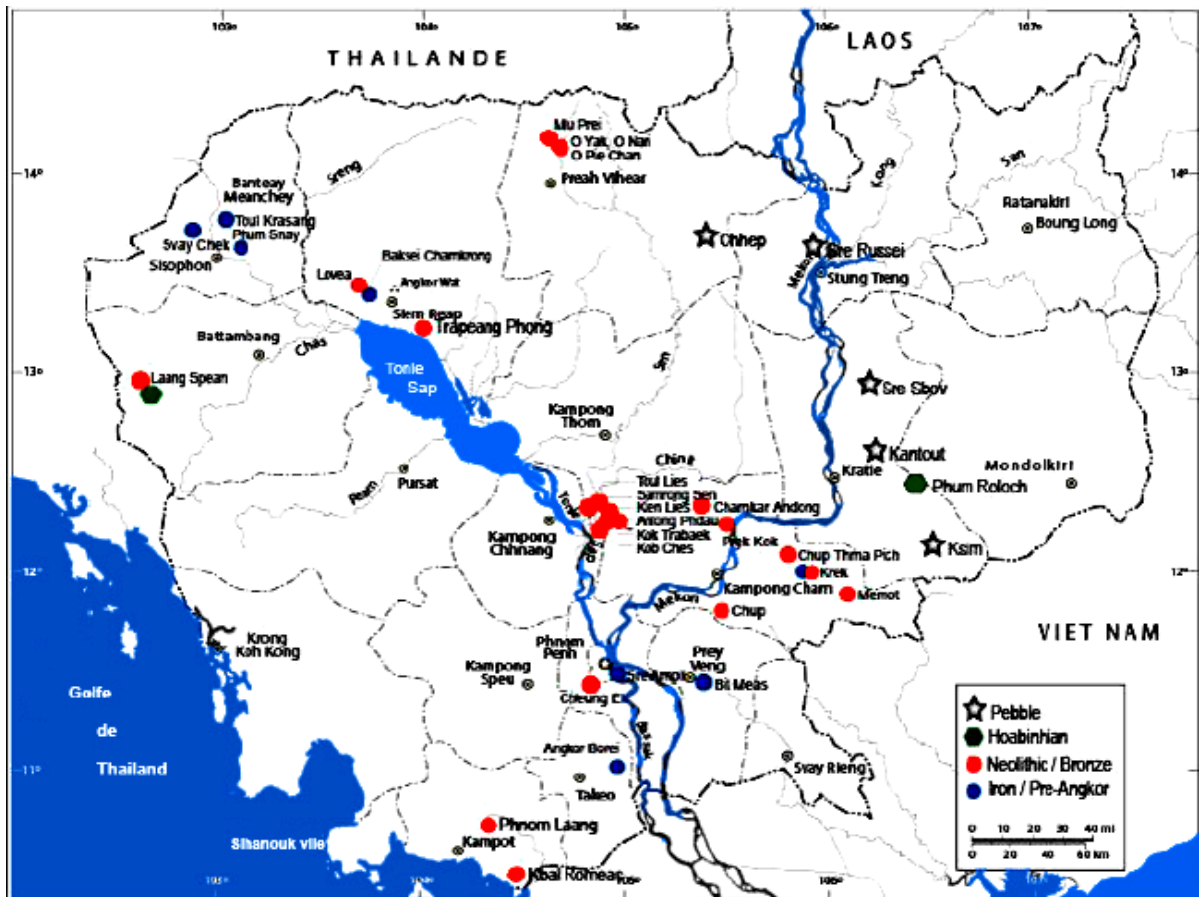
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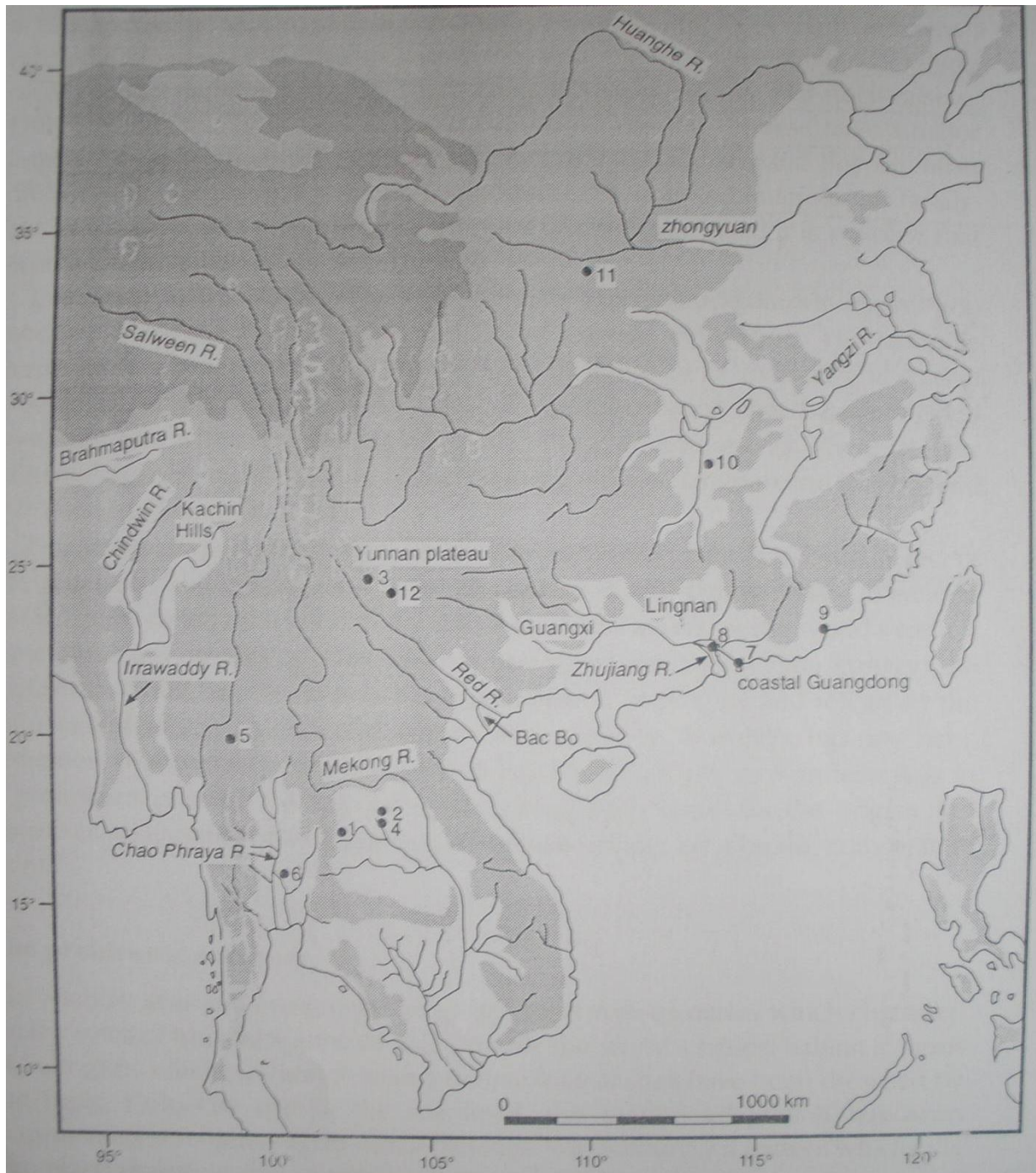
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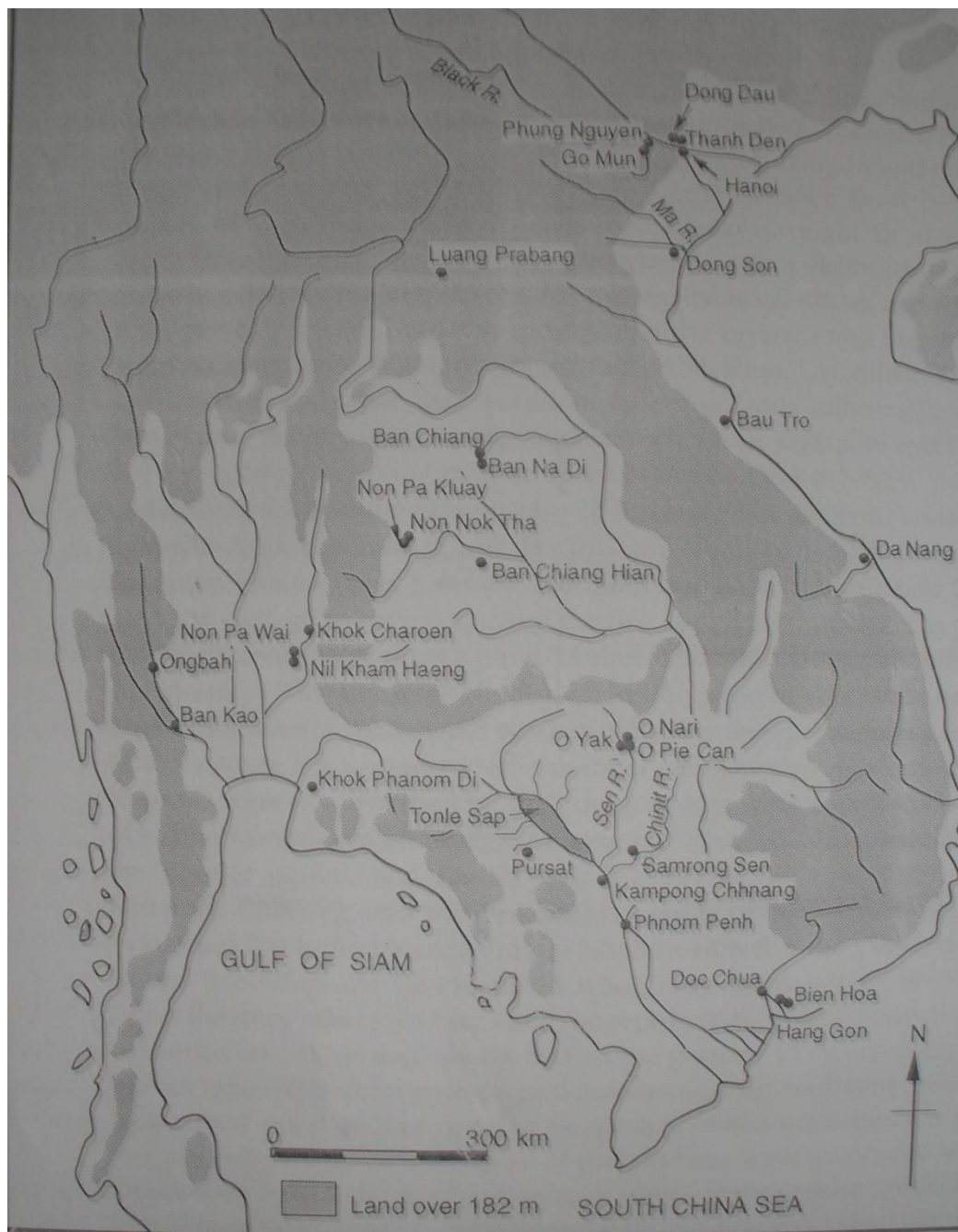
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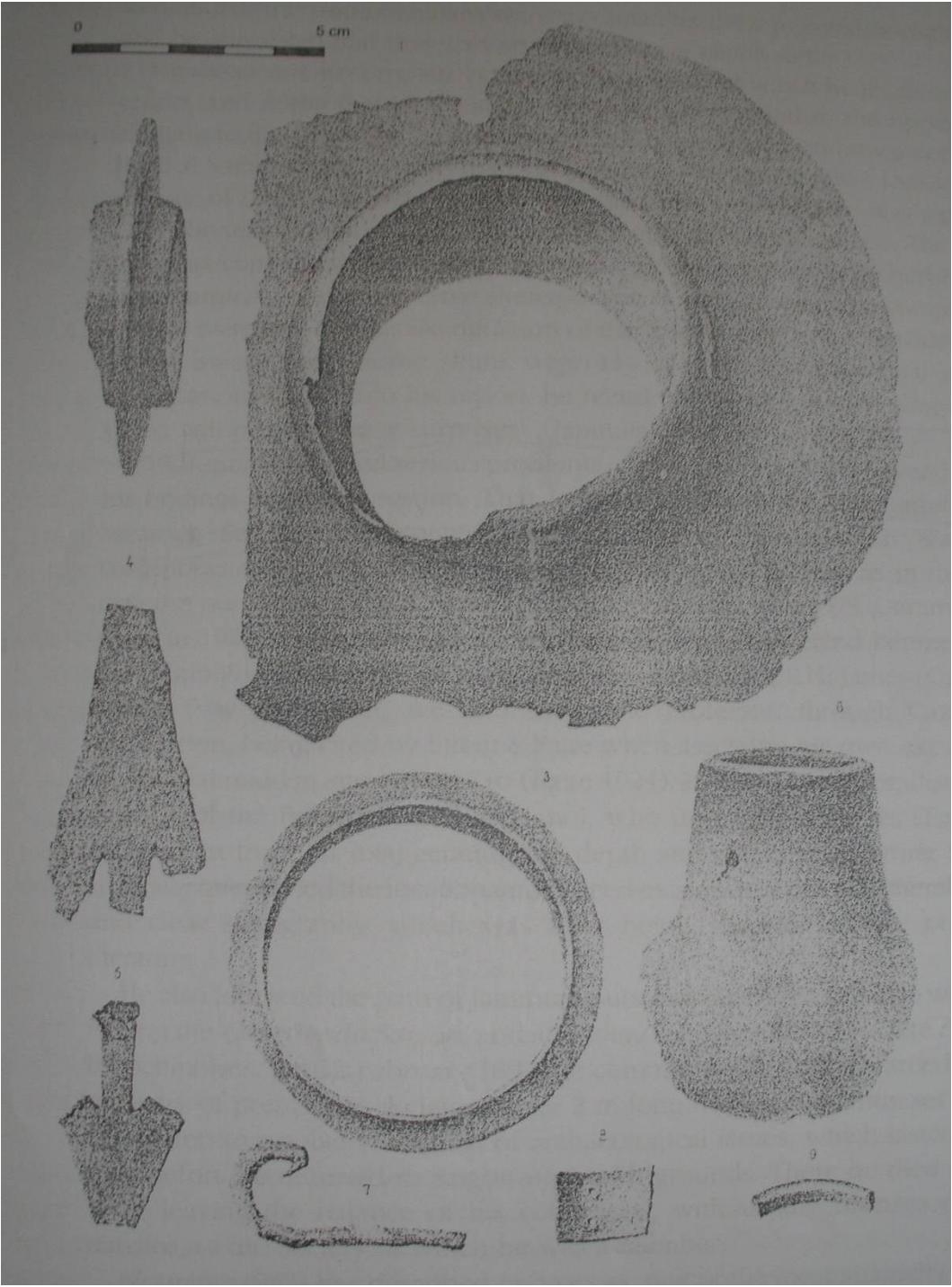


