BRONZE STATUES MADE FROM THE LOST WAX CASTING TECHNIQUE AND THEIR MEANING IN CONTEMPORARY THAILAND: A CASE STUDY OF THE BRONZE FOUNDRY OF THE FINE ARTS DEPARTMENT IN SALAYA, NAKHON PATHOM

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รูปหล่อสำริดจากเทคนิคการสำรอกขี้ผึ้งและความหมายในสังคมไทยปัจจุบัน: กรณีศึกษาโรงหล่อรูปสำริด กรมศิลปากร ศาลายา จังหวัดนครปฐม

นางมังกาลา ปราทาน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาอักษรศาสตรมหาบัณฑิต
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Field of Study: Thai Studies

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มังกาลา ปราทาน: รูปหล่อสำริดด้วยกรรมวิธีสำรอกขี้ผึ้งและความหมายในสังคมไทยร่วมสมัย: กรณีศึกษาโรงหล่อของกรมศิลปากร อำเภอศาลายา จังหวัดนครปฐม. (BRONZE STATUES MADE FROM THE LOST WAX CASTING TECHNIQUE AND THEIR MEANING IN CONTEMPORARY THAILAND: A CASE STUDY OF THE BROZE FOUNDRY OF THE FINE ARTS DEPARTMENT IN SALAYA, NAKHON PATHOM) อ. ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร. สุเนตร ชุตินธรานนท์, 288 หน้า

รูปหล่อสำริดปรากฏเป็นส่วนหนึ่งในวัฒนธรรมไทยมานานหลายศตวรรษกระบวนการสร้างรูปหล่อสำริดมีพัฒนาการมาโดยตลอดและมีความสำคัญอย่างยิ่งในสังคมไทยวิทยานิพนธ์นี้มุ่งศึกษาและทำความเข้าใจคติความเชื่อในการสร้างรูปหล่อสำริดของชนชั้นนำไทยและที่สำคัญยิ่งไปกว่านั้นยังมุ่งที่จะบันทึกกระบวนการและอธิบายความแตกต่างระหว่างกรรมวิธีการหล่อสำริดที่มีมาแต่ดั้งเดิมกับวิธีการหล่อสำริดแบบสมัยใหม่และด้วยเหตุที่คนไทยส่วนใหญ่ล้วนให้ความเคารพสักการะพระรูปหล่อสำริดของพระมหากษัตริย์คติความเชื่อในการสร้างพระรูปเหล่านี้จึงน่าสนใจที่จะศึกษาด้วย

วิทยานิพนธ์นี้ศึกษาความนิยมในการใช้กรรมวิธีการหล่อสำริดแบบสำรอกขี้ผึ้งและเหตุที่กรรมวิธีดังกล่าวได้รับความนิยมพร้อมทั้งศึกษาความนิยมในการสร้างรูปหล่อของชนชั้นนำไทยพระวีรกษัตริย์ตลอดจนบุคคลที่ได้รับยกย่องต่างๆทั้งในระดับชาติและระดับบุคคลและพิจารณาคติในการสร้างว่าเป็นเพราะวัฒนธรรมตะวันออกที่มีมาช้านานหรือเป็นเพราะคติการบูชาบรรพบุรุษที่เป็นรากเหง้าของสังคมไทยหรือเป็นเพราะความศรัทธาที่มีต่อสถาบันพระมหากษัตริย์พุทธศาสนาศาสนาพราหมณ์ฮินดูและความเชื่อดั้งเดิมที่ทำให้มีการตั้งหรือประดิษฐานรูปและพระรูปเหล่านั้นไว้ตามที่สาธารณะต่างๆและทำให้ผู้คนนิยมมาสักการะบูชาเพื่อแสดงความกตัญญูกตเวทิตา

วิทยานิพนธ์นี้ยังมุ่งที่จะจดบันทึกกระบวนการหล่อสำริดแบบสมัยใหม่และกรรมวิธีการหล่อสำริดแบบดั้งเดิมกรรมวิธีการหล่อสำริดแบบดั้งเดิมมีคุณค่าด้านความงามและสะท้อนให้เห็นความสามารถในเชิงช่างของไทยแม้ว่ารูปหล่อสำริดที่สร้างขึ้นด้วยกรรมวิธีการหล่อแบบสมัยใหม่ดูจะมีคุณค่าน้อยกว่าเมื่อเทียบกับรูปหล่อที่สร้างขึ้นตามวิธีการดั้งเดิมแต่เหตุที่การหล่อสำรอกขี้ผึ้งแบบสมัยใหม่ได้รับความนิยมมากกว่าก็เป็นเพราะวัสดุและเครื่องมือต่างๆที่หาได้ง่ายรวมทั้งการสร้างสรรค์ผลงานศิลปะตามแนวทางสมัยใหม่

สาขาวิชาไทยศึกษา ลายมือชื่อนิสิต.....

ปีการศึกษา 2553 ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์หลัก .....

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KEYWORDS : BRONZE / LOST WAX CASTING TECHNIQUE/CONTEMPORARY TECHNIQUE /SILPA BHIRASRI

MANGALA PRADHAN: BRONZE STATUES MADE FROM THE LOST WAX CASTING TECHNIQUE AND THEIR MEANING IN CONTEMPORARY THAILAND: A CASE STUDY OF THE BRONZE FOUNDRY OF THE FINE ARTS DEPARTMENT IN SALAYA, NAKHON PATHOM.THESIS ADVISOR: ASSOCIATE PROFESSOR SUNAIT CHUTINTARANOD, Ph.D.

Bronze statues have been a vital part of Thai culture over the past number of centuries. The process of making these statues has evolved over time and moreover, these statues have always been very prominent within the Thai community. This thesis attempts to understand and study the beliefs behind making bronze statues of Thai elites. More importantly, this thesis attempts to document the process and differentiate traditional techniques of bronze casting with the contemporary method of bronze casting. As the bronze statues of past kings and monarchs are also worshiped by the majority of local people in Thailand, the spiritual dimension of making such statues are also considered.

This thesis studies the popularization of contemporary lost wax process and reasons behind its popularity. Likewise, the popularization of making bronze statues of Thai elites and heroic figures nationally and individually; and whether it is the reason of the deep rooted eastern culture or specially the deep rooted Thai belief in ancestral worship, faith on Monarchy, Buddhism, Hinduism, and animism, that imparts the public display of such figures which ultimately ends up as a cult object and places of pilgrimage, veneration and to show gratitude for the normal Thai people.

The thesis attempts to make inventory and document the process of contemporary and traditional bronze casting technique. Traditional bronze casting technique has its own aesthetic and technical value. Although bronze statues manufactured from the contemporary bronze casting technique lacks its value compared to the bronze made from traditional technique, the reason of popularization of the contemporary lost wax process is the easy available modern material and equipment as well as the modern way of making art objects.

Field of Study	Thai Studies	Student's Signature……
Academic Year	2010	Advisor's Signature……

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Finally I would like to express my deepest gratitude to my parents for encouraging me. Support and endurance of my family husband Binod, son Amish and daughter Ami is really appreciable for my study. I am deeply grateful to my late mother in law who always encouraged me to achieve my goal. Her passing away during my study was a great loss. I pray, may her soul rest happily in the realm of heaven.

CONTENTS

LIST OF FIGURES

Page

Page

Page

Page

Page

Page

Page

Page

GLOSSARY

Anatomy: The bodily structure of a plant or an animal or of any of its parts.

Avalokitesvara: One of the most popular of the five Bodhisattvas of Mahayana Buddhism, he is portrayed with as many as 11 heads and 22 arms. On his tall chignon, he wears the emblem of Amitabha from whom he emanates. His body is heavily ornamented and he may be portrayed with an antelope skin over his left shoulder or a tiger skin tied at his waist.

Avatar: An incarnation of a god, specifically of Vishnu. Phra Ram is an avatar of Vishnu.

Bodhisattva: An emanation of the five *Dhyani Buddhas*, four of the cardinal points and one of the zeniths, in Mahayana Buddhism. A Buddha- to- be who has postponed his passage to nirvana to help others reach enlightenment.

Brahman: A devotee of Brahmanism prior t the creation of Hinduism. The term also describe a member of the highest rank in term describes a member of the heist rank in the Hindu caste system. The Brahmans have been responsible for conducting ceremonies of state and rites of passage for the royal family.

Brahmanism: The religion of India out of which Hinduism and Buddhism grew.

Bronze Age: A period of human culture between the Stone Age and the Iron Age, characterized by the use of weapons and implements made of bronze.

Chakravartin: A "universal monarch" and one of the two forms it is said Buddha could have assumed in his last birth to lead mankind. Instead, he chose to be a Teacher and by that means to bring salvation to mankind.

Cire Perdue: Lost wax method of bronze casting. In this method the shape of the desired object is modeled in wax which is then given a molding of clay all over except for the mouth of the pouring channel. After the clay mould dries the wax is melted out and replaced with the molten metal poured into the cavity. After the metal is sufficiently cooled the clay mould is broken off in order to reveal the cast image.

Cold Hammering: Beating a sheet of metal with a hand hammer to strengthen the metal as well as take out different embossed pattern on the metal. Cold hammering is performed entirely by hand, a highly skilled and labour- intensive process.

Crucible: Pot of clay or other refractory material, used from ancient times as a container for melting metals or other materials. Modern crucibles may be small laboratory utensils for conducting high-temperature chemical reactions and analyses, or large industrial vessels for melting and calcining metal, ore, or glass, and may be made of clay, graphite, porcelain, or a relatively infusible metal.

Dhyani Buddha: In Mahayana belief, there are five Buddhas, four of the cardinal points and one of the zenith. They are generally portrayed in an attitude of meditation with different hand positions. The most popular is Amitabha.

Die casting: Die casting is the process of forcing molten metal under high pressure into mould cavities.

Dong Son Culture: The Dong Son culture is a Bronze Age culture including all of South East Asia and into the Indo- Malayan Archipelago from about 1000 to 1 BC. Centered on the red river valley of Vietnam, the Dong Son people were sophisticated agriculturalists, farming rice and domesticated buffalo and well known for the bronze artifacts like Dong Son drums. Dong Son probably arose from local Neolithic cultures, such as Phung Nguyen and Dong Dau phase. This culture is identified with the Van Lang ruling dynasty, the first ruling dynasty of Vietnam. Dong Son culture is contemporary to the major Han Chinese imperial expansion. Archaeologists associated with Dong Son include French explorer L. Pajot, J.M. Janse, Victor Golougew, and Ha Van Tan.

Gypsum Plaster: Gypsum is a mineral that is used in plaster. Ground gypsum is calcined and then mixed with various additives to control its setting and working qualities; used with the addition of aggregate and water, for base coat plaster.

Ingot: A mass of metal, such as a bar or block, that is cast in a standard shape for convenient storage or shipment. It is made by pouring molten metal in a mould to solidify.

Iron Age: The period in cultural development succeeding the Bronze Age in Asia, Europe, and Africa, characterized by the introduction of iron metallurgy.

Kiln: A kiln is a thermally insulated chamber or oven in which a controlled temperature regime is produced. Kilns are used to harden, burn, or dry materials.

Mahayana Buddhism: One of the two major sects of Buddhism, which arose 300- 400 years after Buddha's death in 543 B.C. It's prime principle is that it is the duty of those who have achieved Enlightenment to refrain from passing into nirvana but to remain behind to aid others to reach their own state of perfection. Practiced in Japan, china, Korea, Nepal and Tibet.

Mongkut: The term describes the crown worn by Thai kings. The term also denotes the architectural structure comprised of tiers of disks which rise in descending order of size to a pointed finial. Used to cap important wat buildings, notably the Prasad, the tiers symbolize the 33 Buddhist levels of perfection, a concept borrowed from the Hindu 33 levels of heaven representing the prang.

Nirvana: The state of total extinction entered after one has achieved Enlightenment and thereby escaped the cycle of deaths and rebirths to which all life is subject.

Radio Carbon Dating Method (C14 dating): Radiocarbon dating is a process for determining the age of a prehistoric object by measuring its radiocarbon content. The technique was developed by an American chemist, Dr. Willard F. Libby (1908-1980), in the late 1940s. All living things contain radiocarbon (carbon 14), an isotope that occurs in a small percentage of atmospheric carbon dioxide as a result of cosmic ray bombardment. After animal or plant dies, it no longer absorbs radiocarbon and the radiocarbon present begins to decay (break down by releasing particles) at an exact and uniform rate. Its half-life of 5,730 years made it useful for measuring prehistory and events occurring within the past 35,000 to 50,000 years. A recent development, called the Accelerated Mass Spectrometer, which separates and detects atomic particles of different mass, can establish more accurate dates with a smaller sample. The remaining radiocarbon can be measured and compared to that of a living sample. In this way, the age of the 50,000-year-old or less, animal or plant (or more precisely the elapsed time since its death) can be determined.

Rama: Also known in Thai as Phra ram, he is an avatar of Vishnu and the hero of the popular classical tale, the Ramakien in Thailand and Ramayana in India/Nepal. He is revered as the perfect monarch and the perfect husband.

Samadhi: State of deep meditation or the attitude of meditation usually performed with sitting cross- legged.

Silicone Rubber: Silicone is a synthetic polymer, derived from silicon metal. The nature of its origin gives it a number of significant advantages over conventional rubber polymers. Silicon is available in the form of rubbers, greases and fluids.

Smelting: The process of extracting usable metal from an ore by heating to extreme temperatures in a hearth or furnace. Some metals melts when smelted and these can be trapped in crucibles and make ingots. The main chemical reaction in smelting is to reduce metal oxide in the form of a bloom which can be further worked by forging to drive off the remaining impurities.

Stratigraphy: It is a sub branch of geology dealing with either stratification in sedimentary rocks or in volcanic rock folds. In another word, stratigraphy is the study of rock layers (strata) deposited in the earth. It is one of the most challenging of geologic sub disciplines, comparable to an exacting form of detective work, yet it is also one of the most important branches of study in the geologic sciences. Earth's history, quite literally, is written on the strata of its rocks, and from observing the layers; geologists have been able to form an idea of the various phases in that long history. Naturally, information is more readily noticeable about the more recent phases.

Wai: A gesture of respect to a Buddha or an important monk or person or simply as a gesture of greeting. It is performed by placing the palms of both hands together before the chest in an attitude of prayer.

Wat: A term meaning both ‘temple’ and ‘monastery’ and describing the complex of building including the bot and vihan contained within a single courtyard.

CHAPTER I

INTRODUCTION

The people of Thailand have a lot of respect and are very loyal to their monarchy. Portraits and monuments of Kings are present and exhibited all around the city of Bangkok. On my last short visit to Thailand, the tourist guides used to praise very highly of the present monarch, which was evident what he did towards his country. This left me with a good impression of those portraitures back then that my instinct grasped the compassion and nobility of the King. One could say it was my karma that led and gave me this opportunity to study at Chulalongkorn University. I was always impressed with King Chulalongkorn and his son King Vajiravudh's portrait in the main building and the bronze statue of both father and son on the premises of the University ground. Most of the students used to pay respect whenever they pass by those portraits and monuments. And spontaneously I also started to pay respect in my own way, filled with respect and adoration which always gave me some kind of relief in my heart.

As my study progressed and I was able to gain more knowledge of Thai history, I came to know that the equestrian monument of King Chulalongkorn in front of Ananta Samakan Throne Hall or Royal Plaza and Chulalongkorn University is somehow connected with its past history. And the truthful fact is that the University was established with the left over money after constructing the equestrian monument of the King Chulalongkorn. Being acquainted with and able to gather new information of these portraits and statues, and also how these incidents and customs has played an important role in my personal life, the history behind these bronze statues gave me insight to study more of these bronze statue and also to know how those statues are actually manufactured.

History of tradition of bronze casting and using bronze in Thailand goes back to the prehistoric period. The endemic technology transformed its artistic ability to the very rich artistic workmanship still prevalent at present. With the modernization process

public monumental arts made of bronze have been the testimony of its artistic achievement to its political and spiritual back force. The viewer's envy on the art piece as well as their inherited traditional belief like animism, Buddhism, Hinduism and ancestor worship towards the past rulers and hero personnel had helped such monuments to get more popular. Among the popular and most revered are the statues of King Chulalongkorn. King Chulalongkorn commissioned foreign artists to make his sculptures in the European styles. The kings and elite then were impressed with realism and technique of creating art objects in the western world. The consequence was, many western engineers and artists were brought by the government to work in Thailand which changed the landscape of the country to the neo classical era. The climax of this reached in 1908 when the first public monument, the equestrian statue of King Chulalongkorn was unveiled on the occasion of the fortieth anniversary of his accession on the throne was celebrated. After this a new chapter in monumental art history had officially began.[1]

Italian sculptor Corrado Feroci (later to take the Thai name Silpa Bhirasri), who became the most influential figure in shaping Thai modern art , was selected by his government and invited to Thailand in 1922 by King Vajiravudh. He is known as the Father of Modern Art in Thailand. Feroci aimed to raise the standard of Thai art to an international level and encouraged Thai artists to appreciate the value of cultural heritage. He promoted western styles and methods including the mastering the nature, and one which freed artists from the duty of illustrating old literature. His duty was to establish trust and gain credibility for western art style with the Thai powers. The statue of King Rama I now located at the memorial bridge was his first contract for which the bronze was casted in Florence and took four years to finish the task. After this he gained fame and government acceptance in Thailand and well established after that. [2] He encouraged the Thai artists and sculptors to study in the European tradition, followed western

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[1] Wang, Ka F., *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006). pp. 17,18

[2] Henderson, Virginia, *The Social Production of Art in Thailand: Patronage and Commoditization, 1980-1998,*(Chulalongkorn University, Bangkok). 1998, p. 60

conventions of drawing and portraiture and most importantly, sculpture. Silpa Bhirasri's initiative succeeded on the establishment of the Silpakorn University. He inspired his students to look for new ways of both classical arts and European art.

Professor Feroci's contribution on Arts in Thailand gave a new dimension in Thai arts. A foundry was made in a warehouse beside the Department of Fine Arts in 1941. In 1987, the office of the Division of Handicraft was moved to Salaya district in Nakhon Pathom where new and modern foundry was built for more capacity. The old foundry is converted to a Museum of models and prototype of the National Statue bearing the name as "Hall of Sculpture".[3]

Students taught by Silpa Bhirasri were having very good performance on producing many bronze statues during and after his death. Because of the public demand and fashion of making statues and monuments of the Thai elites, the Group of sculptors of Thai Traditional Arts Division of The Fine Arts Department had very good reputation until present. Opportunity to meet Professor Silpa Bhirasri's one of the student of 5th generation Mr. Boonsong Nootnomboon gave me many insights on the making of bronze and his experiences with Silpa Bhirasri. The interaction with young generation of artists of Silpakorn University helped to differentiate the modern way of learning arts.

At present, foundry of Salaya specially produces bronze sculptures with lost wax process. There are many similarities and differences in lost wax process in Asia and Europe. The rich cultural heritage of Europe developed various technologies on the casting bronze by the 19th century. That contemporary and scientific technology of lost wax bronze casting was introduced in Thailand by Corrado Feroci. Lost wax or *cire Perdue* is French word meaning, a kind of technology in which wax is lost and liquid metal is poured in the wax lost hollow part of the mould to make an item of art. Item of art are mainly sculptures in this research was made for religious purposes or for the royal

[3]Nildum, Nilwan, *The Architectural Heritage For Wang Tha Phra And Wang Thanon na Phra Lan*: *From The Palaces of Builders and Craftsmen To the Art And Cultural Centre*, (Silpakorn University, Bangkok, 2003).

and national purposes which required highly innovative process requiring great skill, experience and patience.

Although the modern casting method of bronze was introduced in Thailand, the lack of written documents or text books explaining the process might put in danger the technology in long run. The experts on making bronze image were the individual persons. They were supposed to transmit their knowledge through teacher student relationship and it was done merely by practice. Therefore keeping this problem in consideration an initiative must be done to document all the process of making bronze statue in written form with good illustrations.

1.1 Objectives of the research

The purpose and objective of this thesis was, (1) to study the contemporary Lost Wax casting technique used in Thailand in comparison with the traditional one and (2) to study the beliefs behind making of bronze statues of Thai elites and their spiritual dimension.

The thesis aimed to study the idea behind making of bronze statues of Thai elite. The study was done on the process of making the bronze sculptures. The thesis helped to understand how much effort and contribution is given by the sculptors, casters and their group of artist to make a single piece of bronze sculptures. People appreciate a work of art but how and on what circumstances the art and artisans goes through is less studied. The study for some extent able to justify the hard works of the artisans, spirit behind the techniques, the purpose behind making the art and its emotional and spiritual comprehension by the general public.

1.2 Research argument

Bronze images are very popular and considered as a medium to express the feeling and expression which influence the society in general. This thesis attempted to answer the questions such as: (1) what are the techniques of contemporary bronze casting with lost wax process done in the foundry of Fine Arts Department? (2)Are there any differences between traditional and contemporary bronze casting? (3)What is the history behind the establishment of the foundry of the Fine Arts Department and its functions? (4)Who are the famous figures and elites been casted in the foundry? (5)What is the spiritual and emotional attachment of the sculptors and casters?

This thesis investigated whether the contemporary bronze lost wax casting process lack its value when compared to the traditional process. The popularization of the making bronze statues of elites and national figures reflect the deep rooted Thai belief in ancestral worship, monarchy, Buddhism, Hinduism and animism. These beliefs permeate the public display of such figures with religious and spiritual significance. These figures would therefore be considered cult objects and places of pilgrimage. In technical aspect the reason behind the popularization of the contemporary lost wax process is the use of modern material and equipment which are easy available at present.

1.3 Scope, Source and Methodology

The foundry of the fine arts department was taken as a case study area for my research. This study is based upon the case study of making of a bronze casting with lost wax process in the foundry of the Fine Arts Department in Salaya. The methodology applied in this research consist of interaction with the different experts involved in the foundry, research of different scholarly publication written in English and by the process of participative observation at the above mentioned foundry.

A Thai friend working in the Fine Arts Department Mr. Naruporn Saowanit helped arrange all the meetings with various people in the foundry. Due to the language barrier he had to find a staff who could speak English to be my interpreter. In the foundry Mr. Pongpan Chantanamattha and Ms. Chonlada Srichamrus the sculptors helped to take

interviews and interpret in English. At times it was very hard for them to explain what they actually meant. Nevertheless I found all the members of the foundry very kind, cooperative, and hospitable and greeted me as their family while I was looking at all the sculptures and their working processes. They also answered to all my queries. (Appendix 6, 7)

Apart from this the head of the Sculpture Group of Thai Traditional Arts, Mr. Somkuan Oumtrakul gave me permission to observe all the casting process from the beginning till end, to record and photograph progress of the sculptors work from the beginning. The artisans of that foundry provided very detail information of the process of making a bronze image which I was able to give in detail in the research. Likewise, the senior traditional cast master Mr Nikorn Koehapong made a model demonstration of traditional casting method for my study which I had recorded from the beginning to the end of the final procedures. I attempted to acquire the humanitarian ideas, personal views and experiences and background of the individual artisans who are working in the different fields in the foundry.

1.4 Expected Benefits

From this thesis, the expected benefit is to have better understanding of the process of bronze casting techniques. The study also intends to highlight the mix traditional and modern technology of bronze casting which is very much in practice at present. It will also help those who want to understand the process in detail either for informative, educational or further research purpose. The study will also benefit future research on Thai visual arts in contemporary Thai society.

Apart from this expectations, the study will benefit those who are involved in this research, for example to the sculptors, casters, mold makers etc. who will have a chance to express their experiences of their profession and emotional and spiritual back force by which they are usually guided to overcome their work.

CHAPTER II

ANTIQUITY OF BRONZE IN THAILAND

To comprehend present status of bronze monumental sculptures in Thailand, bronze considered as semi noble material, has been used from the pre historic time. The people subsequently were fascinated with the metal that the evidences found from the archaeological excavation and exploration shows its popularity. The popularity is still evident at present with new technology and new practice. The chapter discusses on the discovery and dissemination of bronze in different pre historic, historic ages and present scenario of modern bronze and history behind the establishment of contemporary bronze culture in Thailand.

2.1 Discovery of Bronze Age

History of tradition of bronze casting and using bronze in Thailand goes back to the prehistoric period. There are various examples of bronze objects found from the archaeological excavations from different prehistoric sites of Thailand. Study on the metallurgy in pre historic Thailand discovered evidences of pre historic mining and copper smelting both from the northeastern and central regions, i.e. at Phu Loan in Nong Khai province, at Khao wong Phra Chan in LopBuri province and at Noan Pah Wai in Huey Pong Village, Khok Samrong district of Lop Buri province.[4] With prevalence of die casting techniques in pre historic Thailand, Thai molders during the 4000-3500 years ago were capable of lost wax casting and fully realized that metal could be strengthened by cold hammering. They also knew how to heat the metal in order to return its capacity or to reduce its brittleness by cold hammering.[5] Very famous examples of bronze tools and bangles, rice tempered clay crucible[6] and sandstone mould included[7] as a mortuary

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[4] *Guide to the Gallery of Thai History* (National Museum, Bangkok, 2002). p. 41

[5] Ibid, p. 42

[6] Everly, Daniel Eugene, *The Relevance of Contemporary Bronze Casting in Ubon Thailand for Understanding the Archaeological Record of the Bronze Age in Peninsular Southeast Asia,* Master's Thesis, (Faculty of Anthropology, Office of Graduate Studies, Texas A& M University). 2004

[7] Hingam, Charles, *Early Cultures of Mainland Southeast Asia* (River Books, 2002). P.139

objects were unearthed from the excavation of Ban Chiang, Ban Nok Tha. These are considered to be the oldest found objects which are dated about 2,500 – 1,500 years ago. Hingham concludes that there are considerable changes to the means of smelting and castings during the course of time and by the middle of the first millennium BC major technological changes spread rapidly across Southeast Asia which spread the knowledge of working with metal and introduced new opportunities.[8]

To study the bronze history of Thailand it is important to understand the pre historic bronze culture of Southeast Asia in general. When Indus valley civilization was considered as the oldest pre historic site of Asia, the date of pre history of Southeast Asia goes back beyond the Indus civilization. Archaeology came rather late to Thailand than other south Asian countries like Vietnam, Lao, Cambodia etc. Discovery of Bronze Age in Thailand was announced in 1968 by Solheim. During the excavation of Non Nok Tha, he found bronze artifacts and their stone moulds in a cemetery. On the basis of radio carbon dates, he dated the bronze to the third millennium BC. He concluded that bronze was being worked in north eastern Thailand nearly one thousand years before it is now considered to have begun in Shang China and one hundred or more years earlier than it started in the Harappa culture of the Indus Valley. Solheim wrote that a socketed tool coming from Southeast Asia and the oldest socketed tool yet found anywhere. [9]

Prior to this the existence of a bronze age in Southeast Asia first entered the historical record when the Han Chinese expanded to the south and where they encountered so called barbarian groups who were masters in the casting of bronzes. Casting bronzes were unknown to the Chinese until then. The Sui Shu(History of the Sui), which was compiled by Wie Zheng and covers the years AD 586-617 noted that: " the different Lao tribes make bronze drums,…… before going to war, the chief summons the warriors of the tribe by beating the drum." Another literature Man Shu dated AD 618-906 of Tang dynasty

[8] Ibid, p. 167

[9] Solheim,W.G.Li,*An Earlier agricultural revolution*, Scientific American,CCVI(4)

describes how the southern barbarians beat war drums when in mourning and during feasts.

According to Higham first recorded western descriptions of such drums came after the establishment of the Dutch east India Company. One of the Dutch employees, George Rumpf, who lived at Ambon in the Moluccas during the second half of the seventeenth century, heard of the discovery of a large piece of metal, said to have fallen from the sky. This was the Pejeng drum. In 1687 he described a second specimen from Serua as a huge and extraordinary bronze vessel.[10]

Early works in French Indo China and southern China by the French enthusiasts on the antiquities lead to a significant discovery of bronze culture in Southeast Asia. Higham states if the Bronze Age in island Southeast Asia was first recognized by the Dutch, that on the mainland ,excepting the early Chinese reports, was initially encountered by the French, who colonized much of the region in the second half of the nineteenth century. In 1876, M Roque, director of the Company of River Transport of Cochin China explored Sanrong Sen. Main focus was on a settlement mound located in the valley Chinit, one of many rivers which flows into the lower Tonle Sap or the great lake of Cambodia. His study revealed a deep stratigraphy of shells interspersed with layers of flood deposited sand. The sells represent food refuge from pre historic occupation, and ceramic, stone and shell artifacts were kept by the diggers as good luck charm. In 1879 M. Moura, representative of the French protectorate, went to investigate some site and collected some artifacts, including bronzes from villagers. The report of this was published in 1879 by M. Noulet in the first number of a new publication, the Archives du Musée d' Histoire Naturelle de Toulouse. Apart from stone axes, chisels, bangles and rings, bronzes comprised of three large bracelets, an axe, two arrow heads and a fish hook. The arrow heads were found to have 4.8% tin, fish hook 4% tin and a bracelet had a tin content of 12%.[11]

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[10] Higham, Charles, *The Bronze Age of Southeast Asia* (Cambridge University Press, UK, 1996). p.17

[11] Ibid, p. 20

Another systematic prehistoric excavation was conducted by Ludovic Jammes in Samrong Sen. He is said to have employed the first systematic approach to pre history in Cambodia, both by seeking a range of sites, and excavating with due attention to stratigraphy. Jammes excavation in Samrong Sen to the depth of 4-10m revealed three distinct layers. The lowest contained only stone implements and coarse pottery. The second included some bronze items with some stone artifacts, and a thinner variety of pottery, while the third a pure Bronze Age with some polished stone artifacts pottery bearing rich ornamentation. Many of the artifacts were associated with the mortuary objects.

Following Jammes there were several other personnel performed the excavation and exploration around Cambodia and Lao that Lefévre_ Pontalis(1894). When surveying the situation near the turn of century, observed a range of similarities between bronze artifacts found in the south, mainly in Cambodia and the Luang Pranang area of Laos. This suggested that the pre historic sequence involved a Stone and a Bronze Age. Likewise, in another area of expansion, Balfour(1901) reported finding a Bronze Age spear head and a socketed axe in the Shan states of Burma. Sand stone moulds discovered near Mlu Prei(O Pie Can, 0 Navi and 0 Yak), by Lévy (1943) by Mansuy at Samrong Sen shed light on the bronze casting tradition.[12]

In 1912, an assemblage of 165 large bronze drums was published by Heger. He subdivided them on the basis of form into four types. Most of the drums came from southern China and the valley of the Red River, and other were from further afield in Southeast Asia. By 1918, the number of drums increased to 188. Henri Parmentier who was working with the Ecole Francaise in Hanoi, undertook a survey of them particularly on the form and decoration. The pattern on the drums shed light to the then culture and way of life of the people. One of the drum was dated AD 30 which commemorated the sixth year of the reign of the Han emperor Wudi.

[12] Ibid, pp. 17- 29

In 1929 Victor Goloubew conducted excavation at the settlement and cemetery of Dong Son. The result of Dong Son excavation revealed the Dong Son bronze workers were also skilled in the difficult technique of lost wax casting. The figure to be cast was first rendered in wax and surrounded by clay. Wax was then removed and placed by molten bronze. Goloubew concluded that Dong Son bronze industry was influenced by China that the Bronze Age did not start there until the mid first century AD, and then it was inspired by China.[13]

Another excavation on Dong Son was conducted in 1935 by Janse whose report published in 1958. The detail report of excavation done in tomb no. 1 showed that the tomb was oriented on a north- south axis, although the bones have not survived because of soil conditions, the body was accompanied by a bronze drum, vase and plate, a few spearheads and arrowheads, three miniature drums, and slit stone rings and nine pottery vessels. Janse concluded that this was probably the burial of a chief. The site also showed the Han Chinese influence.

During the year 1935 Madeleine Colani was excavating in the uplands of Laos. She had previously concentrated her research on the rock shelters in the Karst hills south of the Red River, but later she was attracted to Laos by the huge and enigmatic stone jars. Her excavation revealed prehistoric crematory in association with a number of cemeteries. The stone jars contained cremated human remains associated with bronze and iron grave goods like bronze bells and spearheads. Likewise presence of moulds for casting bronzes added to the growing body of evidence for wide spread metal working. This site was associated with the site of Dong Son.[14]

In 1943, Levy investigated three sites in the head waters of Sun and Chinit river near Samrong Sen. He found sandstone moulds to cast sickle and axe at Pie Can, in addition to crucible fragments. At O Yak, bronze bracelet and at O Nari, he found evidence of bronze working. Hingham states that,

[13] Ibid, p. 27
[14] Ibid, p. 31

"By the time that the Second World War slowed archaeological enquiries, therefore, evidence for bronze working in Southeast Asia had been found in the valley of the Red River, along the coast of Vietnam, in the Mekong River valley from its mouth to Luang Prabang in Laos, in the lowlands surrounding the Tonle Sap in central Cambodia and even at an altitude of a thousand metres in the Laotian uplands. Indeed , prehistoric bronzes had been found in virtually all the areas explored by the French. Only Thailand, never colonised, remained little known, at least in terms of prehistoric bronze working."

In archaeological research one positive aspect of the Second World War in Southeast Asia was the importance given to aerial photography. During the mission of Northeast Thailand, Milliams Hunt(1950) had identified many large, moated prehistoric settlements now known as Bronze Age site. Higham states that, [15]

"Post war research in Southeast Asia,…….has increased our information beyond recognition through more intensive fieldwork…….. Thailand, however, a late starter, is now the best documented, due to the absence of warfare, training programmes for Thai archaeologists in America, Europe and Australia, the vigour of the Thai Fine Arts Department and the permission given ti foreign archaeologists to excavate. Two regions of Thailand have received particularly close attention: the northeast, or Khorat Plateau, and the Chao Phraya Valley."

The decade of the sixties was blossoming period for research in Southeast Asia. In Southern Vietnam, Saurin(1963) reports on the site of Hong Gon, had revealed a prehistoric site from where four sand stone moulds were found, two for casting the socketed axe heads which had been so well known since the 1870s, and two for casting round- headed pins. A radio carbon date on the basis of organic material from a pottery vessel at this same site was 3044- 3045 BC.

In 1960 a remarkable report from the north east Thailand, Ban Chiang was revealed.[16] The site was reported from the findings of surface of the earth during heavy rain mostly pot sherds of red painted pottery. In 1967, the Thai archaeologist Vithya Inlakosai excavated there, and encountered human burials associated with bronze and iron bracelets, as well as some of the very attractive red-on –buff painted pottery.

[15] Ibid, p. 32
[16] Ibid, p. 34

Another excavation of 1970s conducted by Nikom Suthisagsa found deposits about 4m. deep, a skeleton at the very base wearing eight bronze bracelets. The Thermoluminescence (TL) dates on the pre historic pottery found from the same site came as fifth millennium BC.

In 1974-5, Fine Art Department of Thailand combined with the museum of the University of Pennsylvania excavated the same area. According to the archaeologists Gorman and Charoenwongse(1976) the bronze they had uncovered might, on the basis of radiocarbon dates have been as early as about 3600 BC. Higham states that these would have placed them among the earliest in the world and certainly considerably earlier than any bronze items found in the Huanghe Valley, home of the Chinese bronze tradition.[17]

In 1966 and 1968 in Non Nok Tha the same part of Northeast Thailand was the focus of a major program of field work under the direction of W.G. Solheim II, of the University of Hawaii. The excavation revealed a large number of burial, bronze artifacts, in the main socketed axes and bracelets. There were also bronze moulds made of sandstones, of identical form to those recovered from Hang Gon. The radiocarbon determination from Non Nok Tha revealed that the bronze tradition at this site was far earlier and less complex than that identified at Dong Son and related sites in Vietnam.[18]

In mainland Thailand the Chao Phraya Valley has also been a focus for fieldwork from the early sixties. In 1961 a Thai- Danish expedition under the direction of Per Sorensen undertook a series of excavation in Kanchanaburi province on the western margins of the alluvial lowland. Some fragments of bronze bracelet were found from non mortuary findings. With radiocarbon dates the place was dated about 200BC. Located upstream of the Bang site, cave of Ongbah was investigated which was a burial site. A wooden coffin found contained a rich contains of grave goods, including six bronze drums of Dong Son affinities.[19]

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[17] Ibid, p. 34
[18] Ibid, p. 36
[19] Ibid, p. 36

Henceforth, the early period of the so called era of research into Southeast Asia provided evidence for the widespread presence of bronze casting. According to Higham there was an early phase when few bronzes of limited forms were found in some of the graves, and a later one when bronzes became very much more elaborate and varied. It seems that bronze was considered very important and useful metal that played a vital role to the inhabitants of the pre historic people. It can be presumed from the mortuary bronze objects that they were supposed to be possessed even after life realm. An important issue that can be noted from above study is that the Southeas Asian bronze can be dated as earliest in the world. The initial findings from this area can be dated second millennium BC would place the earliest bronzes comfortably later than those in the Huanghe Village in China. Another fundamental issue for those concerned with origins, lay in the finding, that, all the early phase artifacts comprised an alloy including copper and tin. It is clear that the search for such illusive objects of copper was necessary. This issue would be most profitable considered in the same context as tracking down the source of copper ore, and seeking the early evidence for mining and smelting. Some archaeologists tracked down the source of copper and tin mines and its smelting sites around Southeast Asia.

2.2 Basic Cultural Framework

The archaeological investigation helped to determine the basic cultural framework of pre history and early history of Southeast Asia.[20] It can be divided into five interlinked phases. The earliest phase is the two distinct type of adaptation by the hunter and gatherers. One group is found from the interior uplands that seem to move in small groups. Their cultural remains are found from the fore front of caves. They are generally named as Hoabinhians, which is named after the Vietnamese province from where it was discovered. The second group of habitat was found from the coastline. Excavation on such places uncovered prehistoric settlements, with remains of large, permanent and rich hunter gatherer communities.

