

A Study on the Comparison of Shipbuilding Technique of Unification Silla · Koryo Dynasty during the 8th and 9th Century

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<Abstract>

Hull forms of Jiao Yi Ship for shipping and foreign trade in Silla and Tang Dynasty were transformed and developed in accordance to their voyage and regional routes. The trade ship was a sea ship, used by Chang Po Go's, the Silla great sea merchant ship, in the marine trade with China during the 8th and 9th Century. It is not easy to presume the hull type and trade formal of Chang Po Go's Jiao Yi Ship of the 8th and 9th Century.

Studying on the ship type of the trade ship is the urgent problem to be solved, in the sphere of leaning about the history of communication between China and Korea.

The authors take the initial probe into this subjects, by researching Chang Po Go's marine activities, and point out that the trade ship's original type should be the Sha Ship which was the sea ship sailing the sea in northern China, in the Tang Dynasty.

This study aims to present materials concerning hull forms of Chang Po Go's Jiao Yi Ship by analysing ancient voyage history, foreign trade history, and ship history of Silla, Tang and Japan during the 8th and 9th century.

1. Introduction

The Jiao Yi Ship(交易船) was a sea ship, used By Chang Po Go's(張保臯) The Silla(新羅) Great sea merchant, in the marine trade with China during the 8th Century A.D. and 9th Century A.D.

Chang Po Go's achievements about the marine activity and trade in East Asia are recorded in the history of the marine trade. But it is regrettable that documents on Chang Po Go's Jiao Yi Ship(交易船) can scarcely be found.

Research on Chang Po Go's marine activity is important because it enables use to infer the sea route and the ship type and structure of the Jiao Yi Ship(交易船) employed in

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the marine trade.

The study of the Jiao Yi Ship(交易船) type is closely related to the investigation of the history and the territory of activity in the marine trade between Unification Silla(統一新羅) and Tang Dynasty(唐).

We can infer that the Jiao Yi Ship(交易船) was a Merchant Ship(貿易船) when Chang Po Go's opened up trade with Silla(新羅), Tang and Japan.

We can assume that the type of Jiao Yi Ship(交易船) is that of Tang Ship(唐船), but first of all, it is necessary that we begin to study the level of shipbuilding technique of Bai Ji(百濟) and Silla(新羅) in the Tang age. Yet it is frustrating that the historical documents on the subject cannot be found.

But we believe firmly that Chang Po Go's Jiao Yi Ships(交易船) were navigated in the 8th and 9th Century, and so those who made the Jiao Yi Ships(交易船) had a good knowledge about the comparative characteristics of each ship made in Tang, Silla and Bai Ji(百濟) at that time, and also those who operated the Jiao Yi Ships(交易船) had a good navigation technique.

Therefore, we can estimate that Chang Po Go's Jiao Yi Ships(交易船) were equipped with excellent installations, and might have strong ship structure and good capacity.

It is doubtful to argue that every Jiao Yi Ship(交易船) was made by the Sillaian in Tang. Yet we can infer that they could not help taking Tang Ship(唐船) as its model when they made ships because of geographic conditions.

This paper aims to provide not only materials about the comparative study on the type of Chang Po Go's Jiao Yi Ships(交易船) but also the history of Jiao Yi Ships(交易船) involved in marine activities of Unification Silla, Tang(唐) and Japan.

2. The Sea Route of Tang and Silla Jiao Yi Ship

First of all, I want to examine the sea route of Jiao Yi Ships(交易船) by inferring the way the Jiao Yi Ships(交易船) could sail across the Yellow Sea by wind force only, conquering currents and winds.

The sea around many countries of East Asia is classified into several sections. Tang, Silla, and Japan are connected together by the sea in the east of China. And this sea is extended from north to south and is divided into four sections.