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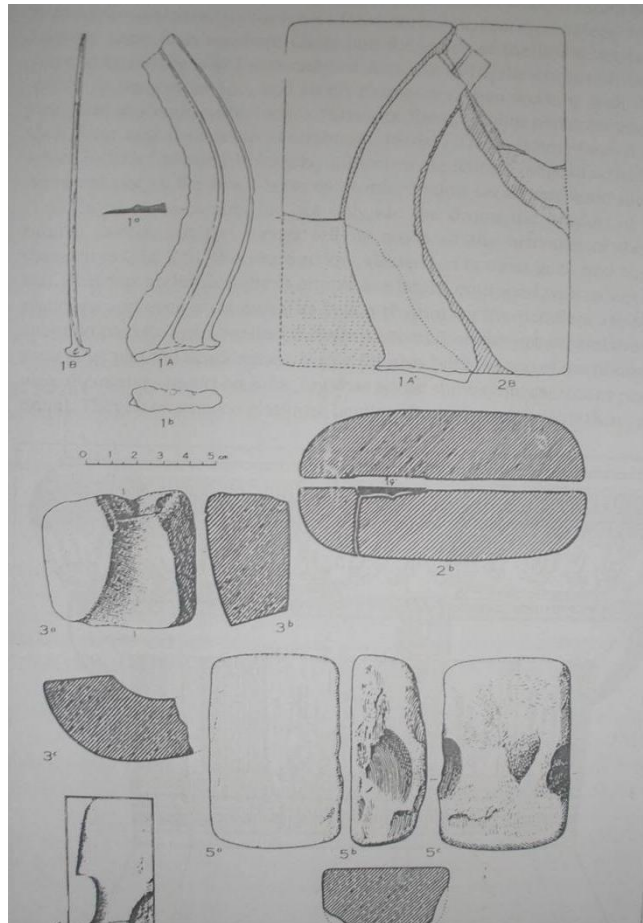


