

**MARITIME ARCHAEOLOGICAL STUDY ON
BRONZE GONGS AND ORNAMENTS FROM
TANJUNG SIMPANG MENGAYAU WRECK
SALVAGE (2003): METAL COMPOSITION
ANALYSIS**



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UNIVERSITI MALAYSIA SABAH

**FACULTY OF HUMANITIES,
ARTS AND HERITAGE
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**PRESENTED IN PARTIAL FULFILLMENT FOR
THE DEGREE OF MASTER OF ARTS**

**FACULTY OF HUMANITIES,
ARTS AND HERITAGE
UNIVERSITI MALAYSIA SABAH
2014**

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I hereby declare that the material in this thesis is my own except for quotations, excerpts, summaries and references, which have been duly acknowledge.

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30 September 2013

ABSTRACT

This thesis presents a quantitative result from the elemental Inductively Coupled Plasma – Optical Emission Spectrometry (hereafter known as ICP-OES) analysis for three bronze gongs and 10 copper alloy artifacts from the shipwreck site off the northernmost tip of Borneo, Tanjung Simpang Mengayau Wreck. Despite various tools and techniques to obtain the elemental composition of metal artifacts, ICP-OES is considered modern and reliable analytical chemical instrument for these bronze artifacts from shipwreck and museum collection. The analyzed artifacts from the cargo, based on the decoration of ceramics pottery, patinas and colors evidence, are dated back to the Song Dynasty era circa 960 AD - 1279 AD. The elemental data would pertain the metal present in China and reflects the maritime trade by the Chinese to the Southeast Asian countries during the time period. These artifacts were analyzed using ICP-OES before a simple statistical data used to pick up the trend of their metal composition. Other studies have also been done on musical instruments were the type of gongs, preliminary study on the gong-making in Borneo and briefly on its actual metal composition to today's appearance. The analysis on recent gongs is dealing with its tune as percussive musical instruments. To the bronze ornaments, they are severely damaged due to the reaction of bronze metals to the sea-water in such a long period and being the only type of bronze found in the wreck site along with gongs. In par, the bronze ornaments are referred bronze mirror or bronze ornaments or bronze discs. The average of metal composition for bronze gongs is Cu 67.9%, Pb 3.7%, Sn 0.10%, As 0.080%, Fe 0.10%, Ag 0.052%, Ni 0.02%, Zn 0.010%, Mg 0.0015%, Au 0.0024%; meanwhile for the bronze ornaments is Cu 70.5%, Sn 0.070%, Zn 0.0063%, Pb 2.0%, Au 0.0024%, As 0.087%, Ag 0.040%, Ni 0.022%, Mg 0.014%, and Fe 0.0063%. The trend of metal compositions on bronze gongs implicitly shows no trending at all, but appears consistent in bronze ornament mostly in copper (89%), lead (10%), and tin (1%). Analytically, the contents shows the quality of these bronze artifacts to be used as currency apart from as trade goods. Regarding to the lack of elemental analysis on both artifacts from other sites in Southeast Asia, it cause difficulty to compare their composition for cross-referencing and for further provenance assessment.

Keywords. Bronze gong, bronze ornament, characteristics, maritime trade, musical instrument, Song Dynasty, Borneo

ABSTRAK

KAJIAN ARKEOLOGI MARITIM KE ATAS GONG DAN PERHIASAN GANGSA DARI TAPAK KAPAL KARAM TANJUNG SIMPANG MENGAYAU (2003): ANALISIS KOMPOSISI KIMIA