[20] Higham, Charles, *Early Cultures of Mainland Southeast Asi*a (River Books, Bangkok, 2002). P. 26

Within the period of 8000- 6000 BC in the middle reaches of the Yangzi Valley, the transition of rice cultivation took place. Agriculture leads to establishment of permanent settlement by 5000 BC in the lower Yangzi Valley and by third millennium BC an intrusive occupation of Southern China was identified.

By the way of river route, rice cultivators reached the Red River Valley, the Khorat Plateau and central Thailand during the period 2500- 2000 BC. According to the evidences, early Austroasiatic language was spoken by the new settlers and it was defused to Burma and Eastern India at about the same time. This period is described as Neolithic period of Southeast Asia. This period was of short duration. Higham states:[21]

> *"A few late sites in Viet Nam and Lingnan include exotic imported jades and bronzes which originated in the Shang Civilization of China. Such contact might well have brought the knowledge of bronze casting, for from about 1500 BC, a distinctive Southeast Asian Bronze Age can be recognized. Sites with similar casting technology are found from Hong Kong and the adjacent mainland west to Viet Nam, Cambodia, Thailand and Burma. Southeast Asia some high-quality deposits of copper ore, and rich sources of tin. A series of excavations in the copper mines and the villages they serviced now make it possible to assess the social as well as the technological correlates of metallurgy."*

Bronze Age lasted around millennium before we encounter to the first evidence for iron forging. According to Higham origin of iron smelting are not known, but the dating of the earliest iron, in the mid first millennium BC is similar to that for the Warring States Period of China. Iron Age of different places might have co related. A local innovation in central Thailand, or contact with India, might also have occurred, for the Iron Age of Southeast Asia differed regionally. However Iron Age societies reveal indigenous and increasingly complex structures, a rapid growth of population, and participation in a growing international trade network.[22] By AD 100-200, it is possible to identify the rise of an early state in the Mekong Delta and to the Valleys of Mekong and Chao Phraya rivers, and the coastal plains of Viet Nam. States were formed upon local traditions emerged under the leaders who adopted aspects of Hinduism and Buddhism,

[21] Ibid, p. 27
[22] Ibid, p. 27

and Sanskrit names. The Indianized characteristics of states are states of Angkor, Dvaravati in central Thailand and Champa in Vietnam.

2.3 Diffusion of copper smelting and casting in Southeast Asia

In interpreting the archaeological record in terms of cultural change, it is important to determine in which direction each change spread and, as nearly as possible, where it originated within the area being studied. By the process of diffusion, metallurgy spread from Huanghe River Valley of Northern China into the Khorat Plateau of Northern Thailand within a span of the second millennium BC. In Thailand's case substantial archaeological data exists in support of diffusion as the primary change agent.[23]

To investigate the origins of bronze working tradition, the stance lead us to the broad expanse of North China to Eurasian steppes. The earliest bronze casting in China came from the remote western provinces. Sites of the Majiayao and Machang cultures in Gansu, Qinghai and Xinjiang which include cast and forged copper knives and other tools, dated between 2740-1900 BC. China's earliest known metallurgically produced artifact is a 6- 10 percent tin-bronze knife from Linjia located in the Gansu region of the upper Huanghe River Valley. The knife was found from a storage pit. Fragments of metallic residue found in other pits at the site suggest the possibility of local casting, but the lack of additional evidence for metallurgical activity indicate otherwise. "Only one further metal item has been recovered from the Machang phase, a fragment of a second knife from Jiangjiaking. This has been reported as a copper- tin alloy.[24]

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[23] Rowe 1962:41, Cited Daniel Eugene Everly, *The Relevance of Contemporary Bronze Casting in Ubon Thailand for Understanding the Archaeological Record of the Bronze Age in Peninsular Southeast Asia,* (Texas A& M University, 2004). p. 34

[24] Higham , Charles ,*The Bronze Age of Southeast Asia* (Cambridge University Press, UK, 1996). pp. 44-45

In China Afanasievo culture of the Irtush, Ob and Yenesei valleys is an intrusive element east of the Urals, and it represent an eastward movement of people belonging to the Yamnaya culture. Yamnaya culture concentrates west of the Urals and dates in its earliest phase to about 3500 BC. It is significant not only for the presence of copper based metallurgy, but also for the presence of domestic horses and wheel carts. [25] Most of the cemeteries excavated from the Afanasievo sites contained pottery vessels along with copper beads, and gold and silver ornaments, as well as the remains of horses, sheep and cattle. The greatest density of this site lies in the copper rich Minurinsk Basin and the middle reaches of the Yenesei Valley. It is also claimed that the form of the crania of the people matches that found to the west and was of Europoid affiliations. The metal industries became more sophisticated in the succeeding Okunevo sites. By now copper was being alloyed, and cast into knives, awls, fish hooks and bangles.

It is presumed that because of horse transport the technology of copper based industries expanded further east. A site similar to Afanasievo culture was found from Tarim Basn. During the early period of this site, Radio-carbon dated between 2000-1500 BC from the organic materials, grave goods included copper, bone and jade ornaments, together with wheat grains were uncovered. Investigations on clothing included to the inheritance of some textile traditions from a common source which was found from far to the west at Hallstatt in Austria. Higham states that,[26]

> *"These sites cast serious doubt on an indigenous origin for the Chinese bronze tradition…….the western parallels in copper and bronze working, and the strategic location of the Qijia sites adds weight to the possibility that horse transport across the steppes in the third millennium BC brought not only speakers of an indo- European language, but also the technological expertise developed in the west."*

The established bronze industry helped to produce finest and as heavy as 800 Kg bronze object. The Shang Dynasty influenced to a wide range of typical jade halbards and

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[25] Higham, Charles, *Early Cultures of Mainland Southeast Asi*a (River Books, Bangkok, 2002). P. 114

[26] Ibid, p, 115

yazhang blades, as well as the occasional bronze, found their way into northern Vietnam and Lingnan. In Hong Kong and Bac Bo area the first local bronze castings in bivalve moulds was found. Schofield(1975) found six moulds for casting socketed axes at Shek Pik on Lantao Island, Hong Kong in 1937.[27] Dated between 1300 and 1000 BC, axe moulds belonging to the Northeast or central Thailand, were found at Kwo Lo Won (Meaxham 1993). Likewise axe mould and bronzes were found from Chau Hing Wah and Tung Wan Tsai, dated 1700-800 BC.

Higham gives two alternative interpretations from extensive body of data. It shows that either the origins of the Southeast Asian Bronze Age as being part of a continuum, which began in the Near East and progressively expanded across the steppes to the Gansu Corridor and into China. From there, knowledge of copper smelting and alloying would have spread south along well established routes of exchange to Lingnan and Southeast Asia, and New Guinea. Higham's second alternative involved the local discovery of the properties of copper and tin ore, and their enhancement through alloying, coincidentally at the very time when the Neolithic Societies were being exposed to imports and, presumably, ideas, which originated in one of the most sophisticated of early sites. It seems that whether of exotic or local origin, knowledge of how to smelt ores of copper and tin to make bronze and cast this alloy have spread very rapidly along the Neolithic exchange route. Similar bronze artifacts and casting technology were found from Hong Kong and the coast of Guangdong to Yunnan, into Central Thailand. The transition from the Neolithic into Bronze Age occurred. As far as can be judged at present by the local and long established communities.[28]

The transition is well represented at the site of Non Pa Wai in the Khao Wong Prachan Valley in Central Thailand. Radio carbon dates reveal that copper smelting at Non Pa Wai began in the period 1500-1000BC. During excavation from the two periods (2A and 2B) of the Bronze Age sequence from these places, mortuary objects like ceramic moulds designed for casting a large socketed axe, along with other associated

[27] Ibid, p. 116
[28] Ibid, p. 118

tool for casting a large socketed axe, along with other associated findings and deposits of oxidic copper ores which were rich in copper and low in impurities were found. The ores were crushed into manageable pieces, and charged in ceramic crucibles in which smelting took place. The excavation in Non Pa Wai showed how technology of smelting ores, and casting change in method. Some large ceramic copper smelting crucible, some ingot and ingot mould was found from Non Pa Wai.

Likewise Nil Kham Haeng is a second major smelting site in the valley, located near Non Pa Wai. Copper production continued at this site for about 800 years, from CA, 1100-300 BC. Mixed ore were being smelted here from initial occupation. Ceramic-lined bowl furnaces cut into the ground, and covered by a portable furnace chimney was used for copper smelting operation. Nil Kham Haeng was a center for continuing copper production into Iron Age, and must have supplied copper for extensive exchange network.[29]

In Northeast Thailand at Phu Lon, Natapintu and Pigott investigated a copper mining complex strategically placed to take advantage of the Mekong River as a conduit for access and distribution of copper ores and bronzes. [30] From here, actual mining shafts have been explored, the stone moulds used to extract the ore and ceramic vessel still lying within. The Pottery Flat excavation revealed a substantial accumulation of crushed ore host rock, containing within evidence of some smelting activity, including slag and fragments of small ceramic crucibles and two casting moulds. The site was given date of 830- 590 BC by Radio Carbon. The analysis of the crucibles by Verman(1996-7)[31]indicates that they share not only the same shape as those known from village sites on the Khorat Plateau such as Ban Chiang and Bang Na Di, but remarkably they share the same technology of their manufacture as well.

[29] Ibid, pp. 118-122

[30] Natapintu 1988, Cited Higham, Charles, *Early Cultures of Mainland Southeast Asia* (River Books Ltd. Bangkok, 2002). pp. 122-123

[31] Cited, Ibid, p. 122

The excavation of Non Nok Tha(1965) in Northern Thailand, located 120 km south of the Phu Lon copper mines, revealed the presence of inhumation burials associated with whole pottery vessel and bronze artifacts. A socketed axe made of a 14% tin bronze was found from over the chest of an adult male as a mortuary offering. Likewise in another burial bronze socketed axe and two crucibles containing fragments of casting spillage testify the local metallurgy.

The 1974 excavation of Ban Chiang revealed Bronze Age grave over a Neolithic cemetery. Bronze Age casting was established within the period 1500-1000 BC. But in some cases date goes further back than the more available date which can be harmonized. The earliest Bronze Age graves in the 1975 excavation area underlay the remains of a clay furnace, surrounded by ceramic crucible fragments still retaining bronze from the casting procedure. Some copper and tin ingots along with a casting mould and crucible fragments were found. Likewise a socketed spear, bronze anklets, bronze axe, bronze bangles were found from the graves of Bronze Age. [32](Fig 1, 2)[33]

The 1984 excavation of Ban Na Di which lies 23 km Southeast of Ban Chiang revealed some Bronze Age artifacts. Most of the artifacts were associated to mortuary objects. Some crucibles and bronze were uncovered. One of the interesting features comprised the remains of a clay- lined furnace ringed by bronze detritus and remnants of crucibles. It has been used to heat copper and tin to melting point prior to casting. The site of Ban Na Di has provided evidence for all the stages of bronze casting like sandstone casting moulds, clay mould etc. some of the bronze found from the mortuary context include 19 bronze bracelets with one woman and one bracelet worn by a child. The Bronze Age falls between the span of 900-400 BC on these sites.

1999 excavation by O' Reilly in Ban Lum Khao dated within the period 1400-500 BC, found crucibles and mould fragments indicating bronze casting. Excavation of Nong

[32] Ibid pp. 134-135

[33] http://penn.museum/banchiang/wp-content/uploads/2009/06/2008_White_Bougon.pdf, 22 Aug 2010.

Nor found small socketed copper implements which were probably imported from the Khao Wong Prachan Valley. [34] Higham concludes that,

"The bronze age of Southeast Asia can be traced from Lingnan to the Chindwin Valley, and from Yunnan to the Mekong Delta. We can pursue the technical basis of this Bronze age from the mines to the ore processing and smelting facilities and hence to the casting of ingots and their arrival in agricultural village communities. There, smiths used small, clay- lined furnaces to bring their copper and tin ingots to melting point before casting socketed axes and spears in bivalve moulds. Arrowheads were also cast, while clay moulds were used for casting bangles by the lost- wax technique."

The Bronze Age within this area lies within the period 1500-100BC. It is to be noted that Lingnan, a component region of this region, lies open to the exchange of goods and ideas flowing south from the early Bronze Age civilization of China. China might have involved in introduction of the properties of copper and tin ore when smelted. There were long established exchange networks that would have sped the transmission of ideas as well as ingots. Higham states that "evidence for the social organization associated with the mining and exchange of copper suggest a long tradition of community participation without the formation of controlling elites. In the Khao Prachan Valley, there were changes in the means of smelting and casting. [35]

2.4 Iron Age bronze

Bronze culture continued to the proceeding Iron Age. Iron was being used in South East Asia between 300 and 500 BC. Along with iron artifacts, both the quantity and range of bronze artifacts increased greatly from about 500 BC for example from Dong Son. Remarkable of the artifacts are the Don Son drums found in 1997-8 at Crio Son and Tra Loc, Quang Tri Province in Viet Nam.[36]The Co Loa drums, weighs 72 kg, and would have entailed the smelting of between 1-7 tons of copper ore (Nguyen Duy Hinh 1983). [37] One burial from the Long Ca cemetery contained the remains of a crucible

[34] Ibid p. 145, See Fig 7.12 Higham, Charles, *The Bronze Age of Southeast Asia* (Cambridge University Press, UK,1996). p. 147

[35] Ibid pp. 166-167 Higham 2002
[36] Ibid pp. 169-177
[37] Cited Higham 2002

and four clay moulds for casting axe, spear head, dagger handle and a bell. The mould for the dagger handle suggests that it may have been intended as a bi- metallic weapon with the blade of iron. Many novel and decorated artifacts form were cast. The drums and rectangular ornamental plaques suggest an interest in ritual and ceremony, personal weaponry like daggers, swords and agricultural objects like socketed bronze plough suggest various objects of varied purpose. It suggests that the Dong Song metal workers were a master in difficult field of bronze casting. [38] The skill required to cast a massive drum surely entailed specialized workshops. The alloys comprised copper, tin, lead and arsenic, and literally hundreds of copper pins were employed to separate the two clay moulds during the pouring of molten bronze. The distribution of such drums covers much of southern China where rich chiefdoms of contemporary Dong Son phase are well known.

Excavation of moated site of the Chi River Valley on the Khorat Plateau revealed evidence of iron and water buffalo.[39]At the large site covering approximately 38 hectares is Non Chai, located in the upper reaches of the Chi drainage system, was excavated by Pisit Charoanwongsa in 1978. Continous occupation of the site is described in five phases dating from 400 BC through 200 AD. Phases II and III dated between 300 and 200 BC yielded bronze and crucible fragments along with four glass beads. Clay moulds for casting bronze bracelets and bell were found in phase III through V context.[40]

Non Dua, the moated site of the Mun River Valley,yielded a deep stratigraphic sequence, the initial phase of occupation being assigned to the period 500 to 1 BC(Higham 1989:215). Pottery sherds found at Non Dua match both the form and elaborate decorative elements (geometric and curvilinear motifs) of contemporaneous ceramics at Ban Chiang Hian. Excavation by Welsh at Ban Tamyae, located just a few kilometers from the stone temple Phimai, document a pattern similar to that witnessed in

[38] Ibid 169-177

[39] Higham, Charles(1989:210) Cited, Daniel Eugene Everly, *The Relevance of Contemporary Bronze Casting in Ubon Thailand for Understanding the Archaeological Record of the Bronze Age in Peninsular Southeast Asia* (Texas A& M University2004). p 65

[40] Ibid, p. 65

the Chi Valley. Bronze found at the lowest level of the site's two and a half meter deep cultural stratigraphy is dated 1000 to 600 BC. Both iron slag and the water buffalo made their first appearance during the Prasat phase dated at 600 to 200 BC. Excavation done by Wichakana in 1986 within the moated site revealed three phases of inhumation graves contained bronze jewelry along with agate ornaments and small fragments of glass beads. "Third phase grave goods were richer and much more varied. Burial two was associated with a bronze head band, bronze earrings and bronze belt with a central buckle or plaque. Iron rings had been placed at the shoulder and in the groin area. A tanged iron knife was found at the left shoulder and a socketed axe had been placed at the left elbow." [41] it indicates that evidence of local smelting activities exists in the form of several smelting furnaces located on the southeastern edge of the site.

The first evidence of iron casting in Southeast Asia is found in the Bac Bo region of Northern Viet Nam in late Dong Son contexts following the area's incorporation into the Chinese Han Empire during the first Century AD. Higham states, iron working in the rest of Southeast Asia was, according to available evidence, based on the small bloomer furnace to produce iron, followed by forging.(Higham 1989: 192)[42] " Along with importation of the Indian method of iron working and glass agate and carnelian beads, the Kautilyan political doctrine of the fourth century BC Mauryan Empire is likely to have served as impetus for the development of the first large commercial centers on the Khorat Plateau. Thus, instead of a mere thousand years, India's political and economic influence on the Khorat Plateau appears to have extended back for a period of at least two thousand years."[43]

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[41]Hingham , Charles, *The Bronze Age of Southeast Asia* (Cambridge University Press, UK, 1996). p. 222

[42] Everly, Daniel Eugene, *The Relevance of Contemporary Bronze Casting in Ubon Thailand for Understanding the Archaeological Record of the Bronze Age in Peninsular Southeast Asia,* (Texas A& M University2004). p 69

[43] Ibid, p. 69

Bronze objects from the period of 500- 100 BC was found from the excavation done during 1990 in Ban Kan Luang, located on the outskirts of modern day Ubon. Nine large globular clay jars with lids were found at a depth of one to two and a half meters below the original surface. The range of grave goods found inside the burial jars suggests an elite status of those interred. A 45 millimeters high bronze figurine of a man was found in one of the urns, the decorations on the body described as discoid motifs, being matched on the bracelets. The importance of this object was representation of human figures in bronze. Virtually human figures are unknown in Khorat Plateau sites but are present in Bac Bo at the same juncture.[44] Bronze ornaments were thinly casted by lost wax technique into eight types. Bronze ornaments such as bangles are similar to artifacts of Dongson culture (500-100 BC) which has its center in North Vietnam.[45]

Influence of Cham in Khorat region is evident from the bronze artifacts found from the coast of Vietnam from the mouth of the Mekong to the southern boundaries of Dong Son culture in the Bac Bo region of northern Vietnam. Jar burials with cremated remains are found often large, covered with lids, aligned in rows, approximately a meter below the present surface and contain a range of grave goods.radio carbon date gives 400 to 275 BC at the site of Hang Gon which is contemporary to Ban Kan Luang. On the west side of the Truang Sen Cordellero near Ban Ang in modern day Laos, two groups of stone burial jars rest on the modern surface of the " Plain of Jars". These jars yielded glass and carnelian beads, bronze jewelry and iron knoves, arrowheads and spear heads. Small bronze bells and a bronze figurine similar to those from the Ban Kan Luang site were found at the Bang Ang site, which has been dated at 300 BC. Everly states that Cham continued to exchange trade with their motherland in the islands to the south, but it is likely the Cham who brought the knowledge of iron working and importation of glass and carnelian beads from India. Their style of treatment of the dead can be found at the

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[44] Hingham,Charles, *The Bronze Age of Southeast Asia* (Cambridge University Press, UK, 1996). pp. 228-229

[45] Daniel Eugene Everly, *The Relevance of Contemporary Bronze Casting in Ubon Thailand for Understanding the Archaeological Record of the Bronze Age in Peninsular Southeast Asia,* (Texas A& M University2004). p70. See Figures 1,2,3 pp. 71,72, 73

mouth of the Mekong, in the highlands of Laos and at ubon. Cham brought Indian Kautilyan political doctrines that led to the centralization of authority and the development of the first large commercial centers on the Khorat Plateau.[46]

Copper mining activities are evident for example from Khorat Plateau along the Mekong River; large deposits of copper ores are available. Excavation of 1984/ 85 conducted by the Thailand Archaeometallurgy Project at Pottery flat revealed a single stratum comprised primarily of crushed sharn. A charcoal sample from the basal level of the stratum, presumably associated with some of the initial activity of the site, is dated to ca. 1750-275 BC. Numerous rice chaff tempered crucible fragments, some with green dross adhering, a fragment of a sandstone mold, a fragment of a ceramic mold, large amount of charcoal and some slag point to the presence of metal working activities at the Pottery Flats.(Natapintu 1988: 113)[47]

The use of the extensive river systems as well as a means to transport exotic goods and ideas was a key prerequisite practice of the indigenous people that facilitated the spread of the metallurgical technologies throughout Peninsular Southeast Asia within the span of the first millennium BC. Despite the availability of large quantities of copper, use of this material without being alloyed with tin appears to be totally absent from the region's archaeological record. This together with the fact that the bronze artifacts found at Bac Bo and the Khorat Plateau are the oldest of any in Peninsular and Island Southeast Asia supports the impression that the technology to produce those items came from an outside source that was not likely east Asia. Data from second millennium BC cemetery at the Non Nok Tha site, locates along the Phetchabun Range in Northwestern corner of the Khorat plateau, indicate that a stone mould and a rice tempered clay crucible were found along with bronze grave goods that exactly match the design from the stone mould. Likewise data from occupational zone at Ban Na Di site, located on the Sakhon Nakhon plate in the extreme Northeastern corner of the Khorat Plateau indicate that clay lined bowl furnaces, sandstone moulds, crucibles and clay mould have been found in

[46] Ibid, p. 75
[47] Cited, Ibid, p. 79

association with bronze grave goods dated to the first millennium BC. At present some types of tools are being used by the smiths to manufacture bronze objects by the lost wax casting process on the Khorat Plateau.[48] Therefore there is a strong possibility of lost wax casting process may be the method by which bronze artifacts were manufactured in the wider area to mainland Southeast Asia.

Likewise according to the guide book of the National museum Bangkok[49], the copper fields with evidence of prehistoric mining were discovered in Thailand at present both in the northern and central regions at Phu Loan in Nong Khai province, at Khao wong Phra Chan in Lop Buri province and at Noan Pah wai in Huey Pong village, Khok Samrong district of Lop Buri Province.

2.5 Bronze in Historical Age

There is a great historical gap between the known Ban Chiang cultures to the early known culture of Thailand. However from the beginning of the first century AD new flow of trade and migrations were taking place in this part of Southeast Asia. Indian merchants seeking new products and markets began moving eastward and they sought to set up trading posts as key points of call, integrating themselves into the local communities. In the process, they introduced new concepts including art objects and techniques of casting. The effects of Indian culture in every aspect of Thai as well as in the South Asian life, literature, language, art, architecture, religion was beyond calculable. The art of Thailand in the first to sixth centuries is characterized by a total Indian domination either by imports of statues or by local creation of sculptures and other objects which were copies of Indian works or whose stylistic elements can be directly traces to a particular Indian school of arts. The concepts of Indian style existed until the 16th century.[50]

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[48] Ibid, p. 80

[49] *Guide to the gallery of Thai History* (National Museum, Bangkok, Fine Arts Department, 2002). p. 41

[50] Beek, Steve Van, Tettoni, Luca Invernizzi, *The arts of Thailand* (Periplus Editions Ltd, Hong Kong, 1999). p. 51

During third to sixth century, stretching across the peninsula in the region of Surat Thani, Dan Sun was a well organized state whose artisans possessed considerable expertise in casting bronze as evidences by bronze drums, found at several sites. [51]A 20 cm tall, standing bronze Buddha in the collection of National Museum of Nakhon Si Thamarat is dated between fifth and sixth century is a very important example for the evidence of bronze craftsmanship in Thailand.[52]

Tradition of bronze art continues further to the Mon Dvaravati period which covered the area of central Thailand of which the art is named as Dvaravati School of art, in the span of sixth to eleventh centuries.(Fig 3,4)

Srivijaya was the most outstanding period for art which flourished between eighth and thirteenth centuries on the south of Thailand which covered its territories to Sumatra and Borneo. Srivijaya marks a high point in Thailand's artistic developments. The artists produced finest stone sculptures ever produced in the country and for reaching a new height in bronze casting especially creating large pieces of sculptures. Bronze craftsmen produced Buddhist images, mainly Bodhisattva Avalokitesvara of flawless beauty that stands as the finest example of art in Southeast Asia. (Fig. 5)

Likewise Lop Buri artists preferred to work in bronze and used bronze sometimes used high silver content which gave the look of oiled iron. The art works are monumental with up to 3.3 meters tall. An example can be taken of a crowned bronze Buddha image (12^{th} C. AD) from the collection of National Phraya Museum of Ayutthaya.

Bronze art and its workmanship reached its zenith during Sukhothai and Ayutthaya period. Sukhothai sculptors preferred bronze as their medium. Thais may have preferred a material which starts from nothing and evolves into something, unlike carving, which begins with a massive block and is chipped away at its bulk to reduce it to the desired form. Shaping the wax and clay of a bronze mold by hand is a sensuous experience which allows the subtle feelings to flow into the lifeless clay. It also imparts

[51] Ibid, p. 52
[52] Ibid, p. 57

the smoothness and fluidity which are the prime characteristics of Sukhothai sculpture and which cannot be achieved with stone. The Thais learned the art of bronze from Mons, southern Indians, whatever technology remained after the disappearance of Ban Chiang and the Khmers. Their techniques were perfected by Sri Lankan monks visiting Sukhothai. The latter, however, imparted their knowledge long after the Sukhothai style was well established, so were able to exert little influence on the artistic sensibility of the sculptors.[53](Fig 6)

The principle activity of Ayutthaya sculptors was the creation of Buddha images and some Hindu images. Bronze was the principle medium. Until the period of Ayutthaya the techniques of casting was very much in developed stage and the sculptors were the technical masters. The method of bronze casting until this period obtained was the traditional lost wax or *cire perdue* casting method which was prevalent from the centuries before. (Fig 7)

2.6 Bronze in Modern Age

According to art critics Bangkok period sculptures are not shining stars in the annals of Thai art.[54] It is said that artists were not as prolific as those of previous age; who demonstrated an admirable willingness to explore new themes. The inspiration of art was not only religious and it went through gradual modernization process. Sculptures of the period between 1782 to 1851 delved into old literary and Hindu texts to find new themes and new ways in which for example to depict the Buddha, and created a variety of pieces without precedent. Early Bangkok sculptors also preferred to work in bronze as well as in wood and stucco. It was a challenging period for King Rama I to reestablish the legacy of art after the destruction of Ayutthaya. People were gathering their will and courage to help reestablish the new kingdom. In order to fill Bangkok's many new Wats with Buddha images, King Rama I brought statues from Sukhothai and Ayutthaya which had not been destroyed by looters. He provided sculptures with examples of various

[53] Ibid, p. 113
[54] Ibid, p. 180

styles enabling them, like court poets, dramatists, artists and religious scholars to create the work lost in Ayutthaya's destruction.

King Rama III(1824-1851) was an active patron of arts. Tamra Devarupa(in Sanskrit meaning- features of copper god icon) , a Hindu iconological treaties were written at the time of King Rama III. Many Buddhist and Hindu deities were cast in bronze during this period. Among the most remarkable creations of sculptures created during this period is a series of 33 kings [55](40 according to Subhadradis Diskul[56]) which depicted the main events of Buddha's life. Earlier Bangkok period artists created numerous statues of disciples and hermits. Other similar examples are the sculptures of King Rama I and Rama II established at the both side of the Emerald Buddha temple. (Fig 8)[57]

King Rama IV, with his other political, religious and social reforms, took the same approach in arts. New forms of bronze were casted during this period. From King Mongkot's period western and Thai artists started to make sculptures of the ruling king. King Mongkot received the first western- style bronze busts and sculptures from Queen Victoria of England as a gift of good will in1859. Another 59 cm high standing sculpture wearing a traditional Thai dress of King Mongkot was presented by the French Government in 1863. The sculptures were made upon the base of pictures provided.(Fig 9) With the interest of making more realistic sculpture of the king he commissioned a local artist named Luang Theprojana(later named Phraya Chindarangsan) to make his

[55] Ibid, p. 181

[56] Subradradis Diskul, *Art In Thailand: A brief History*(Amarin Press, Bangkok, 1981). P.29

[57] Apinan Poshyananda, *Western- Style Paintings and Sculptures in the Thai Royal Court* (Bureau of the Royal Household,1992)

standing bronze statue which was very remarkable in its own way.[58] Another bronze statue of the King Mongkut was made by Prince Praditthavorakarn in 1871. (Fig 10)[59]

After King Mongkot, his son King Chulalongkorn, Rama V was seen always as an admirer of art and very fond of western art and architecture. King Rama V gave new dimension to the tradition of bronze art. He ordered to make copies of famous images like Phitsanulok's venerated Phra Buddha Jinnarat(Fig 11) now in Wat Benjanabopit. He also commissioned to undertake original Hindu and Buddhist art. The images were inspired by the *Tamra Devarupa*, the Hindu Iconological treaties. The images were made in entirely traditional way of lost wax casting method.[60]

King Chulalongkorn was taking very keen interest on making his portrait and bronze image while he was on a tour of Europe. On his first visit to France he commissioned French artists to make his portrait and bronze image. It is interesting to note that when Thai artists were capable to make such a good quality of bronze arts, why Thai kings chose European artists to make their portrait and sculptures? It was definitely the exposure to the western world at the period when they were having profound change in habit and thought. King Chulalongkorn was very much influenced by the French artist on their skill of making art work very quick compared to Italian counterparts.[61]

However king Chulalongkorn was impressed with the engineers and architects of Italy, some of them were commissioned by the Chulalongkorn's government in service of building many important royal palaces and public places in Thailand. [62] King Chulalongkorn visit to European countries brought back not just ideas for technical and

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[58] Wong, Ka, F. *Vision of a Nation: Public Monuments in Twentieth- Century Thailand*, (White Lotus, Bangkok, 2006). p.p. 14.15

[59] Apinan Poshyananda, *Western- Style Paintings and Sculptures in the Thai Royal Court* (Bureau of the Royal Household,1992). p. 31

[60] Beek, Steve Van , Tettoni, Luca Invernizzi, *The arts of Thailand* (Periplus Editions Ltd, Hong Kong, 1999). P. 185

[61] Peleggi, Maurizio, *Lords of Things: The Fashioning of the Siamese Monarchy's Modern Image* (University of Hawaii Press, USA, 2002). p. 107

[62] Watanangura, Pornsan(editor)*The visit of King Chulalongkorn to Europe in 1907: Reflection on Siamese History* (Chulalongkorn University Printing House, Bangkok). P. 109

economic advancement, but also architects, painters and sculptors, mostly from Italy. These artists worked together with their Thai counterparts at court. Then after the way the art was regarded and the forms it took underwent gradual transformation in Thailand. Historical facts prove that major renovations and reforms of Siam with the spirit of modernization were initiated by King Chulalongkorn before his first visit to Europe. Art and architecture in western style were also adopted in Siam long before the voyage of 1897, in particular through artistic contribution of western private entrepreneurs in Bangkok. Western artists and architects entered into the service of the Siamese government with an important role to develop the infrastructure and new form of art and architecture. It was the national plan to modernize the nation.

One of the most profound changes and achievement in art was a great concern with realism and the techniques in creation of art objects. In 1897, a life size marble sculpture of Rama V was commissioned to an Italian professor, Cesare Fantachiotti, in Florence. The statue is now placed in the Chakri Maha Throne Hall which was the realistic depiction of the King, wearing full western military attire with medals and sashes, holding a top hat in his right hand with left hand leaning against a long sword that touches the ground. The king was much delighted by the image which signified a westernized and civilized political power. Further he ordered Fantachiotti to model bronze versions after this statue and then sent them to foreign sovereigns as well as local subjects as a token of diplomacy. (Fig12)The climax of this reached in 1908 when the first public monument, the equestrian statue of King Chulalongkorn was unveiled on the occasion of the fortieth anniversary of his accession on the throne was celebrated. After this a new chapter in monumental art history had officially began.[63] (Fig 13,14,15)

King Chulalongkorn's son King Rama VI, under the royal patronage conducted significant activities for the introduction and development of the concept of modern art in Thailand. "The reign of King Vajiravudh was a period when traditional arts and crafts of

[63] Wang, Ka F., *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006). pp. 17,18

the Royal preference were promoted. The king was determined to revive the Thai people's interest and appreciation of Thai culture, which had been on the decline in the face of the powerful western influence and the enthusiasm of the *Siamese* in adopting Western culture."[64]To revive and restore the traditional Thai arts of different field, King Rama VI established the Department of Fine Arts in 1911. In the following year the arts and crafts school was established where instructions were provided in a range of visual and performance arts. King Rama VI commissioned a number of overseas artists to work on the decoration of various palaces and throne halls. The Royal Siam government requested a proficient sculptor from Italy. From this request Professor Corrado Feroci, an Italian sculptor from Florence was selected from 200 applications to work in the Department of Fine Arts. Professor Feroci's contribution on Arts in Thailand gave a new dimension in Thai arts. A foundry was made in a warehouse beside the Department of Fine Arts in 1941. In 1987, the office of the Division of Handicraft was moved to Salaya district in Nakhon Pathom where new and modern foundry was built for more capacity. The old foundry is converted to a Museum of models and prototype of the National Statue bearing the name as "Hall of Sculpture".(Fig 16)[65]

The special and royal statues were made in the then found foundry of the Fine Arts Department under the supervision and active participation of the Italian sculptor Corrado Feroci or Silpa Bhirasri (his Thai name).He was in service for the Siam Government from the time of King Rama VI from 1923 to 1962 until his death. He acted as a father figure and mentor for generations of Thai artists. The most outstanding life size statues made by Silpa Bhirasri were the King Vajiravudh's(Rama VI) (1941)statue of Lumphini Park(Fig 17), King Prajadhipok's(Rama VII) statue, Thao Suranari statue of Nakhon Ratchasima province(1934), statue of King Naresuan(1959), Monument of King Naresuan(1958)of Don Chedi of Supanburi etc. Another significant statue made by him

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[64] Apinan Poshyananda, *Western- style Painting and Sculpture in the Thai Royal Court* (The Bureau of the Royal Household, Bangkok, 1992). p. 288

[65] Nilwan Nildum, *The Architectural Heritage For Wang Tha Phra And Wang Thanon na Phra Lan*: *From The Palaces of Builders and Craftsmen To the Art And Cultural Centre* (Silpakorn University, Bangkok, 2003)

and prince Naris was monument statue of King Rama I (1932) placed on the memorial bridge. Some other statues made by him along with his students are King Chulalongkorn (Rama V), King Ananda Mahidol(Rama VIII) (1959), King Naresuan the great placed in Non Bua Lom Phu province, King Ramkhamhaeng the Great, relief panels of the democracy monument[66] etc.

Students (Fig 18, 19) (Appendix 5, Bio-data 1) taught by Silpa Bhirasri were having very good performance on producing many bronze statues during and after his death. Because of the public demand and fashion of making statues and monuments of the Thai elites, the Group of sculptors of Thai Traditional Arts Division of The Fine Arts Department had very good reputation until present.

Before the introduction of modern arts, Thai artists had traditionally served an apprenticeship under a master painter or sculptor, who would set them exercises in technique which trained them in every aspect of their work. There was relatively very little room for variation in style or content and the concept of art as the expression of an individual vision was unknown. Silpa Bhirasri's position was to develop their own skills and styles to break free from the constraints of their predecessors, and to serve as the master whose lead was followed by his disciples. Under the support of Prince Naris Ranuwattiwong[67], a patron of art, a "Ranaissance Man", "The Great Teacher"(borom khuru), whose impact on Thai art was phenomenal[68], Silpa Bhirasri was able to establish his impression on modern art in Thailand. He encouraged the Thai artists and sculptors to study in the European tradition, followed western conventions of drawing and portraiture and most importantly, sculpture. Silpa Bhirasri's initiative succeeded on the establishment of the Silpakorn University. He inspired his students to look for new ways of both classical arts and European art.

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[66] Wang,Ka F., *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006). pp. 14-117

[67] This information was provided by Ajarn M.R. Chakrarot Chitrabongs, Shastravighya, Chulalongkorn University.

[68] Ibid, p. 30

The discussions have revealed the fact that bronze as a fascinating metal still holds the popularity at present with the deep rooted culture of using bronze as an object of utility and art from the pre historic society. With the variation of presenting the art form the contemporary bronze statues made in modern scientific way and process is the testimony of the different monumental sited of the past kings and hero personnel scattered all over Thailand.

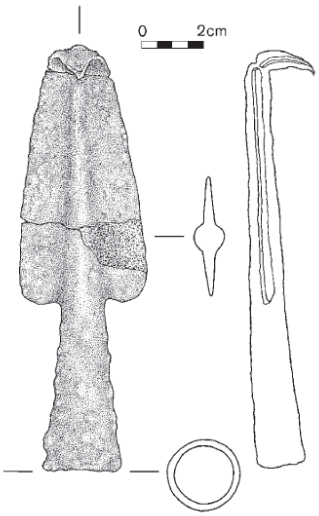

Figure 1. Bronze spear point, BCES 762/2834 from BCES Burial 76 dates to the early second millennium B.C., Ban Chiang

Figure 2. Bronze bangles found from Ban Chiang excavation.

Figure 3. Buddha Descending from Tavatimsa Heaven, bronze, Dvaravati art, 8th- 9th century, National Museum, Bangkok.

Figure 4. Teaching Buddha, Dvaravati Art Style, 8th -11th century, Excavated at Pong Tuk,Kanchanaburi Province, 1927, Collection of National Museum Bangkok.

Figure 5. Avalokitesvara Bodhisattva, Shrivijaya Art Style,9th century AD, From Wat Phra Boromathat, Chaiya District, Surat Thani Province.