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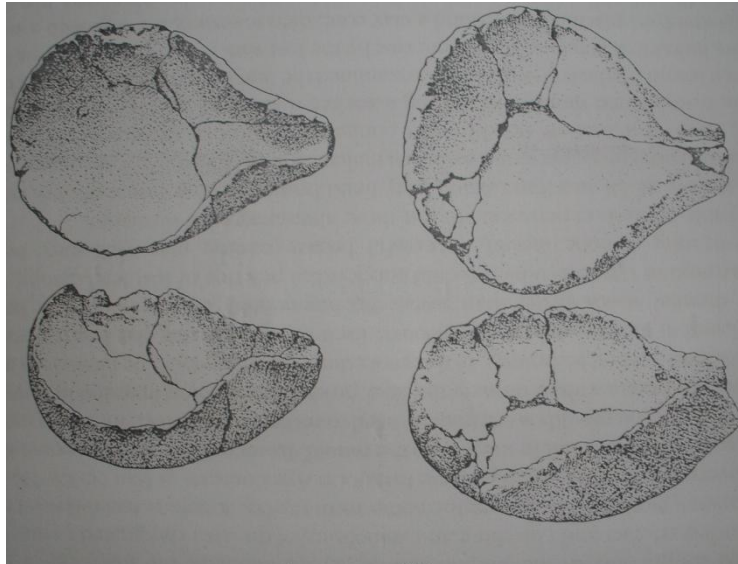