Tesis ini membincangkan mengenai keputusan kuantitatif dari analisis elemen oleh Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES) ke atas tiga artifak gong gangsa dan 10 artifak perhiasan gangsa yang diselvaj dari tapak kapal karam Tanjung Simpang Mengayau di perairan utara Borneo. Sungguhpun terdapat pelbagai peralatan dan teknik untuk memperoleh komposisi elemen kimia sesuatu artifak logam, ICP-OES merupakan teknik moden dan instrumen kimia analitikal yang berkebolehpercayaan tinggi terhadap artifak-artifak logam dari tapak kapal karam dan koleksi muzium. Artifak yang dianalisis ditemui di kargo kapal dan berdasarkan bukti corak hiasan, warna dan patina pada seramik, artifak dalam tesis ini dianggarkan berasal dari China ketika era Dinasti Song 960 M hingga 1279 M. Data komposisi elemen mampu menyumbang kepada pengetahuan terhadap logam yang terdapat di China dan sejarah perdagangan maritimnya antara kerajaan sekitar Asia Tenggara pada era tersebut sekaligus menerangkan ciri barangan yang diperdagangkan. Kajian lepas keatas instrumen muzik membincangkan pengelasan gong, penyelidikan awal pembuatan gong di Borneo dan sedikit mengenai komposisi kimia gong moden. Terbaru, kajian keatas gong lebih mengarah kepada hasil bunyi gong sebagai alat muzik jenis pukulan. Manakala bagi artifak perhiasan gangsa sebagai artifak logam yang ditemui bersama-sama gong, artifak ini telah mengalami kerosakan teruk akibat tindakan logam gangsa dengan air laut dalam tempoh masa yang lama. Sehingga kini, artifak gangsa ini dirujuk sebagai cermin gangsa, perhiasan gangsa atau disk gangsa. Oleh kerana kurang analisis elemen ke atas kedua-dua jenis artifak ini di mana-mana tapak arkeologi di Asia Tenggara, kesukaran melakukan kajian asal-usul menggunakan perbandingan komposisi antara artifak logam yang ditemui. Data yang diperolehi dianalisis menggunakan analisis statistik mudah untuk menentukan jujuk komposisi logam pada artifak gong adalah Cu 67.9%, Pb 3.7%, Sn 0.10%, As 0.080%, Fe 0.10%, Ag 0.052%, Ni 0.02%, Zn 0.010%, Mg 0.0015%, Au 0.0024%; perhiasan gangsa pula Cu 70.5%, Sn 0.070%, Zn 0.0063%, Pb 2.0%, Au 0.0024%, As 0.087%, Ag 0.040%, Ni 0.022%, Mg 0.014%, dan Fe 0.0063%. Komposisi logam pada gong gangsa jelas tidak menunjukkan sebarang trend tetapi bagi perhiasan gangsa pula, secara konsisten mempunyai trend komposisi kimia yang menonjol iaitu kuprum (89%), plumbum (10%), dan tin (1%). Secara analisisnya, kandungan ini merefleksikan kualiti artifak gangsa yang digunakan sebagai mata wang selain dari barang dagangan. Atas sebab ini, data komposisi elemen yang diperolehi akan sepenuhnya digunakan untuk mencirikan artifak ini untuk ditafsir dalam konteks arkeologi maritim dan sejarah.

Kata kunci. *Gong gangsa, perhiasan gangsa, ciri-ciri, perdagangan maritim, alat muzik, Dinasti Song, Borneo*

TABLE OF CONTENTS

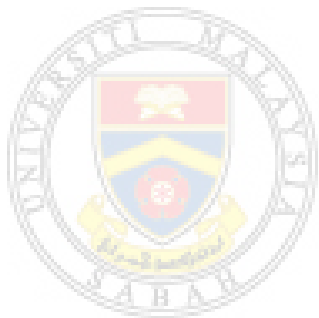
	Page
TITLE	i
DECLARATION	iii
CERTIFICATE	iv
ACKNOWLEDGEMENT	v
ABSTRACT	vi
<i>ABSTRAK</i>	vii
TABLE OF CONTENTS	viii
LIST OF FIGURES	x
LIST OF TABLES	xi
LIST OF ABBREVIATION	xii
CHAPTER 1: INTRODUCTION	
1.1 Background	1
1.2 Research Problem	2
1.3 Research Objectives	2
1.4 Research Significance	3
1.5 Scope	4
1.6 Conclusion	5
CHAPTER 2: LITERATURE REVIEW	
2.1 Maritime Trade In Borneo	6
2.2 Tanjung Simpang Mengayau Wreck	8
2.3 Law of Association	12
2.4 Bronze Artifacts	16
2.4.1 Bronze Gongs History	16
2.4.2 Bronze Gongs Classifications	18
2.4.3 Bronze Gongs Metal Composition	19
2.4.4 Bronze Ornaments	20
2.5 Characterizing Gong Artifacts	22
2.5.1 Musical Instrument	22
2.5.2 Trade Commodity	25
2.6 Analytical Research On Metals Artifacts	26
2.7 Metal Composition Instrumentation	27
2.8 Conclusion	29
CHAPTER 3: METHODOLOGY	
3.1 Introduction	32
3.2 The Cargoes	33
3.3 Bronze Gongs	34
3.4 Bronze Ornaments	34
3.5 Methodology	40