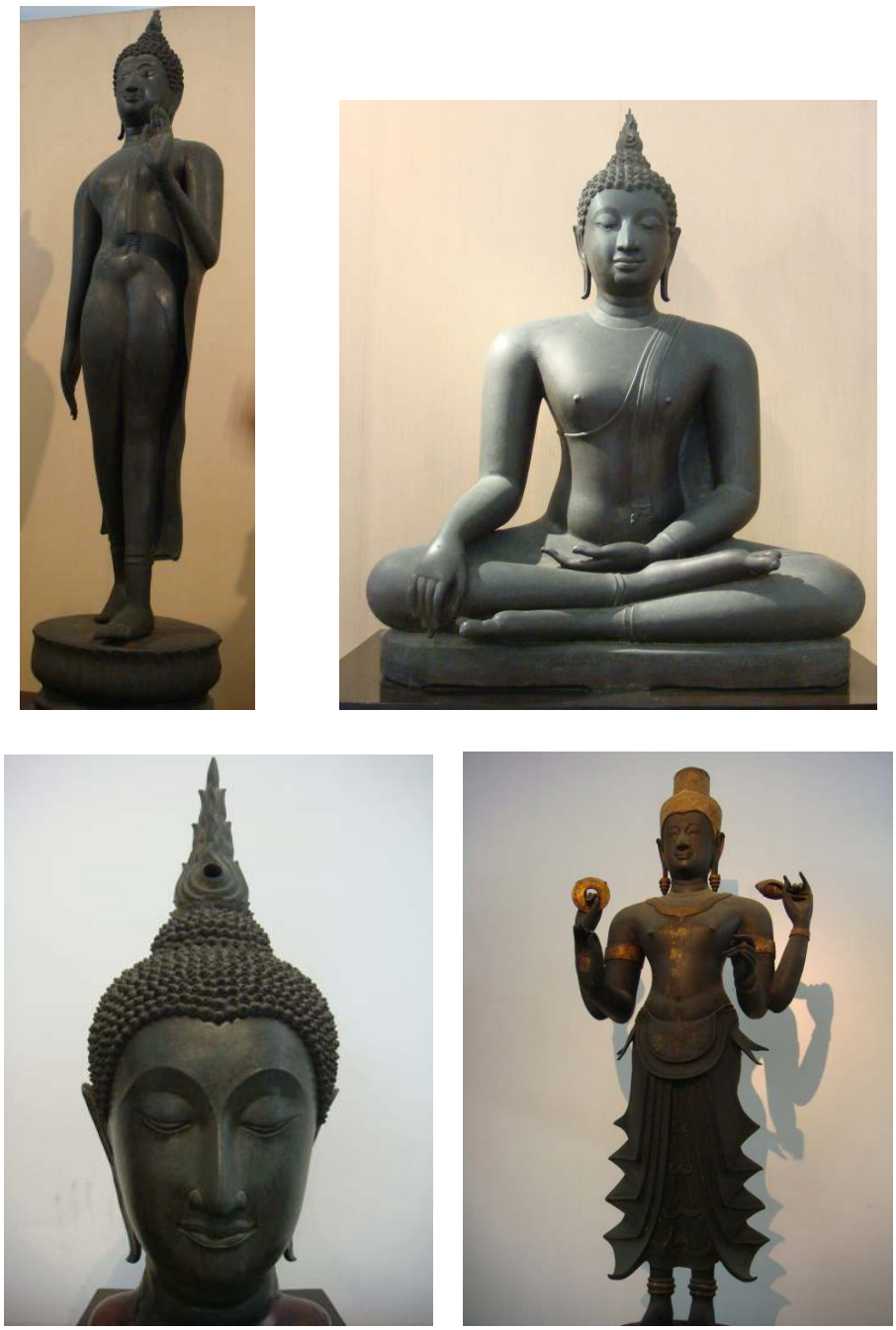

Figure 6. Sukhothai style bronze Buddha and Hari Hara sculptures, 14th -15th century, National Museum, Bangkok.

Figure 7 Seated crowned and bejeweled Buddha, bronze, Ayutthaya Style, 16th century. Collection of National Museum, Ayutthaya.

Figure 8. Phra Phuttha Loetla Napalai, and Phra Phuttha Yotfa Chulalok, Bronze with gold enamel and precious stones, third reign, height 300cm. Convocation Hall, temple of Emerald Buddha, Bangkok.[69]

[69] Apinan Poshyananda, *Western- Style Paintings and Sculptures in the Thai Royal Court*, (Bureau of the Royal Household, 1992). p. 16-18

Figure 9. Emile Francois Chalrousse, King Mongkut, Guilded Bronze, Height 59 cm, 1963[70]

Figure 10. King Mongkut, Guilded Bronze, height 160 cm, 1871, Phra Thepbidorn Hall, Temple of the Emerald Buddha, Bangkok, made by Prince Praditthavorakarn.[71]

[70] Ibid, plate 27(1)
[71] Ibid. P. 31

Figure 11. Phra Buddha Jinnarat, bronze, Pitsanulok.

Figure 12. Marble(1897) and bronze(1901) life size sculptures of the King Chulalongkorn made by Cesare Fantacchiotti.[72]

[72] Ibid. pp.153- 154

Figure 13. Sketch and the equestrian sculpture of the king Chulalongkorn. Foundry members of Georges Earnest Saulo, Susse Freres, France 1907- 1908[73]

Figure 14. Photograph of silver jubilee of the King Chulalongkorn's coronation, 11 November 1908, Bangkok.[74]

[73] Ibid, pp.110-113
[74] Ibid, pp.110-113

Figure 15. The equestrian statue of the King Chulalongkorn in front of Ananta Samakan Throne Hall or Royal Plaza, by Georges Earnest Saulo, 1908

Figure 16. Hall of Sculpture, Fine Arts Department, Bangkok.

Figure 17. Monument of King Vajiravudh, Rama VI (1941) by Bhirasri, Lumphini Park, Bangkok.

Figure 18. Professor Silpa Bhirasri at center with his students.

Figure 19 Ajan Boonsoong, Professor Silpa Bhirasri's student.

CHAPTER III

LOST WAX BRONZE CASTING TECHNIQUE IN THAILAND

Technology of manufacturing bronze objects in South East Asia and Asian sub continent is fundamentally similar and in some cases the material and process differs according to the context, geographic region, workmanship or technology and use of the materials. Traditional bronze casting technique is considered the asset and cornerstone of bronze workmanship. With the modernization and change of society the technology tend to change according to the contexts and demand of newness by the pioneers of art. The chapter discusses with the establishment of the Department of fine Arts, keeping the aesthetic technology of traditional bronze casting technology as a valuable asset, the contemporary bronze casting technique is acquired to make more scientific, realistic bronze statues. The difference between the traditional and contemporary method is discussed with the peculiarity of technology practiced in other places of Asia.

3.1 History of the Department of Fine Arts

Religion and art is the vital component of culture. Art whether tangible or intangible, is a source of knowledge and a heritage which is handed down by generation to generation. It is obligatory that it needs to be observed, ready to be passed on to posterity. There is also a need for the promotion of creative contemporary art which can be added to the wealth of wisdom for the current generation. Art as a component of culture; it was given very important attention by the royals of Thailand. During the time of King Rama V, all kinds of artisans in the ministry were collected into one place which was called Wang Thanon Na Phra Wang. In royal initiative, for the convenience of controlling and cooperation of the art and performance, a group of various artists was created which was named as Krom Chang Sib Mhu(the ten groups of artisans). In the reign of King Rama VI, Krom Chang Sib Mhu was incorporated into the Department of fine Arts, which was created on March 27, 1911 attached to the former Royal Household.

According to the information obtained via website of the Fine Art Department, before 1911, Thai cultural heritage in the fields of archaeology, history, literature, drama, music, artistic works, archives, and museums were under the care of various government agencies. The wide range of responsibilities tended to be scattered and left unattended. Until 1911, in the reign of King Rama VI who regarded art and culture as the root of the Thai people and their Kingdom. The Fine Art Department was founded by the Royal Command on March 27, 1911. In this period European art was popular in the country, so Royal Siam Government requested a proficient sculptor from Italy. From this request Professor Corrado Feroci, an Italian sculptor from Florence was selected from 200 applications to work in the Department of Fine Arts. Professor Feroci's contribution on Art in Thailand gave a new dimension in Thai art.

In 1926 during the reign of King Rama VII, the fine Arts Department was dissolved as the Government was unable to allocate sufficient budget for cultural affairs owing to the world economic crisis. All divisions in the department, except the artisans group, transferred to incorporate with the library division, and created to be the Royal Academy called the Royal Academy of Fine Arts. The artisans group was created to be the outer Royal Household Division attached to the former Royal Household. After the political change of the country, the Royal Household was abolished and a group of artisans were transferred to under the Department of Fine Arts which was reinstated in 1933 and until present, the department has under gone continuing changes so as to keep up with the changing circumstances. In 1934, Luong Vichitrawatakron was appointed as the first Director General of the Department. During this period, the art works products from the Department had been well known because all kinds of artisans were collected into the department in the new created division, named the Fine Arts Division. Since this period the status of the department has been secured and continued to prosper until present. Now a day the Department of Fine Arts has duty and responsibility for conservation, promotion and supports in many kinds of National Arts and culture,

particularly the National Heritage. At present Fine art Department is under the jurisdiction of the Ministry of Culture.[75]

The history behind the establishment of the Ministry of Culture goes back to the period of Rama VII. It was during the Field Marshal Plaek Pibulsonggram's government, culture was viewed as key dimension in the process of nation building and decided to assume a more active role in cultural development. In 1940 AD and 1943AD two acts on the development of national culture were promulgated. These two acts were later suppressed by the National Culture act 1942 AD and the amendment act – the National Act 1943 AD. As required by the National Culture Acts, the National Culture Institute was founded. Subsequently the Ministry of Culture was established on March 12. 1952. The first minister of the Culture became the Field Marshal Plaek Pibulsonggram as an acting minister. During the late 50s because of political condition the Ministry of Culture was dissolved and their personnel transferred to the Culture Division attached to the Ministry of Education. In October 2, 2002, the Ministry of Culture was reestablished according to the new structure of the Thai government under the 2002 restructuring of the Government Agencies Act. With the jurisdiction over the different departments: 1. Office of the Minister, 2. Office of the Permanent Secretary, 3. Department of fine Arts, 4. Office of the National Culture Commission, 5. Office of the Contemporary Art and Culture, 6. The religious Affairs Department, 7. The Bundit Palansilpa Institute and the public organization like The Princes Maha Chakri Siridhorn Anthropology Centre, the main mandate of the Ministry of culture is to protect , sustain, art and cultural affairs on the nation, and thus contribute to maintaining ultimate symbol of Thai social Values i.e. nation, religion and monarchy.

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[75] Nildum, Nilwan, *The architecture heritage management for wang Tha Phra and Wang Thaton Na Phra Lan: from the palaces of builders and craftmaen to the art and culture centre* (Silpakorn University, 2003). P. 20

As a part of Ministry of Culture[76], mission and function of the Department of Fine Art have specialized in arts, archaeology, literature, museum, architecture, national archives, performing arts, education in the areas of dance, music, composition, craftsmanship etc. [77]

Within the structure[78] of the Fine Art Department's one of the major area of work is the visual arts. The institute of fine arts is responsible for a wide range of arts in visual arts ranging from arts education, studies, preservation, design and supervision of the construction of government agencies and Buddhist temples in the traditional style. Likewise, the erection of national monuments and the reproduction of Buddha images come under the supervision of the Institute. In education, the scope of work covers the administration of the College of Fine Arts. The Institute of fine Arts has one of the duties of strengthen traditional craftsmanship known as "Chang sip mu" and ensures its continuity.[79]

Some of the major division of Fine arts Department is the Division of Handicrafts and the School of Fine Arts. After the outer Royal Household was abolished, the groups of artisans were transferred to a new created division named "Kong Praneet Silpa" (The Division of Fine Arts) under the Department of Fine Arts. At that time art works produced from this division was really remarkable, especially sculptures which were produced under the supervision of Professor Feroci. To create lots of national arts the Department of Fine Arts needed lots of craft people. For the purpose to train young apprentices of sculpture, painting, architecture, drafting, and design and for the works in the department, the school of Fine Arts was found under the direction of Professor Feroci. Feroci's studio was made in a western style building near the office building. In 1938, the division of Fine Arts changed its name to "Kong Hattha Silpa"(Division of Handicraft), and adapted Thong Phra Rong Wang Klong to use as an office of the division. The first chief of the division was Phra Phromha Pichitr, a master of Thai traditional arts and

[76] Appendix 1
[77] Appendix 2
[78] Appendix 3
[79] Appendix 4

architects, and the other experts were Professor Feroci, a specialist in sculpture and Mr. S. Miki, a Japanese specialist in lacquering. A temporary workshop was built in the area behind the department office building in 1941, but the foundry was made outdoor. Later the working area was moved to the warehouse near Wong Tha Phra. According to Nildum the important statues made at that time was of King Naresaun, King Taksin etc. the following year the Section of Handicraft was taken under the Division of Architecture and the same year with the Government fund a standard foundry with current equipments was built to replace the old warehouse and important statues like of king Ram Khamhang and U – Thong etc. was made in this foundry.

In 1952, ten years later, section of Handicraft was upgraded to Division of Handicraft and consisted with unit of ten groups of artisans, unit of painters, unit of sculptors, and unit of founders. In 1987, the office of the Division of Handicraft was moved to Salaya district in Nakhon Pathom and new and more modern foundry was built for more capacity. In the same year this unit was developed to be a section of sculpture under the Arts Institute. In 1988 the old foundry was adopted as a museum under the project of "Museum of models and prototype of the National Statues". It was the first museum of prototype. In 1998 the Director General of Fine Arts, Nikorn Musikamara resurrected the project and a committee was assigned as 'the Project of the prototype of Thai Arts Gallery". The project improved the gallery and rearranged the artifacts on display and the foundry was named as "Hall of Sculptures".

Here it is relevant to find some information on the establishment of the School of fine Arts, which is the important factor of revitalization of Arts in Thailand. With the modernization of Thailand the taste of modern realistic arts particularly in sculpture was greeted with broad enthusiasm by the people. With the increased demand the number of artist, experts became inadequate. With this in mind Professor Feroci was assigned to train a small group of artisans in the Department to be the apprentices for sculptures. Later in 1933, the school of Fine Arts was found in the department by the effort of Professor Feroci in the support of the chief of the division of Architecture, Phra Saroch Rattanimman. The School of Fine Arts was officially found in 1934 and the name was

changed from Rang- Rean(School) Oraneet Silpa to Rang- Rean Silpakorn. Both of them have the same meaning as 'The School of Fine Arts". There were three sections in this School, fine arts, creative arts, and musical arts.[80] The aim of the school was to produce qualified artisans who would work for the government in both modern and traditional art. After the establishment, systematic study of western modern arts had started in Thailand. Professor Feroci is responsible for teaching European style fine arts and other Thai Artisans are responsible to teach traditional art and helped to recognize tradition and awareness in heritage value.

With the initiative of Professor Silpa Bhirasri (Professor Feroci's Thai name after he became Thai Citizen) first arts exhibition was held in 1942 in the constitutional day and since then the art exhibition is held every year. The school gained good reputation and in October 12, 1943 the school was promoted to the Silpakorn University from the support of the Field Marshal Po Phibolsongkrom. The faculty of painting and sculpture is the original faculty, later other faculty like, archaeology, decorative art, architecture, etc. was added in this university. With the yearly art exhibition, modern arts and artists had gained good opportunity to reveal themselves to public. And the university had become a promising centre of knowledge of art education.

Handicraft Division Salaya, Nakhon Pathom

In 1952, section of Handicraft was upgraded to Division of Handicraft and consisted with unit of ten groups of artisans, unit of painters, unit of sculptors, and unit of founders. In 1987, the office of the Division of Handicraft was moved to Salaya district in Nakhon Pathom and new and more modern foundry was built for more capacity. In the same year this unit was developed to be a section of sculpture under the Arts Institute.

The sculptors consist of altogether 50 expert persons in which ten persons work as sculptor who make the model of the image to be cast. In this group there is one head

[80] Nildum, Nilwan, " The architecture heritage management for wang Tha Phra and Wang Thaton Na Phra Lan: from the palaces of builders and craftmaen to the art and culture centre(Silpakorn University, 2003). P. 23

sculptor who is the head of this division. In mould section ten persons work as mould makers and in casting section 30 person works for casting and finishing of the sculpture. In casting and mould maker group too consist a head that instruct and take initiative for the works allocated.(FIG 20)

Figure 20 Foundry of sculpture in Salaya.

3.2 Lost Wax "cire perdue" Bronze Casting Technique

Bronze

'Bronze, according to Concise Oxford Dictionary, means as 1. a yellowish brown alloy of copper with up to one –third tin. 2. A yellowish brown color. 3. A work of sculpture or other object made of bronze.[81] Likewise Encarta Dictionary gives some definition of bronze as follows- Copper and tin alloy, a hard yellowish brown alloy of copper and tin, sometimes containing small amounts of other metals. Bronze is harder than copper, is often cast to make statues and work of arts. It is metal with typically hard, shiny, malleable, fusible, and ductile, with good electrical and thermal conductivity. Some other similar metals are, iron, silver and copper.

In this study bronze generally taken as an art object or the sculptures made of bronze from the prehistoric period in which the amount of other alloys mixed in the metal varies such as to make bronze copper, tin, zinc and lead and other noble metals as silver and gold are mixed in different combination in different case.

Casting

According to Concise Oxford Dictionary, 'cast' means an object made by casting metal or other material. In plaster cast, a mould is used to make such an object.[82] According to the Encarta Dictionary,1. Casting means making of objects using moulds which is the making of a solid object by pouring molten metal, glass, or plastic into a mold and allowing it to cool and 2. Manufacturing arts objects using a mold.

Casting is a manufacturing process by which a liquid material is usually poured into a mould, which contains a hollow cavity of the desired shape, and then allowed to solidify. The solidified part is also known as a casting, which is ejected or broken out of the mould to complete the process. Casting materials are usually metals or various cold setting materials that cure after mixing two or more components together; examples are

[81] JudyMarshall, *Concise Oxford Dictionary* (Oxford University Press, New York,1999).

[82] Ibid, p. 219

epoxy, concrete, plaster and clay. Casting is most often used for making complex shapes that would be otherwise difficult or uneconomical to make by other methods.[83]

Lost Wax 'cire-perdue' casting method

Lost wax or 'cire – perdue' in French, is a method of casting bronze using a clay core and a wax coating places in a mould; the wax is melted in the mould and bronze poured into the space left, producing a hollow bronze figure when the cast is discarded. The wax is the exact impression of the bronze figure to be made. Clay core is not required for the solid cast method, only the outer surface is covered with layers of mould.

3.3 Contemporary Bronze Casting Technique in the Foundry of Fine Arts Department in Salaya

Thailand has a very old history of bronze casting. The traditional bronze casting technology is more or less similar to the ancient technology mentioned in old Indian literary sources, only the casting materials varies according to the geographic region, traditional bronze casting technology is a slow and time consuming process. The case study of the traditional bronze casting process is discussed from the beginning in second part of this chapter. For the first part process of the contemporary bronze casting technology with 'lost wax' or 'Cire Perdue' is discussed.

The foundry of The Fine Arts Department in Salaya specializes mainly on contemporary bronze casting technique. The sculptures made in this foundry are monumental and religious. Monumental sculptures are made of the big Thai monarchs and hero personnel as well as elite persons. Item of art mainly sculptures in this research was made for religious purposes or for the royal and national purposes which required highly innovative process requiring great skill, experience and patience which will be

[83] http://en.wikipedia.org/wiki/casting,27 Dec. 2009

outlined in the process description. During the period of the study the foundry was undergoing big projects of making huge and very time consuming sculptures which due to time constraints I was unable to follow and document from the beginning to the end of the procedures. However any statues which were made in the foundry took more than a year depending on the size. For the purpose of my study I followed different sculptures and photographs provided by foundry officials that are described on sequence but the photographed objects may vary with the availability of the objects being cast or molded.

Preparation for the construction of bronze sculpture

Bronze Sculptures are made in the initiative of the Fine Arts Department or on the order basis from any organization, provincial government offices or from the donor companies. The proposals for the making of the statue, a project are formed with consultation of the sculptor of the foundry. The project then does numerous researches on the person whose sculpture is to be made and start to collect photographic and portraiture documents with short history on the person. Then the place is allocated where the statue will be consecrated and layout design is prepared by a consultant agent. The design represents the sense of the place after the establishment of the statue as a national monument. For example, Phetchaburi Province Government had a project of Phra Nakhon Khiri Historical Park to build King Mongkut Memorial Park. Principle reason of the project was to honor Rama IV who initiated the modernization of Siam. And another reason to choose the land was that, the King Rama IV bought 714 rai of land at Phetchburi by his own money in 1858 and built the palace at Phra Nakhon Khiri. This is Thailand's first palace located on the hill. Currently there are 24 rai of land left which is available for the construction of the statue.(Fig. 21) (Annex 8 for plan)

The employee of Kasikorn Bank Public Company Limited, Mr. Wuttichot, had joined hands with the authorities of Phetchaburi as a coordinator to consult the Fine Arts Department about the construction of this statue. After that, they asked the construction permission from the Prime Minister's Office and the Bureau of the Royal Household. After they are permitted to build the statue, they have asked the Fine Arts Department to

build the statue. The royal representative had participated in the ceremony to lay the Foundation Stone and the establishing ceremony of the statue. Besides, many monks and Brahmans performed the sacred and holy ceremony.

Constructing the Inner Moulds

Casting image is a delicate process which is always executed by specialized artists who belong to a professional of family business or the individuals. Due to the fact that entire manufacturing process is divided into several separate stages, the artisans specialize in particular skills according to their individual ability and qualification. There is always a chief artisan who supervises and coordinates the complete process, and is also responsible for contacting patrons and suppliers of the requisite materials.

After the proposal is approved by the Fine Arts Department, the appointed sculptor prepares himself for the performance to make an idol which in future will become a national monument representing the historic value. The size and type of the image determines whether or not solid or hollow casting is admirable. Small and big statues can be cast hollow in order to save metal. If the image to be cast has to be solid and heavy, the wax model of it must be prepared out of a solid piece of wax.

The finalized pictorial document is taken as an authentic visual aid to make a sculpture. When photograph was not in practice a picture was drawn with free hand and in proportion if a god's sculpture was to be made. When a human sculpture was to be made the person whose sculpture have to be made, he have to be a model for the sculpture. In the foundry of Fine Arts Department the sculptors mostly take evidence of the pictorial document to make the sculptures of the Kings and the Hero personals.

At the beginning a prototype image is prepared with the detail to be made at the final image. This image is usually not taller than two feet or even smaller than one foot is sculpted by clay or wax. To start sculpting the sculpture the sculptor must have knowledge of the anatomy of human body. He makes first the body without cloths on which is only the naked body. When he makes the naked body he takes utmost care to

show the curvature of the muscle, bone structure, position of the statue or posture. He has to take reference from the live human form from a human model or have to take help from the anatomy book.(Fig 22,23) After the small model is prepared, a sketch with the required proportion and scale to the height is drawn on a big drawing board attached to the wall. The sketch will determine where the strengthening rods and wooden clutches are to be placed. (Fig 24,25)

Miniature model of the sculpture is inspected by the head official and the experts for its perfectness. After the donor or the ordering party is satisfied with the model, the appointed sculptor makes preparation to mould the real size sculpture. At first a revolving wooden base is set up, upon which a frame for the chair which is just like a table is set up. On the chair an iron rod bent according to the requirement of the posture of the body from head to the leg portion is securely attached. The wooden clutches tied on the iron rods are attached on several places to help hold the clay in place as shown on the figure. (Fig 25)

After the base and strengtheners are set the sculptor places the small model at side and pray to take permission from the soul of the person whose statue is going to be made and offer a flower garland (in Thai, *malai*) and burn incense stick. (Fig 26)

Special sticky clay brought from outside Bangkok is sorted out for its impurities and stone particles. Clay is grounded into more fine dust and soaked in water to make clay lumps which enable the sculptor to apply on the sculpture. The sculptor starts to paste wet water based clay[84] on the frame previously made by iron and wood. He uses various tools to shape, scrap and mould as his very intimate tools. Tools are very important for the molding sculptures in required shape. (Fig 27)

[84] Water based clay is used for larger sculptures for which it is desired to capture a gestural quality- one that transmits the motion of the sculpture in addition to that of the subject. Water based clay must be protected from drying. Water must sprayed from time to time and covered properly by cloth and plastic.

The wet water based clay is shaped according to the small model. (Fig 28)The sculpture is made naked with taking keen interest to reveal the anatomy of the body. A human model is used to take reference and model spends the day with very tiresome posture to give his best of attitude towards the sculptor. (Fig 29) Since making the anatomy is the most important part of constructing a sculpture, the time limit is unlimited. It may take more than six months or so depends on the size of the sculpture and for the finished sculpture takes more than a year for the monumental statues.

Figure 21. Plan of the King Mongkut Memorial Park, Phetchburi. Photo by Mr. Wuttichot

Figure 22. Photographic References.

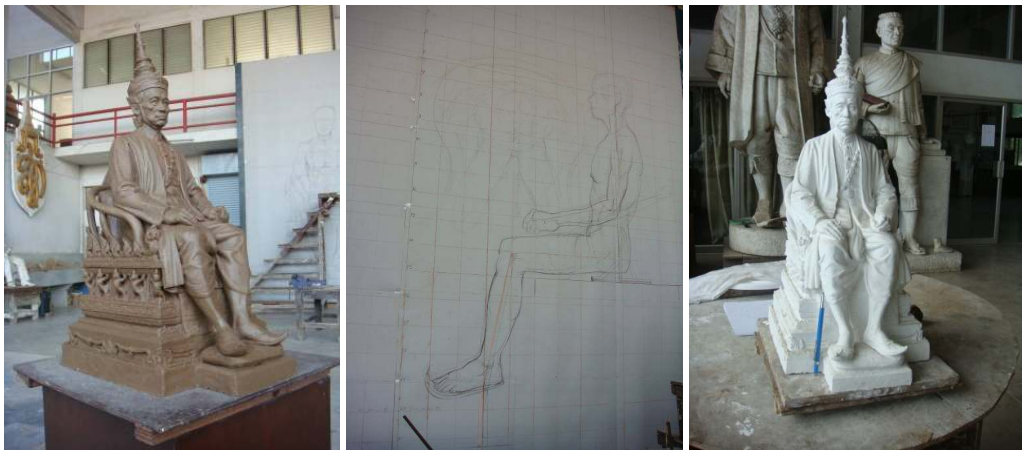

Figure 23 Model of King Mongkut and the scale drawing of the sculpture.

Figure 24 Small models of the statues previously made by the Fine Arts Department

Figure 25 Iron and Wooden Strengtheners and clay.

Figure 26 Offering flower to the model sculpture before starting the statue

Figure 27 Tools of different sizes and shapes.

Figure 28 Small model of King Mongkut and the clay sculpture being made.

Figure 29 Human model posing for the anatomical reference.

When the sculptor is satisfied with the anatomy, he prepares to make cloths on the necked body. The way he makes the clothes is really amazing that the cloths upon the body reveal the contour of the body as well. (Fig 30) The clothes' folds and designs on the clothes are carved with care and intricacy. The clothes, facial expression and the whole sculpture ultimately seem very realistic. To give the finishing touch to the sculpture is the most tiring job. The sculptor is never satisfied with his work that every time he see his work, he see something lacking and defect on the sculpture as the head of the sculptor says. The clay sculpture is the most important work to cast a bronze sculpture because the accuracy of the clay sculpture gives the bronze statue the perfectness and the purpose that the makers want from them. In another word the clay sculpture testifies the resemblance to the final bronze statue.

The clay statue finishes with long effort of the sculptor. Other parts of the statue for example the chair or the throne and other associated parts are carved and if to be attached, they are attached to the sculpture. In some cases the accessories can be carved separately and joined afterwards the bronze cast. While the statue of King Rama V was made, the chair was attached and the leg of the chair was the prototype they already have in the foundry. The prototype leg can be detached easily so that it can be cast or mould separately. With the completion of the sculptor's task, the task of the mold section begins henceforth.

Figure 30　Fashioning Clothes over the body.

Process of making plaster moulds

As stated before I followed different statues for the casting process. To start the documentation of the mould making process I got chance to record the process from the beginning. For this King Chulalongkorn's statue was ready. The clay sculpture was made by the head of the foundry and head sculptor Mr. Somkuan Oumtrakul. He was working on the sculpture until the last moment that is the moment the mould group takes charge on the statue to make a plaster mould. He said that every time he looks at the statue he may find some error and he want to correct with his all effort. It took nearly a year to finish the clay statue. (Fig 31)

Cut off the unattached part: On 2nd February 2010, the head of the mould group along with his staffs makes preparation to make the plaster mould out of the clay sculpture of the King Chulalongkorn. After inspection of the sculpture with the expert eyes of the molders, the detachable leg of the chair which is the prototype of the chair legs is detached from the clay chair. (Fig 32) Then two hands which were not attached to the body of the sculpture were cut off with help of a cotton thread or a sharp knife. Likewise the tip of the coat which was not attached to the leg was cut off to make separate mould. While cutting off the parts there is a chance of some damage to the sculpted object which is repaired again by the sculptors without any difficulty. (Fig 33)

Insert zinc dividers: The statue is now ready for the further process. A bowl full of zinc dividers is prepared beforehand. The divider plates are soft enough which can be cut with a scissor in required size and angle. The statue is divided in several parts with inserting several zinc dividers. Dividers enable to separate big block of sculpture into several part. The dividers are inserted on row with the contour of the body sometimes cutting into required shape and bend. Likewise the dividers are inserted into the chair handles and the back of the seat as well. The width of the zinc plates determines the thickness of the plaster coat. (Fig 34,35)

Apply soap mixed oil on the surrounding base: A solution of traditional soap is boiled and allowed to cool for a moment. Then coconut oil is mixed with lukewarm soap

solution and boiled again. The oil solution is applied on the wooden surface of the seat around the base of the statue and on the foot rest. The oil is applied with a brush to make sure that the plaster does not stick to the wood when it is taken off. (Fig 36, 37)

Figure 31 The sculptor giving finishing touch and the mould making group inspecting the statue.

Figure 32 Detaching the Prototype Leg of the Chair.

Figure 33　Separate two hands with string and repair the damaged parts.

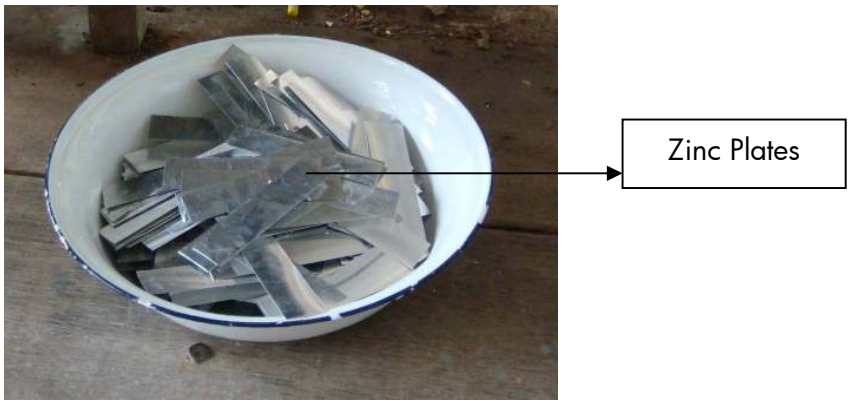

Figure 34 Zinc Plates.

Figure 35 Inserting the Zinc Plated on the clay statue.

Figure 36 Mixture of Coconut oil and soap solution apply on the surrounding wooden surface.

Figure 37 Gypsum Plaster mixed with water and color.

Spray colored Gypsum Plaster solution on the statue: To cover the statue with plaster mould, powder of gypsum plaster is soaked in water and yellow color is added to differentiate with the white plaster. Then the solution of the yellow plaster is poured into small bowls. Taking turn, the staffs of the cast section spray the plaster by hand all over the clay statue making sure that the plaster solution covers all the details and corners. After the statue is properly covered by the sprayed plaster, it is left for dry for that day. (Fig 38)

Apply thick white Gypsum Plaster upon the yellow surface: On the second day that is third of February 2010, the powder of Gypsum plaster is soaked in water let it settle a while. When it is thick enough to apply, the mould makers hold the plaster paste with the five fingers starting from the edge of the bowl and gently apply on the surface of the yellow plaster. While applying the plaster, they have to be careful not to leave air pocket for which they have to make the surface smooth with fingers from time to time. The thickness of the plaster as stated before is determined by the thickness of the zinc. With the help of sharp knife or with a flat scrapper, the zinc surface is marked and smoothed which reveal the edge of the zinc plate inserted before. With this process the plaster is applied all over the statue and zinc surface is carefully marked distinctly. (Fig 39) The plaster is allowed to settle and dry for one day.

For the small piece for example the piece of the jacket corner, at first a plaster mould is made and apply on the half portion of the piece. Then oil solution is applied on the surface and let it dry for a moment and then make lock by scrapping off some plaster from the edge portion. After the lock is made the rest of the piece is covered by the Gypsum plaster paste. Let the plaster to dry for a day and next day the plaster is split open into two halves. The lock makes the attached plaster easy to open. By this time the impression of the jacket tip is imprinted on the Gypsum plaster. Then the clay is removed easily for the plaster. (Fig 40)

Figure 38 Spray Colored Gypsum Plaster Solution on the Statue.

Figure 39 Applying Gypsum plaster paste on the statue and revealing the edge of zinc plates

Figure 40 Taking out impression of the small piece.

Strengthen the partitioned portion of the statue with iron rods: On the third day 4th February iron rods cut into the required length and bend were stick to the zinc partitioned parts. To stick the rods same Gypsum plaster paste was used. The handful of coconut hair was soaked in plaster paste and the lump of the coconut hair was used as strong adhesive to stick the rod on the plastered statue. Iron rods do not need any wielding. Strengthening the pieces can make the plaster impression intact on place. While sticking the rods care must be taken that later the part can be removed easily from the statue. Then let the joints to set firmly for a day. (Fig 41) Before commencing the task of strengthening, the leg portion from under the knee was separated from the statue since it has to be mould separately. Since the leg part is quite small it does not need to be strengthened by the iron rod. The leg part was separated and opened from the zinc divider with spraying water on the joint. The clay inside the plaster is removed for the further process of making plaster mould. (Fig 42, 43)

Strengthen with zinc pipe: On fifth February, the fourth day of the molding process, the mold group usually gets ready early morning to finish the required work before noon to avoid the heat. On this day they were working on the four inch Zinc pipe for that they prepare a pipe cutting machine and some zinc pipes as well as the plaster paste and coconut hair for the adhesive purpose.(Fig 44)

The leader of the mould group guides the staffs to make approximate measure of the height of the statue from head to the ground. The pipes are cut with the electric machine in the required length and three cut pipes are kept vertically slightly slanted position from the ground to the head. The pipes are arranged on the two sides and on the center of the statue. The pipes are attached to the plaster with the help of coconut hair soaked in the plaster paste. Then other small zinc pipes are cut in smaller pieces to attach from the base of the chair to the ground. All the pipes are interconnected and attached with the adhesive plaster and coconut hair. Now the statue is much secure and can stand on the zinc pipe after the wooden base is removed for another process.(Fig 45)

Figure 41 Strengthening the plaster with iron rods.

Figure 42 Strengthening the plaster with iron rods.

Figure 43 Detached part of leg.

Figure 44 Attaching the zinc pipes for the strength and for stand.

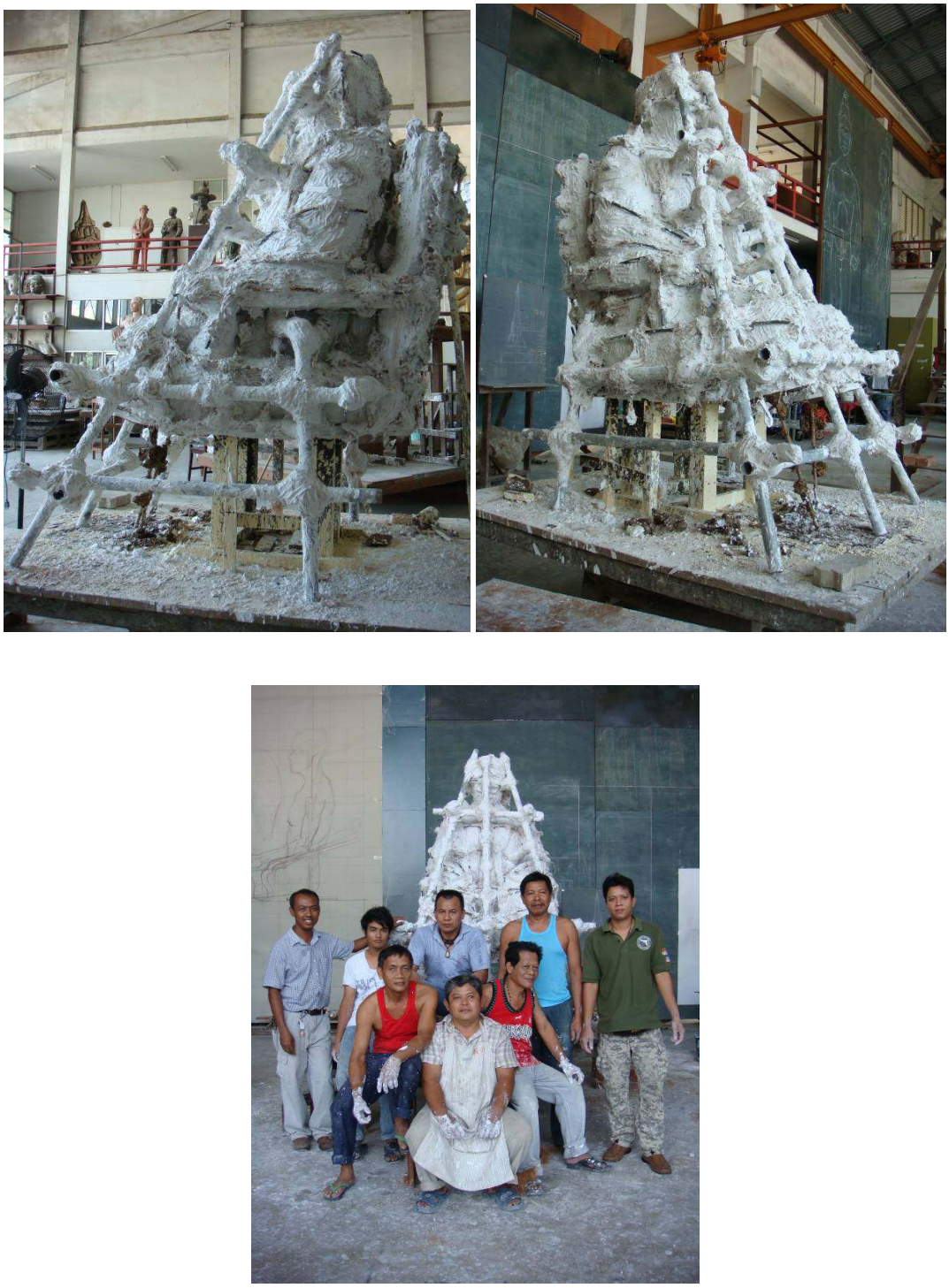

Figure 45 The finished strengthened plaster covered statue and the group of mould makers.