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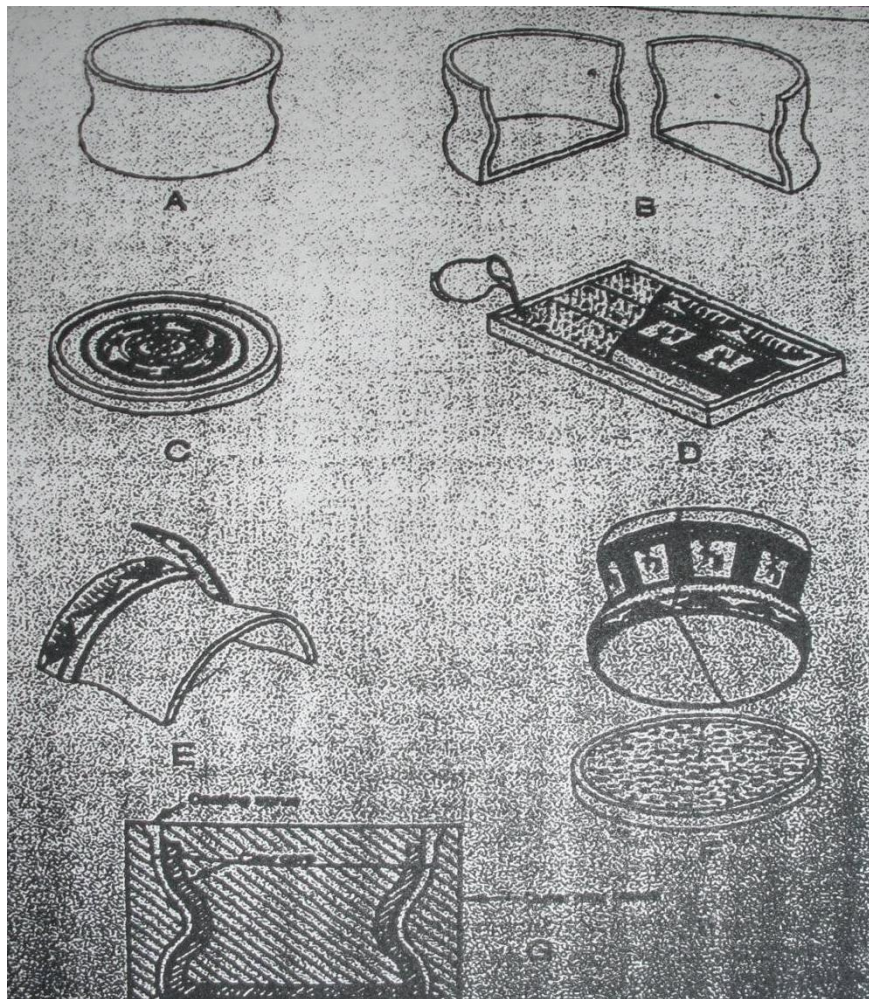


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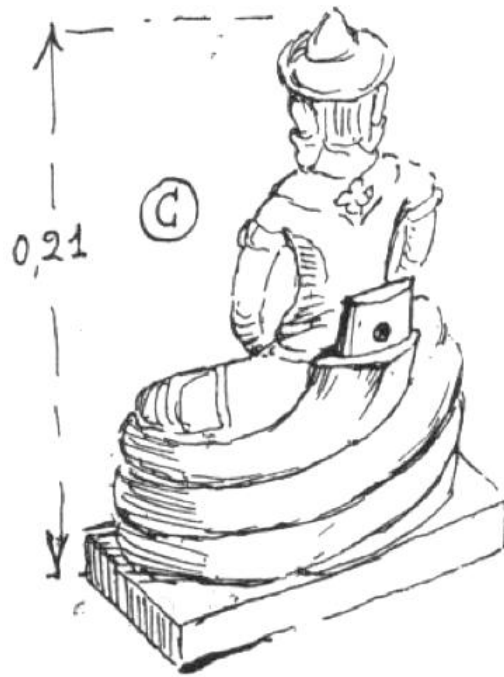


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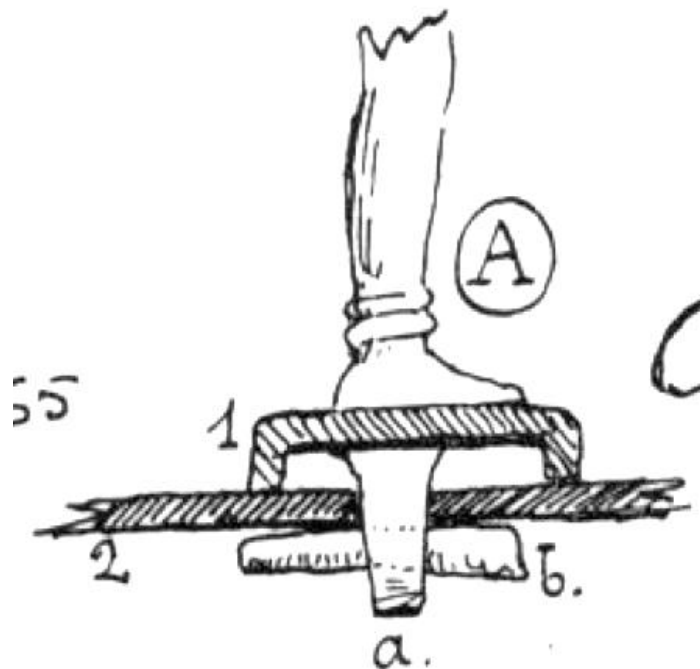


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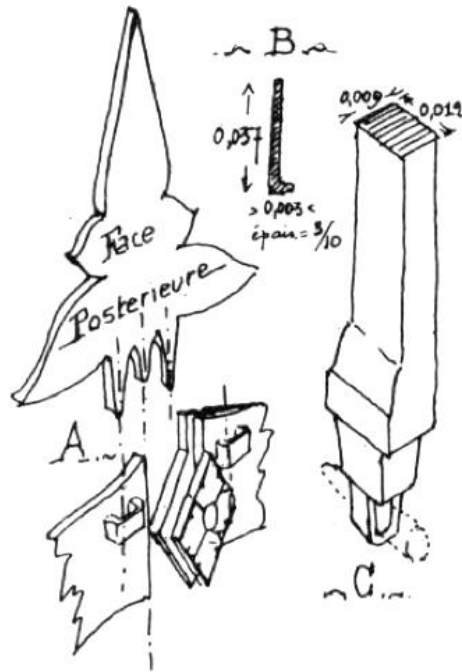