The sea which is located in the north of Shandong Peninsular(山東半島) is Bo Sea(渤海), the sea from Shandong Peninsular to the entrance of Yang Zi Jiang(揚子江) is the Yellow Sea, the sea from Yang Zi Jiang to Taiwan(臺灣) and Liu Giu(琉球) is the East Sea which is called the doing zhi na hai(東支那海) or the Sea in East China and the sea of south and west of the Pacific Ocean is the South Sea.

First, we should examine the sea route of ancient Jiao Yi Ships(交易船) across the

Yellow Sea. Because of the geographic conditions such as currents and the direction of wind, Jiao Yi Ships(交易船) could not sail from the north port of the central Xiong Jin Peninsular(遼津半島) to Shandong Peninsular.

We can assume that Chang Po Go's Jiao Yi Ships(交易船) sailed from Chi Shan Po(赤山浦) to Xiong Jin Peninsular(雄津半島) by a north-west seasonal wind and advanced southwards along the coastline. We can confirm that the sea route of Jiao Yi Ships(交易船) in Unification Silla age was recorded in Japanese Monk Ennin《入唐求法巡禮行記》

We should examine the sea route between Tang and Japan in Unification Silla age. The coastal route was extended from the northern part of China through Deng Zhou(登州), Mi Zhou(密州), Hai Zhou(海州) in He Na Dao(河南道) to Chu Zhou(楚州), Yang Zhou(揚州) in Huai Na Dao(淮甯道), Ming Zhou(明州), Quan Zhou(泉州) in Jiang Na Dao(江南道), and Guang Zhou(廣州) in ling Na Dao(嶺南道) along the Chinese coastline. And Yang Zhou(揚州) at the northern beach of Yang Zi Jiang(揚子江) became the border of the south-north transportation.

Continuously, the route was extended to Xing E(襄鄴) along the Jiang Xi(江西), and up north to Luo Yang(洛陽) through a canal, and advanced southwards to Kang Zhou(杭州).

As a result, the south-north route and the east-west route were formed. Therefore, the route to Yang Zhou(揚州) through Luo Yang(洛陽) along the south-north coast of China was connected to Kang Zhou(杭州) great canal, and was extended to south and north from Yang Zhou(揚州).

There were two sea routes of Jiao Yi Ships(交易船) in Unification Silla age. One was the north route to Deng Zhou(登州) in Shandong Peninsular, and the other was the south route to Ning Bo(寧波) or Quan Zhou(泉州).

The business men at that time should know how to utilize seasonal winds. Thus they sailed from the port towns of Jiang Su(江蘇), Zhe Jiang(浙江) to Japanese Islands with the South-West seasonal wind in June and July, and returned with the North-East seasonal wind in August and September. Before opening of the route there had been another route from Chu Zhou(楚州) in the mouth of Yang Zi Jiang(揚子江) by way of sailing to the north near the Chinese coast and Shilla which had the favorable relationship with China.

The China and Japan trade turned on the Song's ships, for Japan closed her door to foreigners and the Japanese people couldn't have shipbuilding capacity like Song's.

We can see the shipbuilding capacity of Japan in the phrase that 「費工甚多，費材甚大，非大力未易造也」 and the phrase 「其底平，不能波浪」 shows that the Japanese ship sailed slowly and were not safe in sailing.

While the phrase 「上平如衡，下側如力，可波浪而行，舟師職地理，夜則視星，晝則視日，陰晦視指南針」 shows that the Chinese ships of the Tang Dynasty were grand and safe

enough to load two thousands bags of rice, getting solidity.

Examining Japanese Monk Ennin daily 《入唐求法巡禮行記》, we could assume that Jiao Yi Ships(交易船) sailed through Ming Zhou(明州) route, and the ships employed in sea transport might be the Merchant ships of Silla.

3. Hull Form Property of Tang and Silla Jiao Yi Ship

In order to understand Jiao Yi Ships(交易船) of Tang age, we need to know the ship type employed in four sea areas of the Chinese east coast.

We can assume that the ship type in the northern sea area was Sha Ship Type(沙船型), Fu Ship Type(福船型) in the south eastern area, and Guang Ship Type(廣船型) in the southern sea area.