Separate plaster mould: On 8th February 2010 on the fifth day of the process, the line of zinc plate joints was smoothened with sharp blade to reveal the edge of the zinc plate. When taking out the mould first the upper portion and the complicated part is taken out. The joint of the plate is sprayed with water to make moist on joint to make easy to detach. Then slowly and carefully the mould is taken out. The inner side of the mould has the negative impression of the clay statue. The clay glued on the mould is taken out with the help of hand and iron tools and the mould is kept on the safe place. Heavy moulds are supported by pulley to make sure not to crash on the floor. For this process the mould section group works together at the same time to separate the mould from different part of the statue. (Fig 46)

In this statue of King Rama V the back portion of the chair was secured formerly by iron rod. The iron rod was taken out with the help of electric cutter. (Fig 47) The big piece of the remaining back part was carefully taken out from the statue lifting up to prevent from accidental fall with the roller lifters which is attached to the walls of the foundry. (Fig 48) After this the main part of the back of the body is exposed and the clay is taken out. Again the iron rod attached to it is cut off with the electric cutter. (Fig 49) The plaster mould is now ready to transfer to the mould section for the further process. With the help of the wheel trolley the mould is taken to the mould section. (Fig 50)

Clean mould with water: On 9th February 2010 on the sixth day of the moulding process, in the mould section the inner side of the plaster mould which has the negative impression of the clay statue, is washed with water spray to make sure that no residue of clay remains on the mould. Likewise all the small pieces of moulds are cleaned with water and let dry for a day or two.(Fig 51,52,53)

Apply soap mixed coconut oil on the plaster: For this process traditional Thai soap is boiled on a charcoal stove and after the soap boils coconut oil is mixed in it. The mixture is boiled for 25/ 30 minutes to its smooth texture. (Fig 54) The hot mixture, with the help of brush, applied on the surface of the mould which has the negative impression

of the model. The hot liquid helps water to absorb into the plaster which helps to strengthen the plaster mould and makes easy to apply oil.

Figure 46 Separate plaster mould from the clay statue.

Figure 47 Separate plaster mould from the statue.

Figure 48 Iron rods taken out attached in the clay statue.

Figure 49 Separating plaster mould of the back of the seat.

Figure 50 Lifting up the separated plaster mould of the back of the seat.

Figure 51 Taking out the clay and iron rods from the plaster mould.

Figure 52 Transfer the plaster mould to the mould section for the further process.

Figure 53 Clean the plaster mould with water spray.

Figure 54 Boiling coconut oil and Soap solution to apply on the plaster mould**.**

Apply first layer of liquid Gypsum plaster: The gypsum plaster which is a wonderful material for the casting is soaked with water to make a liquid solution in a bowl. Within a couple of minutes the liquid solution settle to its thick liquid texture and with the help of hand and fingers the mould workers apply on the surface of the previously oiled plaster mould. The liquid plaster is literally poured on the surface of the mould and smeared evenly on the surface of the small parts of the mould like head, chair back etc simultaneously. While applying the plaster they have to be careful not to leave any part and corner of the negative impression of the plaster mould.(Fig 55)

Apply second layer of liquid Gypsum plaster mixed with jute fabric: The second layer of plaster is very important to make the mould strong and thick to hold the impression of the statue for many process. Before the process the jute fabric is cut in small pieces. (Fig 56) The fabric is soaked in the liquid plaster and applied on the first layer of plaster. While applying the plaster the thickness have to be even and make sure not to leave any part of the mould. The jute helps to hold plaster and make strong and helps to determine the thickness of the plaster mould. Plaster is smeared upon the fabric mixed layer and with hand plaster is smoothened in all surface of the mould. (Fig 57) This process is done in all the big and small pieces of the mould.

Strengthen the mould with zinc pipe: After the above process the main big mould have to be strengthened. For this zinc pipe are cut in required pieces and placed vertically from the head to the bottom of the body with the help of the coconut hair and plaster mixed as joining adhesive. The pipes are supported with wood blocks sometimes with bricks as well. Again the pipe is supported and strengthened in several places with the coconut hair mixed plaster. In big statues pipes are placed in several places on cross section. (Fig 58) In small pieces for example for the leg and foot of the statue some brick and magazine paper was filled inside the cavity of the plaster mould.

Join the pieces together: When the process of plaster smearing on the negative impression finishes, the main mould and the other small pieces are joined together. The other half pieces are lifted up with the help of electric pulley and carefully joined on the

exact places of the plaster. (Fig 59) The small separate mould pieces are joined with the same process as stated before. But if the mold is not so complicated and small, there is no need of joining instead the plaster covers the whole object as shown in the figure. (Fig 60)

Figure 55 Applying first layer of Gypsum plaster solution.

Figure 56 Cutting Jute fabrics to small pieces.

Figure 57 Applying jute fabric mixed plaster.

Figure 58 Strengthen the mould with zinc pipe.

Figure 59 Joining the pieces together.

Figure 60 Small moulds joined together.

Strengthen and join zinc pipe to make stand for the mould: When the joined plaster mould dries it is strong enough to put into the upright position. On the next day with the help of pulley the big and with all the pieces intact mould is turned over on upright position which now stands on the zinc pipe which was attached before. Then again from inside the hollow mould zinc pipe is attached on the center pipe. The pipes are welded on the center pipe as two at front and another two at rear which will function as a stand for the other process. (Fig 61)

Detach the iron rod and zinc pipe from the mould: Another step is to detach the iron rod and zinc pipe which was attached to the mould at the beginning of the mould making process. The joints which were made of coconut hair and plaster are cut off by saw and with careful hammering all the iron and the pipes are taken off. (Fig 62)

Break off the first layer of Gypsum plaster coat: The exposed first and the outer layer of plaster are very hard to break off. The staffs gently tapping on the plaster break off the plaster with the help of hammer and sharp scrapper. With taking care not to damage the inner mould the plaster is chipped off from all part of the plaster mould. The oil applied previously helps to detach the inner and the outer mould. When touched with hand we can feel slippery oil on the exposed inner plaster. The plaster inner mould reveals the positive imprint and texture of the clay model. For the small mould for example the leg part in this case, the process is the same foe taking off the outer plaster mould from the inner mould as shown on the figure. (Fig 63)

Detach parts of imprinted plaster mould from the main body: When the outer layer of the plaster is chipped off the inner mould with the positive impression is exposed. The mould makers detach the arms, chair rest which are previously planned to detach. Locks or joints are made when the plaster coat is applied on the negative impression. To make lock is very simple just they must have vision on which part it is made by scooping a bit of plaster when it is still wet and after the scooped plaster dries, then another coat of plaster is applied. The detached parts are kept safely aside. This process takes more than a day which depends on the size of the statue. (Fig 64a, 64b)

Figure 61 Strengthen and join zinc pipe to make stand for the mould.

Figure 62 Detach the iron and zinc pipe from the mould.

Figure 63 Break off the first layer of Gypsum plaster coat revealing the inner plaster mould.

Figure 64a Detach parts of imprinted plaster mould from the main body.

Figure 64 b. Plaster Model.

Make a pedestal for the statue: For the statue of King Rama V of which the molding process is being followed, was supposed to attach another standing statue of Prince Mahidol at the side. After both the plaster mould statue was ready the pedestal to stand the statue was made with plaster and zinc pipe and iron rod strengtheners. (Fig 65)

Join the separated parts of the plaster mould for retouching the detail: After the plaster mould with positive imprint is exposed making sure not to leave the outer mould intact, the main mould is again moved to the sculpture area for the retouch by the sculptor. Here the detached parts are joined with the iron clamp. (Fig 66)

Give finishing touch on the plaster statue: The plaster sculpture is the exact imprint of the clay model which is made at the beginning. This is very important in the process that all the damaged and other details must be carved in the plaster mould because the details on this mould is imprinted on the finished bronze statue. This process takes very long time depending on the size of the statue. The finishing touches are given by the sculptor himself who made the main clay mold and others are the experts on carving personnel. (Fig 67)

Process of making silicon mould

Apply silicon on the plaster mould: The finished plaster statue is transferred to the mould section for the process of silicon mould. To start the process the statue is laid down on the ground with proper support of brick and wood blocks. The statue is surrounded exactly on the halve section by ply wood and news paper is laid on the plywood. Mixture of coconut oil and soap is applied on the surface of the paper to make easy to pull out from plaster. Then liquid plaster is applied evenly on the surface of the paper. (Fig 68)

According to the lady mould maker Mrs Boondharik Yodnval silicon plaster are imported from German and United Kingdom. Silicon made in the United Kingdom is little bit cheaper than the German silicon. German silicon is used for detail of the statue.

Both silicones are found in the liquid form and there are not such rules or ratio of amount mixing the silicon with the standard blue or pink catalyst for high tear moulding rubber. The molders of The Fine Arts Department are very professional and experienced that they mix both silicon and the color catalyst as required for the silicon rubber mould. (Fig 69, 70,) Coconut oil and soap mixed liquid is applied on the partition line and on the base of the board which is placed on the middle line of the statue to separate the halves. A line is made with thin clay line to mark the partition line. The colored silicone is applied on the thin and loosely woven cotton fabric laid upon the statue. Silicon is applied at least three times before apply silicon layered with cloth. The fabric can be seen in Figure . Around the edge one square inch rubbers are nailed to make locks. (Fig 71)

Partition to cover silicon coat with plaster and iron: For the big statues partitions are made to make easy to separate the portion for separate cast. Silicone applied surface is covered with liquid Gypsum plaster piece by piece. While applying the gypsum plaster, the area of complicated curves on the statues are separated with thick plaster partition. The edge of the plaster partition must be smooth in straight clean line and locks are made around with scooping plaster while it is still wet. Upon the plaster piece another layer of plaster is applied upon which iron rods are attached with the help of coconut hair and plaster to strengthen encase of silicone mould. Same process is repeated on the other side of the statue. After finishing this process the mould is left to dry for several days which depends on the size. (Fig 72)

Take out Silicone rubber sheet from the plaster mould and insert on the outer plaster mould: From the above mentioned process dried plaster mould is prepared for the process in which the outer layer of plaster is taken out carefully with the help of several people and in some case with the help of pulley. This block is kept aside with the inner side up. After this layer comes out there remains the block of plaster partition stated at the former process. The partition pieces are taken out form the silicon layer and places on the exact position of the outer plaster layer. Then the sheet of silicon layer is peeled off from the plaster sculpture and laid down on the outer plaster on the exact position upon the partition pieces which reveals the inner impression on the silicon layer. This

inner layer is the main negative imprint of the plaster sculpture. When seen from above the form of the statue can easily be recognized. (Fig 73)

Figure 65 Making pedestal for statue.

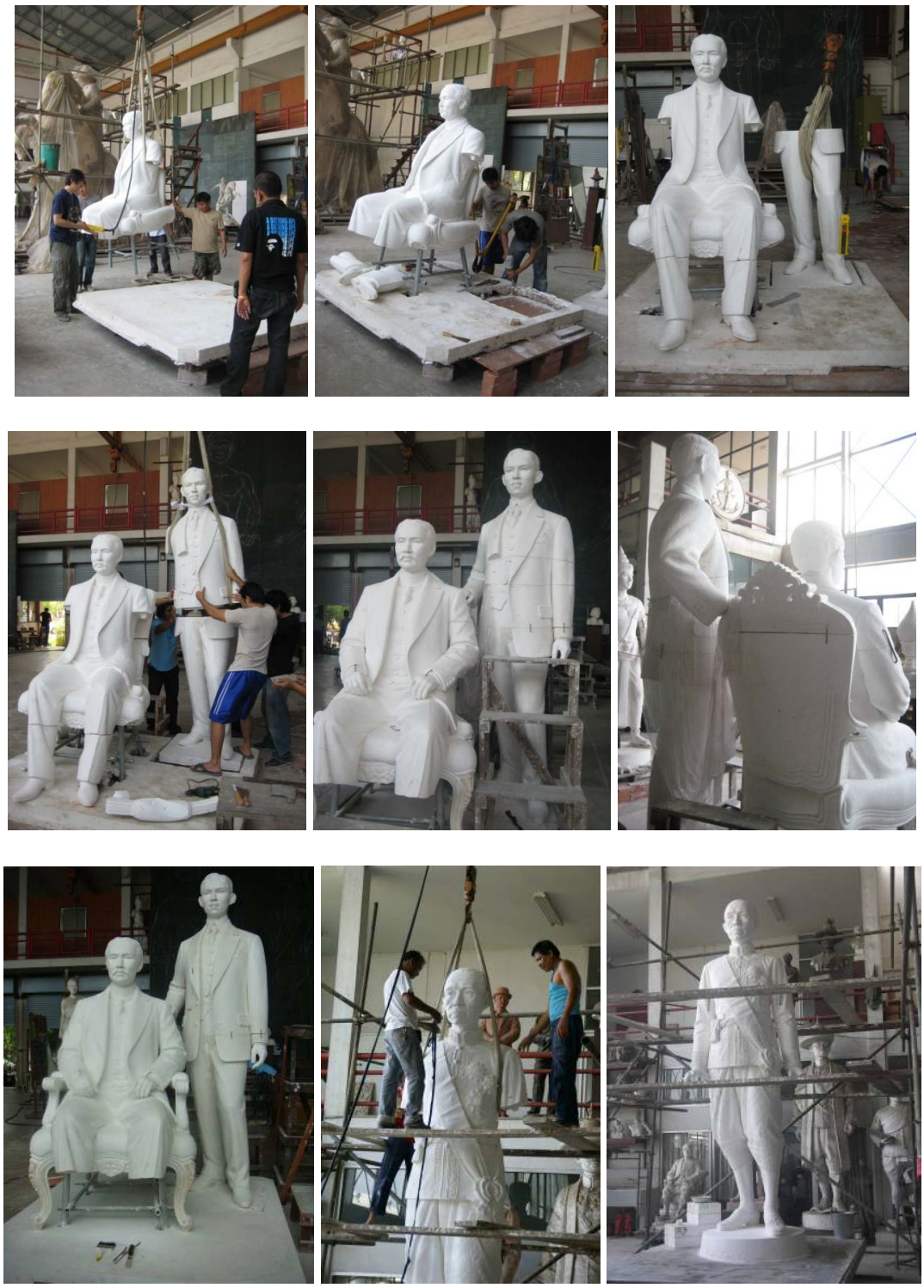

Figure 66 Joining the separated plaster pieces together.

Figure 67 Giving finishing touch on the plaster statue.

Figure 68 Preparation for silicon mold.

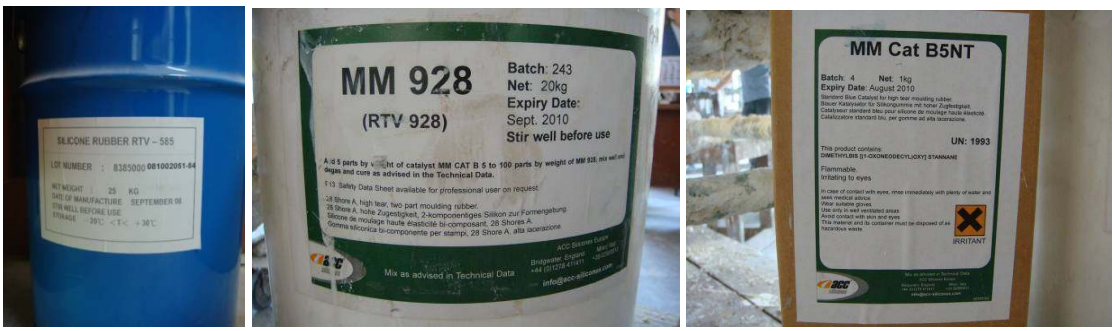

Figure 69 Silicone Rubber and Standard Blue Catalyst for high tear moulding rubber

Figure 70 Mixing MM 928 Silicon Rubber and Standard Blue Catalyst.

Figure 71 Apply Silicone Rubber on the thin cotton fabric.

Figure 72 Apply Silicone and strengthen with Gypsum plaster and iron rods.

Figure 73 Take out Silicone rubber sheet from the plaster mould and insert on the outer plaster mould.

Process of making wax mould

Apply first layer of liquid wax on the silicon: Main process of lost wax process commences from the further process. At the beginning of this process colored wax is boiled on a pot to melt. Then the melted wax is applied on the exposed silicon sheet with the help of brush and makes sure all the surface is covered with wax. (Fig 74)

Apply second layer of liquid wax on the first layer: A good quality wax is melted on a pot and applied evenly on the surface of the first layer of colored wax. The reason to use melted wax is it helps to give details of the sculpture.(Fig 75)

Stick wax sheet on the second layer: For this process a good quality wax, same used for the above mentioned process, is melted on a tin pot and after the wax melts and boiled for some time, the liquefied yellow wax is poured on a pool of water. Wax semi cools in the water and floats on the surface, then the wax taken out from water by hand and mashes firmly to make a ball. The ball of wax is rolled on the wooden board which has half to one centimeter raised boarder on the edge. Wax is rolled until it become as plain as a uniform layered sheet. Then the sheets are dipped in the pool of water to cool and after taking out, the sheets of wax are cut in square shapes. (Fig 76)

The most important part of making the sheet of wax is, the thickness of wax determine the thickness of the bronze. The thickness of bronze varies the cost and quality of the bronze sculpture. The thicker the bronze, more expensive and more durable and strong it becomes.

The wax sheets are again cut in required pieces to stick on the second layer of wax. Before sticking the wax, the adhesive made of vegetable oil and resins are boiled and the hot liquid is applied on the surface with the help of brush. (Fig 77)Then the wax sheets pre heated to its softer form is stick to the adhesive. Wax sheets are pressed by hand in all the corner and folds with the expert hands of the mould makers. They have to make sure that the wax sheets are laid firmly and evenly on the surface.(Fig 78) same process are repeated on the other halve portion of the plaster sculpture.

Joining the halves together: After the silicon mould is covered by the wax sheets the two halves of the mould is joined together. Since this is the hollow cast the hollow part of the mould is strengthened with iron rod and if necessary insert the wax rod for strength afterwards and filled with mixed solution of sand, mud and Gypsum plaster solution. The liquid when dries is very hard enough to hold the wax on place and heat resistant when heated to melt the wax off for the lost wax process. (Fig 79)

Take off silicon sheet from the wax revealing the wax sculpture: The ceramic plaster and sand filled silicon mould covered with wax sheet is left for some days to dry. Then the plaster cover encased silicon is taken off and the silicon cover reveals. The silicon is then peeled off revealing the wax sculpture with positive impression of the sculpture. (Fig 80, 81)

Finishing touch on the wax sculpture: The wax statue stands firmly because inside is the plaster sand mixed block. The sculptors again have to give the finishing touch on the wax not to leave any defects. The texture on the statue is refined. (Fig 82, 83)

Attach wax rods to make runner and channels

Wax rods join on the sculpture to make runner and channels: To make the channels of wax, wax is heated in a pot. When wax melts, some portion of wax is poured in a pot of cold water and when the wax cools a bit is taken out and mashed with hand until it becomes soft without any lumps. Then with hand wax is rolled on a wooden board with hand to make uniform parallel rod as channels and some conical rod as sprues of about one inch in diameter. An iron rod is heated on the fire, then the rods are cut in required length and heating the bottom of the rod and the exact spot of the statue with the iron rod where the wax rod has to be attached is heated and soon the wax rod is attached on the same spot. One or more wax sprues are added to conduit the molten metal into the sculptures which typically directs the liquid metal from a pouring cup to the bottom of the sculpture, which is then filled from the bottom up in order to avoid splashing the

turbulence. Additional sprues may be directed upward at intermediate positions, and various vents may also be added where gases could be trapped.(Fig 84)

Apply methyl alcohol: The finished wax statue with wax runners and channels are coated with methyl alcohol. Methyl alcohol helps the wax not to attach on another mould or shell going to apply in another step. The alcohol coat helps to smooth the surface of the bronze as well. (Fig85)

Figure 74 Apply first layer of liquid wax on the silicon.

Figure 75 Apply second layer of melted wax.

Figure 76 Making wax Sheet.

Figure 77 Apply adhesive solutions on the second layer of wax.

Figure 78 Stick wax sheet on the adhesive solution.

Figure 79 Join the two pieces together and strengthen the hollow with pipes and pour plaster and sand mixed liquid.

Figure 80 Separating the outer plaster incase revealing the silicon.

Figure 81 Pealing off the silicon sheet revealing the wax statue with the positive impression.

Figure 82 Wax Sculpture exposed from the silicon encase.

Figure 83 Final retouch and refine the texture on the wax.

Figure 84 A Attach wax channels and runners.

Figure 84 B Attach wax channels and runners.

Figure 85 Applying methyl alcohol on the wax sculpture.

Wax structure invested in another mould or shell: The complex structure and previously added core is then invested in another kind of mould or shell. Before the process begins at least two inch long iron nails are hammered gently on the wax which has to penetrate a bit into the core plaster as well. The nails are not fully inserted on the wax but leave at least one inch outside. The nails help to put together the plaster of core and outer mould at place during wax melting and bronze casting. Next process is to make a solution of plaster and sand mixed with water. The liquid solution with hand is sprayed on the wax structure. With several coats of solution which covers the wax and its attached wax channels, the outer layers are made thicker and thicker so that the encasement become more hard with heat resistant ability. Outer layer of plaster is literally pasted and smeared by hand to make the layer of plaster thick and even at all places. (Fig 86)

Strengthen mould with iron rods: Plaster layered wax sculpture is strengthened with mesh of iron rods. Rods are tied and welded together from top to bottom of plaster with horizontal and vertical mesh of iron rods. (Fig 87)For once again iron rods are encased with the sand plaster mixed paste evenly to make the mould strong. While applying the plaster the wax sprues and pouring channels are keep open. (Fig 88)

Heating Process to lost wax from the invested mould

Make kiln to melt wax: The mould prepared with above process is arranged to melt out wax. For this the mould is places on a base of brick and clay. An iron or zinc pipe is attached as a channel to help run out wax at the bottom of the mould where previously wax channel is exposed. At the mouth of the hole where wax comes out a spout is made of clay to make easy melted wax fall on the pipe. Then the invested mould is surrounded by brick wall leaving holes to send fire inside from two directions and a small hole to check the status of melting wax just above the flowing pipe. Small holes are covered with loose bricks which can easily be removed to inspect the wax flow. Usually brick walls are made round on two side and straight with corner is made at the side of the burner. Round walls helps hot air of fire go around the mould which enable heat move to

all direction of the mould. (Fig89, 90) Brick walls are made high to the top of the mould which can be covered with tin sheet to prevent heat leak while heating process goes on. To prevent possible heat loss, holes on the brick and cover are closed by applying mud paste inside and outside of the brick wall. (Fig91)

Give heat by burning gas or firewood: When the kiln gets ready to heat, firewood or gas is burnt directing the flame from the hole into the space around the mould. At present gas is easy to use for burning out wax and it save time and can control the heat as well. Fire wood is used in some special cases as to heat gas cylinder or to heat the mould before casting bronze. The temperature of heat has to exceed more than 1000 degree centigrade to melt wax and liquefy to run out easily from the channels created by sprues.. The mould is heated for several hours to melt wax and flow out of the mould. The flow can be checked from the small hole which was prepared before when kiln was made. Wax is collected on bowls. If steam comes from the hole from where wax runs out it is understood that there is no more wax in the mould. When all wax runs out, the space in the place of wax in the mould becomes hollow and heating the mould longer enables to get rid of moisture inside. The removal of all wax and moisture prevents the liquid metal from being explosively ejected from the mold by steam and vapor. (Fig 92)

Turn the mould upside down to prepare for bronze cast: After the wax in the mould is lost completely, the mould has to turn over to prepare for the casting bronze. The holes on the bottom of the mould is closed with plaster and sand and other holes exposed at the top of the mold will be used as pouring hole for bronze and air vent. The pouring funnels are made on the holes with attaching funnel surrounding with plaster. Moulds are again places on a brick pedestal and strengthen with zinc pipes to stand erect until the casting process finishes. Pouring holes and vent holes are covered with brick which can be taken out time to time to check the air inside the mould. The mould is again pasted with clay mixed plaster to close cracks occurred by heating to melt wax. Then the mould is surrounded by a wall made of brick. The brick wall also has to cover by plaster and clay to close the holes between the brick joints. There have to be space left between the mould and brick wall inside. On the day of casting bronze in the space inside, burnt

charcoal is placed to preheat the mould before pouring the melted bronze into the mould. (Fig 93). Before pouring the melted bronze, the brick walls are dismantled and the invested mould is again pasted with clay plaster to close cracks and make as strong as possible to make heat resistant. (Fig 94)

Figure 86 Applying Gypsum plaster and sand mixed liquid on the wax.

Figure 87 Strengthen wax mould with iron rods.

Figure 88 Applying Gypsum plaster and sand mixed plaster on the iron frame.

Figure 89 Prepare mould and kiln for melt wax.

Figure 90 Brick Kiln to heat mould and melted wax flowing out.

Figure 91 Wax running out from pipe and tiny hole to see the status of wax running out**.**

Figure 92 Gas cylinders on boiling water to make easy flow of gas

Figure 93 Pre heating the mould before casting bronze.

Figure 94 Dismantle surrounding brick wall and close possible holes with wet clay plaster.

Process of melting Bronze

Prepare crucible: In the traditional casting process, the crucible used to hold the molten bronze is made of clay that is very pure and plastic type as used for making the clay statue. Clay is mixed with sand, cow dung and rice husk. The higher percentage of rice husk together with the use of a more plastic type of clay produces a much stronger vessel which can withstand the very high temperatures required to melt the bronze. In the contemporary process the crucibles are made of silicon, cobalt and graphite.The crucibles are about fourteen inch in height and eight inch in diameter, with one inch thick walls. The crucibles are conical in shape with flat base with smaller diameter than the rim of the crucible. (Fig 95)

Get ready tools and furnace: Different kinds of tools are needed to cope with high temperature of heated metal and for safety of the people involved in the process. Tools are usually made of iron because iron melts in high temperature more than the temperature needed to melt bronze. (Fig 96) The foundry of the Fine Arts department used to make brick furnace to melt bronze. When the study was on progress the foundry used the gas furnace to save time and safety. (Fig 97)

Melting the bronze: A block made of cement is placed inside the gas furnace. An inch thick layer of wet mud is spread upon the cement block. Then three to four pieces of bronze ingots are kept in the crucible which is placed upon the cement block inside the gas furnace. (Fig. 98)The mouth of the furnace is covered with lid which has small hole for the inspection. Some ingots are placed on the hole to pre heat to add in the melting bronze. At the bottom of the furnace the air hole and fire hole is prepared with air machine and gas burner. When all is ready and time to give fire into the burner, the head of the metal cast group does some religious pray to god of fire and the god Vishwakarma for the success of the task. He burns incense sticks and offer flower garland or *malaai in* Thai to the gas furnaces. (Fig. 99)

Then the furnace is set afire. To bring the fire to the temperature needed to melt the bronze, air is forced from electric blower into the gas fire in the furnace. The fire is

burnt continuously and when the bronze melts the impurities are taken out by iron spoons and stir time to time with iron rods. The molten bronze does not stick to the stirring rod due to iron's higher melting points. The cast members constantly monitor the melting bronze for three to four hours until a bright orange glow with brownish crust is achieved. The bronze used to make the project of fine arts, contained copper with 95 percent, zinc 1 percent and silicon 4 percent which is called silicon bronze. Silicon bronze are strong and flow easily in the details of the mould. (Fig. 100)

Pouring the molten bronze: Two person lifts up the crucible of molten bronze with the help of iron clutch. The crucible of molten bronze is placed in the holder with long handles which is held by two persons. Then the liquid bronze is poured in the pre heated mould until the liquid can be seen on the surface of the pouring funnel. Bronze flows through the hollow parts of wax lost channels and runners. The pressure of molten bronze push air to the air vents which flows outside. (Fig. 101) This act is very dangerous and the persons involved in it have to cooperate and take utmost care not to spill the molten metal in any case otherwise the consequence might be very hazardous. (Fig. 102) The remaining bronze left on the crucible is poured on the crucible tray to reuse later. (Fig. 103)

Breaking off the mould: The mould with bronze is left some days to cool down. Since the mould is made of plaster, it takes time to cool. In traditional process the material of the mould is made of mud, sand and cow dung which cools sooner than in the contemporary process. The plaster coat and iron strengtheners are cut open and break to detach from the bronze inside. (Fig.104) Remaining plaster attached to the bronze is sprayed with water to clean the surface and take out inner core plaster as well. Any fragments of the ceramic shell are removed by sandblasting. The sculpture is also carefully inspected at this point. (Fig. 105)

Cut off the bronze channels and sprues: When the plaster coat is taken out from the mould, the bronze structure reveals from inside the mould. The bronze is attached with all the channels which was made of wax and after casting with bronze all are

converted into bronze channels. The sight of this new manufacture is very interesting and one can understand how the molten bronze might have flown into the channels. (Fig106)These bronze channels are cut off from the main sculpture for the further process of cleaning and finishing. (Fig. 107)

Assemble the bronze pieces together: All the pieces of the sculpture are welded together by the skilled craftsmen, who are artisans themselves. The bronze statue after cast is very rough so that the metal worker have to work on the statue for several days to grind the uneven parts and if there is any accidental holes or cavities, it has to be welded again with repairing agents. (Fig. 108)Pieces of the other parts of the statue which are casted separately are joined together with bronze flux and welding rod a material for welding bronze. For welding gas oxygen and DA gas is passed from a nozzle with fire at the welding rod and the rod melts to adhere on the edges of the bronze statue, which helps to join the two pieces together. Welding rods are the same material as of the bronze statue which can be merged with the same color of the statue. All the weld marks are chased, re-detailed and sanded for the Sculptor's inspection and approval before the finishing processes. (Fig 109)

Glass Beading and apply patina on bronze: Glass beading is similar to sand blasting, the glass beads are extremely fine to ensure an even bronze finish prior to patination. When all the process of joining and cleaning finishes the statue is now ready for its final process. The statue is erected for the first time after casting. In this occasion the casting member along with the head caster prays to the statue and offer flower garland to the statue. Then for the finishing touch the bronze patina is applied on the statue to give required color which gives the statue its classic and exotic look. The bronze is first heated. The patina chemical is hand applied by the skilled foundry artist, with the Sculptor's oversight and directions, to obtain the desired colorization. Patinas are different in color such as green, black, ash color etc. Patina gives the statue look antique. For patina, Ferric Chloride ($FeCl_3$, $6H_2O$) and Potassium Sulphide (K_2S) chemical is used on the bronze sculpture. Ferric Chloride is mixed with water and the color of water become yellow.(Fig. 110) Yellow solution with the help of a brush, apply on the bronze

sculpture and let dry on sunlight or giving heat with electric heat. Then Potassium Sulphide is mixed in water which becomes greenish color solution.(Fig. 111) The solution of Potassium Sulphide is applied upon the ferric Chloride coat on the sculpture. The chemical reaction changes the color of the bronze to blackish bronze. If the bronze need more antique look, Kiwi shoe polish is applied on the upper coat. (Fig.112) Chemicals are applied several times to required color giving heat in all intervals. After applying patina wax is applied on the surface to ensure protection of the patina and together it gives beautiful lustrous look then, the statue now is ready to consecrate on its pre-decided location with special ceremony.(Fig.113)

Figure 95 Rice husk tempered crucibles and cement stand for crucible.

Figure 96 Different tools and utensils for casting bronze.

Figure 97 Modern gas furnace and traditional brick furnace for melting bronze.

Figure 98 Bronze ingots placed in the crucible inside the gas furnace.

Figure 99 Pray to fire god and firing the bronze ingots.

Figure 100 Stir and take out impurities.

Figure 101 Pouring liquid bronze in the mould.




Figure 102 Liquid bronze seen in the pouring cup.Figure103 Pour remaining bronze in ingot tray.



Figure 104 Cut out outer layer of plaster and iron strengtheners.

Figure 105 Clean inner and outer plaster with water jet spray.

Figure 106 Bronze layer on the place of wax layer.

Figure 107 Cut off the bronze channels and runners.

Figure 108 Grind uneven parts to make shine.

Figure 109 Joining the pieces together with Bronze Flux, a material for welding bronze.

Figure 110 Ferric Chloride solution mixed with water.

Figure 111 Potassium Sulphide solution mixed with water.

Figure 112 Kiwi black shoe polish.

Figure 113 Giving finishing touch with bronze patina.

Consecration of statue

The statues manufactured are taken away from the foundry with religious rituals. In the case of the King Mongkut or King Rama IV's statue was ordered by the Royal House Hold to establish in front of Wang Saranrom Palace outside the Grand Palace. The palace was built by King Rama IV. The open space in front of the palace boundary wall was converted as a park to consecrate the statue. (Fig.114) The present King Rama IX wanted to make this statue to honor King Rama IV as he is the ancestor of the present king and as a great modernizer UNESCO had honored him as important historic personnel.[85] The foundation stone was laid on 1st June 2007 by Her Royal Highness Princess Maha Chakri **Siridorn.** Her highness was present at the time of pouring bronze on the mould of the same statue in the foundry of Salaya. The statue was financed by the Ministry of Science, so on the auspicious day of 6 July 2010 the honorable Minister was present to perform the rituals. The head sculptor of the Sculpture Group Mr. Somkuan Oumtrakul modeled the sculpture in this project.

At the foundry, the statue is places safely on a pickup truck decorated for the occasion. (Fig.115) The chief Royal Brahman and his group of priests are present to perform religious rites before taking away from the foundry. Candles are burnt before the effigy of the statue in front of the big statue, with Vedic enchants and a flower garland is offered to the statue with blow of conch shell and clappers. (Fig.116, 117)Then the statue is taken away from the foundry to its actual destination on a grand procession followed by the foundry members. Before establishing the statue on the pedestal high above the ground, final respect is given by the sculptor and cast groups by offering holy scents on the foot of the sculpture and bowing head *wai*[86] at the statue to take blessing from the soul within, then the guests and officials from the ministry follow to pay respect at the king's statue. (Fig. 118) The Brahmin priests and Buddhist monks perform the religious rites to sanctify the statue while drums beaten and conch shell are blown to purify the

[85] http://portal.unesco.org/en/ev.php-RL_ID=18529&URL_DO=DO_TOPIC&URL_SECTION=201.html, Accessed on July 2010

[86] Wai is the gesture of joining palms of two hands together with slight bow head while doing this. This is also known as Namaste and Swasti pose in India and Nepal.

atmosphere. (Fig.119) The statue is again paid respect by offering garlands after it is established and sanctified on the main pedestal forever. At last the closing contract is signed by the head sculptor and the coordinator of the project. (Fig. 120) The sanctified statue stands on the tall pedestal for ever to be respected by the people. (Fig.121)



Figure 114 Decorated garden for the monument and preparation by Brahmin priests.


Figure 115 Decorated vehicle for the grand procession.

Figure 116 Performing worship and chant Vedic mantras with blowing conch shell and clapper.

Figure 117 Offering *malaai* by the minister and grand procession in front of Grand Palace

Figure 118 Paying respect to the statue.

Figure 119 Brahmin and Buddhist religious recitals to consecrate the statue.

Figure 120 Replica going back to the office and signing the closing contract.

Figure 121 Sanctified statue standing forever.

3.4 Traditional Bronze Casting Technique in Thailand

Silpa Bhirasri argues[87] that during his time in Thailand contemporary sculpture followed the traditional techniques. The most important is bronze casting which since remote times had reached a technical perfection in Thailand. According to him traditional statuary was confined to creating images of the Buddha, and in this art the Thai of Sukhothai, created magnificent statues from the 13th to the 15th century. From the traditional sculpture, the modern sculptors could transmit in their new work the principal characteristics of the old which are an extreme understanding of the simplified and synthesized human forms and a harmonious delicate outline.

A study of Isan and Lao[88] (Niyon, 2009) revealed the fact that the development and history of bronze alloy product in Isan adjoining Lao of Thailand dates back to pre historic age and is still evident in modern times. There is similarity between the moldings processes of replacing wax from other places of south East Asia. The local indigenous knowledge for selecting natural material in locality by applying animal dung, soil, termite hill, and paddy husk in producing process in the north eastern region still conserves the ancient producing process. Similar process is found from south India at present. This testifies the technique spread from one place to other.