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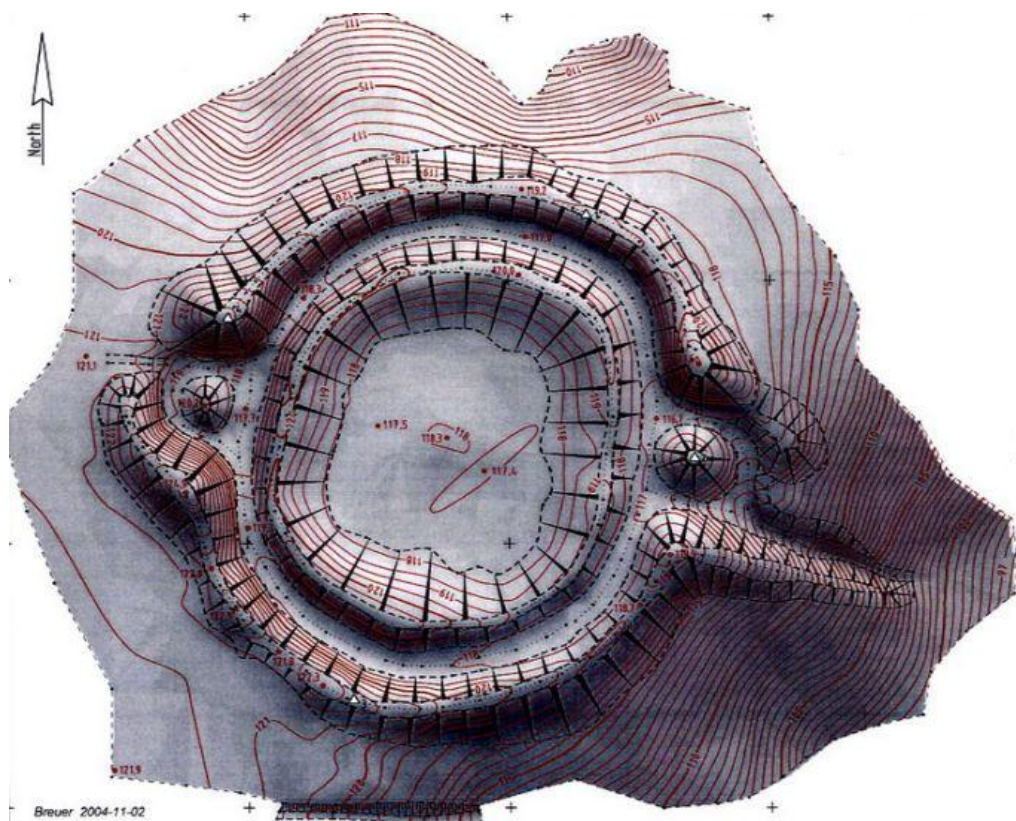


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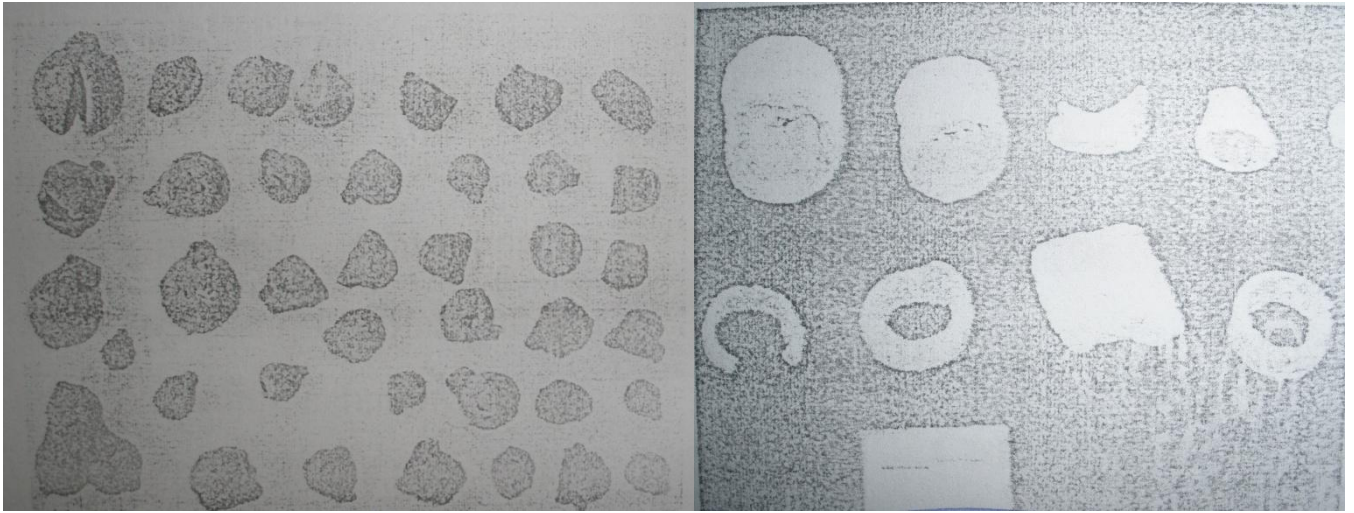


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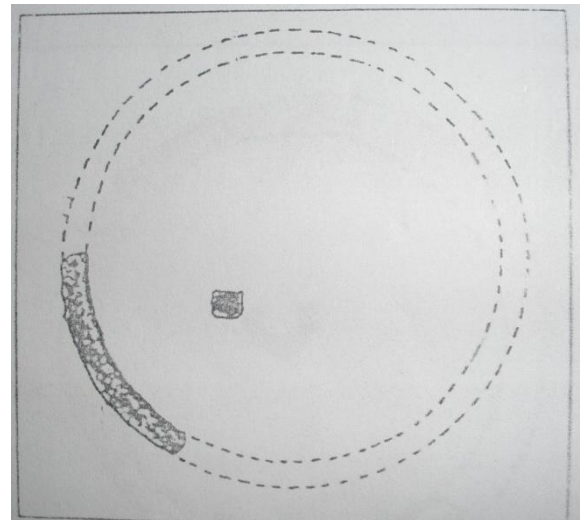
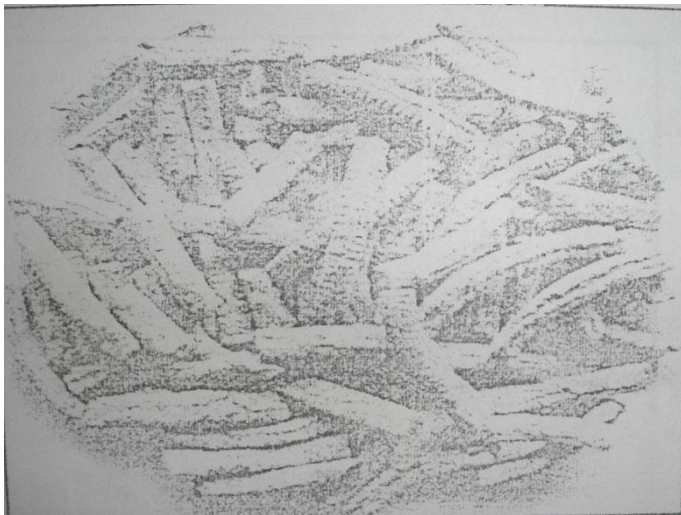


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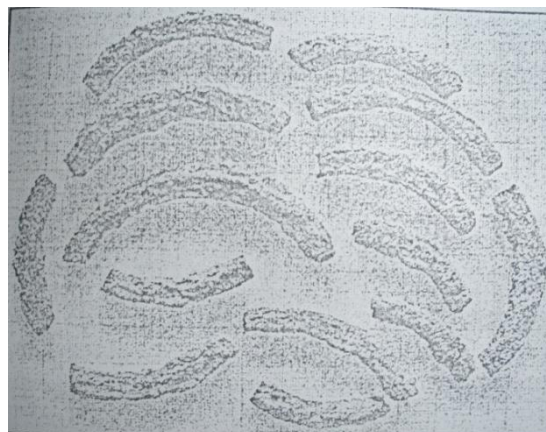