3.5.1	Selection of Bronze Artifacts	41
3.5.2	Sample Preparation	41
3.5.3	Preparation of Aqua Regia Acid-Digestion Treatment	42
3.5.4	Aqua Regia Acid Digestion	43
3.5.5	Calibration of ICP-OES	43
3.5.6	Selection of the Experimental Instrument Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)	44
3.6	Data Analysis	44
3.6.1	Metal Compositions	44
3.6.2	Metal Compositions Analysis	45
3.6.3	Distribution of Metal Phase Analysis	45
3.7	Archaeological Analysis	46
3.8	Method of Validation	46
3.9	Conclusion	47
CHAPTER 4: RESULTS AND DISCUSSION		
4.1	Introduction	48
4.2	Physical Properties Of Bronze Gong Artifacts	49
4.3	Physical Properties Of Bronze Ornament Artifacts	52
4.4	Method Validation	53
4.5	Historical Characteristics Of Bronze Gongs	54
4.5.1	Gong Law of Association Dating	54
4.5.2	Gong Physical Characterization	54
4.5.3	Gong Chemical Characterization	55
4.6	Elemental Composition of Bronze Ornaments	60
4.7	Bronze Ornaments Characteristics	65
4.7.1	Database of Chinese Copper-Based Artifacts and Its Application in Provenance Studies	66
4.7.2	The Quest for the Ornaments Cultural Components of the Early Age of Commerce in Borneo	67
4.8	Physical Comparison Of Bronze Ornaments	68
4.9	Comparison And Contrast Of Both Types Of Artifact	69
4.10	Elemental Composition Of Bronze Gongs	70
4.11	Historical Context Of Song Dynasty Bronze Metal Artifacts In Borneo	74
4.11.1	Cultural, Musical and Historical Components	74
4.11.2	A Possibility of Local Copper Supply during the Early Age of Commerce in Southeast Asia	75
4.11.3	Evidence of Maritime Networks during the Early Age of Commerce in Borneo	76
4.12	Conclusion	78
CHAPTER 5: CONCLUSION		81
REFERENCE		86
APPENDIX		95

LIST OF FIGURES

	Page
Figure 2.1: Map of early Southeast Asia and maritime trade routes from 3rd to 9th centuries CE	7
Figure 2.2: Maritime trade in Southeast Asia, first to sixth centuries A.D.	7
Figure 2.3: Maritime trade networking in Southeast Asia ca. 1000-13	11
Figure 2.4: Law of superposition. Series of rock layers with the oldest at the base and the youngest at the top.	15
Figure 2.5: Type I-IV of Drums by F. Hager	18
Figure 2.6: Ming Dynasty mirror	21
Figure 2.7: Percussion family with gong	24
Figure 2.8: Chinese gong	25
Figure 2.9: PentaFET® Precision OXFORD Instruments INCAx-act EVO MA 10 SEM instrument in <i>Makmal Instrumen Gunasama, Unit Instrumentasi, SST</i>	28
Figure 3.1: Front side of bronze gong (TSM03/JMS/UMS/No. 014)	32
Figure 3.2: Front side of bronze gong (TSM03/JMS/UMS/No. 015)	32
Figure 3.3: Front side of bronze gong (TSM03/JMS/UMS/No. 016)	33
Figure 3.4: Front side of bronze ornament (TSM03/JMS/UMS/No. 001)	35
Figure 3.5: Front side of bronze ornament (TSM03/JMS/UMS/No. 002)	35
Figure 3.6: Front side of bronze ornament (TSM03/JMS/UMS/No. 003)	36
Figure 3.7: Front side of bronze ornament (TSM03/JMS/UMS/No. 004)	36
Figure 3.8: Front side of bronze ornament (TSM03/JMS/UMS/No. 005)	37
Figure 3.9: Front side of bronze ornament (TSM03/JMS/UMS/No. 006)	37
Figure 3.10: Front side of bronze ornament (TSM03/JMS/UMS/No. 007)	38
Figure 3.11: Front side of bronze ornament (TSM03/JMS/UMS/No. 008)	38
Figure 3.12: Front side of bronze ornament (TSM03/JMS/UMS/No. 009)	39
Figure 3.13: Front side of bronze ornament (TSM03/JMS/UMS/No. 0010)	39
Figure 3.14: Example of cut-out	40
Figure 4.1: Structure of untreated bronze gong (front)	50
Figure 4.2: Structure of treated bronze gong (front)	51