Everly[89] had described in detail the process of lost wax casting of bronze object which was practiced by the bronze smiths of Ban Pba Ao. The process entirely follows the traditional lost wax process which was supposed to be prevalent from the prehistoric period.

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[87] Bhirasri, Silpa, *Contemporary Art in Thailand*, Fine Arts Department, 1963, Bangkok, p. 11

[88] Niyon Wongpongkam, Songkon Chantachon, and Subun Ieamvijarn, A Study of Isan and Lao Indeginous Knowledge in Making Bronze Brass Products for Commercial Purposes, Medwell Journal. 2009

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3.4.1 Process of Traditional Lost Wax process

For the purpose of the study a practical case study on traditional lost wax technique was conducted in the foundry of Fine Arts Department in Salaya. For this a head of Buddha was prepared for casting, because to create Buddha statue is easier, than to create any realistic human feature. Also for the spiritual back force that lead me to start my case study by paying my respect to the Lord.

Prepare core model of sculpture with clay mixed with sand: Preparation for the traditional bronze casting technique case study started from 16 June 2010. At first the most important was to determine the sculpture to be made. For the case study a head of Buddha was taken from the numerous plaster replicas scattered all over the foundry of Fine Art Department in Salaya. (Fig. 122) The clay we used for sculpting was collected from outlying areas around Bangkok and pounded by hand into a smooth consistency. This clay is being used in the foundry for all the sculptures. The clay is taken in proportion of one part wet clay and three part of fine sand and mixed together to make dough.(Fig.123,124)

For the preparation of the clay the Khun Pongpan,(Appendix 5, Bio-data 2) the sculptor takes help from the intern students of Arts Institute. When the clay is mixed and pounded properly for its malleability, the sculptor places the clay on a wooden base and starts with his expert hand to shape the head. At first it is just rough shape of a head and at the very moment he pierce through a wooden stick from the top of the head to strengthen the head, then reshaping of the head follows with several hands until the shape of head is completed. The center line is drawn from forehead down to nose and mouth. Then the sculptor mark facial line for the eyes, nose and mouth at the front of the face portion with a sculpting tool. (Fig125)With the help of finger and tools the detail of nose and eyes and mouth is carved. Since this is for the case study the sculpture wanted to show only the impression of eyes and nose not the detail distinct character. After a couple of hours the sculpture seems complete and it has to be left to dry completely for three to four days on shed. On the fourth day the sculpture is completely dry. (Fig.126)

Prepare wax sheet to stick on the core sculpture: Another procedure for the process of traditional lost wax casting is to apply wax upon the clay core. On 22nd of June the preparation for wax sheet commenced. Thickness of the wax determines the thickness of the bronze to be cast. At first a wooden board was prepared and two strings of iron 2/3 mm. thick were nailed on parallel line on the two edges of the board as shown on the picture. After the board was ready wax was melted in a tin vessel on a charcoal stove. After the wax melt unto liquid, a bowl filled with detergent mixed cold water is prepared. Some portion of liquid wax is poured into the detergent water. The wax cools at the mean time the texture of wax changed to yellowish. Same detergent water is spread upon the wooden board to make sure that the wax does not stick when it is rolled upon and easy removal of the wax later. The semi cool wax shaped into a ball was placed upon the previously prepared wooden board then to be rolled flat until the wax surface is smooth. The wax sheet is rolled until the sheet is as thick as the iron rod nailed along the border of the board. The thickness of the wax is important, since it determines the thickness the metal will be afterwards. If it is too thin, it will lose strength and cracking or breaks will occur. If it is too thick, it results in a heavy and more costly statue. The sheet of wax is cut from the uniform surface into a square shape. The sheet of wax is immediately dipped in cold water to let it cool quickly. For the purpose of the study three sheets of wax is prepared. (Fig. 127,128, 129)

Stick wax sheet on the core sculpture: On 25th June, as Khun Pongpan was supposed to stick the wax upon the surface of the statue, he ordered one of his colleagues to prepare glue (*Therk* in Thai)to stick wax sheet on the statue.(Fig.130) To do this, vegetable oil mixed with natural resin used as an adhesive agent is prepared in a bowl ready to be heated before apply on the statue. When the glue was ready and hot enough to be applied on the surface of the statue, Khun Pongpan cut the wax sheet in half and put upon the charcoal heat and sometimes upon the steaming glue to melt the wax little soft that to make easy to apply on the surface and stick malleably. With a brush, the melted hot glue is applied upon the surface of the statue and immediately the softened wax sheet is stick with taking care that the impression of the core comes out on the wax when

pressed gently with the fingers. With utmost care wax sheet was glued upon the head taking care not to overlap the sheet. The excess sheet was cut out with the cutting tools. After finishing the wax coating it has to be left to set for a day or two for the further process.(Fig.131,132,133,134,135)

Smoothen the wax surface and joints and make texture: As this case study was being done with the sculptor's free moments the days was not accountable because I have to ask for his free time for all the process. He called me to come on 29th June to document another process on the statue. On that day the statue was smoothened on the wax joined parts and the seams were filled with wax. The sculpture was scrapped take out the texture on the statue. (Fig.136)

Figure 122 Prototype plaster statue of Buddha head.

Figure 123 Wet clay and sand mix to make core of head of Buddha.

Figure 124 Mixing sand and wet clay.

Figure 125 Outline facial proportions and make shape of head.

Figure 126 Mr. Pongpan giving finishing touch on the sculpture.

Figure 127 Prepare a board to roll to make wax sheet and melt wax on fire.

Figure 128 Melted wax poured in cold water and rolled on the board.

Figure 129 Wax sheets cut in square shape.

Figure 130 Boil traditional glue name as *therk* made of tree resins

Figure 131Wax sheet make warm and cut into required size.

Figure 132 Apply glue on the sculpture.

Figure 133 Wax sheet sticking on the glue.

Figure 134 Wax sheet sticking on progress.

Figure 135 Wax coated sculpture.

Figure 136 Refine joints and make texture.

Mix cow dung and clay to apply on the sculpture: After long waited days, on 29th July some arrangement was done by the expert in traditional mould method, Ajarn Nikorn Koehapong. On that day we went to collect cow dung in the village of Nonthaburi. To search the cow that only eats grass was very hard to find. Because dung quality is very good for casting for its heat resistance and adhering quality if the cow eat grass only instead of straw and modern readymade food. It took about an hour to search such cow and finally we were able to get the cow dung required for the process. (Fig. 137)Back in the foundry, cow dung was mixed with water and mashed very hard by hand to make a fine mixture. (Fig. 138, 139) The liquid contained in the mixture is strained and squeezed by thin cloth. The liquid obtained from this is used to make fine paste of clay to apply on the wax coated statue.

To make the paste very fine quality clay called *Din Nuan* mean soft clay is beaten into fine pieces and again strained by a flour strainer to get the fine dust of clay.(Fig. 140) this type of clay have sticking quality and have to dig out from several feet under the ground. This clay is yellowish in color. The clay is mixed with the cow dung liquid in a ratio of four cup of liquid and one cup of clay. For the purpose of this mold eight cup of cow dung liquid was mixed with two cup of fine clay to make a paste. (Fig. 141) Before applying the paste on the wax coated sculpture, the wax is cleaned with soap water with the help of brush to clean dust from it. Then let it dry or wipe with a clean cloth. (Fig.142) Then with the help of fine brush, the liquid paste is applied on the wax. Wax coat is applied two times a day for seven days. In each coat the former coat must get dry to apply another coat. The outer investment is dried slowly in the shade to prevent any cracking as this would show in the final bronze image. On the seventh day the coat on the sculpture looks quite thick and almost the feature covered with the paste. (Fig.143)

Creating wax channels and runners: Mr. Mana Sukkhe or nick name as Ding who has been working on the casting process since he was 13 years and at present he is one of the senior most casting official of the Traditional Arts section of the Fine Art Department, gave me honor to demonstrate the following process. On 4th August, the seventh day, wax was melted to make wax channels and sprues. Some portion of melted

wax is poured in cold water and it gets a little bit cool. Then the wax is kneaded by hand for fine texture and rolled on the wooden board to make cylindrical rods and conical rod as sprue. Conical wax rod is made longer than the cylindrical rods. (Fig. 144, 145) The diameters of the rods are approximately two centimeter and lengths are thirty to thirty five centimeter long. The sculpture is placed on the raised platform made of brick and iron rods are heated on the gas stove for another process of attaching the wax rods on the sculpture. (Fig. 146)

Attach wax channels on the statue:. To attach wax channels, the tip of an iron rod is heated on the gas stove. Then with a sharp knife the place where the rod has to be attached is scratched gently to take out the cow dung coat to reveal the wax inside. Wax rod is cut in about two and half inch long. The end of the rod is heated with the heated iron rod tip and the also the place where it is going to attach. After attach the wax rod at the sculpture, it is allowed to cool for some minute. Wax rod is placed on top of the head, at the back and upon the ears on the both side. Rod kept at the back head upward and the two on the both side of the ears head downward. One bent as C shape rod is attached on the front bottom of the statue and another bent in S shape is attached on the back bottom of the statue. Both C and S shaped wax rod have to touch the base of the board not on the brick on which the sculpture mould is placed. (Fig. 147)

Insert nails on the mould: After the wax channel is attached on the sculpture, two inch long nails are inserted on the mould in different spots. The nails have to penetrate the base core to be strong enough to hold the mould intact while heating wax and pouring the melted bronze in. Due to religious and aesthetic belief nails are not inserted on the fore head of the god statue. (Fig.148)

Sealing the mould with first coat of sand and clay plaster: For the next process, a pot of sand and water based clay is prepared (Fig. 149) and both sand and clay is strained by a strainer to obtain fine sand and clay.(Fig150) Since this is the first coat of plaster, the combination of mixing sand and clay is three part sand and one part clay (i.e. 3:1). (Fig) The combination of fine sand and fine clay is mixed together and pressed by

hand until it gets soft and sticky enough to apply on the mould. Since the clay already have water, there is no need to add additional water on the mixture.(Fig. 151)After the sand and clay plaster is ready, the cow dung solution previously prepared to apply on the sculpture, is applied on the surface by brush and the thick layer of clay and sand mixed plaster is pasted upon the cow dung which here too act as a strong adhesive agent. (Fig.152, 153)

Figure 137 Collecting cow dung in a village in Nonthaburi.

Figure 138 Smash cow dung with water.

Figure 139 Strain water from cow dung from a thin cotton cloth.

Figure 140 Strain soft clay dust.

Figure 141 Mix soft clay dust with cow dung water.

Figure 142 Wash the wax with soap water and dry with cloth.

Figure 143 Apply cow dung and clay solution on the wax of sculpture.

Figure 144 Melt wax and pour in cold water and kneaded by hand to make soft.

Figure 145 Wax rolled on a wooden board to make conical and cylindrical wax rods.

Figure 146 Heat iron rod and place the statue on a raised platform.

Figure 147 Attaching the wax rods on the statue.

Figure 148 Insert nails in different places of the mould.

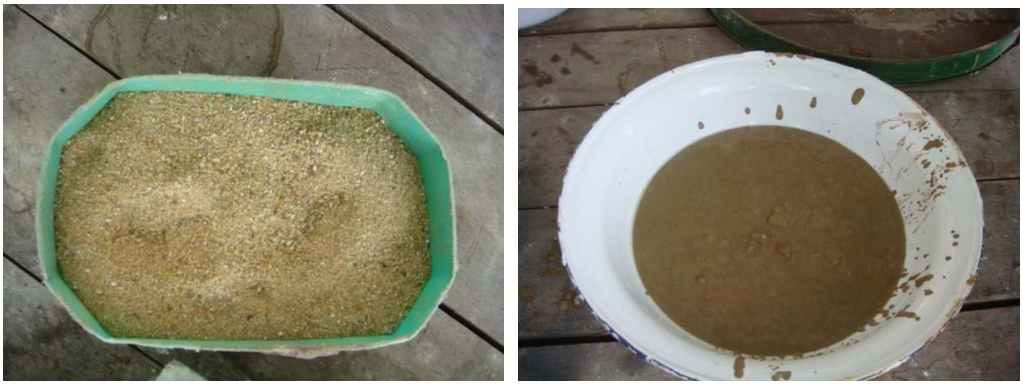

Figure 149 Sand and water based clay.

Figure 150 Strain sand and clay to get finer material.

Figure 151 Mix sand and clay together.

Figure 152 Apply cow dung and clay paste as glue and stick clay/ sand mixed plaster.

Figure 153 The clay mould covered sculpture.

Attach wax sprues, channels and runners: On 6th August the clay plaster coat dried and another process commenced on this day. The wax rod with the shape of cone at one end is attached at the back of the head of the sculpture where S shaped wax rod also known as wax gates, is attached previously. The cone shaped end is turned down while attaching and melting the joints at the same time with preheated iron rod. (Fig. 154, 155) The wax rod is fixed with the S shaped wax rod and the wax rod places at the top of the head. (Fig. 156)Then another wax rods are attached to the wax rod placed at the two sides of the head above the ears, one end is joined at the bottom of the cone shaped wax rod. Another slightly bent wax rod is attached to the side of vertical wax rod placed at the top of the head as shown in the figure.(Fig. 157)

Seal the mould with second coat of sand and clay plaster: After attaching the sprues and wax channels, the mould is invested in another layer of clay and sand plaster. The combination of sand and clay now is five portion of sand and two portion of clay mixed together. (Fig. 158) While applying the plaster, the wax rod on the top (Fig. 159) and at the bottom of the mould is not covered. The bottom two wax channels will help to flow away the molten wax to go out and the top wax rod edge helps to inspect the status of molten wax while heated to lost wax. The bottom two wax channels later will be converted to pouring metal and for air vent. While applying the clay and sand mixed plaster the mould is smeared with water to make easy to stick the plaster. The sand and clay plaster have to cover the nails and the wax rods completely. At the top of the plaster cover, four or five steps are made for a purpose which will be described on another process. (Fig. 160) Then the mould is left to dry for four or five days on shade to dry slowly. The moulds are not dried on direct sunlight since the heat may cause cracks on the mould.

Strengthen the moulds with iron wires: On 9th August the mould was dry enough to perform another process. For commencing the process iron rod and a roll of iron string was prepared. Iron rod was tied on four sides of the mould from top to bottom in vertical line as shown on the figure. (Fig. 161) Then around the iron round iron string was tied around starting from the bottom to the top and tied with the same iron

wire in different places. The step structure at the top of the mould was made to hold the iron strings at place. (Fig. 162)

Seal the mould with third coat of clay and sand plaster: After the iron wires were surrounded around the mould, to strengthen, the mould, once again needed to be covered with clay and sand plaster. The combination of sand and clay is sand five portions and clay two portions. The wet clay and sand is kneaded properly to make good mixture. Then wetting hand and also the mould with water, the clay plaster is applied on the mould covering the iron wires with thick layer. On the top of the mould where the wax rod is exposed, a cup shaped structure is made around with the same clay plaster. Inside the cup the wax is exposed for inspection during the firing the mould to lost wax. The mould is left to dry for two days to commence further process.(Fig. 163, 164, 165)

Make air vent and pouring cup: On 11th Aug the mould was dry enough and the mould was turned upside down. The brick bats attached at the bottom of the mould is taken out (Fig. 166) and the mould is secured upside down on a secured place surrounded by bricks. (Fig.167) The hole reveals the base of the core of the mould and the wax rods are now exposed on the two sides of mould base. The base also reveals the thick layers of mould applied before. In the core of the mould two inch long iron nails are gently hammered. The nails are inserted just four or five millimeters in the core. (Fig.168) The exposed nails and empty hole is covered with the same combination of sand clay plaster mixed with water. (Fig.169)With the expert hand of the mould maker the base of the mould is modeled for lost wax and casting bronze. The exposed two wax rods are surrounded by the clay cup securely modeled to make easy to pour the molten metal. The mouth of the cup is made in cone shape to give pressure which enables the molten metal flow smoothly into the gate or the channel which is hollow after the wax is lost. The finished mould is let dry for four days to do the lost wax process. (Fig.170)

Build kiln to lost wax: Until the mould gets dry, the kiln for the melting the wax out was built on the same day. The kiln was made in a traditional way to use firewood for melting the wax inside the mould. The bricks with 14 x 7 x 3cm in size are used to make a

single parallel line brick wall. The bricks are stalked in order to the height of 45 cm and 126 cm long.(Fig.171) Upon the brick wall seven pieces of zinc pipes80 cm long and diameter of 6cm is placed across the brick wall at the center. Two pipes on either side are tied together with iron string and the pipes in between are secured with brick bats in equal intervals.(Fig.172) Then brick masonry is built upon the zinc pipes attaching with equal portion of clay and sand mixed with water used as mortar.(Fig.173) The round shape brick wall is built to fit the mould inside the empty space. The brick wall is plastered with the same combination of clay and sand mixed plaster. (Fig.174)

Figure 154 Showing how the wax rod as sprue is going to be attached before attaching the wax rods.

Figure 155 Heating iron and wax rods

Figure 156 Attaching wax sprues.

Figure 157 Attach wax channels and runners.

Figure 158. Mix water based clay with sand.

Figure 159. Apply second coat of sand mixed clay on the mould to cover wax rods and nails.

Figure 160 Wax channel exposed and finished second layer of clay and mud plaster.

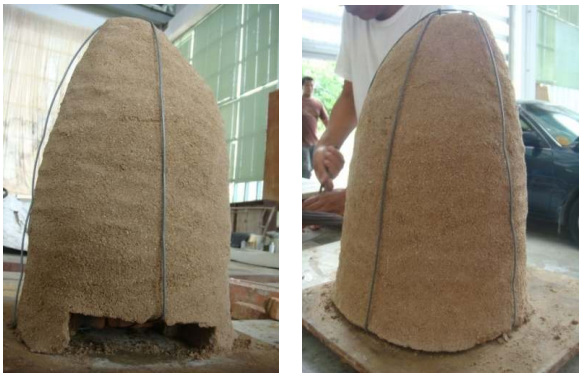

Figure161 Tie iron rods.

Figure162 Surround and tie iron wires around the mould.

Figure163 Applying sand and clay mixed plaster on the iron wire.

Figure164 Exposed wax rod and preparing to make cup on the wax rod.

Figure 165 Making inspection hole on the exposed wax rod which will be covered by brick while melting wax out.

Figure166 Taking out brick bats from the base of the mould.

Figure167 Exposed wax rods and inserting the nails on the base of the core.

Figure168 Fill the hole on the base with clay and sand mixed plaster.

Figure169　Make air vent and pouring cup with clay and sand plaster.

Figure170 The finalized mould left for dry.

Figure171 Constructing Kiln with brick.

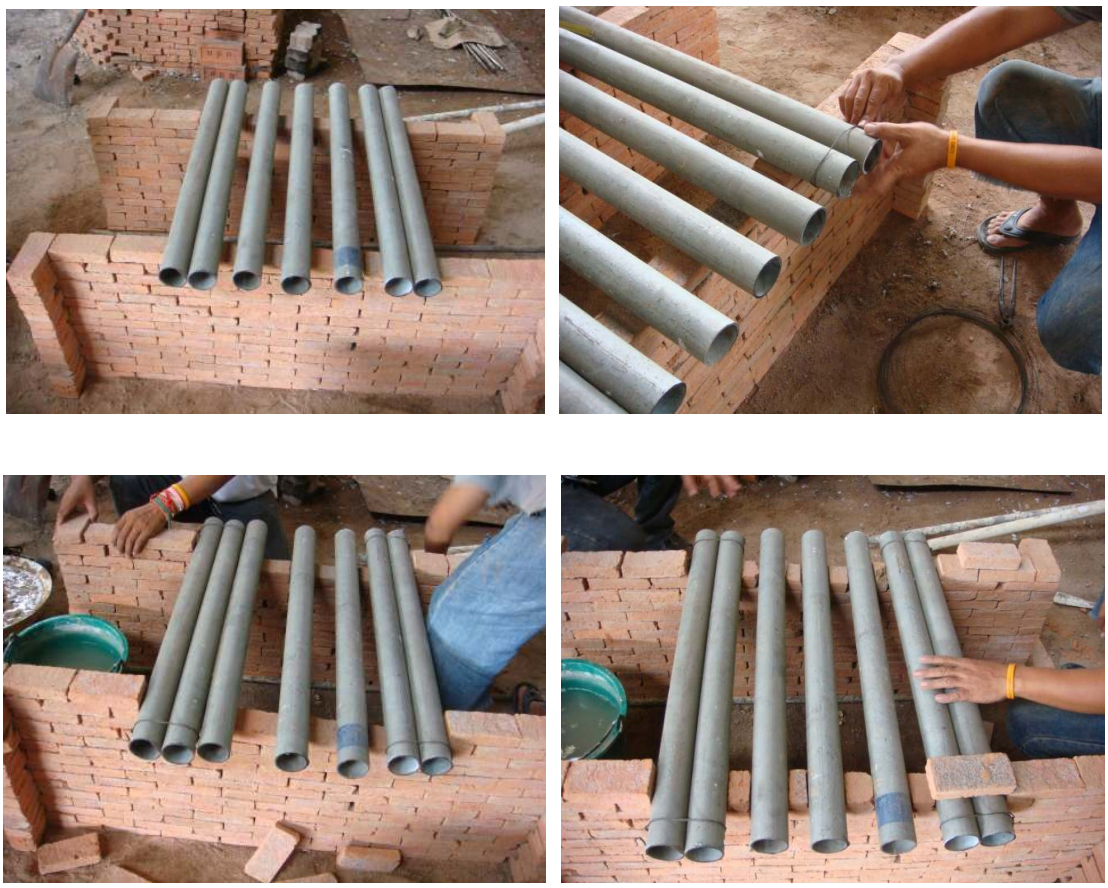

Figure 172 Tie zinc pipes and strengthen with brick.

Figure173　Build brick masonry on the zinc pipe.

Figure174 Round brick masonry for placing the mould inside.

Figure175 Apply clay and sand mixed plaster on the brick wall.

Lost wax from the mould: The day was fixed for 16th August to lost wax and cast with bronze. The mould was dry enough on this day to prepare for further process. Early in the morning, Ajarn Ding(Full name: Mana Sukkhee) at 6.0 AM placed the mould on the previously made kiln. The single hole side of the mould was faced up and two sprue holes side was faced down which was erected upon the zinc pipe. The hole on the top was covered with a new brick which is used later to check if the wax is completely lost or not. (Fig.176) Then for temperature control and monitoring, a temperature monitor is prepared and the sensor rod was fixed inside and the kiln. The temperature measuring device is operated by electricity. And temperature is displayed on the temperature indicator. (Fig. 177,178)

At 6.30 AM by offering a flower *malaai* to the fire god and praying to the spirits for safety and any ask forgive for unknown misbehaves, on both side of the kiln fire was ignited on the special wood prepared for the process. According to Ajarn Navin the fire wood name as *Kongkang* has specially quality. The trees of these kinds are found near the sea water and it has salty quality which helps to give high heat when it is burnt. The charcoal obtained from these woods is very good for high heat. They grow fast after planting and also can be found on the seashores of Petchaburi province of southern Bangkok. The trees are very nutritious that fish, crab and small water animals stay near the tree roots as well as it helps to protect tsunami to some extent.(Fig.179) The process of giving fire on the mould is very unique because the fire is not burned directly under the mould at the beginning. But the fire is burnt on the mouth on the both side of kiln. After fire starts to burn properly, the fire burning on the mouth of the kiln is partially covered with a zinc sheet which helps to redirect the heat of fire inside the kiln. The heat and flame goes inside the center of the kiln from both side which helps to heat the mould. (Fig. 180)

At 8.0 AM at the temperature of 140 degree centigrade wax started to melt and dropped on the floor through the wax sprue holes which are melting at this point. From this very moment phenomenon of lost wax from the mold starts. Melted wax dropped on the floor and allowed to evaporate since the quantity of the wax is very small in this case

otherwise in the case of big statues melted wax are collected on a pot through an iron pipe which can be reused for other statues. When wax starts to melt the temperature of the kiln is raised by adding more fire woods and at 8.30 AM the temperature indicated 153 degree centigrade. (Fig. 181)

Figure176 Dry mould placed in the kiln and covers the hole on the mould with brick.

Figure177　Insert temperature measure rod in the kiln.

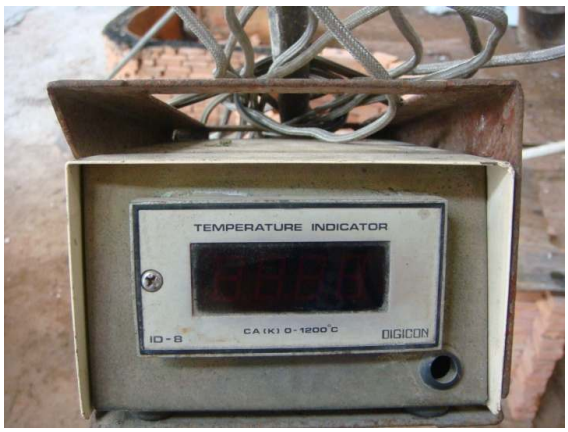

Figure178 Monitor of temperature indicator.

Figure179 Offering Malaai to God and spirit to start fire in the kiln.

Figure180 Giving heat under the mould from fire burning at the two mouth of the kiln.

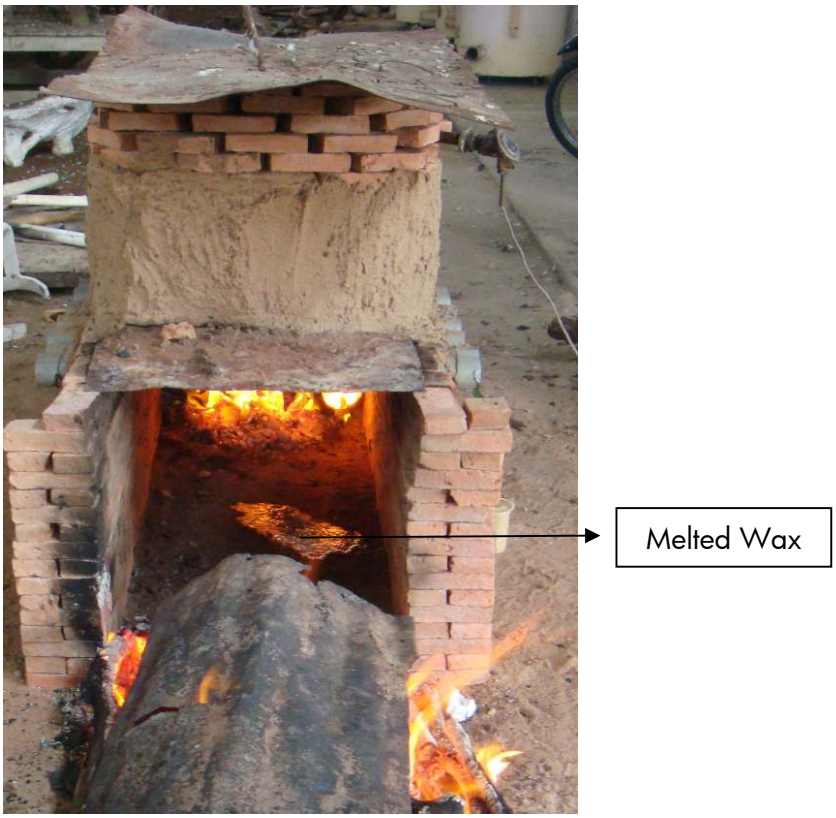

Figure181. Wax melting down from the mould.

Phenomenon of fire ball: At 9.0AM temperature indicated 245 degree centigrade. Melted wax seems not coming out at this moment. Ajarn Ding increased heat but too much heat is not good for mould which may crack in sudden high heat. The constant heat moves through the hollow part of the mould and makes it dry from inside. At 9.30 AM Ajarn Ding put charcoal and wood directly under the mould. In different interval of time temperature of the mould increased and decreased such as, at 9.50- 203 degree, at 10.0 AM heat was increased and at 10.20 AM temperature was 390 degree, at 10.34 AM- 320 degree to 388 degree and increased to 409 degree. At 11.15 AM temperature was 524 to 536 and at 11.30 temperature of the kiln was 542 degree centigrade. At this moment the phenomenon of the fire ball occurred inside the kiln. Fire ball occur at some point after the wax melts, the gas goes inside the mould and from the cavity gas comes out and the gas burns when it comes out. The gas comes out underneath the brick which is covering the hole on the top of the mould. The wax residues stick inside the brick.

When the fire balls happen fire is increased to 542 degree centigrade to take out gas completely. If the gas burns that means there is wax gas or residues remaining inside.(Fig.182,183) If the fire ball does not occur that means there is no wax inside the mould. The heat slowly decreased to 385degree at 11.45AM and 380 degrees at 11. 50 AM, again fire wood was added to raise heat and covered the mouth of kiln with zinc sheet. During this process a crucible made of Graphite and clay, which has high heat resistance, is places on the mouth of the kiln to pre heat the crucible. The crucible is small with height of 10 inch and when it falls on the ground it can break into pieces.(Fig.184) At this moment the brick placed on the top of the mould is inspected if there is any waxy residue left. The brick was very clean as a new brick at the part of the cover. (Fig.185)If the brick is clean it is understood that the mould has lost wax and there is no wax left inside. This is the traditional way to check the process of lost wax. Then some time the heat was very high then allowed to cool down slowly and the heat were 178 degree at 1.45 PM and 129 degrees at 3.00 PM.

Build furnace to melt bronze: When the heating process of the mould is going on and after the wax is lost, a furnace was built to melt the bronze. The furnace was made of brick and an air hole was made at the bottom center of the furnace. The furnace is made according to the size of the crucible in every case. The size of the furnace is calculated by putting the crucible in the middle of the brick wall in the initial stage. (Fig.186)

Figure182 After wax stops to melt give fire directly under the mould.

Figure183 Increase fire heat until the fire ball stops to appear from the mould.

Figure184 Crucible and pre heat on the heat of fire.

Figure185　Checking the brick placed on the upper hole of the mould.

Figure186　Making brick furnace with air hole at the bottom to melt bronze.

Plaster with sand and clay paste and make air circulation placement: When the brick wall is tall enough to the level of the crucible mouth, the walls are plastered with wet clay mixed with sand on the upper part of the furnace. The clay paste is applied in all the places of the inner part of the furnace. (Fig.187) Then a brick is raised on its wide side right at the center of the furnace in front of the air hole. Then another four pieces of bricks are placed in front of the corner of furnace facing the to the corner direction as shown in the figure.(Fig.188) The arrangement of the bricks helps to circulate air inside the furnace and make coal burn more to high temperature when the bronze is being melt.

Place zinc sheet on the air circulation brick and strengthen with brick and clay: Upon the air circulation bricks inside the furnace base, a zinc sheet fitting the width of the brick arrangement is placed as shown on the figure. Then small brick pieces are places in slanting position at the edge of the sheet touching the wall of the furnace which surround the sheet from four directions. (Fig.189) The bricks are covered with the clay paste and the base of the zinc sheet as well. This helps to strengthen the sheet at its place and the holes made by the bricks helps to circulate air around and give more intense heat. The wet clay is dried by putting some burning charcoal taken out from the wax melting furnace. (Fig.190, 191)

Place crucible with the bronze ingots inside and surround with charcoal: The furnace dried after an hour and the crucible was placed at the center of the furnace and the height of the furnace rose by adding more bricks on the wall and then plaster with clay paste. Two pieces of bronze ingots were kept in the crucible, then empty place around the crucible filled with burning and dry charcoal layers.(Fig.192,193,194) The crucible is completely covered with charcoal. When air blows through the air hole at the bottom of the furnace, the burning charcoal starts to burn more and other dry charcoal also starts to burn. The mouth of the furnace is covered with zinc sheet to make sure that heat do not go out and wasted. The intense heat inside the furnace starts to melt the bronze ingots and liquefy slowly. When there is enough space in the crucible another ingot of bronze was added. The temperature inside is nearly 1500 to 1700 degree

centigrade when all the metal melts in the ingot. The heat in the furnace can be seen from above the zinc sheet which at this point is in intensely heated that the sheet is red and looks like it will melt too. (Fig.195)

Figure 187 Plaster upper part of furnace with clay paste.

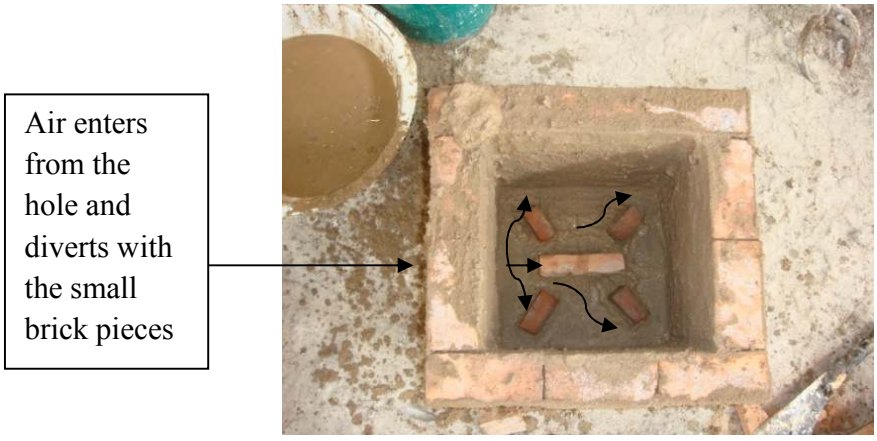

Figure 188 Arrange brick for air circulation right in front of the air hole.

Figure 189 Place zinc sheet on the air circulation brick.

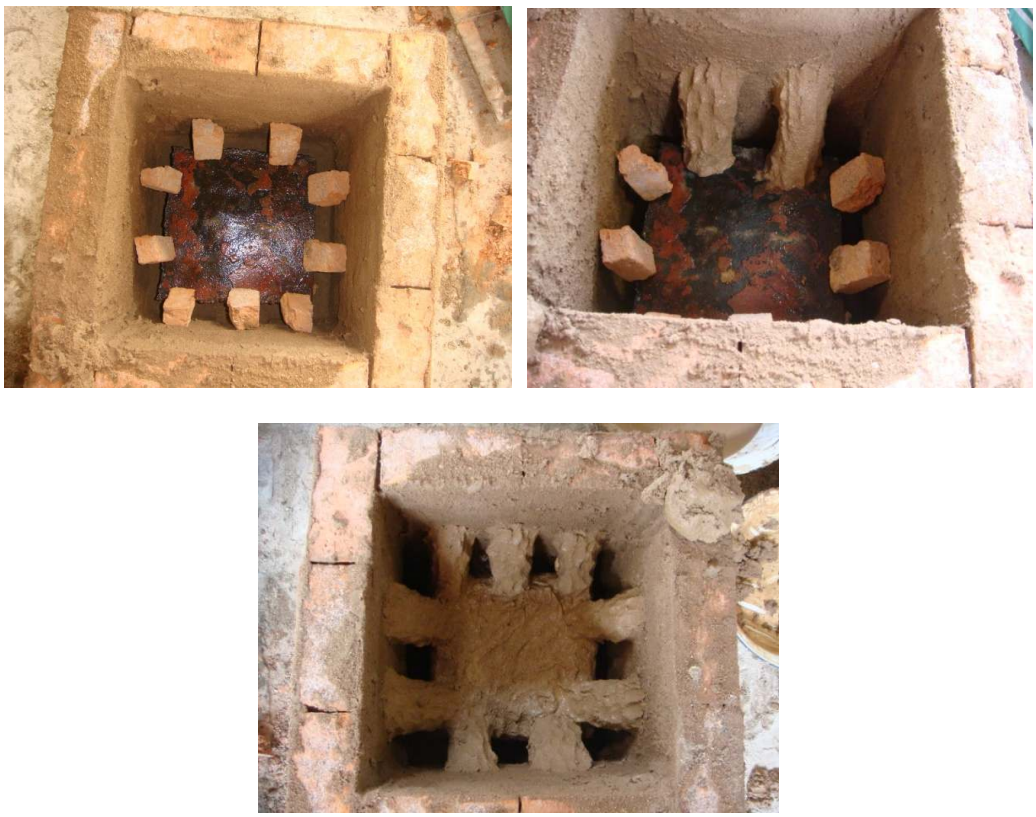

Figure190　Another brick arrangement of air circulation and plaster with clay paste.

Figure191　Put burnt charcoal on the wet clay to dry faster.

Figure192 Secure the crucible at the center and raise the furnace height by adding brick layer.

Figure193 Surround the crucible with big charcoal pieces and bronze ingots.

Figure194 Bronze ingots placed in the crucible and cover with burnt charcoal.

Figure195　Air blow makes the charcoal fire burn to its highest temperature.