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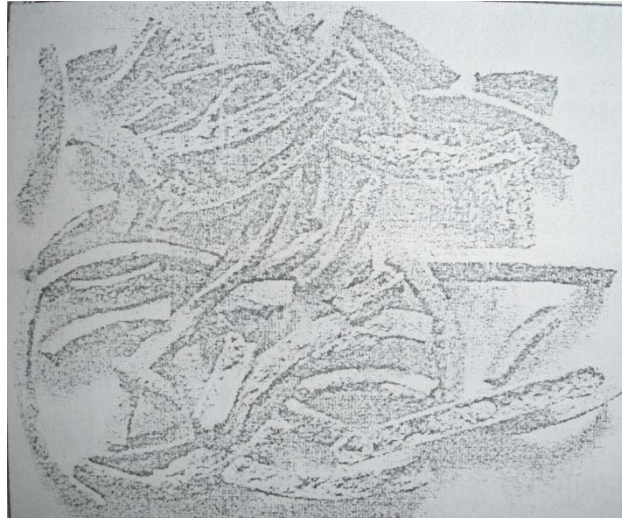


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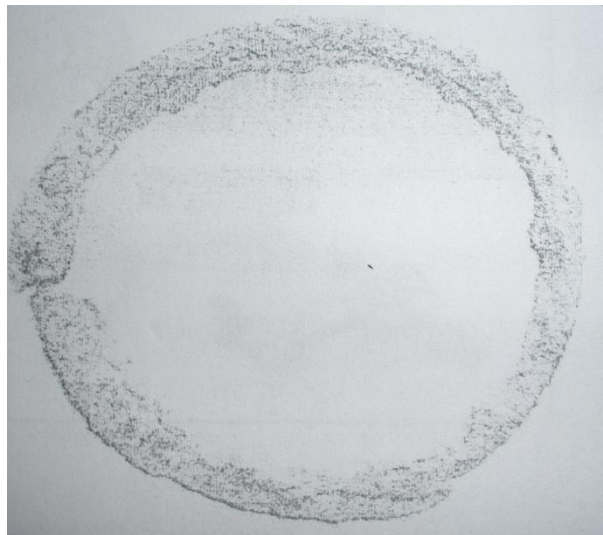


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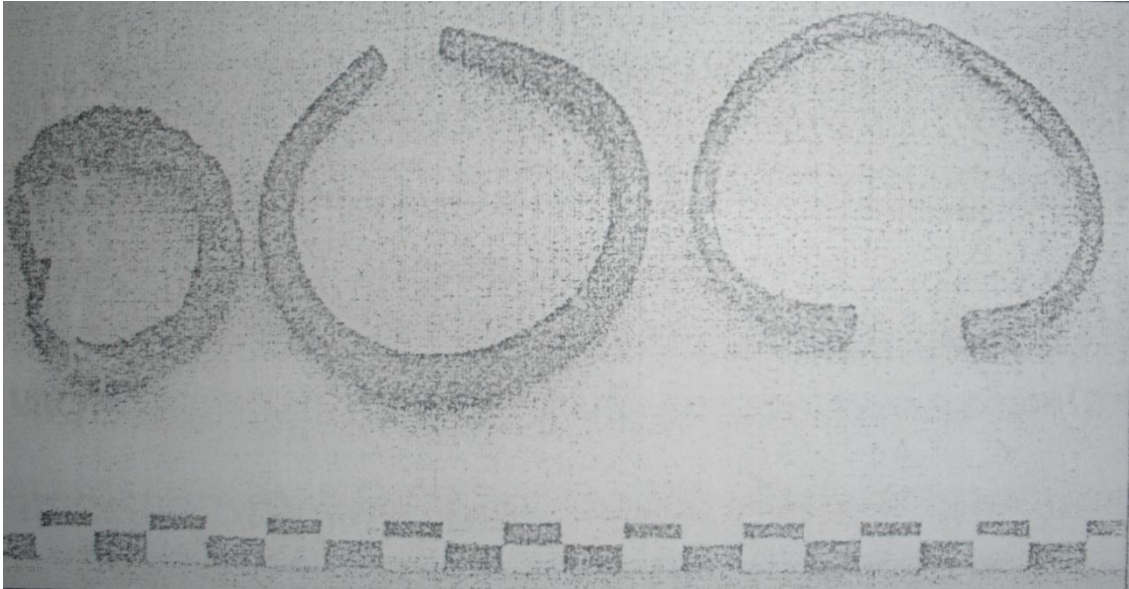


Figure 21: The sixth type of bronze bracelet, and its drawing, Tadong village site. Source: Ratha. 2003: 42

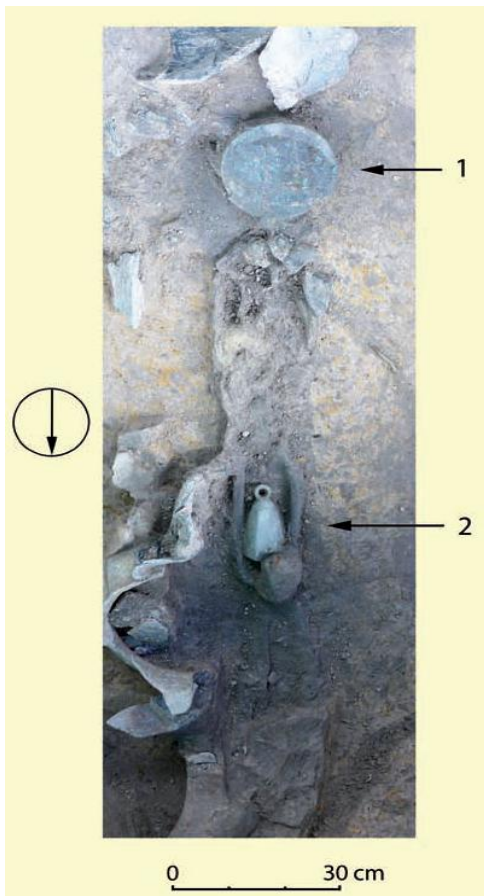


Figure 22: Bronze bells, fund at Prohear excavation site. Source: Andrea; Vin, Seng. 2009: 96



Figure 23: Bronze mirror? , fund at Prohear excavation site.
Source: Andrea; Vin, Seng . 2009:23