Figure 4.3:	Structure of bronze gong after treatment (back)	51
Figure 4.4:	Structure of bronze gong after treatment (side)	52
Figure 4.5:	Bronze ornaments physical appearance	53
Figure 4.6:	Ming Dynasty mirror	69
Figure 4.7:	Song Dynasty ornament 2003	69
Figure 4.8:	Pattern recognition charts for gongs	73



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LIST OF TABLES

	Page
Table 2.1: Comparative Tanjung Simpang Mengayau Wreck To Standard Guide Of Chinese Ceramics	14
Table 2.2: Comparison Of Metal Composition Of Chinese Gong Manufacturers' And Paiste's Gongs	20
Table 2.3: Ming Dynasty Mirror Metal Composition	22
Table 3.1: Technique And Its Purpose	46
Table 4.1: Elemental Composition Of Bronze Ornaments	56
Table 4.2: Chinese Gong	59
Table 4.3: Paiste Gongs General Composition	59
Table 4.4: Paiste Traditional Gongs (1971)	60
Table 4.5: Tanjung Simpang Mengayau Wreck Gong Artifacts	60
Table 4.6: Elemental Composition Of Bronze Ornaments	61
Table 4.7: Elemental Composition Of Bronze Ornaments Artifact From Song Dynasty And Ming Dynasty	62
Table 4.8: Results Of Compositional Analysis Of The Inclusions In Some Hanzhong Samples	64
Table 4.9: Consolidation Of Coin Data	65
Table 4.10: Elemental Composition Comparison	70

LIST OF ABBREVIATIONS

AAS	-	Atomic Absorption Spectrometry
ICP-OES	-	Inductively Coupled Plasma – Optic Emission Spectrometry
PCR	-	Polymerase Chain Reaction
UMS	-	University Malaysia Sabah
XRD	-	X-Ray Diffraction
XRF	-	X-Ray Fluorescence



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CHAPTER 1

INTRODUCTION

1.1 Background

To date, studies on the bronze artifacts from shipwrecks during Song Dynasty era are focused more on to its typology, classification as percussive musical instruments (Nicolas, 2009: 62-87), and its value to the tradition, beliefs of native people of Southeast Asian countries, gong-making (Pugh-Kitingan, 2010: 225-229), and report finds (Bala & Baszley, 2009: 128). A few studies have been made to acquire the artifacts metal composition for their provenance studies (Nicolas, 2009: 83) and their characteristic as the Chinese merchants' maritime trade commodities.

The present study was carried out to attain the trend of metal composition data for bronze artifacts provenance studies and to assess the characteristics of these bronze metal artifacts for archaeological and history definition using chemistry analytical instrument as tool to provide such information. The bronze metal artifacts from Tanjung Simpang Mengayau Wreck were not well-documented regarding to looting activity on the wreck site before it was officially salvaged and the probabilities of bronze gongs and bronze ornaments found in wreck sites around Southeast Asia, and hence the importance of its elemental composition and characteristic remain indefinite.

Conservation procedure usually will take many years to complete, exhibition purpose of artifacts will not allow any intentional damage on them and limited access to the artifact under preservation and permission of state museum are some constraint factors that lead to the minimum studies conducted. Despite the fact that chemical analysis is a crucial study to provide a chemical content and metals present, it is also able to portray the linkage of metals trend to its value as finishing product. Thus, the elemental composition of metal artifacts is significant

for characterizing artifacts and validates unravel the history of the people who used and traded it in the past.