Prepare the mould for pouring bronze: When the bronze is melted and boiling to its highest temperature, the mould is taken out of the kiln and placed carefully on a jute cloth.(Fig.196)

Close cracks and hole of the mould: The mould develops cracks in the heat. It must be covered before pouring the liquid bronze. Ajhan Ding closed the cracks with clay paste and the single hole of the mould was closed with a lump of clay paste and smoothen the surface with hand. This side of the moulds was faced down when the mould was securely placed on the ground surrounded by bricks and iron ingot frames.(Fig197) When the mould is secured to pour bronze, air pressure increased at the covered furnace where the metal is melting. When the heat is sufficient enough for pouring, the impurities in the melted bronze are taken out with a long handled spoon. (Fig.198)

Take out crucible from the furnace and pour bronze into the mould: To take out the crucible from the furnace some layer of bricks are dismantled to take precaution and for easy to clutch the crucible. It was nearly 4.0 PM in the evening then Ajarn Ding now wearing a heat protecting gloves on his both hands, took out the crucible with melted bronze from the furnace and placed on the ground.(Fig.199) With another clutch with long handle, the red hot crucible is hold up to get ready to pour into the mould. When the liquid metal is about to pour, another person stir the liquid with iron rod. Then the liquid is poured from one pouring hole of the mould and came out from another air vent hole. The liquid bronze pushes out air inside the mould while it comes out from the air vent vole.(Fig.200) Then both holes are filled with the bronze and the remaining bronze is poured in the ingot pot. (Fig.201)

This whole process of pouring the bronze takes only one to three minutes. It seems so quick and fast that time has stopped and the atmosphere of the moment is very intense and all pray for safety while pouring the metal and believe the task will be without any error. And of course this is the climax of the whole casting process which starts from clay model and going through different phases of mould and end up in the

bronze sculpture. There we can see red hot metal and fire all over the places cooling down from the climax moment.(Fig.202,203)

Break the mould: Since the sculpture for this case study was very small, the bronze in the mould can cool faster than the big ones. We waited for one and half hour for the liquid to settle in all the hollow part of the mould and after one hour one of the staff started to break the mould. (Fig.204) While breaking the mould was still hot and revealing all the layers of the plaster, wires until the sculpture within starts to reveal. Sculpture was shining golden in color which rejoiced the onlookers who were anxiously waiting to see the bronze sculpture. (Fig.205, 206)

Bronze sculpture with channels: The sculpture revealed completely from the broken mould with the channels attached to it which was made of wax before the mould was manufactured. The molten bronze went through these channels to all over the empty cavity of the mould. To our disappointment nose and forehead part on the face of the Buddha sculpture was missing. (Fig.207) Ajarn Nikorn Koehapong, the senior sculptor informed us that it was the fault of the thin layer of wax applied at that part. According to him wax layer play the vital role which makes the difference on casting bronze. Due to very thin layer of wax there was almost no cavity in the mould. (Fig.208a)

The fault can be corrected by welding at the missing part. The nails and channels attached on the sculpture are cut and taken out to do another process of finishing. The rough joints are smoothened with a hand tool. To take out shine and get rid of access residue on the surface, electric shiner as shown on Figure 208b is used.

Figure196 Carefully taking out the hot mould from the kiln and place on the ground.

Figure197 Close cracks and the single hole with wet clay plaster and securely place upright with the two holes facing up.

Figure198 Taking out impurities and raise air blow to prepare for pouring the melted bronze.

Figure199 Take out crucible from the furnace and place on ground.

Figure 200 Hold up the crucible from the ground and pour molten bronze into the first hole.

Figure 201 Pouring molten bronze on the air vent after the air is pushed out from inside bronze.

Figure 202 Pouring remaining bronze in the ingot pot.

Figure 203 Hot liquid metal and with hot crucible and furnace.

Figure 204 Breaking the mould after it cools.

Figure 205 Breaking the mould revealing the layers of burnt clay and sand plaster.

Figure 206 Revealing the bronze figure from inside the mould.

Figure 207 Bronze head of Buddha with missing forehead and nose.

Figure 208a Bronze Buddha head with bronze channels and nails revealing.

Figure 208b Different stage of finishing process.

3.4.2 Traditional Bronze Casting in Nepal

Ulrich von Schroeder[90] gave detail description of the lost wax or the *cire Perdue* process. He gave comprehensive detail of wax modeling, casting mould, casting, finishing, and gilding in the process of bronze casting technology. He deals with the traditional method of bronze casting. According to him casting image is a delicate process which is always executed by specialized artisans of India and Nepal belong to specific sub cast. Due to the fact that the entire manufacturing process is divided into several stages, the artisans specialize in particular skills according to their individual ability and qualifications. There is always a chief artisan who supervises and coordinates the complete process, and also responsible for contacting patrons and suppliers of the requisite raw materials.

For reference to the traditional casting technique which is similar to India and Nepal, an example from the statement of Ian Alsop is relevant in the context of bronze casting. Ian Alsop[91] states that Nepalese metal sculpture has continued without a break from the earliest metal sculpture known until present time in the Newar heartland of the Kathmandu valley. The patrons were likely to be either royal or members of the richer elements of the diverse and energetic Newar society. It seems that Nepalese metal sculptors[92] were taken from the ranks of the Buddhist elite or priesthood, in particular the Sakyas of a Buddhist monasteries of Patan. It is likely that they provided fine metal icons for the Hindu and Buddhists.[93]

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[90] Schroeder, Ulrich Von, *Indo Tibetan Bronzes* (Visual Dharma Publication, South China Printing, Hongkong, 1981).

[91] Alsop, Ian,*Metal Image casting in Nepal,* www.asianart.com., 1 December 2009

[92] In some cases Newari Jyapu caste used to work on metal caste. The Newari word Jyapu is the name of the farmer caste, whose members are likely among the oldest inhabitants of the valley. Although there are several noted Jyapu metal sculptors, the majority of the metal sculptors of the valley are member of the high Buddhist Sakya caste, and are largely concentrated in two Buddhist communities in Patan, Oku Bahal and Nag Bahal.

[93] 1. For general studies of the technique and process of image casting in Nepal, see Ian Alsop & Jill Charlton, 'Image Casting in Oku Bahal', in *Contributions to Nepalese Studies*, vol. 1, no. 1, December 1973 pp. 22-49, and Marie-Laure de Labriffe, 'Etude de la Fabrication d'une Statue au Nepal', in *Kailash*, vol. 1, no. 3, 1973 pp. 185-192

Ian further states that Newar casting techniques differ from the standard casting practice in the rest of the world. They have always cast their precious icons almost exclusively in a nearly pure copper.[94] Pure copper is rarely cast in the west in modern times because the molten copper, no matter how strongly heated, never flow easily and produces abundant gases, which tend to flaw the casting. They avoided some of the defects through the use of relatively porous mould materials. Modern casting technique calls for relatively on porous mould materials. To vent gas, the pour is directed first to the lowest point of the casting via a main pour channel; the metal, once reaches the bottom of the mould, then moves up through the rest of the sculpture while the gases produced by the process escape through the vents at the top. The Newar casters avoid the relatively complex system of pours and vents that this system requires, instead opting for a simple system usually incorporating a tripod of channels for the pour leading directly to the sculpture, which does not have further venting.

This system works largely because the mould material used by the Newars is a composite of fine clays mixed with various organic materials, notably rice husks in the outer layers and cow dung in the fine inner layers. These organic materials are burned out of the mould during the firing of the mould prior to casting and the mould becomes somewhat porous, allowing the gases to escape without vents.

Similar materials are used in the traditional casting method of Thailand. At present due to introduction of modern materials like plaster and silicon mold, above mentioned materials are rarely used in the foundry of the Fine Arts Department.

The first step in making a cast metal image in the lost wax process, called *thajya* in Newari[95], is sculpting the image in the wax that will hence be lost. The wax mixture is prepared by melting together beeswax, vegetable oil, and resin from sal tree (Sorea

[94] In the past the Newars generally cast their sacred images in almost pure copper, the best metal for fire gilding, which was almost always carried out after the casting and finishing. Indian metal sculpture traditions more commonly used variations on bronze (generically the term refers to any copper alloy, more specifically an alloy with tin predominant as the second metal after copper) or brass (where zinc is the second metal); often brasses and bronzes would have trace elements of the other metals of the pancha dhatu combination.

[95] *Newars* are the ethnic group originally concentrated in the Kathmandu Valley. Their language is called Newari which is descended from the Tibeto- Verman Language stock.

Robusta), a tropical hardwood tree.[96] After the wax hardens, lumps of it are warmed and pounded into thin, flat sheets. The wax sheet is further warmed over a charcoal brazier and the artisan begins gently to mold the image with the tips of his fingers. He first shapes the rough contours of the face and neck and then sculpts the facial features.

The excess wax of the sheet is cut away with a thin, heated steel blade, leaving just the contour of the face and neck. The facial features are further refined with a sculpting spatula made of buffalo horn, called a *silayku* in Newari. Using the different shaped ends of this versatile tool the artist articulates the facial features. The front and back halves of the Buddha head are produced from separate sheets of wax, allowing the artist to manipulate the wax from behind. Then the halves are joined, the head covered with small beads of wax which will be refined to represent hair, and the face completed. The head of an image of Buddha is covered with small beads of wax representing short curls. This is a tedious process because for each curl a precise amount has to be assessed and pinched from a soft piece of wax. It is rolled between the thumb and forefinger, heated over a brazier and attached by pressing it to the head. To further complicate the process the beads in each row change in size depending where they are places on the head, and then must be further refined by hand using the s*ilayku* tool. (Fig.209)

To join the halves of the head their edges are heated over a brazier, called a *milayca* in Newari, and pressed together. A long thin bamboo stick with one end wrapped in cloth, called a *sikathica* in Newari, is dipped into a small pot of liquid was. The liquid wax is dropped onto the unfinished seam which is worked smooth with the *silayku* tool. While molding a bust, the head, ears and shoulders are always made separately and joined together. With a full body sculpture the torso, arms, hands, legs, feet and pedestal would also be done in halves, joined and finally all assembled. (Fig.210)Seams are completely smoothed out with the buffalo horn spatula. Final adjustment to the image are made by adding and shaping thin layers of molten wax or scrapping it off with various sized and shaped knives. The last step in the wax modeling process of the bust of the

[96] The use of clay for the original sculpture, while customary in Western metal-casting traditions, is relatively rare in the religious sculpture of Nepal where the sculptors more frequently model the original image out of the same wax combination used for casting.

Buddha for example is to attach wax channel to connect chin to chest and ears to shoulders. (Fig.211)These channel help distribute the molten metal evenly throughout the mold during the process of casting. Finally the artist carefully goes over the wax image to make sure that no excess wax is present and that the surface are smooth. Refinements can be done at this stage by adding soft wax or by cutting away wax with thin steel blades. The completed wax image is what will be "lost" and replaced by molten metal and must therefore be perfect in all its details.

The clay mold to surround the wax is made in four stages. First the wax model is dipped in a fine sieved mixture of clay, cow dung, and water. If the sculpture is to be hollow the mold is also coated inside and requires a clay core. The mold is dried in the shade, dipped in a second layer of the shade, dipped in a second layer of the same clay mixture and dried again. Third and fourth clay layers with increasingly higher proportion of cow dung and added rice husks are applied by hand and dried in the sun. For hollow-cast images, iron nails are driven through all exterior clay cores. The nails keep the core from displacing when the wax is removed and the molten metal added.

The cow dung has an adhesive quality that ensures proper binding of the clay mixture to the wax. It also regulates the temperature- its nitrogen element keeps the mold at the high temperature required for casting and its porosity allows the heat of the molten metal to escape so that the metal can be solidify rapidly. When the mold is complete, its bottom layer is scraped away to just expose the wax and waxen channels. Pouring spouts are attached and mud- coated. On the casting day, the clay mold is heated and drained off the wax which is not actually lost but collected and saved for future work.

The empty molds and metal- laden crucibles are stacked in separate kilns and fires for several hours. With well-honed intuition the master assesses when they have reached the right temperatures. The heated molds are removed with 4 foot metal tongs and placed in position to receive the molten metal. With dramatic timing the master rapidly fills each mold with the exact quantity of molten metal needed while an assistant throws resin into it to prevent the metal from oxidizing as it cools.(Fig.211) To complete the cooling, the

metal-filled mold is immersed in water, then removed and broken open to reveal the image.

After rudimentary cleaning the rough cast image, in this case copper, is taken to another craftsman for finishing. With special scrapers he removes any residue of the blackened mold and soaks the image in sulfuric acid to complete the cleaning process. The excess metal of the pouring channels is removed with hammers, chisels, and dies. Then the entire surfaces are pounded with hammer and die in a cold forge process to condense and harden the metal. This process is generally done by an apprentice who has been taught the process by the master.(Fig212,213,214,215)

The smoothing of the surface is begun with files and sandpaper, usually by an apprentice. The master then uses various shaped dies and hammers of different weights to refine the details. This process is called chasing. The finest tools are used to finish ornaments, such as the earrings, and to engrave delicate textile patterns like those on the folds of the robe over the left shoulder. If an image is to be gilded a goldsmith does it by process called fire- of mercury gilding. (Fig.216)

The process of gilding is a lengthy, complex, and dangerous one. Highly toxic mercury is first combined with gold foil to make it adhere to the metal but then driven off by heating to leave only the gold. By various processes the gilded surface is then burnished and polished to achieve a rich golden color. As an ultimate step it may be immersed in a red dye obtained from tree bark which produces a warm reddish glow, a finish particularly appreciated in Tibet.

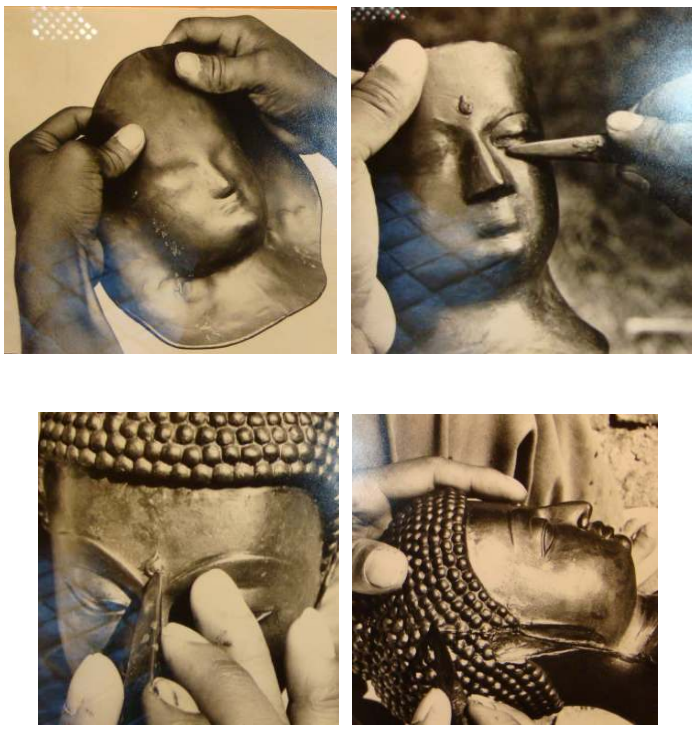

Figure 209 Shapping and joining the wax model of the sculpture.

Figure 210 Wax models being developed, Collection of Patan Museum.

Figure 211 Join separate pieces together and wax channels on chin and ears.

Figure 212 Wax coat before applying clay mould.

Figure 213 Different layers of mould.

Figure 214 Pour liquid bronze into the mould and bronze statue inside the broken mould.

Figure 215 Cutting off channels and hammering for refinement

Figure 216 Different stage of refinement for finished product.

3.5 Difference between Traditional and Contemporary Bronze Casting Technique

Silpa Bhirasri argues[97] that during his time in Thailand contemporary sculpture followed the traditional techniques. The most important is bronze casting which since remote times had reached a technical perfection in Thailand. According to him traditional statuary was confined to creating images of the Buddha, and in this art the Thai of Sukhothai, created magnificent statues from the 13th to the 15th century. From the traditional sculpture, the modern sculptors could transmit in their new work the principal characteristics of the old which are an extreme understanding of the simplified and synthesized human forms and a harmonious delicate outline.

A study of Isan and Lao[98] (Niyon, 2009) revealed the fact that the development and history of bronze alloy product in Isan adjoining Lao of Thailand dates back to pre historic age and is still evident in modern times. There is similarity between the moldings processes of replacing wax from other places of south East Asia. The local indigenous knowledge for selecting natural material in locality by applying animal dung, soil, termite hill, and paddy husk in producing process in the north eastern region still conserves the ancient producing process. Similar process is found from south India at present. This testifies the technique spread from one place to other.

Everly[99] had described in detail the process of lost wax casting of bronze object which was practiced by the bronze smiths of Ban Pba Ao. The process entirely follows the traditional lost wax process which was supposed to be prevalent from the prehistoric period.

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[97] Bhirasri, Silpa, *Contemporary Art in Thailand* (Fine Arts Department, Bangkok, 1963). p. 11

[98] Niyon Wongpongkam, Songkon Chantachon, and Subun Ieamvijarn, *A Study of Isan and Lao Indeginous Knowledge in Making Bronze Brass Products for Commercial Purposes* (Medwell Journal. 2009).

[99] Everly, Daniel Eugene,*The Relevance of Contemporary Bronze Casting in Ubon, Thailand for Understanding the Archaeological Record of the Bronze Age In Peninsular Southeast Asia* (University of Houston,2004).

After completion of the case study of traditional and contemporary modern bronze casting technology in the foundry of the Fine Arts Department in Salaya, some similar and different technique was revealed. (See Appendix 9 for table)

The main differences between Traditional and Contemporary Bronze casting could be summarized as follows:

Raw Materials

Although materials such as sand and clay are used in both traditional and contemporary methods of bronze casting, the traditional method involved more natural substances such as firewood, cow manure, etc. whereas in the Contemporary method, materials such as Gypsum, Silicon rubber, iron were more often used.

Time Factor

This is one of the major factors which resulted in the evolvement of today's contemporary method of bronze casting than the traditional method. In the traditional method the moulds were made by a mixture of clay, sand, cow manure took longer to dry, whereas the contemporary method used materials such as gypsum and silicon which would dry faster and normally took half of the time as in the traditional method.

Quality

Although the issue on quality of the bronze statue is based mostly on a sculptor's skills and dexterity, it is however debatable as to which method makes the work of a sculptor easier and perhaps complete the statue to perfection.

The use of only clay on the core statue in the contemporary method, rather than a mixture of clay and sand, helps the sculptor to make appropriate modifications to the core to get the desired result. Similarly with the use of gypsum, it can also be modified over and over to get the desired result. This foundry's focus has been on making realistic statues and it has also been easier for the sculptors to do so with the use of modern equipments, technology and the knowledge of human anatomy.

Technique

Both traditional and contemporary method although use similar technique yet the steps involved in the process differ. The steps involved in the contemporary method are a lot more than the traditional method and is also more complicated. For example, in the initial phase of making a bronze statue, in the contemporary method, the core moulds are cut and divided into many parts prior to applying the gypsum. It is up to a sculptor's intuition and insight as to how and where to make these distinct cuts, which are complicated and also requires a lot of experience. After cutting these different sections the parts are reassembled using iron nails and screws. The traditional method also does involve this process of cutting and dividing, however it is basically done by cutting huge sections of the major parts of the statue, such as the whole arm of a statue. In the contemporary method, this would be done by cutting of several sections from the arm.

Cost

As the process of traditional bronze casting slowly evolved to new contemporary methods, the materials used and the process has also differed. Materials such as gypsum and silicon which are mostly used in the contemporary method are more expensive than the materials such as clay, sand and cow manure, used in traditional method. As firewood was used in the traditional method to melt the bronze, etc. now days the contemporary method mostly uses gas furnaces and coal which tend to be more expensive. However, even though the contemporary method is more expensive, one advantage of using silicon moulds is that these moulds could be reused to make other statues hence reducing the cost and time taken to re-do the process all over again.

Most important in traditional and contemporary lost wax process, apart from other materials, wax plays a vital role which was demonstrated when the traditional process commenced. The wax coating makes difference on the quality of the sculpture. If wax coat is very thin there is a chance to develop a hole when bronze is poured. The pores can be welded later but the quality of weld cannot compete with the first hand bronze figure.

The traditional bronze casting technique has its own value which cannot be compared to any new and so called contemporary techniques. With the demand of change and by the circumstances, introduction of new technology and scientific way of learning and creating art gave new dimension on the bronze art creation. When the equestrian statue of King Chulalongkorn and the art itself acted as an appetizer to go into new course of creating bronze art, entry of Corrado Feroci in the world of art in Thailand took its main course for the development of modern art mainly the bronze monumental art. The inborn ability of the Thais in understanding art and its aesthetics, gave sustainable workmanship and ability to retain the effort of Feroci. The introduction of wonderful materials like gypsum plaster and silicon by Feroci gave more intricacy in creating realistic bronze art. Moreover, the ability of the workers can be seen when they use their intuition and experience while performing their task of designing, modeling, molding and casting. The experience makes them perfect to smell and feel the condition of the mould while being casted and the whole lost wax process. They seldom use the temperature measuring equipments; rather they can interpret by touching the heated mould and smelling the wax and molten metal vapor in the air. The older generation of sculptors and casters speak very highly and kindly of the essence of traditional casting method. Their kind words seem very short and easy, but their echoes are truly endless. Since they are acting for the increase of goodness and happiness of the society, in this way the world of bronze sculptures ceases to be one’s object, but the object of the whole world.

CHAPTER IV

Reflection of Bronze Sculptures and Thai Society

Bronze art in Thailand have been very popular since last century. It had been the policy of the Thai government in different regime that all the provinces and the government houses should have the portraiture of the Royals or the monuments of the important pioneers. With the popularity of the monumental sculptures the fashion of establishing the sculptures on public places and in private and government houses, educational enterprises, hospitals etc. took very popular move that at present there are hundreds and thousands of such can be found all over Thailand. The chapter discusses on the popularity of the bronze sculptures of the Kings, the hero personnel and pioneers are unique Thai society and the different kind of belief system prevalent in the Thai society.

4.1 Bronze sculptures, reflection of Thai society

The tradition of making bronze sculptures of the Thai elites began its fast pace from the period of King Rama IV. Before Rama IV period only for the religious purposes statues of kings were made to consecrate in some wats as a offering on the service of the god. The reigns of King Mongkut and King Chulalongkorn were the times when Thailand enthusiastically opened its door to western countries for political and economic reasons. As a result, western art came to gradually have an influence on Thai artisans and artists.[100]

Ka F. Wang[101] had portrayed the nation with the means of public monuments. On the basis of public monumental images and narratives his discussion is unique on the

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[100] Apinan Poshyananda, *Western- style Painting and Sculpture in the Thai Royal Court* (The Bureau of the Royal Household, Bangkok, 1992). p.263

[101] Ka F. Wong, *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006)

study of Thai history. Public monuments were the means of visual manifestation of Thai regimes which symbolize how they have imagined their nation. From absolute monarchy to the present people's democracy, they erected public monument and memorials of different kinds to legitimize their own rule and promulgate their own concept of modern Thailand to the people. Wang gave very comprehensive knowledge of the absolute monarchy, modern nationalism, traditionalism and diversity via public monuments which portray different stage of Thai political history as well as social and art history. To talk about only of the public bronze monumental sculptures, as stated before, the public bronze monuments were manufactured under the direct royal patronage from the time of King Mongkut apart from few foreign made and gifted bronze sculptures of the elites. The tradition of making bronze was reached to its zenith during the time of King Chulalongkorn and King Vajiravudh's regime. Therefore during the absolute monarchy the kings and elites used their bronze monuments to transcend their legacy on the general public. Bronze monumental sculpture representing the absolute monarchy was the famous equestrian statue of the King Chulalongkorn.

The equestrian statue testifies the absolute monarchy of the time. King Chulalongkorn tried to establish his power strongly with his visual representations of any means in front of public and its neighbor. He searched for a novel symbol for an ideal absolute monarchy. During King Chulalongkorn's entourage to Europe during 1897 and 1907, he was inspired by the portraiture of different kinds of the ruling monarchs which were then culture of Europe to display such in the public spaces. He must have thought to use royal portraiture as useful propaganda, as a way of presenting the rulers as civilizes individuals as well as he used the Thai sentiment of *devaraja*, *chakravartin raja* or the incarnation of *Lord Vishnu* embodied on the king to reflect on the portraiture.

The traditional Thai custom believed that the soul of the persons dwell upon the photographs, portraitures and idols. The superstition of making an image of a living person, including photograph, portrait and sculpture was harmful to the individual

changed after the living power elite became more willing to use and even actively utilize their image for personal and political purposes. The superstition positively impacted on the status of the monumental art of the elites. Thais are very flexible in nature and their belief. They can adjust in any kind of situation if it gives them mental and spiritual satisfaction. As Wang states[102],

> "*The general masses are convinced that the spirits of the revered personality, or at least some fragments of his or her essence, inhabit the picture or sculpture. The artwork that captures and conserves the image of that individual naturally becomes a spiritual representation of that person. It is a common scene now a day that the setting of a photograph or statue of a particular king or queen is at the center of worship. It is also a popular custom that Thai people pay homage and oblations to many of the royal monuments as scared icons all over the country.*"

Even though the political scenario have changed toward the course of time in Thailand, the absolute rulers to the rulers of constitutional monarchy, military regime to the present peoples' government still revered the absolute Chakri rulers which is testified by still in practice of making bronze sculptures of those rulers.

Another famous equestrian statue not to be forgotten in this context is the equestrian bronze statues of the King Naresuan. In early Bangkok period, Thai Historiography developed with the heroic deeds of the King Naresuan in Ayutthaya period. King Naresuan had reestablished the sovereignty of Ayutthaya after its first fall to the Burmese in 1569 by which he became a hero personnel.[103] Position of King Naresuan I Thai society took a new meaning as a hero of Thai history which was recorded under the direct effort of the ruling regime. Thai historical records confined only among the royals was later from the time of King Chulalongkorn and King Vajiravudh' s time starts

[102] Ibid. p. 15
[103] Ibid, p 87

to emerge in general public with the means of education to bolster morale and provoke a sense of patriotism among the people. The effects of two world wars and the military government, Thai patriotism was reaching to its height with the glory of the stories of the King Naresuan. The military government started to establish monumental art of King Naresuan. The famous monuments of King Naresuan was made in 1958 by Bhirasri in front of don Chedi in Supanburi with narrative panels and others are in Pitsanulok, Ayutthaya etc. Until 2010 numerous bronze sculptures of King Naresuan were manufactured. The most recent is the one equestrian sculpture with the mobile heroic pose is under construction in the foundry of Fine Arts Department by Mr. Paradron Cherdchoo. Because of the society Thais lives in, even though the military initiates the monuments of the King Naresuan with political motives, the image of Naresuan has reached its height from hero figure, historic and military idol to a God. According to Wong statue King Naresuan is regarded as holy image that its worshippers believe the spirit of the King will protect the community as well as the country. Like Chulalongkorn Day, King Naresuan Day is celebrated on 25 January every year by performing colorful rituals and procession held around the Don Chedi monument in Supanburi and other places of the country. There are numerous bronze sculptures made during different regime by the famous artists of the Fine Arts Department. See some of the sculpture list in Appendix 10.

4.2 Spiritual dimensions and beliefs behind the making of bronze statues of Thai elites

Art work of any country not only possesses its aesthetic values, but also reflects in various aspects representative characteristic of a nation. [104] Art and religion reflects the society which become the identity of the nation. Thai society is the amalgam of different religious beliefs mainly, animism, Hinduism and Buddhism. Deep rooted animistic,

[104] Apinan Poshyananda, *Western- style Painting and Sculpture in the Thai Royal Court* (The Bureau of the Royal Household, Bangkok, 1992). p.258.

ritualistic practice, belief is still prevalent in any modern or ultra modern people's thought. Any modern Thai from inside do have faith in spirit, supernatural power, astrological belief. So this is their social heritage that is prevalent in the Thai society.

Thailand has a long history of Brahmanic culture. Brahmanism and Brahmanic faith took hold in Thai since this part of land was influenced by Indian traders and mostly the Hindu Khmer civilization. Thai art and literature is replete with the Brahmanical faith and Sanskrit influence.

From the artistic point of view bronze monumental and commemorative arts was adopted in such condition by the extant Thais that the whole region was undergoing assimilation of many cultures of Southeast Asia. Literary works as well as various forms of arts are influenced by extant animism, Brahmanism and Buddhism. Hinduism has existed in Thailand in a syncretistic relationship with Theravada Buddhism since pre Thai period (at least since the fifth century B.C.). It is rooted in the land being a part of its sacred geography and archaeology. However its function, its meaning, and its relevance to a Thai differ fundamentally and radically from what it is for a Hindu in Indian subcontinent.

Hinduism is a religion of social order and culture. With the philosophical aspect Hinduism leads human being to Mokshya from the freedom of Samsara. In social order one has to perform the duty in the form of Dharma and proper fulfillment of his Dharma eventually prepares a Hindu for his final goal the Mokshya. Culturally Hindu religion is the source, the theme and the motif of sacred rituals, ceremonies, festivals, music, art and literature.

In Thailand on the other hand the main religious tradition is Theravada Buddhism which is also the basis of Thai social order. The role of Hinduism therefore is subordinate and peripheral to Buddhism. Hinduism exists not as a total tradition but as a piece-meal

way, lacking in depth, structure, inner unity and cohesiveness.[105] The Thai have acquired theology and philosophy from Theravada Buddhism not from Hinduism. Thus the Hindu scriptures, the Vedas, the Upanishads, Bhagavad Geeta- the very basic Hindu theological speculations and philosophic insights have absolutely no influence on Thai religious life. Apart from this, the Brahmanas, the priestly text on ritual and ceremony, the Puranas, the Hindu text on cosmogony, astrology and mythology, Dharmasutras, the aphorisms on duty and morality, the Dharmasastras, the Law books of the Hindus, especially the Manusmriti, the Epics, particularly the Ramayana, in short the entire ritualistic, cosmogonical and Dharma literatures of the Hindus, has contributed a great deal towards the sanctification and embellishment of Thai religious, social, cultural and political life.[106]

According to Santosh significant contribution of the Hindu tradition to Thai life is in the form of rituals, ceremonies, certain cosmogonical and astrological beliefs, a reverence for Hindu major deities, Shiva, Vishnu, Brahma as well as for minor gods, and towards the development of the concept of Dharma, the law. It has also played an important role in the formulation of Thai script and their language which is rich in Sanskrit.

4.2.1 Devaraja, the God King

One effect of Khmer civilization on Thai is that, the Thai acquired and made their own was its religious dichotomy. They embraced two exclusive Indian religious systems, Hinduism and Buddhism. Until towards the end of Khmer empire, these systems were separate, the former appertaining to the court, and the latter to the people. The kings reinforced their absolute temporal power by claiming to be the mortal representative, and indeed the incarnation, of one of the Hindu deity Narayan, and a temple was built for each that became on his death his funerary monument and cult center. The people

[105] Desai, Santosh, *Hinduism in Thai Life* (Popular Prakashan Private Limited, Bombay, 1980). p. 108.
[106] Ibid, p. 109

meanwhile devoted Buddhist most suited to their situation, nevertheless paid homage to their god king or *devaraja* as a matter of course. This system was acquired by Thai and modified by them to the extent that what had been a dichotomy became a duality. That is, the religion of the court continued to be Hinduism, the Thai king became an adherent of his people's faith. Thais adopted the Hindu concept of divinity and the Hindu coronation ritual which imparted divinity to the king in a situation devoir of other essential and integrative forces of Hindu concept. The notion of Hindu social system to regard the ruling class as *kshatriya* emplied on the Thai ruling class as well. The Buddha himself was from the same cast of *kshatriya*.[107] At the present the Hindu element of the religious duality is still strongly in evidence in the rituals of the Thai court and state. A chapter of Brahmin priest still attends and to a certain extent regulates the court and officiates at royal state ceremonies. The king is still clocked by the title of Rama deriving from the Hindu God. The ashes of the deceased monarchs is kept in the altar of the royal temples and still treated as a piece of veneration.

Likewise new phenomenon of modern monumental bronze statues of the different monarchs has played as a cult object to be venerated by the devoted citizens of Thailand. History of kings meant for normal Thais is like *tamnan* meaning folklore, legend, story or myth rather than history. The word *history* known as *prawatsat* in modern Thai word was acquired at the reign of King Rama V. [108] Because of the long rooted tradition of believing in the folklore and legend, the Thais usually tend to admire their monarch's deeds and history and consider them as a hero figure or God that are benevolent to their well being.

4.2.2 Chakravartin monarch

[107] Ka F. Wong, *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006).p.164.

[108] Ibid. p. 162

Thai adopted the Buddhist belief of *Chakravartin* monarch which means the universal monarch. Wong[109] states that,

> "The idea of *chakravartin* (universal monarch) evolved to accommodate the various godly identities of the Thai kings. The word chakra originally meant wheel. It then was linked to the wheel. It then was linked to the wheel-turning sovereign (dhamma) of the world and elucidated as the sun and the symbol of Vishnu. Besides, the favor of white elephant also arose from this belief, for white elephant was one of the seven treasures of the universal monarch. In Buddhism there are five kinds of *chakravartin*, primary based on weapons, wealth and power. They are as follows: (1) *Awudhawattiraja*, the *chakravartin* who has various kinds of weapons; (2) *Punnawadda chakkawattiraja*, the *chakravartin* who has enormous wealth and never runs off; (3) *Anachakkawattiraja*, the *chakravartin* whose power is so great that he can depute lifeless fetters to catch *naga*; (4) *Punnachakkawattiraja*, the *chakravartin* whose feet are marked with the sign of chakra to let the chakra world know that he will rule over it; (5) *Gandhari chakkawattiraja*, the *chakravartin* whose magic power enable him to fly in the sky and go underneath the earth."

The virtue of the five elements of the *chakravartin* character is supposedly reflected on the equestrian or other types of monumental bronze statues of Thai monarch. When the statues are made, the sculptures bring those as far as they can to portray those qualities which are in the respected monarchs and heroes of the Thai history.

4.2.3 The Bodhisattva king

Thai kings are often regarded as Bodhisattva Avalokitesvara. Avalokitesvara enjoys a special place in the hearts of millions of Buddhists worldwide whether they follow the Mahayana or the Theravada traditions of Buddhism. Also in the Buddhist pantheon of deities, he embodies the essence of the Mahayana tradition of Buddhism, for he is the compassionate one, the one who personifies the compassionate nature of the Buddha. According to Nandana Chutiwongs, "Avalokitesvara, the Ever-watchful, lord and personification of universal compassion *(Mahakaruna)* represents the highest ideal of

[109] Ibid p. 165.

Mahayana Buddhism and, consequently became the most important figure in the vast Mahayana pantheon. He is, in other words, the very being in whom the evolution of Mahayana thought is reflected"[110]. The idea of the Bodhisattvas are found in The Mahayana belief of the 'would be' Buddha and the Theravada belief in the past Buddha as exemplified in the Jataka stories.[111] Bodhisattvas are an enlightened and self sacrificing being who postponed his own entry into nirvana in order to help others achieve salvation. Thai Chakri kings were named by the Buddhist names which denote of being a Bodhisattva. As Wong states,[112]

> "……. such as King Rama I, Pra Puttayotfa(Buddha Yotfa), King Rama II, Phra Phuttaloela(Buddha Loshia), and King Rama III, Phra Nangklao(Nan Klau) given respectively by King Mongkut (Rama IV) denoted that the monarchs were Bodhisattva. *The Chronicle of Buddhist Councils* (1789) explicitly the king and his brother (Prince of the Front Palace) as Bodhisattva. Meanwhile Rattanakosin dynasty was seen as the beginning of a new era, and the king himself referred to as a savior- king."

Wong also states that, the assertion of the king as Bodhisattva not merely evoked and admiration of the monarch's subjects but could as well justify his position in terms of merit accumulation. According to Tambiah, the Buddhist conception of kingship as understood in Sukhothai and Ayutthaya times and later in 19th century can be simply puts as: "*Chakravartin* equals *Bodhisattva*"[113]

Hence in the monumental bronze statues of the Thai kings the utmost care was taken to show the compassionate nature on their face and on their body language. For example the statues of King Chulalongkorn and the present King Bhumibol reflects afore

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[110] Nandana Chutiwongs, *The Iconography of Avalokitesvara in Mainland South East Asia* (New Delhi, India: Aryan Books International, 2002), p.14

[111] Sutra Translation Committee of the United States and Canada, *The Seekers Glossary of Buddhism*, (Taiwan: The Corporate Body of the Buddha Educational Foundation, 2000), p. 44

[112] Ka F. Wong, *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006). p.165.

[113] Ibid, p. 166.

mentioned characteristics. To conclude, the monumental statues of the Thai monarchs denote the resemblance of the Devaraja, Chakravartin and the Bodhisattva nature.

4.3 Different patronage on making of bronze statues

In Thailand, art has generally been under royal patronage. According to Silpa Bhirasri[114], as far as the economy of the state is concerned, in the old days, there were no ways to dispose of financial resources on so many necessities or luxuries. A large amount of the income of the nation was invested in the erection of temples because this was the highest merit making a Buddhist could perform in his life. Thus religious structures rose one after another without interruption, which enabled Thai artists to be very active in all branches of religious art. In the last quarter of the 19th century, under the reign of King Chulalongkorn (1868-1910), western civilization was adopted, involving the construction of railways, road, hospitals, schools, water supply installations, electricity etc. the revenue of the nation was devoted to works of public welfare, the erection of Buddhist temples came to an abrupt standstill and accordingly traditional art no longer had its natural outlet of expression. Likewise sculptures and paintings of realistic semi commercial character were imported into Thailand together with many other objects which for the sake of novelty engendered in the upper class a new taste in art. The equestrian statue is the very famous example on this context. (Fig.217) On the patronage of Thai kings many westernized bronze statues were imported from Europe and the realistic art was very famous that the custom of making the bronze statues of the royal elites started to manufacture in the foundry of France and Italy and later in the foundry of Fine Arts Department. Under the direct patronage of the ruling monarch still bronze statues are made of their ancestors and consecrated on the public places in Bangkok and other provinces. The very example is the recently installed King Rama III's statue at the side of Grand Palace. (Fig 121)

[114] Bhirasri, Silpa, *Contemporary Art in Thailand* (Fine Arts Department, 1963). Bangkok, p. 4

Likewise under the direct patronage of present and past Kings of Thailand ancestor worship is on practice until present. On the particular ancestor's day the royals and people gather around the past monarch's statues and pay respect by offering flowers and wreaths. Every year 23 October is celebrated as Chulalongkorn Day. King Chulalongkorn passed away on the same day in 1910 AD. His son and successor King Vajiravudh decided to honor his father by declaring the anniversary of his death as Chulalongkorn Day, or *wan piya maharat* (the day 'wan' of the Great Beloved King). Since King Vajiravudh is regarded as the 'Victorian Siamese Princes', his act of commemorating his father by celebrating as Chulalongkorn Day was influence of the Victorian British custom. Irene Stengs argues that Chulalongkorn Day sprang from the kind of modern nationalism promoted by prince Damrong. But it was the continuation of the royal ancestor worship elaborated by King Mongkut and King Chulalongkorn which was in combination with already existing practice of paying homage to deceased kings by the general public.[115]

Similarly every year 6 April is celebrated as Chakri Day. The present King Bhumibol and Queen Sirikit pay respect to eight gilded life-size statues of the previous kings of the Chakri dynasty. The statues are enshrined in the Royal Pantheon in the Wat Phra Kaeo complex in the Grand palace. The temple has become the palace of divine ancestors of the Chakri Dynasty. The kings of Thailand worshipped their ancestors as guardian spirits of the monarchy and the kingdom. King Chulalongkorn cast images of his Father King Mongkut as *phra sayam thewathirat* and other previous kings from King Rama I to Rama III as objects of worship. The system was established by his father King Mongkut.[116] According to Apinan, although the statues were made according to the custom and feature like making of crowned Buddha, they are true portrait statues which

[115] Stengs, Irene, *Worshipping the Great Moderniser: King Chulalongkorn, Patron Saint of the Thai Middle Class,* (Nus Press, Singapore, 2009). pp.129-130

[116] Ibid, p. 131

were reproduced the feature and anatomy of each king. [117] At present Chakri Day is celebrated as traditional royal ancestor worship and modern National Day.