Figure 24: Buffalo bracelet of Bronze , fund at Prohear excavation site. Source: Andrea; Vin, Seng. 2009: 55



Figure 25: the second type of bronze bracelet , fund at Prohear excavation site. Source: Andrea; Vin, Seng . 2009: 54



Figure 26: bronze earring , fund at Prohear excavation site. Source: Andrea; Vin, Seng. 2009:56



Figure 27: A decoration of birds, stars on bronze drum. Source: Andrea; Vin, Seng. 2009: 58



Figure 28 : Set of Buddhist statues, at Ak Yum temple (a group of Angkor). Source: Brice. 2007: 32



Figure 29: Set of Buddhist statues, Prasat Ak Yum (a group of Angkor).
Source: Brice. 2007: 33



Figure 30: Visnu "miter", Tan Phu Oc Eo region (province of An Giang, Vietnam) 7th -8th century. Source: Brice. 2007: 34



Figure 31: Avalokitesvara, North Khleang, Angkor Thom (a group of Angkor) Bayon style, late twelfth - early thirteenth century. Source: Giteau., Gueret. 1997: 101.

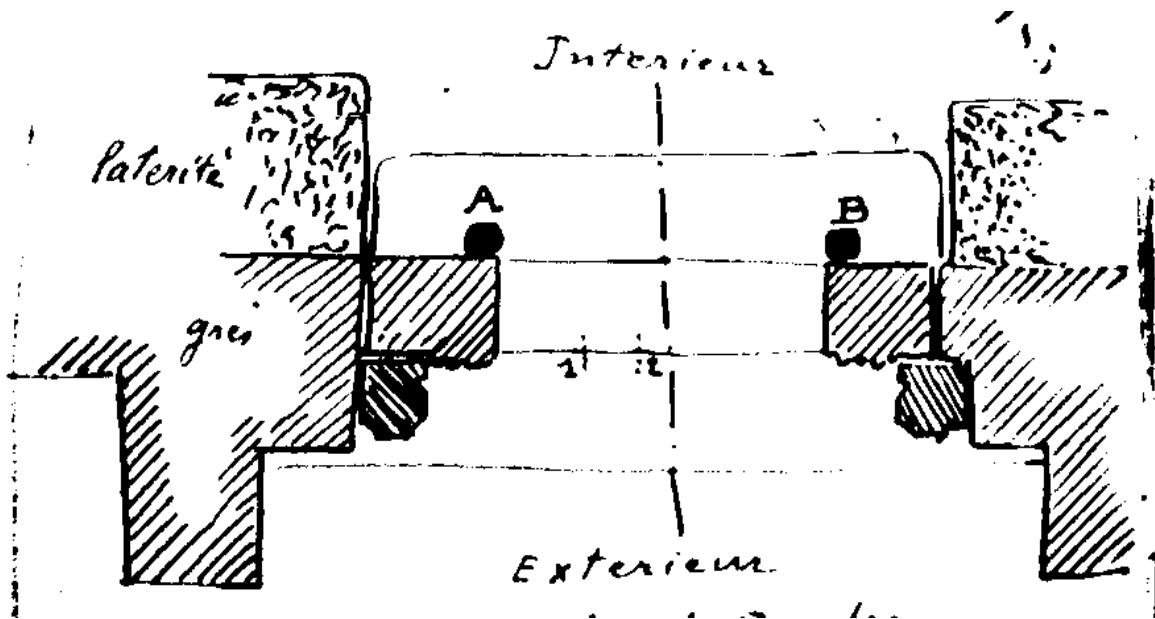


Figure 32: Bronze sockets in situ, Chau Say Tevoda, gopura north, south gate (a group of Angkor). Source: JF. 1924-1926: 185

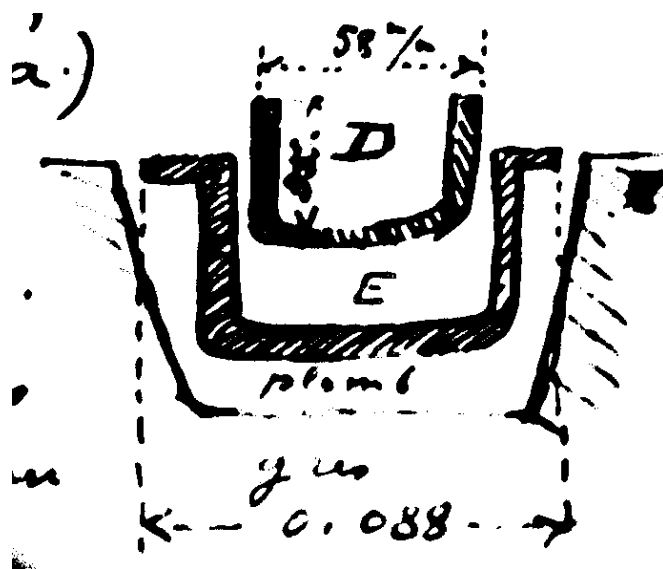


Figure 33: A leaf plates and pivot in Situ, Chau Say Tevoda temple , north gopura, south gate (a group of Angkor). Source: JF. 1924-1926: 185



Figure 34: .About a pattern of crown (?), Gate of the Dead, Angkor Thom (a group of Angkor). Source: *JF*. 1924-1926: 142

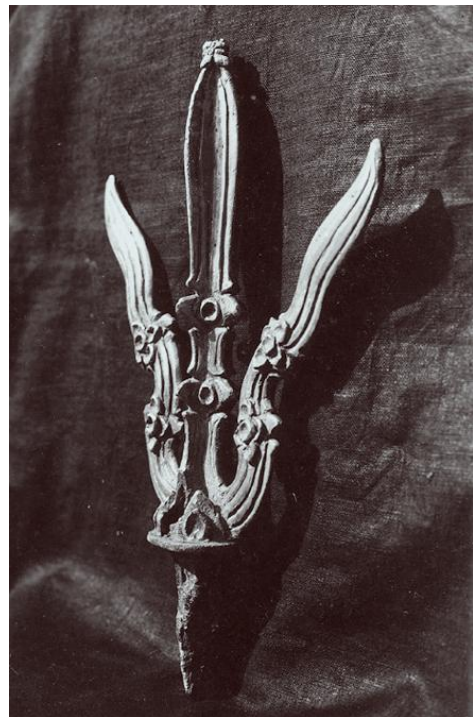


Figure 35: *Trisūla*, Preah Khan, southern gopura of third enclosure (group of Angkor). Source. 2007: 55



Figure 36: Room decorative, plate-shaped square, Tep Pranam temple, Angkor Thom (a group of Angkor). Source: Brice. 2007: 56