1.2 Research Problem

To prove that the manufacturing of bronze gongs and bronze ornaments is related to the marketing strategy and producing product with minimal cost. The marketing strategy by the Chinese is to control the metal composition of the bronze product in the way to gain more profit. Based on this statement, three problems arose.

First, as a type of merchandise, Chinese bronze gongs and bronze ornaments may have a manufacturing metal standard as Song Dynasty to foreseeing its manufacturing process and their characteristics as trade goods. Secondly, both types of artifacts were found in the same cargo and from the same era and yet known as bronze artifacts. Similarities or differences of metal composition in comparison may yields more interconnection on to each other. Besides, a traditional gong-making process affects the gong's quality as indigenous Southeast Asian famous gongs manufacturer. Thirdly, dissimilarity on gong production between Song Dynasty and native Borneo gongs will compose a correlation on its quality as percussive musical instruments and manufacturing sources.

1.3 Research Objectives

In accordance to the problem statement of this study, as there is no experiment been carried out onto these artifacts: in Sabah about bronze drums and bronze ornaments, by analytical chemistry instruments, thus, this study has research objective to obtain the metal composition trend of bronze gongs and bronze ornaments artifact from Tanjung Simpang Mengayau Wreck. Secondly, to compare the metal composition of a bronze gong and bronze ornament artifacts from other shipwreck around Borneo or Southeast Asia with same dynasty with established data. Next, the third objective is to characterize the bronze gong and ornament artifacts from Song Dynasty in maritime archaeology context.

1.4 Research Significance

History can be rewrite little by little throughout time as it is a dependable variable to the findings, research, and study on the artifacts left behind by the people in the past. To dig more information to reconstruct culture, events, history, civilization and life, study on the subject matter is crucial. Some maritime archaeologists may need experts in multiple fields to aids and as tools to reveal the clues for answering questions.

The analysis of ancient artifacts provides maritime archaeologists and historians with meaningful information about the use and origin of archaeological objects as well as the materials that were used. For example, identification of compositional materials in pottery found on a particular site could determine whether it was originally created in a different location will further allowing researchers or archaeologists to draw conclusions related to communication, trade and partnerships, ports, transportation and connection.

By undergoing this research; the findings could contribute into archaeological cataloguing as a documented Sabah maritime artifacts can further to becoming sources for reference on any bronze artifacts that being found before or later this excavation.

Should later bronze drum from any terrestrial and/or marine wreck site found in Sabah this method will be repeated and compared with the documented data released from this study. Researchers could be able to cross-check its metal composition to find out if they have same age, origin, and dynasty with Tanjung Simpang Mengayau Wreck bronze gongs or ornament respectively. In particular, the finding that some correspondence probably exists between the types of artifact and their materials has significant implications for identifying regional technical characteristics of the provenance of the bronzes, as well as for exploring the interaction between areas they were found with the areas beyond its frontiers. This is significantly can qualify the age, its origin place, dynasty that it was made, and so forth explained in term of historic and maritime archaeological value.

The ultimate goal of such analysis in the present study was to disclosed an organized elemental 'fingerprint' or 'marker' of an unknown material, of sufficient

scope and accuracy, that it can be used to characterize them clearly. The spectroscopic examination of artworks is highly important for conservation, art-historians and keepers of private or public museum's collections. These investigations reveal information, which is art-historical interest: the knowledge of the artistic materials that were used and were available at a certain period in particular region and the dissemination of multidisciplinary approach provide information about interactions between distinct, sojourning history and trade routes.

It was therefore this study by all accounts quantitatively; determines, as accurately as possible, the concentrations of those metallic elements most likely to be can be arranged in inferential form for archaeology scholars for historical significance. Hence, with any fraud or counterfeit for artifact happens, the authenticity of these bronze remain the control database.

1.5 Scope

The scope of this study is on the maritime archaeology term involving metal artifacts using both analytical chemistry and archaeology approaches. To narrower point, this study is encompassing the ancient trade route connecting Borneo with China (Song Dynasty) since it was a pioneer era for Southeast Asian's early Age of Commerce, the economics domination and mineral sources. As Franck Goddio, the modern day underwater archaeologist has put it; world trade had begun millennia ago. The time-capsules, the artifacts, plays the ultimate role as the connector between the past to the present. Established data from scientific methodology, in this case chemistry was chosen to being implemented for the course because the artifacts are physically clear as tangible source, and cannot established elements marker sequencer into the artifacts but chemically extractible using series of data arrangement and provide comparative data.