Irene Stengs[118] gave an example of very strange patronage on the establishment of statues of the kings performed by a religious person for example an abbot of Wat Doi Chang temple of northern Chiang Mai. Once the abbot of the temple saw vision of the king Chulalongkorn sitting on golden throne wearing golden attire and the king himself addressed him to make a statue identical to the vision which in search happens to be the moment of the King Chulalongkorn's 2nd coronation ceremony. The abbot collected sufficient amount of donation money to make the statue and the statue was made of wood and gilded with gold. The statue is a masterpiece of its kind which was placed in a wihan. The abbot was very much influences by the notion of the king and divine king and in pursuit of royal protection, embedded in nationalism, induced the abbot to have two more kingly statues made: a more than life size wooden statue of King Naresuan and a statue of King Taksin now placed to the left and right of the king Chulalongkorn's statue. Stengs argues that the nationalist sentiment that goes with the royal images becomes clear that the kings were chosen for their successful defense of Thai nation. King Chulalongkorn and other two kings represents as *phra sayam thewathirat*(the divinity protecting Thailand and its inhabitants) or representing as a protective power the nation can rely on.

In Thai history, various military governments who came in power in the 20th century gave rise to the fashioning of the famous hero figures to give some message to the nation and the people. As Ka F. Wong[119] states that filled with the qualities of vitality, antiquity, and industry, the image of mythical heroes captured the attention of Thai military leaders in the chaotic post war years. The rising new Thai rulers, who had

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[117] Apinan Poshyananda, *Modern Art in Thailand. Nineteenth and Twentieth Centuries*. (Singapore: Oxford University Press. 1992). P. 348

[118] Ibid, pp.100-104

[119] Ka F. Wong, *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006). pp. 75-99

limited historical credentials for their legitimacy, desperately needed a new icon as the old ones faded. The search inevitably laid its grounds in time-honored legends. He further states that the fabulous stories of royal warriors have long fascinated the Thai elites. It was during the tenure of Sarit Thanarat(1959-1963) and Thanom Kittikachorn(1963-1973)that mythical heroes, particularly King Naresuan enjoyed a lofty appropriation. Intensified by the public monuments that were dedicated to then, the resurrection of these ancient forefathers was not simply a gesture for nostalgia or a quest for history. More significant was the use of these figures to serve contemporary politics. In an era of foreign intimidation, domestic disputes and internal power struggles within the military, these traditional kings stood soundly as icons for the ruling circle and became symbols of the Thai nation.

Public monuments in commemoration of the national heroes were established during military regime. During Field Marshal Sarit's period, in 1958, a monument of King Naresuan was established in front of Don Chedi in Supanburi. The statue was designed and mould by Silpa Bhirasri. The Don Chedi was supposedly built by King Naresuan himself to commemorate his victory over the Burmese crown prince in the elephant combat in 1592. The inauguration of the monument held in 25 January in 1858 which is celebrated as Army Day. It seems that the Army still has that tradition at present. In the foundry of the Fine Arts Department a colossal statue of King Naresuan riding a horse showing his heroic depiction is under the making process. This statue is going to establish at the same place at the site of Don Chedi in Supanburi. (Fig218)

Another kind of patronage of making the statues is commenced by the provincial government to develop tourism in the province and for reestablishing the identity of the place. Recently Phetchburi provincial government with the permission of the Royal Household has made a project of constructing the King Mongkut Memorial Park on the empty space of the summer palace of King Mongkut. Principle reason of the project was to honor Rama IV who initiated the modernization of Siam. And another reason to choose the land was that, the King Rama IV bought 714 rai of land at Phetchburi by his

own money in 1858 and built the palace at Phra Nakhon Khiri. This is Thailand's first palace located on the hill. Currently there are 24 rai of land left which is available for the construction of the statue. The colossal sculpture to make in bronze is under construction in the foundry at Salaya. (Fig. 219)

Likewise government offices, hospitals, universities etc. place Thai King's and Queen's statues in their premises. Wherever the statues are, the space around is sanctified and people gather around to pay respect to such monumental sculptures.(Fig 220)

4.4 Social behavior on the veneration of bronze statues

Silpa Bhirasri[120] expressed that art has a moral and spiritual purpose in the life of every race. Art expressions varies from one another; some are comprehensible , others being too advanced, are difficult to understand, but the goal of every artists is to do work, which are intellectually and spiritually beneficial to mankind. The art works may be moral, a moral and even immoral. The immoral is in a sense that the artists sometimes use an immoral subject to correct us from vices and defects. Through evil the artist shows us the right path which we have to follow. In Bhirasri's version morality means to abide by the social laws which are laid down to protect different ethical groups and accordingly each group has its peculiar moral laws. But over these self protecting laws there is one morality which belongs to the whole human family; it is the laws of good conduct, of pure thoughts and pure aspiration, a law taught both by religions and art. The difference between religion and art is that the former affects our soul if we believe; the latter affects our soul if we feel.

Art expression is divided into two kinds: one treats subjects of history, ethics, religion and even politics. It is educational and for this reason has an important role in the social affairs of a nation. This art inspires social advancement; love for the nation, teaching right living and in the whole stimulates an appreciation of beauty. In stating that

[120] Bhirasri, Silpa, *Art and Moral*, Journal (National Theatre Bangkok, 1965). p. 13

this kind of art is comprehensible to the majority of the people it does not mean that such an art has a commercial character. A noble art engenders high and noble ideas and aspirations. For example, a monument to a hero may be understood by the majority of the citizens and serves to inspire them to emulate the hero honored, while monument to a poet inspires intellectual activities. The other kind of art is the one termed for art's sake. In this case the artist is free to do what he likes without the consideration of its usefulness to the human family. The artist works for himself; on the contrary, he firmly believes that his work will be very useful for the progressive development of mankind.

Max Waber[121] argues on the every specialized art that is uncommon and not widely disseminated is regarded as a magical charisma, either personal or more generally, hereditary, the acquisition and maintenance of which is guaranteed by magical means. He further gives an example of the non privileged classes who are changed by the effects of the newly emerged cult in a sense that a product of the inevitable accommodation to the needs of the masses, may be formulated generally as the emergence of a personal, divine or human divine savior as the bearer of salvation, with the additional consequence that the religious relationship to this personage becomes the precondition of salvation. One form of the adaptation of religion to the needs of the masses is the transformation of the cultic religion. The lower the social class, the more radical are the forms assumed by the need for a savior, once this need has emerged. Some phenomenon can be found from some religion which recruits followers from the lower social classes or at least were influenced by them. The transfer of salvation doctrines to the masses practically always results in the emergence of a savior, or at least in an increase of emphasis upon the concept of savior. Weber gives some examples of the emergence of Buddha and the Vaishnava cult and the basic notion of the Bhakti piety relates to them. Similar phenomena can be found in Thailand, the newly emerging Chulalongkorn cult and the Chao Mae Kuan Yin cult. The former is based entirely upon the supernatural and

[121] Waber, Max, *The Sociology of Religion* (Beacon Press, Boston, 1991). pp. 97-117

animistic belief of the lay Thai and the later is related to the incarnation concept of the Chinese Buddhist practice.

Recent phenomenon is spirit of the King Chulalongkorn visiting a spirit medium. This is really astounding that what is his soul doing in a mediums body? This is the popular belief in any part of the world. This kind of spirit medium can be found from all over Asian countries including India, China and Nepal. The mediums proclaim that the gods and the famous people's spirit enter their body and address and solve problems of the people. A lady name as Mae Wan, a spirit medium in Saraphi, a district bordering Chiang Mai city from northern Thailand used to possess spirit of King Chulalongkorn. She has been a medium for King Chulalongkorn since 1992 but her carrier started as a medium since she was seventeen and now she is on her fifties sixties.[122] Later two more spirits of King Chulalongkorn's wives, Chao Dara Ratchami and Mae Bua Khiaw appeared on the spirit medium. Chao Dara Ratchami was the king's only wife from Chiang Mai and she was the daughter of Phra Chao Inthanon, the city's vassal ruler. Mae Bua Khiaw was the king's wife from Wiang Kalong in Chiang Rai, another Northern Thai city.[123] At the Tamnak (residence) of Mae Wan Chulalongkorn's statue with other famous monks were consecrated.

King Chulalongkorn's spirit usually arrived every two weeks on a Sunday when Irene Stengs was conducting his research. While receiving his spirit she used to dress like an official, with white jacket, blue trousers, and white stockings and western style brown hat. And during Thai New Year Songkran, she used to wear Northern Thai Lan Na style indigo blue farmer's shirt and trousers with *pha khao ma*, a checked loincloth. [124] The outfits were chosen according to the famous portraiture of the King Chulalongkorn. On the day of the spirit's arrival the Tamnak is prepared with offerings of pink and red flowers, right choice of wine and cognac, cigars and right choice of fruits which was

[122] Stengs, Irene, *Worshipping the Great Moderniser: King Chulalongkorn, Patron Saint of the Thai Middle Class* (Nus Press, Singapore, 2009).p. 148.

[123] Ibid, p.151.

[124] Ibid p. 159

prepared by five middleclass women. The king presiding in the body of the spirit medium gives royal marks on the forehead of the audience and addresses the people generally. The image of the king during these sessions was fatherly and his speech and behavior evoked the image of the wise and compassionate ruler who genuinely cared for each of his subjects. He used to address to the children as a grandfather, to be humble, should practice patience and endurance. Since the scenario occurred during the economic crisis of 1997, the King addressed his subjects to economize their expenses. Another feature of the king as stated by Stengs is the King's constant reminding of the modernization process he had done in his time just like, introduction of electricity, railways and roads etc. He also used to point out that because of his visit as a spirit the area around the Tamnak had developed with better roads, connection of the area to the waterworks, and the presence of the telephone in the Tamnak. Interestingly the King was easy to reach by telephone that he periodically received phone calls from his followers. He used to show his auspicious power during sessions that whenever he mentions any number in any form the people take note of that number to bye lottery ticket. People eagerly gather to take the note of the number. Likewise the followers mostly women at these sessions are very important for the spirit medium Mae Wan. Because of them she seems to be able to possess the Kings' spirit or the spirit chose those who support his presence.

This speculation can be relevant with the view of Waber that the spirits or soul may dwell more or less continuously and exclusively near or within a concrete object or process. They may somehow possess events, things or categories thereof, the behavior and efficacy of which they will decisively determine. These and similar view are specific notion of animism. Other notion of supernatural powers may intervene in the destiny of the people in the same way that a person may influence one's course of life. A supernatural power may be the power which emanates from a great hero after his death. Either personification or de- personification may be a later development. In Thailand there are different groups of people who believe in the worshipping the kings and heroes but majority of the people seems to pay respect to such figures.

In the famous thought of anthropology the, "Primitive Religion", which was propounded by E.B Tylor, defines religion in such a way that all forms of it could be included, namely as 'the belief in spiritual beings'. He firmly states that religion was a cultural universal, for no known cultures were without such belief. He sought an explanation of how the belief in spirits could have arisen. According to his theory early men must have noted that difference between a living body and a dead one.[125]After death the soul leave the body permanently, but it sometimes appeared in dreams, acting as if it were alive. Thus people had belief that soul continued to exist after death of man. This belief was easily extended to include all other living beings and even non- living objects, because plants and animals as well as weapons, boats and clothes, sometimes appeared in dreams. Early man thus began to believe that everything possessed life and soul and this early phase of religion was called by Tylor as 'animism'. He also pointed out that the soul was superior to body, because of its greater mobility and durability of existence. It was also believed that they protected their own families and tribes, and watched over their moral behavior. Attempts to communicate with these souls led to prayer and active worship. The idea that souls and spirits must reside somewhere gave rise to belief in an afterlife, while their freedom to move about and to appear everywhere led to the idea that they could enter into the bodies of living and thus, the notion of spirit – possession was created.[126]

While the research was under way, an encounter with Mr.Wuttichot (nick name as Oan), who was the coordinator of the Rama IV statue being manufactured in the foundry of the Fine Arts Department in Salaya was very interesting in defining how much people still believe in dreams and supernatural power of a soul. He said that some supernatural force was guiding him to conduct the task he was not expecting he have to do before it came to his hand. When he was very young he said that he dreamt King Mongkut's photograph (Fig. 221) in his dream, which was taken on his 60th birthday. At

[125] Jha, Makhan, *An Anthropological Thought* (Vikas Publishing House PVT LTD, New Delhi,1983), p. 32.
[126] Ibid, p. 32.

that time he didn't realized the significance of the photograph. When he knew that it was the King Mongkut's historically important photo, he searched for the photograph for a long time. The photograph was very rare and it was accidentally found from a foreign auction company. He is very proud that same photo was selected for the bronze statue. Mr. Oan thinks that some spiritual force of the King Rama IV was guiding him do perform this task. The photograph is very meaningful that the crown the King Rama IV is wearing bears a diamond on the top which represent mount Sumeru. That crown was made at the time of King Mongkut. The statue is based on this real image which reflects a status of the king through his traditional dress and five royal regalia.[127] This is one of his diplomatic protocols which helps Thailand survive amid the colonialism. The detail of sculpture, such as the design of the Kingly dress, furniture and accessory i.e., chair and crown will symbolize the majestic status of Thai King. All the accessories as seen in the picture are now kept confidentially in Grand Palace. Those who are interested in this field will be able to visit this monument in order to study some historical details.

Another interesting and most common phenomenon of normal Thais is what they believe of their past kings. As the kings of Chakri Dynasty are regarded as the great modernizer, nation builder and reformers, the people venerate and pay respect to their portraits and statue wherever they are consecrated. Among the most famous is the Chulalongkorn cult which is deep rooted in normal Thais that whenever they are in distress or they wish for something they ask secretly with the past King believing that he will fulfill their wishes and overcome them from distress. Mr. Oan interestingly said that once he desperately wished for a car and he wished before the statue of the King Chulalongkorn. To his surprise his father bought him a car and he was very thankful to the King Chulalongkorn. People like Mr. Oan often goes to such monumental sites to venerate King Chulalongkorn to ask for success and to give thank after achieving their goal. They usually offer candles, pink flowers and burn scented sticks. Some people offer

[127] http://www.thailandtraveltours.com/thailand-thai-kings-royal-regalia-thaikingsroyalregalia.htm, Accessed on July 2010

best wine that was King Chulalongkorn's favorite. These testify that people still believe in ancestor worship and spirit worship at present.

Ka Fai Wong's[128] vision on monuments is the power of the monument lies on their ability to remind. From a building to a sculpture to a written record, a monument refers to something that is set up to commemorate a person or an event in the customary sense. It is the memory or the story behind a monument that keeps the static object alive. Wong states that the statue of king Mongkut helped to contest the time- honored ' superstition' that image making of a living person, including photograph, portrait, and sculpture, was harmful to that individual. The royal support of the realistic art signified a new beginning of Thai politics. After the living power elite became more willing to use and even actively utilize their image for personal and political purposes. On the other hand, the superstitious belief that portraiture or photo taking would capture the soul of the person has positively impacted the status of the monumental art. The general masses are convinced that the spirit of the revered personality, or at least some fragments of his or her essence, inhabit the picture of sculpture. Likewise the art work becomes a spiritual representation of that person. At present the setting of a photograph or statue of a particular king or queen is at the center of worship and paying homage to such is customary in Thailand. Upon the establishment of the equestrian statue of King Chulalongkorn, Wong argues that under the heroic shadow of the equestrian monument , the stories of Rama V are passed on to the next generation, and the glory of modernized monarch somehow lives on in a mythical way.(Fig 217)

Maurizio Peleggi[129] states that visual representation of Rama V's effigy had circulated on coins and stamps since early in his reign. At the beginning of the 1900 illustrated post cards had further expanded the range of the visual representation. When

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[128] Wong, Ka F. *Vision of a Nation, Public Monuments in Twentieth Century Thailand* (White Lotus, Bangkok, 2006). p. 1

[129] Peleggi, Maurizio, *Lords of Things: The Fashioning of the Siamese Monarchy's Modern Image*, (University of Hawaii Press, USA, 2002). pp. 104-105

larger than the life equestrian statue of King Chulalongkorn was unveiled on the 11th November 1908 to celebrate his 40th anniversary of his reign, the amusement among the people must have been considerable. In the Siamese tradition it was not customary to a king to ride a horse. He was usually seen riding on an elephant or carried on a palanquin. But statue with riding horse was entirely European. It was not only the fascination of the king or iconographic newness was not only reason that made the equestrian statue of Rama V. the most important was the statue was officially paid for by his subjects and the foreign residents in Siam as a token of gratitude.

According to Irene Stengs[130], the promotion of the royal images reached its zenith with the unveiling of the equestrian statue of King Chulalongkorn in 1908, an event accompanied by the production equestrian statue stamps and equestrian statue medallions. He further states that the cult of Chulalongkorn and worship of the King draws upon Thai concept of Buddhist kingship and popular belief in the power of sacred images. The cult is shaped and carried by mass media promotion of the image of the King, commercial as well as governmental. Stengs gave many examples of the comprehension of the Royal cult; the cult which reached its height after 1980s. Apart from the statues of the King Chulalongkorn, visual representations of the king still can be seen on people's necklace pendants, pictures in the restaurants, shops as well as in the common people's houses. People believe that the spirit of the king bring good luck and prosperity in their life.

4.5 Sites of statues and monuments

In Thai society public monuments with bronze statues are very popular. Public monuments evoke the sense of place which has very influential aesthetic beauty and takes ones thought to the past history of the country. The place particular has its own identity and aura that no other ordinary place can get. Human beings have privileged access to

[130] Stengs, Irene, *Worshipping the Great Moderniser: King Chulalongkorn, Patron Saint of the Thai Middle Class,*(Nus Press, Singapore, 2009),pp13-91

states of mind, thought and feelings. Humans have insider's view of human facts.[131] Culture is uniquely developed in human beings. It strongly influences human behaviors and values. Tuan differentiated space and place as 'space' is more abstract than 'place'. He further states that,

> " ……. The ideas "space" and "place" require each other for definition. From the security and stability of place we are aware of the openness, freedom, and threat of space, and vice versa. Furthermore, if we think of space as that which allows movement, then place is pause; each pause in movement makes it possible for location to be transformed into place."

The places created for the visibility purpose catches our attention. If we look at a panoramic scene our eyes pause at points of interest. Each pause is time enough to create an image of place and looms large momentarily in our view. It is not possible to look at a scene in general; our eyes keep searching for points of rest. The landmark on the horizon may be prominent that it compels attention.[132] Likewise sculptural art have the power to create a sense of place by their own physical presence. A single inanimate object placed on an important place can draw attention of the world. The human being can command a world because he has feelings and intentions. The art objects mean to do so because its form symbolic to human feeling. Art is created with inner aesthetics of human being. A piece of sculpture appears to incarnate personhood and be the center of its own world. Although a statue is an object in our perceptual field, it seems to create its own world. Objects that are held in awe by one group can easily be overlooked by another. Different culture affects perception on things. [133] A particular landscape which is natural or manmade, persist as places through the certain span of time, outliving the patronage of particular culture. Any large objects in the landscape creates its own world, which may

[131] Yi-Fu Tuan, *Space and Place: The Perspective of Experience* (University of Minnesota Press, Minneapolis, 2003). pp. 5-6.

[132] Ibid, p 161

[133] Ibid, p. 162

expand or contract with the passing concerns of the people, but which does not completely lose its identity.

Heritage Monuments can transcend the value of a particular history and culture. Here any monuments made of bronze which testify its past history is regarded as heritage which is the asset and identity of the people and nation. The equestrian statue is the heritage of the Thai people's legacy and history of the King which testifies the great monarch's modernization, social reforms and royal power. The place around the statue becomes the place of the people in every Tuesday. The sense of place on the particular Tuesday and Chulalongkorn day is very different than other days. On those particular days people gather around and offer garlands, drinks, flowers and wreaths by the official and private organizations. The place transcends the aura of its sacredness and purity in people's heart.

Likewise this is the sense of place or the heritage which was manufactured to draw attention of foreign and domestic tourism. The viewing of heritage sights by domestic tourists is a key aspect in the formation and maintenance of a national identity, when nationalism is understood as an imagined community. Tourist sites may function as places presenting the defining characteristics of nationhood and displaying historical evidence of its existence. Heritage sites, representing a nation's past are an important element in the construction of a national identity. A shared identity is a goal of countries comprised of many immigrant cultures. Both public and private monumental sights may be official governmental- sponsored construction with such clear aims, but may also be privately- established enterprises that play on tourists' own national feelings. With the recreational purpose or with the national feeling among the people such heritage sites created by the government or private, ends up with the potential of tourism development of the particular site. These kind of heritage sites with the monuments of the past Kings and hero personnel helps to imprint the spiritual as well as the glory of its history in the people's mind.

4.6 Sculptor's comprehension on the bronze monumental sculptures

One of the greatest wonders of nature is that every living creature, be it us, Homo sapiens, animals or birds pride in our individual work and effort. For example, an alpha male lion is proud of his territory and his pride and will guard it even if his life is threatened, a bird will be proud of its efforts to build a nest hidden away from its enemies so that its eggs and chicks will be safe. Similarly for us humans, we also pride in our individual work and effort to complete a task or a job that we love.

In this context, *"Art is the product or process of deliberately arranging symbolic elements in a way that influences and affects the senses, emotions, and/or intellect."* [134] As an artist, one of the main motives for making art is so that people are able to understand, appreciate, value and cherish the message or his/her skills portrayed in the art. If the artist is successful in achieving this aim it will be with a sense of pride that he/she can thereon feel or say that he/she made that art and people appreciate/like it.

The sculptors in the foundry of the Department of Fine Arts create and make sculptures so that people appreciate the work they have undertaken to create a particular statue. Even though this work is a source of their livelihood, it is also their passion. There are those who have recently joined the foundry of the Fine Arts Department and also those who have been working within the department over a number of years. Most of the sculptures received their training when they were in schools, colleges and universities. However there are those have also received training from their family members, who are also artists in their own way, and also from experience and teachings within the foundry from senior sculptors themselves.

The survey suggests that all of the workers, artists and sculptors in the foundry are genuinely happy when they create sculptures and also with a feeling of personal value. This way they are able to make sculptures to perfection. They put in extra efforts especially when they make statues of past Kings mainly due to the reason that they

[134] Wikipedia - http://en.wikipedia.org/wiki/Art

worship these statues, as the majority of other Thai nationals who also worship the statues of past Kings; for example the statue of King Rama IV which was completed recently and put in front of the palace of King Rama IV and open to the general public.

The survey also shows that there are certain issues within the foundry that needs to be addressed. For example, some of the sculptors are somewhat unhappy with the Govt. system, and also that they are temporary staff and could be laid off at any time. The uncertainty of not having a permanent job and the possibility of not receiving pension once they retire is also a main reason for their concern with the current govt. system. There are issues of low resources and technology which slows their work and could have made the process a bit simpler and faster. Therefore, although investment in technology and resources would increase the cost initially, it will surely improve the time taken to complete a project and also decrease the cost in due course of time.

However one of the main issues is that there are a lot of time constraints. The sculptors are not able to complete a particular project in time and sometimes are required to overlap the work of making two – three different statues at a time. This certainly puts unnecessary pressure onto the workers and can also hinder quality. The management should clearly pay heed to this issue and to minimize such risks, there has to be proper supervision from the senior sculptors, investment in technology could also speed up the processes involved and new employees could also be hired to handle the extra work involved.

Similarly, there are also concerns of the atmosphere and environment that these sculptors and artists are required to work. As the foundry is in a big warehouse-type hall, some of the employees feel that sometimes there is not enough space to do their work and also if there were several parts and sections, there would be some privacy to their work and perhaps they would be able to focus more on the task at hand.

Another important part more seriously to be taken as concern is the health and safety of the employees. During the observation very little concern was showed for the

safety and health of the members of the foundry. They were neither seen wearing mask during the finishing process of the bronze or wearing boots while pouring molten bronze into the mould. The temporary scaffolds used while molding colossal clay statues seems very dangerous. So the authorities have to take keen interest in the safety of the workers. Likewise almost all the employee's complaint was the problem of birds in the foundry. Large families of birds are living inside the foundry and usually roam around freely under the ceilings. Droppings of the birds are everywhere in the foundry which may cause real health hazard to the employees.

One other important observation from the survey is that majority of the sculptors want to preserve the skills they possess. The average age of employees in the foundry is 39 – 40 and it is a good belief that they want to teach their children the art of making sculptures and of bronze casting. Some also suggests the possibility to open a sculpture school for financially less able children so that the next generation wouldn't lose the concept, value and skills required of making statues and also the traditional method of bronze casting.

However, some also suggests that in this dynamic world where technology plays a pivotal role in every aspect of our daily life and also where children these days mostly dwell in such technology driven activities, the prospect of them having interests in art of making statues and bronze castings perhaps may not appeal much. This definitely is cause of concern and the employees of the Fine Arts department and the Government of Thailand should take heed and act responsibly so as to preserve the art, knowledge and skills required to make bronze statues in Thailand.

4.7 Recommendations

Outdoor bronze sculpture and ornamentation represent a significant part of our artistic and cultural heritage: bronze monuments number in hundreds in this country alone. Increasing pollution in environment, especially acid rain, and salty climate has been linked to disfiguring corrosion of bronzes globally, posing a serious threat to their

aesthetic aspect and ultimate existence. In order to minimize the effects of outdoor atmospheric pollution on objects, it is necessary to use protective coatings.[135] However, coatings in current use are often inadequate in their protective function.

Coating technologies currently used have been borrowed from traditional and industrial applications without accompanying research into adapting and optimizing materials and methods for conservation applications. These applications are generally distinguished from industrial applications by aesthetic considerations, and perhaps more importantly by physical and chemical differences. While industrial coatings are designed for fresh or prepared metal surfaces, or stripped/blasted bare metal, surfaces of artworks and historical objects generally cannot be prepared in this fashion without unacceptable damage. Thus conservation applications typically require coatings to be applied onto, corroded, and contaminated surfaces, which must retain their detail. Aesthetic criteria remain controversial, so that approaches to the appearance of outdoor bronzes after cleaning and coating continue to vary widely around the world.

Traditional coatings that continue to be popular for use on outdoor bronzes include: drying oils, such as lemon oil, paraffin oil, linseed oil and castor oil; and beeswax mixtures; and commercial paste waxes. These types of coating treatments greatly darken existing patinas and require frequent maintenance. Cellulose nitrate, which has poor outdoor durability, and Incralac, an acrylic lacquer coating, are the most widely used modern coating materials on outdoor bronzes. Problems associated with Incralac in normal application include insufficient thickness and physical defects such as orange peel, both of which appear to compromise the coating's effectiveness.

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[135] Andrew Lins and Tracy Power, "The Corrosion of Bronze Monuments in Polluted Urban Sites: A Report on the Stability of Copper Mineral Species at Different pH Levels," Ancient and Historic Metals, ed. D. A. Scott et al. (Getty Conservation Institute, 1994), pp. 119-151; T.E. Graedel, "The Corrosivity of the Atmosphere: Past, Present, and Future," Dialogue/89 – The Conservation of Bronze Sculpture in the Outdoor Environment, ed. T. D. Weisser (NACE, 1992), pp. 13-32; Arthur Beale, "Conservation of Outdoor Sculpture: An Overview," mid., pp. 3-12; Luc Robbiola and Christian Fiaud, "New Model of Outdoor Bronze Corrosion and Its Implications for Conservation," Preprints, ICOM-CC 110th Triennial Meeting, Vol. II, Washington, D.C., 1993, pp. 796-802. Website: http://www.ncptt.nps.gov/ accessed on September 2010

Since outdoor bronze sculpture may spend decades or centuries outdoors, exposed to pollution and extreme weather conditions, the concerned authorities have to develop a coating system to resist corrosion on outdoor bronze sculpture. The modern electrochemical testing methods can be used for corrosion protective coatings and improve protective coatings. A goal has to be made to develop a more effective treatment to prevent as much as possible the corrosion process on bronze sculpture and ornamentation. Bronze, an alloy of mostly copper and tin, is often used in outdoor sculpture. These sculptures must survive in an environment of pollutants, acid rain and varying temperatures. New coating system can be developed to protect sculptures from sometimes hostile environment. Recently discovered fluorocarbon- acrylic blend had the potential to be an excellent coating agent and another is benzotriazole (BTA) when used as coating found to produce significant protection when used along with a topcoat on bronze objects.

In the foundry of Salaya the researcher encountered a couple of bronze sculptures brought from outside for the repair or conservation. (Fig. 222,223) The sculptures were in very bad condition of corrosion and because of that some pieces were deteriorated and started to chipping off from its place. Therefore such bronze sculptures must be consolidated with chemical conservation according to above mentioned recommendations and while doing so the conservation process can be conducted in situ or taken away to the foundry according to the convenience of the conservators.

Figure 217 The equestrian statue of the King Chulalongkorn and stamp with the same picture.

Figure 218 Clay Statue of The King Naresuan and the sculptor Paradron Cherdchoo.

Figure 219 Statue of King Mongkut to be establish in the King Mongkut Memorial Park in Phetchburi

Figure220 Statue of King Chulalongkorn and King Vajiravyudh in the premises of Chulalongkorn University, Bangkok.

Figure 221 The photograph of King Mongkut dreampt by Mr Oan. Photographed by Francis Chit. Photograph provided by Mr. Oan.

Figure 222 Bronze sculpture brought from its original place for chemical conservation.

Figure 223 Bronze sculpture brought for chemical conservation.

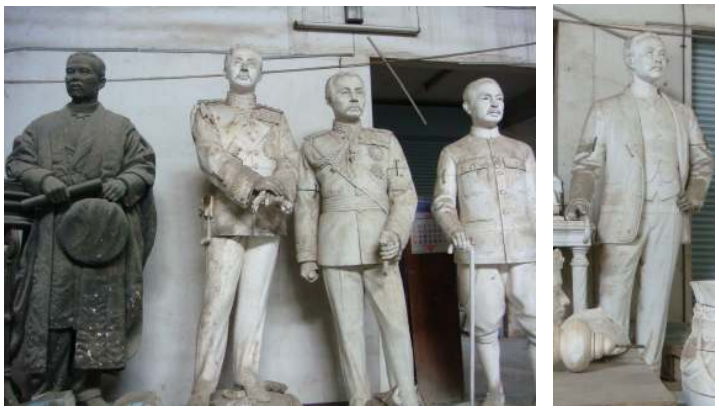

Figure 224 a Plaster Models at the foundry of Salaya.

Figure 224b Plaster Models at the foundry of Salaya.

CHAPTER V

CONCLUSION

Every day the passerby, travelers on the streets and those who ride their vehicles around and near the monumental spaces, spontaneously look at the monuments with many recalls on their mind, some with curiosity and some with realizing its past history and reason behind standing there for generations, and bow their head and join hands in a gesture of *wai*. The gallant sculptures made of bronze erected on different pose and gestures make the people to see them with wonder and awe or mesmerize them with respect and gratefulness towards them. Because monuments are memories of past that has been artistically reconstructed and often invented for the sake of the present and the future. Even though the monuments were created on a narrow circle of elites, politicians, and the artists involved, later it represent the nation, property of the people which sanctify the monuments as cult object.

Bronze culture is very much in practice from the pre historic periods to the present. The malleable as well as long lasting strong material like bronze is used and manipulated from the prehistoric period in different form of art works to the decorative and utility objects. Archaeological excavations had revealed many evidences of bronze culture between the historical gaps of Ban Chiang cultures to the early known culture of Thailand. Diffusion of bronze culture results to wide variety of bronze objects to be obtained from the sites of South East Asia and from mainland Asia. It is evident that the technology too was diffused to this area from one place to another. From the beginning of the first century AD new flow of trade and migrations were taking place in this part of Southeast Asia. To what extent the technique was incorporated in Thai traditional casting technique can be seen from the similarity of using the casting materials like cow dung and clay of ant hills.

Until the period of Ayutthaya the techniques of casting was very much in developed stage and the sculptors were the technical masters. The method of bronze casting until this period obtained was the traditional lost wax or casting method which was prevalent from the centuries before. The modern sculptors considers the bronze sculptures of these period have the aesthetic and artistic value which can be seen by depth and texture on them.

On the process of modernization of Thailand bronze statues were the tangible object to express its intangible aspects hidden behind. Under the direct initiative and patronage of the Chakri monarchs like King Mongkut, King Chulalongkorn and King Vajiravudh the bronze sculptures and the sculptors of the same were having very important position in the elite circle and of course among the people in general. Before the introduction of modern casting method, until at the period of King Mongkut bronze casting was done in traditional way. With the modernization of Thailand, the elites started to import modern European arts and artists to Thailand which started to introduce new concept in art and technology. The reason to choose European artists was the exposure to the western world at the period when they were having profound change in habit and thought.

Particularly modern art and new technology of bronze casting was introduced by the Italian sculptor Corrado Feroci or known as Silpa Bhirasri with his Thai name and well for his title as “The father of Modern Art” in Thailand. With his entry in the Fine Arts Department in 1924 to his death in1962, he worked for the department and Silpakorn University during different military government in the constitutional era. Silpa Bhirasri and his team of artists gained their reputation in all kind of government and mastered numerous monumental sculptures. Main focus of his art journey in Thailand was unique national art style, the trend of contemporary art, and the understanding of international art. Silpa Bhirasri’s realistic art style was able to draw attention of all the regimes and was very famous in its own way that the Fine Arts department still holds that

legacy at present. He inspired his students to look for new ways of both classical arts and European art.

The foundry of the Fine Arts Department still follow the footsteps Silpa Bhirasri had laid and specialize in the contemporary bronze casting technique which was taught by him. The foundry of The Fine Arts Department in Salaya specializes mainly on contemporary bronze casting technique. The sculptures made in this foundry are monumental and religious. Monumental sculptures are made of the big Thai monarchs and hero personnel as well as elite persons. Item of art mainly sculptures was made for religious purposes or for the royal and national purposes which required highly innovative process requiring great skill, experience and patience.

The traditional bronze casting technology is more or less similar to the ancient technology, only the casting materials varies according to the geographic region, traditional bronze casting technology is a slow and time consuming process. The foundry rarely uses the traditional method to cast bronze. The new generation of casters are very less concerned for the use of traditional casting method which I realized when the traditional casting case study was undergoing that some of the new generations stood away from cow dung and felt disgusted with smell. I suppose they will never dare to touch such things in future too. The essences and importance of these materials only matters to the older generations. They talk very highly of the traditional material and show their passion on the process which they have very little chance to perform these days.

There is similarity between the moldings processes of replacing wax from other places of South East Asia. The local indigenous knowledge for selecting natural material in locality by applying animal dung, soil, termite hill, and paddy husk in mould producing process in the north eastern region still conserves the ancient producing process. Similar process is found from south India and Nepal at present. This testifies the

technique spread from one place to other. Since these kinds of materials had replaced with modern materials which is easily available in market, attraction towards the traditional materials is very less. Although some of the process like the process of making model and technique certainly differs from one place to another which is demonstrated by the modeling method of Nepal. The difference itself is a unique character in its own ways.

The finding of the study differentiated some of the issues like raw materials, time factor, quality, technique and cost comparing with contemporary and traditional bronze casting method. The materials are easy available now a day which makes easy to perform contemporary casting than the traditional. The wonderful material like the Gypsum plaster is used entirely through the whole process of mould making. The Gypsum plaster is very useful because of its fast drying capability and strong enough to hold the mould. Another wonderful material is the silicone rubber which makes easy to take out detail of the sculpture and enable to make several pieces of sculpture where as the traditional casting method cannot produce several pieces from the same mould. Although the contemporary process is bit complicated than the traditional process each step of mould making takes short time to dry and proceed to another process where as in traditional process the mould takes many days to dry and the coat of the mould have to be applied several times for several days which have to perform with patience. The traditional process materials are very cheap compared to the contemporary; although because of the availability of the materials contemporary process is very famous in the foundry of the Fine Arts Department.

Bronze sculptures placed on the public spaces and the rituals attached to them reflect the Thai society. Whatever may be the intentions of the builders, the monuments made of bronze transcend its aesthetic value to the people. The makers who make the sculptures can be considered as the pioneers because of them it is still possible to transcend that value to the public and sustain the tradition of art field which was

established during the patronage of the modern Kings like King Mongkut, King Chulalongkorn, King Vajiravudh, present King Bhumibol and the art pioneers like Prince Naris and Corrado Feroci to the present artists like Boonsong Nootnomboon, Somkuan oumtrakul, Nikorn Koehapong, Paradron Cherdchoo Pongpan Chantanamattha etc. are handling the tradition in a very decent manner. Present artists and sculptors are trying to introduce new techniques in their art to give more realistic feature on the sculptures. The sculptures they are making compete with the sculptures which were made at the time of Feroci. Each sculpture they produce is the masterpieces of the present generation.