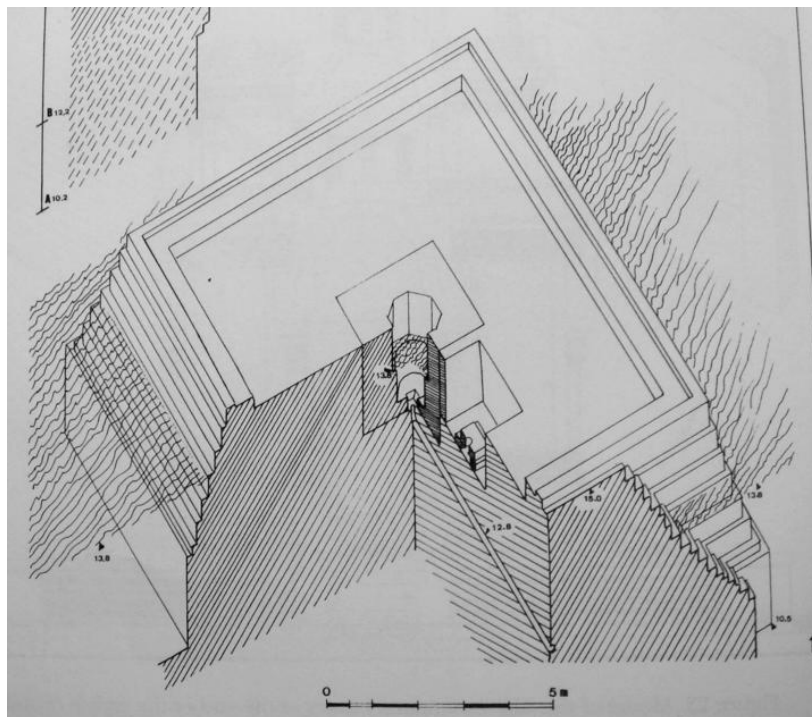


Figure 37: Plan Well axonometric "Nilometer" shaped linga inverted of Western Mebon (a group of Angkor). Source: Dumacay., Royer. 2001: fig. 24.

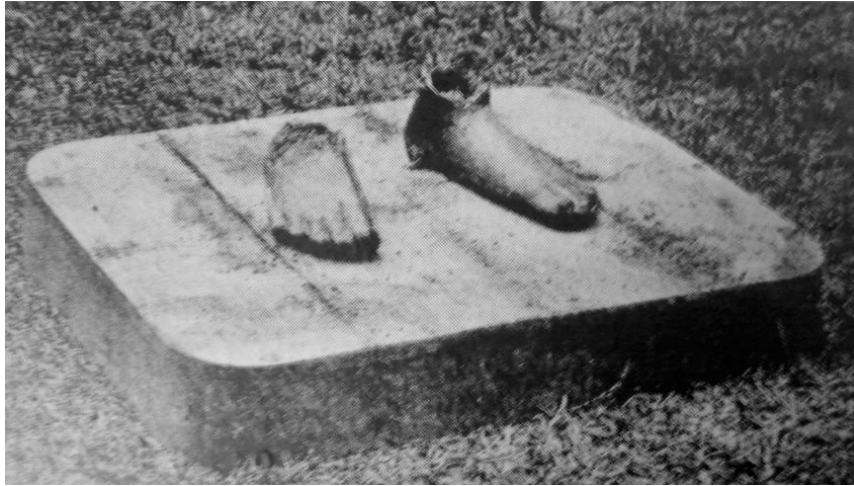


Figure. 38: A Reconstruction of the sandstone slab which were sealed the feet of bronze colossal statue at Phnom Bayang (Takeo province). Source: Mauger.1937: 257



Figure 39: Torso of a male deity, At Bassac (Svay Rieng Province) Baphuon style, 11st century. Source: Brice. 2007: 62



Figure 40: A Fragment of a male deity in front , Bassac (Svay Rieng Province) Baphuon style, 11st century. Source: Giteau.



Figure 41: The Furniture worship of bronze from Sra Moch, Mongkol Borei region (Banteay Meanchey). Source: Brice. 2007: 64

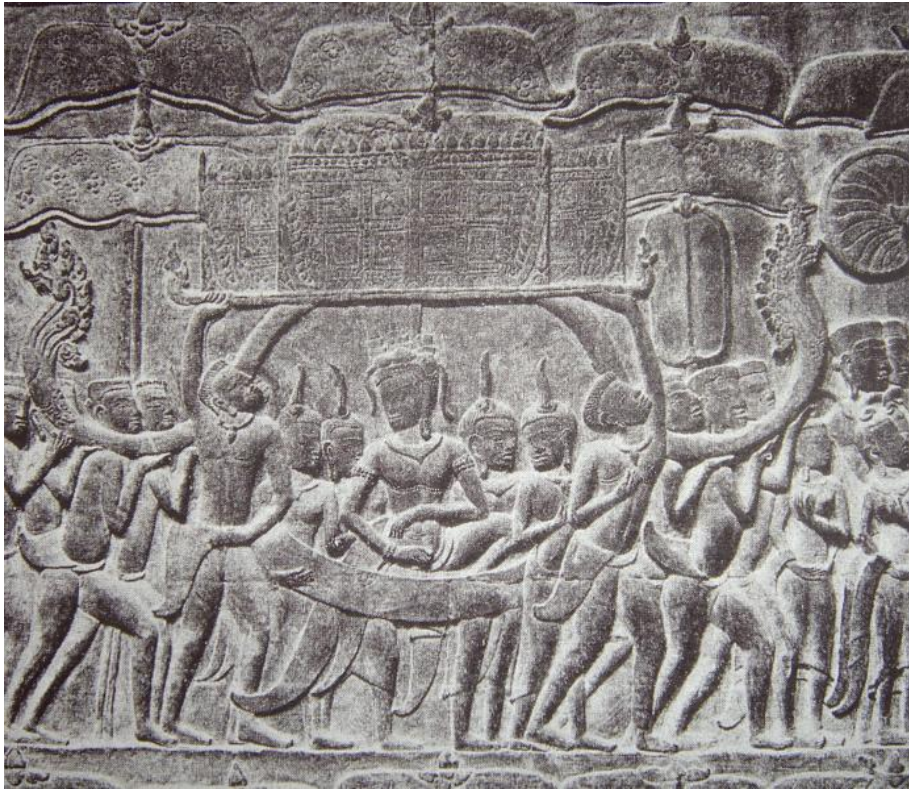


Figure .42: A depicting of Lady palanquin, bas-relief of Angkor Wat, South Gallery, West Wing (a group of Angkor).