1.6 Conclusion

This study is trying to bridge science and humanity specifically using reconstructive analysis with cross discipline methodology of ancient maritime world. Fortunately, there are artifacts submerged underwater of Tanjung Simpang Mengayau useful enough to assist in this academic quest as finest evidence archaeologists could sought, fully intact, accessible, and hopefully, one type of rare artifacts been found and conserved for both its priceless information of the past and value to Borneo community today.

It is an academic cruelty if academicians will just leave precious artifacts without serious efforts to study them in information digging. Its nature of chance proving, gaining the picture of ancient time, and most of all bringing the future more knowledgeable aware of their history is the core essence of studying artifacts.

A millennium ago, the South China Sea and Sulu Sea had witnessed for the very first time maritime activity had bursts into action. The dynamic dispersal of human activities of culture, music, trade, and others brought changes into humanity altogether. Relationship built among ethnics, environmental change shown by ports on coastal area and even the technique of gong-making is improved for smaller marketing was all the output of studying artifacts and the key interests of archaeologists. Finally, this action is should be a continuous activity to keep in pace for the ultimate understanding of history.

PCHAPTER 2

LITERATURE REVIEW

2.1 Maritime Trade In Borneo

The maritime trade in Borneo in this study refers to exchange activities taken place in ports and the goods were transferred or exported from one country to another via water transport or ships during the Chinese government "open-door policy" that allows import and export activities freely. The most encouraging time for maritime trade in China is during the Song Dynasty (960 AD – 1276 AD) which was exhilarated by both financial and foreign trade policy, consistent with the early age of commerce in Southeast Asia starting from 900 AD to 1300 AD as proposed by Wade (2009: 222-223).

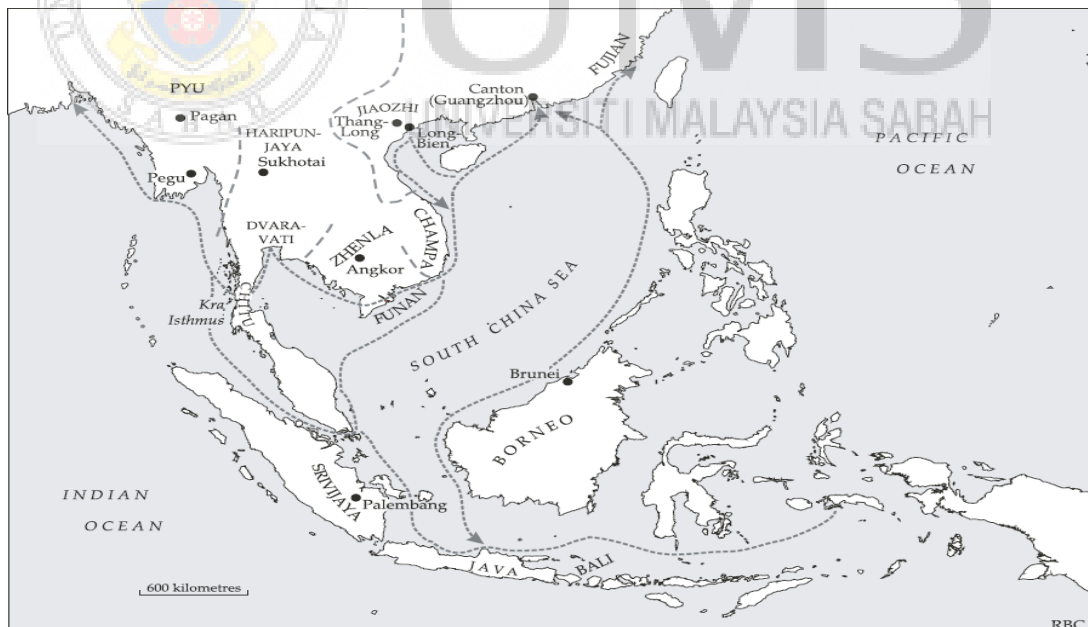


Figure 2.1: Map of early Southeast Asia and maritime trade routes from 3rd to 9th centuries CE.