Initially I found out there is very different views between younger and older generation of artists. Similarity is both generations of artists never consider themselves as a perfect artist. They are always in the process of learning and experimental and always want to make a perfect piece of art as far as possible. Difference is the idea behind the veneration and belief upon the king's statues. Most of them respect the Kings and the heroic figures but very few believe in worship of such figures to fulfill their wishes. Yet they feel very proud to be able to make such sculptures.

The workers, artists and sculptors in the foundry are genuinely happy, proud and satisfied when they create sculptures and they wish if they had done better. They usually perform their duty with a feeling of personal value which enables them to make sculptures to perfection. They put in extra efforts and concentration (s*amadhi*) especially when they make statues of past Kings mainly due to the reason that they worship these statues, as the majority of other Thai nationals who also worship the statues of past Kings. However some of the issues rose in the foundry like the job security, safety, privacy, space, and training opportunities for the artists and the workers must be heard by the government agencies. All these issues heard can sustain the profession and the skill for the future generation. The sculptors, artists and designers of the monuments might get justice if the sculptures and the monuments are conserved and preserved periodically to last long for the generation to come to show and preserve its heritage value.

At the past traditional workmanship used to depend on the family tradition, which with the lack of interest of the younger generation many skill and technology cease to exist and put in danger the traditional profession. The establishment of the universities in arts and fine arts can regenerate new individual professionals with new innovative ideas. An artist does not take an art profession without his passion on art which is the real motivation to take out a work of art from a person.

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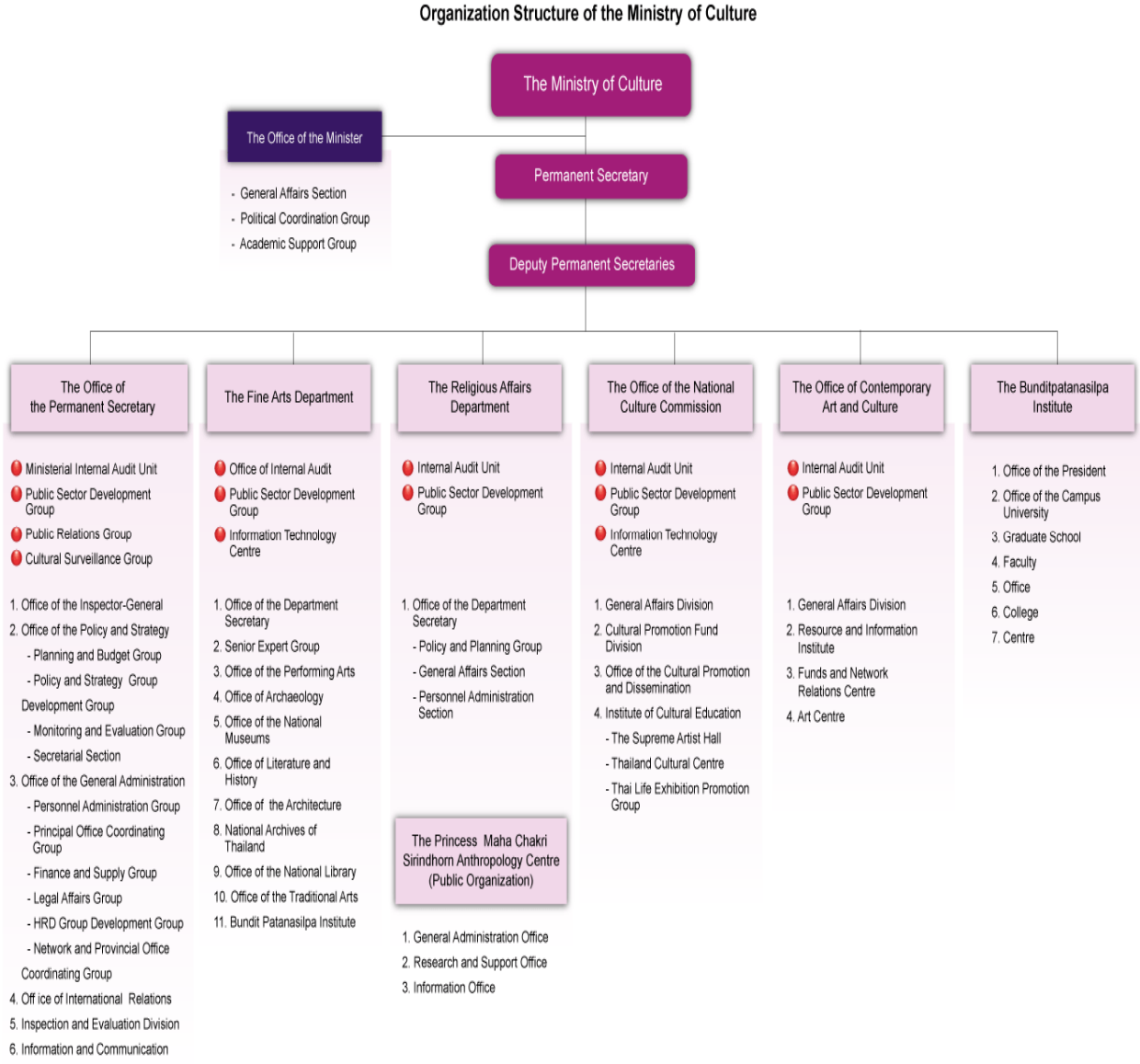
APPENDIX

APPENDIX 1


Organization Structure of the Ministry of Culture
The Ministry of Culture
The Office of the Minister
- General Affairs Section
- Political Coordination Group
- Academic Support Group
Permanent Secretary
Deputy Permanent Secretaries
The Office of the Permanent Secretary
Ministerial Internal Audit Unit
Public Sector Development Group
Public Relations Group
Cultural Surveillance Group
1. Office of the Inspector-General
2. Office of the Policy and Strategy
- Planning and Budget Group
- Policy and Strategy Group Development Group
- Monitoring and Evaluation Group
- Secretarial Section
3. Office of the General Administration
- Personnel Administration Group
- Principal Office Coordinating Group
- Finance and Supply Group
- Legal Affairs Group
- HRD Group Development Group
- Network and Provincial Office Coordinating Group
4. Off ice of International Relations
5. Inspection and Evaluation Division
6. Information and Communication
The Fine Arts Department
Office of Internal Audit
Public Sector Development Group
Information Technology Centre
1. Office of the Department Secretary
2. Senior Expert Group
3. Office of the Performing Arts
4. Office of Archaeology
5. Office of the National Museums
6. Office of Literature and History
7. Office of the Architecture
8. National Archives of Thailand
9. Office of the National Library
10. Office of the Traditional Arts
11. Bundit Patanasilpa Institute
The Religious Affairs Department
Internal Audit Unit
Public Sector Development Group
1. Office of the Department Secretary
- Policy and Planning Group
- General Affairs Section
- Personnel Administration Section
The Princess Maha Chakri Sirindhorn Anthropology Centre (Public Organization)
1. General Administration Office
2. Research and Support Office
3. Information Office
The Office of the National Culture Commission
Internal Audit Unit
Public Sector Development Group
Information Technology Centre
1. General Affairs Division
2. Cultural Promotion Fund Division
3. Office of the Cultural Promotion and Dissemination
4. Institute of Cultural Education
- The Supreme Artist Hall
- Thailand Cultural Centre
- Thai Life Exhibition Promotion Group
The Office of Contemporary Art and Culture
Internal Audit Unit
Public Sector Development Group
1. General Affairs Division
2. Resource and Information Institute
3. Funds and Network Relations Centre
4. Art Centre
The Bunditpatanasilpa Institute
1. Office of the President
2. Office of the Campus University
3. Graduate School
4. Faculty
5. Office
6. College
7. Centre

APPENDIX 2

Mission and function of Fine Arts Department

The Fine Arts Department has since its establishment altered, improved and expanded its structure to serve the following mission and functions :

1. Proceed according to the Act on Monuments, Artifacts, Art objects and National Museums, together with other related legislation and laws

2. Preserve, conserve, revive, promote, create and disseminate the knowledge, wisdom and Culture of the nation in the areas of :

2.1 Museums, archaeology and monuments

2.2 Literature, history, custom and tradition, national libraries and national archives

2.3 Performing arts, architectural and fine arts

3. Provide education in the areas of dance, music, composition and craftsmanship, both in and out of school

3.1 Provide education up to a Bachelor degree course in the areas of visual and performing arts, both in the Thai and western classical schools, together with contemporary art and cultural education

4. Study and research to preserve cultural heritage via museums, archaeology and monuments, language, literature, history, custom, tradition national libraries, national archives, performing arts, architectural and fine arts

5. Act in other areas mandated by laws to be under the department's jurisdiction or as ordered by the Ministry or the Cabinet.

Matters of urgency

1. Support systematic and practical studies and researches on local wisdom and culture

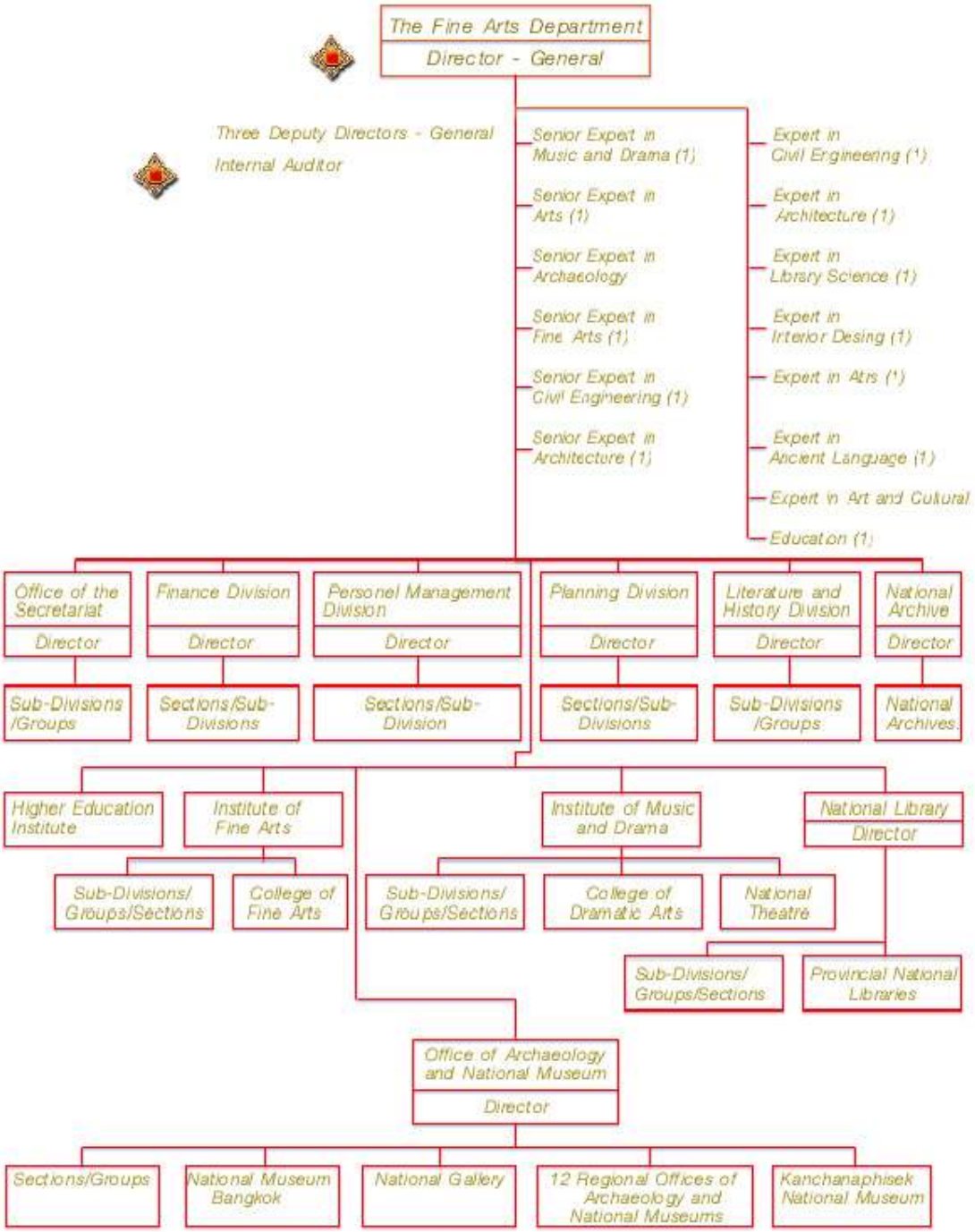
2. Support the development of personnel in cultural management, conservation and creativity

3. Prevent further illicit export / import of antiquities

4. Promote creative efforts in local architectural identities

5. Organize special activities on auspicious events for the royal celebrations

APPENDIX 3


The Fine Arts Department
Director - General
Three Deputy Directors - General
Internal Auditor
Senior Expert in Music and Drama (1)
Senior Expert in Arts (1)
Senior Expert in Archaeology
Senior Expert in Fine Arts (1)
Senior Expert in Civil Engineering (1)
Senior Expert in Architecture (1)
Expert in Civil Engineering (1)
Expert in Architecture (1)
Expert in Library Science (1)
Expert in Interior Desing (1)
Expert in Arts (1)
Expert in Ancient Language (1)
Expert in Art and Cultural Education (1)
Office of the Secretariat
Director
Finance Division
Director
Personel Management Division
Director
Planning Division
Director
Literature and History Division
Director
National Archive
Director
Sub-Divisions /Groups
Sections/Sub-Divisions
Sections/Sub-Division
Sections/Sub-Divisions
Sub-Divisions /Groups
National Archives
Higher Education Institute
Institute of Fine Arts
Institute of Music and Drama
National Library
Director
Sub-Divisions/ Groups/Sections
College of Fine Arts
Sub-Divisions/ Groups/Sections
College of Dramatic Arts
National Theatre
Sub-Divisions/ Groups/Sections
Provincial National Libraries
Office of Archaeology and National Museum
Director
Sections/Groups
National Museum Bangkok
National Gallery
12 Regional Offices of Archaeology and National Museums
Kanchanaphisek National Museum

APPENDIX 4

Visual Art

The Institute of Fine Arts is responsible for a wide range of areas in Visual Arts ranging from arts education, studies, preservation, design and supervision of the construction of government agencies and Buddhist temples in the traditional style. Moreover, the erection of national monuments and the reproduction of Buddha images come under the supervision of the Institute. In education, the scope of work covers the administration of the College of Fine Arts.

The Institute of Fine Arts has one of the duties of strengthen traditional craftsmanship known as "Chang sip mu" and to ensure its continuity. These crafts which comprise drawing, engraving, beating (hammering of gold into thin sheets), and turning (Shaping objects with a lathe), date back to the Ayutthaya period (1350 - 1767 A.D.) These manual arts are based upon a high standard of handed - on skills in which intricate and symmetrical details are of the utmost importance. Despite the Department's efforts, these arts and crafts which embody exquisite features of Thai culture may suffer a severe loss in this modern world.

APPENDIX 5

Bio-data 1

Name: Mr. Boonsong Nootnomboon (student of Silpa Bhirasri)

Date of Birth: 21st April 1939

Education:

1957	-	Art and Craft School, Bangkok
1960	-	Silpakorn University, Bangkok
1965	-	BA Sculpture
		Faculty of Painting and Sculpture

Experience:

1966	-	Worked with the Fine Arts Department, Bangkok

Now retired from past 17 years

Bio-data 2

Name: Mr. Pongpan Chantanamattha

Date of Birth: 1974

Education:

1998	B.F.A. (Sculpture), Silpakorn University, Bangkok
2006	Certificate of Sculpture, Academy of Fine Arts of Florence, Italy (Italy Governor's Scholarship 2005 – 2006)
2006	Studying M.F.A (Cultural Management) Thammasat University, Bangkok (University's Scholarship)
2009	Certificate of Sculpture, Academy of Fine Arts of Carrara, Italy (Italy Governor's Scholarship 2008 – 2009)

Contact Detail: Studio:
93, Moo 3, Phutthamonthon 5, Salaya, Nakornprathom, Thailand
Thai Mobile: 00 668 1575 3020
Italian Mobile: 329 876 9268
Email: chantanamattha@yahoo.com

Present: Sculptor, The Fine Arts Department, The Ministry of Culture

Exhibition:

2009	• 'Non ci sono solo belle arti', Carrara, Italy • 'Belle arti dal segno al concetto', Albissola, Italy • 'Entrata libera', Ceriale, Italy
2008	• 'Art No Wall', Bangkok
2007	• The monument of King Rama IV, high 410cm, Bangkok
2006	• Exhibition of Plastic Artsm Casa do Brazil, Madrid, Spain • Sculpture Exhibition, Cabals Galeria, SantCugat, Barcelona, Spain
2005	• 22nd Art Exhibition by Members of the Faculty of PSG, Silapkorn University, Bangkok • The monument of King Rama V the Great, Pratumtanee
2004	• 21st Art Exhibition by Members of the Faculty of Painting Sculpture and Graphic Arts, Silpakorn University, Bangkok • 7th Changchun Chaina International Sculpture Sumposium, China • The monument of King Naraysuan the Great, Lampang

APPENDIX 6

Questionnaires prepared for the staffs of the Sculpture Division foundry of the Fine Arts Department, Salaya

Mangala Pradhan

M.A. Thai Studies

Chulalongkorn University

This questionnaire is prepared for the field work of my thesis. I am doing a case study on bronze casting process in this foundry of The Department of Fine Arts. Please help me by giving the answers of the questions stated below. I am grateful for your contribution of valuable time filling out this questionnaire and helping the researcher to reach such aim. Thank You.

Name

Age:

Study Qualification:

University: Year:

Major subject:

1. When did you join department of Fine Arts?
2. What is your post in the department?
3. What is your major interest?
4. Where did you receive the training?
5. What do you feel personally when you make statues of the kings and heroes?
6. What are the most common problems you face in the workshop?
7. Do you worship the statues of the kings?
8. Do you think worshipping statue of king Chulalongkorn makes fulfill your wish?
9. How would you preserve the skills that you posses for future generations? Would you pass on your skills to you children?

Thank You

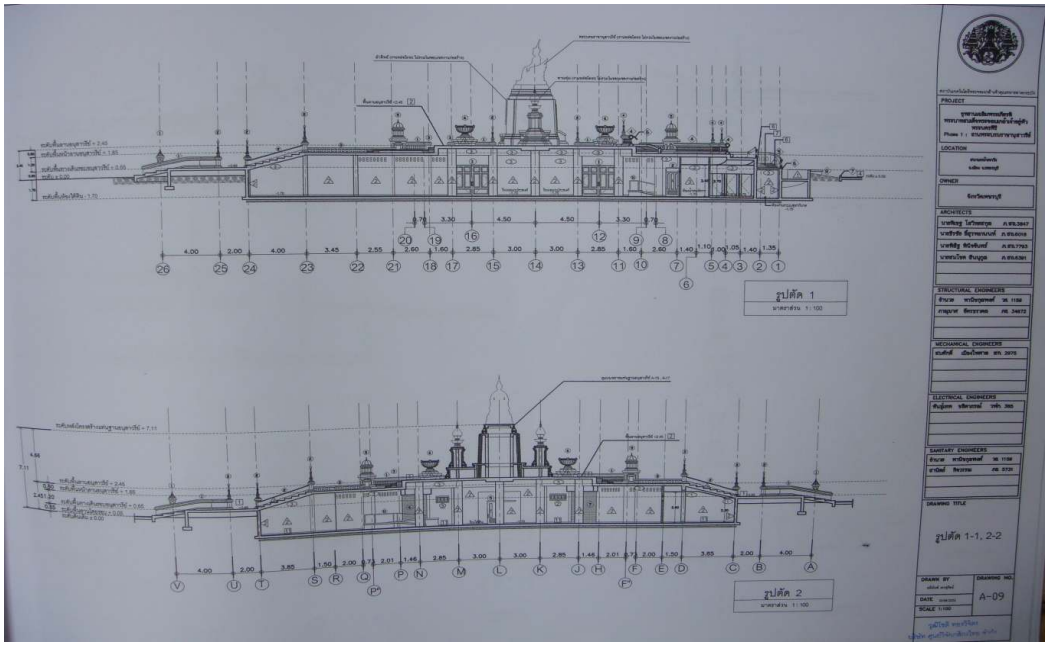
APPENDIX 7

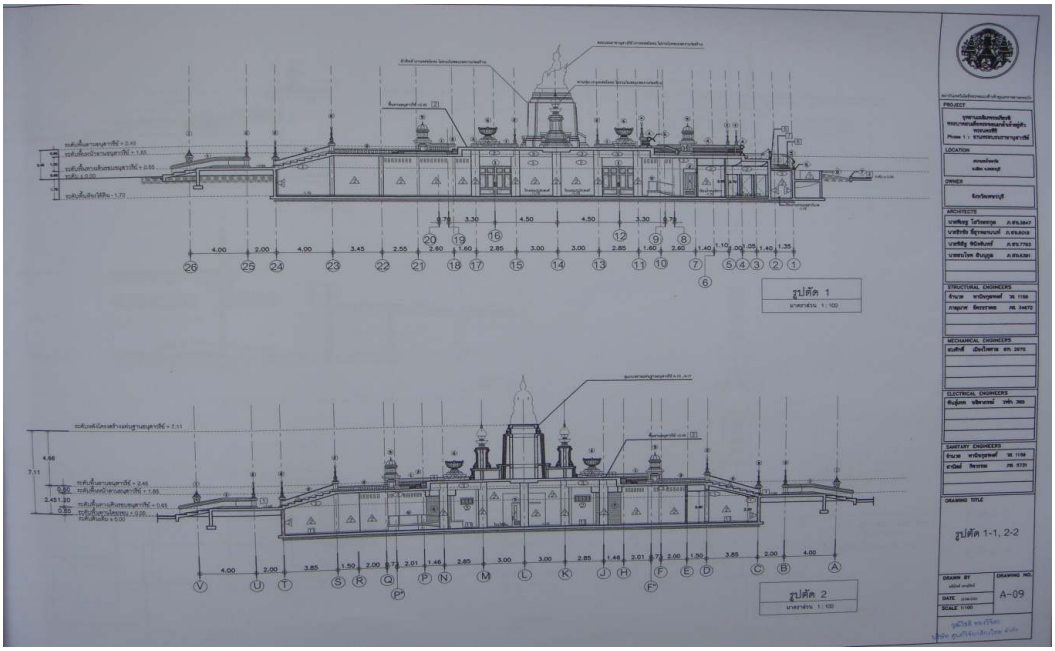
Preliminary questions prepared for the head of the sculpture and casting section of the foundry of the sculpture section of the Fine Arts Department and retired sculptors of the Fine Arts Department.

1) What are the techniques of contemporary bronze casting with lost wax process done in the foundry of Fine Arts Department?
2) Are there any differences between traditional and contemporary bronze casting?
3) What is the history behind the establishment of the foundry of the Fine Arts Department and its functions?
4) Who are the famous figures and elites been casted in the foundry?
5) What is the spiritual and emotional attachment of the sculptors and casters? Who are the persons who order such statues and what is the reason behind making. What are the processes of order for a sculpture?
6) What does the artist feel personally when making statues of the kings and heroic figures of the nation? Do they believe in worshipping the statues of the kings and hero figures?
7) What motivates the artists to make and work upon the sculptures? Is it only for the job or the inner spiritual, faith or belief that motivates them to make an art object?
8) What are the differences between traditional and modern bronze casting process? Which process is more expensive? How long do these processes take and how many statues are made in a year?
9) How are the traditional processes preserved? Are there traditional processes revitalized into, modern processes?
10) Who are the various specialists involved in casting? Do the specialists inherit the profession? How would they preserve the skills that they possess for future generation? Will they pass on their skill to their children?
11) Is there any preference to which the process is undertaken by the government or the customer?
12) How materials are used and economized and in which process? How the residue or the remains of the metal and other casting materials is managed? What is the significance of the modern materials (e.g. Silicon, Gypsum plaster, gas furnace etc.)?
13) How many people are engaged in the foundry and what is the status of manpower? Where did they receive training to make sculpture and cast?
14) What is the economic status of the foundry?
15) What are the most common problems the artisans face in the workshop?

APPENDIX 8

Plan of KING MONGKUT MEMORIAL PARK, Phra Nakhon Khiri Historical Park, Petchaburi. Documents provided by Mr. Oan.





APPENDIX 9

Difference between Contemporary and Traditional Lost Wax casting technique.

Contemporary lost wax casting method	**Traditional lost wax casting method**
Raw Materials ❖ Sand and clay and modern materials such as Gypsum, Silicon rubber, iron are more often used.	**Raw Materials** ❖ Sand, clay, more natural substances such as firewood, cow manure, etc
Time Factor ❖ Gypsum and silicon dry faster and normally took half of the time	**Time Factor** ❖ Moulds were made by a mixture of clay, sand, cow manure which took longer time to dry
Quality ❖ The use of only clay on the core statue, helps the sculptor to make appropriate modifications to the core to get the desired result. ❖ For realistic statues modern equipment, technology and knowledge makes easy for the sculptors	**Quality** ❖ Mixture of clay and sand for the core statue once made cannot modify many times ❖ Quality of the bronze statue is based mostly on a sculptor's skills and dexterity

Technique ❖ The steps involved in the contemporary method are a lot more than the traditional method and is also more complicated. ❖ E.g.. the core moulds are cut and divided into many parts prior to applying the gypsum. It is up to a sculptor's intuition and insight as to how and where to make these distinct cuts, which are complicated and also requires a lot of experience	**Technique** ❖ Steps involved are not so complicated ❖ The traditional method also does involve this process of cutting and dividing, however it is basically done by cutting huge sections of the major parts of the statue, such as the whole arm of a statue
Cost ❖ Gypsum, silicon , gas which are mostly used are more expensive ❖ One advantage of using silicon moulds is that these moulds could be reused to make many statues hence reducing the cost and time taken to re-do the process all over again.	**Cost** ❖ Clay, sand, cow manure, and firewood used in the traditional method to melt the bronze are cheaper than the modern materials ❖ One mould can produce only one statue

APPENDIX 10

List of some of the famous bronze sculptures and monuments

	Name	Year	Place	Designer	Sculptor
1	King Mongkut, Rama IV	1868	Wat Bowonivet, Bangkok		Luang Theprojana (Phraya Chindarangsan)
2	King Chulalongkorn, Rama V	1897	Chakri Maha Throne Hall		Cesare Fantachiotti
3	Earth Goddess		Sanam Luang	Prince Naris	Prince Naris
4	Equestrian statue of King Chulalongkorn, Rama V	1908	Royal Plaza		Georges Ernest Saulo
5	King Phra Phuthayotfa, Rama I	1932	Memorial Bridge, Bangkok	Prince Naris	Prince Naris and Silpa Bhirasri
6	King Vajiravudh, Rama VI	1941	Lumpini Park, Bangkok		Silpa Bhirasri
7	Monument of Thai Hero	1943-6	Vajiravudh Army Base, Nakhon Si Thammarat		Silpa Bhirasri and Sanan Silakorn
8	Hero figures on Victory Monument	1941	Bangkok		Silpa bhirasri
9	The archer	1935-8	Department of Fine Art		Cham Khaomeecheu
10	Proff. Silpa Bhirasri	1962	Silpakorn University, Bangkok		Sanan Silakorn
11	King Prajadhipok, Rama VII	1980	National assembly, Bangkok		Sanan Silakorn
12	King Chulalongkorn and King Vajiravudh	1990	Chulalongkorn University, Bangkok		Khaimook Chudoo
13	Relief panels on the Democracy Monument	1939	Rajadamnern Avenue, Bangkok		Silpa Bhirasri
15	King Taksin Monument	1972	King Taksin Memorial park, Chanthaburi		Suphorn Sirasongkroh, Chin Prasong

					and Pakorn Lekson
16	King Naresuan Monument	1958	Don Chedi, Supanburi	Silpa Bhirasri	Silpa Bhirasri,
17	King Naresuan	1959	Army Base, Pitsanulok	Silpa Bhirasri	Silpa Bhirasri, sitthidej Seanghirun, pakorn Lekson, sanan Silakorn
18	King Naresuan Monument	1993	King Naresuan University, Pitsanulok	Saroj Jarak	Saroj Jarak, Somkuan Umtrakul, Sirichai Limpraphan and Sophit Phuttarak
19	King Naresuan Monument	1999	Ayutthaya		Chin Prasong
20	Thao Suranari Monument	1934	Nakhon Rachasima		Silpa Bhirasri
21	Thao Thepsatriand Thao Srisunthorn Monument	1966	Phuket		Sanan Silakorn
22	Queen Suriyothai	1995	Ayutthaya		Khaimook Chudoo
23	Princess Suphankalaya	1998	Third Army Base, Pitsanulok		
24	Queen Grandmother	1971	Chonburi		Sanan Silakorn
25	Princess Mother	1990			Manop Suwapinta
26	Khruba Srivichai	1946	Doi Suthep Hill, Chiang mai		Silpa Bhirasri and Khien Yimsiri
27	Suthon Phu , Phra Aphai Mani and sea ogress Phee Sue Samuth	1970	Suthon Phu Memorial Park, Klaeng district, Rayong		Sukij Laidej, Kraisorn Srisuwan and Thana laohaphaikul

28	Monument of Ban Rachan Villagers	1976	Singburi	Sanan Silakorn	Sanan Silakorn,Saroj Jarak, Anik Somnoon, Sukij Laidej, Kwanmuang Youngprayoon, Lamthian Kashaphuti, Boongsong Nuchnomboon, Soonthorn Srisoonthorn, Pratueng Thammarak.
29	Monument of Prince Father and Princess Mother	1999	Chonburi Memorial Park, Chonburi		Manop Suwanpinta
30	Monument of King Ananda, Rama VIII	1959	Wat Surthat, Bangkok		Silpa Bhirasri and Paitum Muangsombron
31	King Naresuan	1970	Chiang Mai		
32	King Narai	1954	Lopburi	Silpa Bhirasri	Silpa Bhirasri, Sanan Silakorn
33	King Nangklao	1992	Bangkok		Suporn Silasongkro
34	King Nangklao	1991	Kanchanaburi		Nokorn Kachapong
35	Chao Phraya Bidindecha	1990	Sakeaw		Thane Klinkajorn
36	Maha Amat Tho (Generak) Jao Boonyawat	1978	Lampang		Sampun Utayota
37	General P. Piboonsongkram	1997	Nonthaburi		Piman Munpramook
38	King Prajadhipok	1980	Bangkok		Sanan Silakorn
39	King Prajadhipok	1991	Nonthaburi		Kongkate Chanapan
40	King Rama I	1989	Uthaithani		Leamtien Kachaputi

41	Phra Patumworarach Suriyawong	1989	Ubon Rachthani		Kongkate Chanapan
42	General prince Prajak Silpakom	1985	Udonthani		Piman Munpramuk
43	King Pinklao	1986	Pingklao Hospital, Bangkok		Sanan Silakorn
44	King Pho Khun Pa Merng	1984	Petchaboon	Saroj jarak	Saroj Jarak, Shin Prasong, Kongkate Chanapan
45	General Phraya Pahonpolpayuha Sena	1950	Kanchanaburi		Pima Munpramuk
46	Phraya Pichai Dabhak	1959	Uttaradit		Sanan Silakorn
47	General Prince Pitsanulok Prachanat	1983	Bangkok		Suporn Sirasongkro
48	General prince Jakrapong	1971	Prachinburi		Leamtein kachaputi
49					
50	King Rama I	1982	Rachaburi		Sanan Silakorn
51	Princes Walaialongkorn	1978	Petchaburi		Kanok Boonpokean
52	Phra Pakdee Decha	1981	Prachinburi		Somkuan Umtrakoon
53	King Rama VI	1983	Hospital, Bangkok		Silpa Bhirasri
54	King Rama VI	1992	Bangkok		Sampan Utayata
55	King Rama VI	1973	Ministry of Education, Chonburi	Sanan Silakorn	Sanan Silakorn, Chin Prasong
56	King Rama VI	1986	Naknon Pathom	Saroj Jarak	Saroj Jarak, Tane Klinkajorn
57	King Rama VI	1986	Ranong	Saroj Jarak	Saroj Jarak, Tane Klinkajorn
58	King Rama VI	1982	Songkla	Chin Prasong	Chin Prasong, Sukij Layadej
59	King Mangrai	1977	Chiangrai		Pakorn Lekson
60	Somdej Phra Bowonraracha Chaw Surasrihanata	1979	Bangkok	Sanit Ditapan	Leamsing Ditapan
61	Somdej Phra Maha Weerawong	1989	Ubonrachathani		Nikorn Kachapong
62	Somdej Phra Bowonraracha Chaw	1982	Kanchanaburi		Duang Keaw Tipkornsilp

	Surasrihanata				
63	Prince Mahidol	1950	Siriraj Hospital, Bangkok	Silpa Bhirasri	Silpa Bhirasri, Sanan Silakorn
64	Phraya Rasdanupradit	1993	Phuket	Saroj Jarak	Saroj Jarak, Somkuan Umtrakum
65	Sriprach (poet)	2002	Nakhon Sri Thamarat		Pongpan Chantanamttha
66	King Rama V	2001	Pratumtani		Pongpan Chantanamttha
67	King Rama IV	2010	Petchaburi		Pongpan Chantanamttha
68	King Rama IV	2010	Saranrom Palace, Bangkok		Somkuan Oumtrakul
69	King Ananda Mahidol, Rama VIII	1959	The Royal Pantheon, Wat Phra Sri rattan Satradaram, Grand Palace		Silpa Bhirasri, Paitun Muangsomboon
70	King Prajadhipok, Rama VII	1959	The Royal Pantheon		Silpa Bhirasri
71	King Vajiravudh, Rama VI		The royal Pantheon		Silpa Bhirasri
72	King Chulalongkorn, Rama V		The Royal Pantheon		
73	King Chulalongkorn, Rama V	1966	Royal Thai Army Head Quarter, Bangkok		Piman Mulpramuk
74	King Naresuan	1968	Non Bua Lam Phu Province		Silpa Bhirasri, Sanan Silakorn
75	King Ekathotsarot	1968	The Head Quarters of the 3rd Army Base, Pitsanulok		Suki Laidej
76	King Praphuttalertiarnapalai, Rama II	1964	Wat Umpawanjetiyaram, Samuthsongkram province		Phimarn Mulpramuk, Saroj Jarak
77	King Ramkhamhaeng the Great	1973	Lopburi		Silpa Bhirasri, Sanan Silakorn
78	King Chulalongkorn, Rama V	1980	Prachinburi		Sanan Silakorn

79	King Nang Klao, Rama III	1980	Wat Ratchanatdaram Wiharn, Bangkok		Suporn Sirasongkroah
80	Ganesh	1987	Chiang Mai		Nikorn Kotchpong
81	King Mongkut	1987	Drachuap Khiri Khan Province		Kwanmuang Tongprayoon
82	Prince mahitala Dhibesra Adulyadej Vikram The Prince Father	1972	Faculty of Medicine, Chiang Mai University		Saroj Jarak, Pakorn Lekson, Suporn Sirasongkroah, Boonsong Nutchomboon
83	Prince Yagala Denghambara, Prince of Lopburi	1993	Songkhla Province		Kongket Chanaphan
84	Phra Pichai dap Hak	1968	Uttaradit province		Sanan Silakorn
85	Nang Suphannamatcha	1966	In a corner of the moat around the Chitralada villa, Dusit Palace		Sawet Thettham

BIOGRAPHY

Name: Mrs. Mangala Pradhan

Address: 92 Dasharath Marg, Tripureswar, GPO Box 328, Kathmandu, Nepal.

Date of birth: 6th September 1964, Kathmandu, Nepal.

Marital Status: Married with two children.

Qualification:(1)Higher Secondary Level, Adarsha Vidya Mandir High School, Kathmandu,1980.(2) Intermediate of Arts (I.A.), 1985. and (3)Bachelor of Arts (B.A.), Padma Kanya Campus, Kathmandu, 1991.(4)Masters of Arts (M.A.) in Archaeology and Tourism, Tribhuvan University, Kathmandu, 1995.(5) Masters of Arts (M.A.) in Thai Studies, Chulalongkorn University, Bangkok, Thailand. 2010

Activities:

1 Worked as a Tourism Officer in Urban Management and Economic Diversification Project (UMEDP), European Commission Asia Urbs Program, from 2002 to 2004.
2 Worked in Tribhuvan International Airport, Hospitality Desk as a Ground Hostess throughout the year "Visit Nepal Year 1998" from Dec1997 to May 1999.
3 Participated on International Parents Summit for the growth of Asian Children in Yokohama, Japan in 2000.
4 Participated in the training program of Preservation and Restoration of cultural Heritage in the Asia-Pacific Region 2007: Preservation and Restoration of wooden Structures in Nara, Japan. (18 September to 19 October, 2007)
5 At present working as an archaeological officer in the World Heritage section of the Department of Archaeology, Government of Nepal, since 2004.

Publications:

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Award: (1) Scholarship for training of Preservation and Restoration of cultural Heritage in the Asia-Pacific Region 2007: Nara, Japan by Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO(ACCU)Nara Prefectural Government Office, Japan.

(2)Scholarship by Thailand International Development Cooperation Agency (TICA), Ministry of Foreign Affairs, Kingdom Of Thailand to study Masters in Thai Studies in Chulalongkorn University, Bangkok. 2008