Source : Fox (2003)

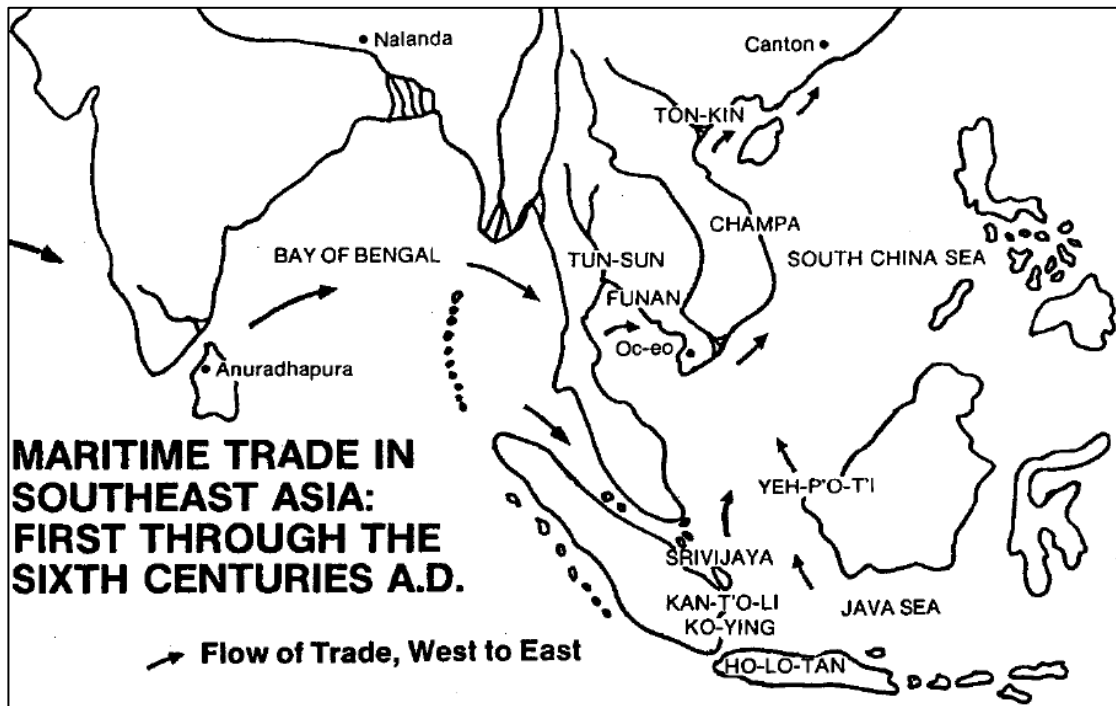


Figure 2.2: Maritime trade in Southeast Asia, first to sixth centuries A.D.
 Source : Hall (1980)

During Song Dynasty trade era, they were not just focusing on importing commodities from ports in Southeast Asian countries. According to Hall (2006: 1), from Song record of import and export product subjected to open market exchange from China are ceramics, copper and iron articles, textiles, assorted Western goods (e.g. Middle East glassware and beads), and coinages. In return, from the 1060s Wang An-shi's record, the Chinese merchants received camphor from Borneo, cloves from the Malukus, nutmeg from the Banda Islands, sandalwood from Timor, and tortoise shells eastern archipelago sources (Hall, 2006: 1-2). In addition, he was also stated that Song mints broke the record of the highest production of copper in Chinese history of six billion copper cash annually, caused changes in Southeast Asian countries that bounded by financial and trade policies.

All of these trade activities potentially lead to deeper question such as the quality of goods from both side are quantified and taken into consideration during trading. The profit margin, bargain, and two-ways advantage or disadvantages would be discovered using the metal composition and its comparison to other metal material, such as the bronze ornaments. The data will form a primary data sources to suggest or support extensive idea on the trade system.

2.2 Tanjung Simpang Mengayau Wreck

Borneo is an island composed with three nations in it: Malaysia (Sabah and Sarawak), Brunei and with the largest part of Borneo, Indonesia (Kalimantan). Located in Southeast Asia, this island is also known as the third largest island in the world and situated in the center between Peninsular Malaysia-Thailand to the west and with the Philippines to the east by the South China Sea on the upper side of Borneo, to the south are the Java Sea and Karimata Strait. Its central geography played a great role in attracting many seafarers and accommodates maritime activities according to season as became the sojourn and trade area.

The northernmost tip of Borneo is well-known as Tanjung Simpang Mengayau. As the major attraction in the state of upper Sabah, Tanjung Simpang Mengayau has strikingly unique promontory nature and beautiful view of the ocean with strong, windy breeze and enormous wave across the shore comes from Sulu Sea on the right and South China Sea on the left meets up. Additionally, Tanjung Simpang Mengayau is also has beautiful geomorphology along the coast of rocks that could be seen during tide ebbs. Its shore is dominated up by coarse gravel that significantly introduced 80% slope (Baszley & Bala, 2009: 36).

Apart from that, the sea current also unpredictable as it could be strong and mixed up. Two monsoons throughout the year (Northeast and Southwest monsoons) also contribute to the stormy weather. Occasionally, tornados and rare cyclones (looks like sea water sucked up to the sky) formed around the area. This situation caused damages to ships looking for land or escaping from stormy weather in the sea since thousand years ago. Furthermore, according to Baszley and Bala (2009: 37-38), a seasonal and irregular presence of sandbanks around the coast demonstrates that the water area is not suitable for sea voyages to crossways or sojourns.

Nicolas (2009: 78-79), Baszley and Bala (2009: 101-102) suggested that Tanjung Simpang Mengayau was an active ancient passage for traders from China, Philippines and Arabs from Brunei, which was also a famous port in Borneo during early Age of Commerce (Wade, 2009: 227) as can be seen by Figure 2.3. The obstacles faced by these sojourners and traders somehow incur shipwrecks in Tanjung Simpang Mengayau coast. Within nine years (2003-2011) of research done

by local maritime archaeologist team, recorded five shipwrecks recorded around this tip of Borneo: Tanjung Simpang Mengayau Wreck (2003), Kalampunian Wreck, Tiga Papan Wreck, Skull Wreck and Tanjung Simpang Mengayau Wreck II (2011). In 2003, the salvage project on Tanjung Simpang Mengayau Wreck was administered by Associate Professor Dr. Khalid Samo from Institute of Oceanography, College University of Science and Technology Malaysia, Sabah State Museum permission, and a company of Nanhai Marine Archaeology (M) Sdn. Bhd. equipped by scientific methodology and contemporary tools salvaged a massive cargo along with metal artifacts in them (Baszley & Bala, 2009: 115) named bronze gongs [up to 61 pieces according to Strojand (2003) website] and bronze ornaments (copper-based material in shape of flat disc or mirror-like).

To date, in Southeast Asia there are only three sites where bronze gongs artifact found: Muara Jambi, Riau, Sumatera, Indonesia (one piece) and Pulau Buaya, Sumatera, Indonesia (eight pieces). Bronze gongs in both sites were dated to 1231 AD (in scripted date on its rim) and 12th centuries respectively are similar to bronze gongs from Tanjung Simpang Mengayau Wreck (Nicolas, 2009: 78-79). Not only 61 bronze gongs were registered in finds record, Tanjung Simpang Mengayau Wreck is also the only wreck that found very close to the shore in shallow water. Evidently, bronze gongs are one of the early-introduced musical instruments recorded in Southeast Asia other than bronze drums (Adnan, 2009: 2).

In conclusion, this island definitely potentially possesses maritime archaeological studies to be explored. According to SilaTripathi (2004: 29), the foremost objectives of maritime archaeology are: (i) to discover, excavate, interpret and preserve for posterity the underwater cultural heritage of our country, (ii) to reconstruct the history of maritime trade: (iii) to preserve antiquities for scientific and educational purposes. Researcher needs to understand the percentage composition of bronze gong and bronze ornaments artifact and which, with the distinct information further be able to makes a scientific speculation on their exact provenance or so from earlier data from other bronze artifacts dated back circa same dynasty and region. This information will improve understanding of the maritime trade history among Chinese traders and Borneo during China Imperial period that distribution of these metals especially in Borneo that used to produce such high strength and importable using barter system into Southeast Asian ports.



Figure 2.3: Maritime trade networking in Southeast Asia ca. 1000-13 A.D.

Source : Hall (2006)