If we consider that most of the marine trades between Tang and Silla was carried out in the north of the Yellow Sea and in the East Sea, and we consider that the Bei Yang(北洋) sea route was located in the northern sea area, the Jiao Yi Ship(交易船) type might be Sha Ship(沙船) which adapted itself to the conditions of the north sea area.

The ancient seamen know well the special configuration of Shandong Peninsular in the Bei Yang(北洋) sea area and had excellent navigation skill for hidden sandbanks and shoals.

It was also very difficult to sail because the coastline of Han Peninsular(韓半島) west coast was long and the depth was shallow.

Sha Ship(沙船) is flat bottom type ship and is also composed of square stem part and stern part.

Due to the flat bottom type, Sha Ship(沙船) can ensure capacity and draft and would not overturn easily in sailing across low draft area.

Moreover, Sha Ship(沙船) was used both in the sea and in the river through canal in north China areas. Sha Ship(沙船) had a ship type which was developed in Tang age and it was used not only as river ship in inland area but also as sea ship in northern sea coast area.

For example, the sea was shoaly and calm at the regions in the Yellow Sea and East China sea. So the ships had wide and long forms. Its bottoms was flat for easy beach-landing. On the contrary, the sea was deep and surgy at the regions in the South China Sea. The value of L/B was large at the ship in this region.

The coastal ships were built in wide form and were excellent in the initial stability. Sea-going ships had rather long and narrow Hull form. So, they were high speed and excellent in the direction stability.

According to the measurement on the dimensions of the ship bodies, the usual ratio of length to width of the traditional Chinese wooden sailing ships was between 2.4 and 2.6.

Suppose the length of 1000-dan Jiao Yi Ship(交易船) was 10 Zhang(30m), the width should be 4 Zhang(12m). Such ships were the broad ones.

We can assume that the medium and small sized of Jiao Yi Ship(交易船) in Tang was 400 dans-1,000 dans as dead weight tonnage, and 24,000 tons-60,000 tons as weight tonnage.

4. Sea Route of Chang Po Go's Jiao Yi Ship

We need to think of two types of sea routes for marine trade and activities with Tang, Unification Silla, and Japan in the 8th and 9th Century.

As previously stated, the first sea route is the one across the Yellow Sea which Chang Po Go's Jiao Yi Ships(交易船) advanced southwards along the coast of Unification Silla starting from Chi Shan Po(赤山浦) and crossing the Yellow Sea.

This route is called Chi Shan(赤山) sea route. We can confirm these facts in Japanese Monk Ennin daily 《入唐求法巡禮行記》

The second sea route is the Ming Zhou(明州) route on which ships sailed across the Yellow Sea obliquely.

If ships used the Ming Zhou(明州) route, they could reach their destination more rapidly than using Chi Shan(赤山) route in windy spring and summer season.

This route started from Quan Zhou(泉州) or Ning Bo(寧波) in the south of Shang Hai(上海), passed through Ji Zhou Island(濟州道), and reached Qing Hai Zhen(清海鎮) in Wan Do Island.

The Jiao Yi ship's(交易船) type is divided into the flat bottom type ship and the round bottom type ship according to sea routes, that is, whether a Jiao Yi Ship(交易船) used Chi Shan(赤山) sea route or Ming Zhou(明州) sea route.

4.1 Jiao Yi Ships of Chi Shan Sea Route

Chi Shan(赤山) sea route is the route which Chang Po Go's Jiao Yi Ships(交易船) started from Chi Shan Po(赤山浦), crossed the Yellow Sea, and sailed along the coast of Unification Silla.

The documents about the Chi Shan(赤山) sea route appear in Japanese Monk Ennin Daily 《入唐求法巡禮行記》

Therefore, Chi Shan(赤山) sea route was the one which the Jiao Yi Ships(交易船) used for official trade in order to pay tribute among Tang, Unification Silla and Japan.

The type of Chang Po Go's Jiao Yi Ship(交易船) which showed its navigation excellence and safety on the sea route crossing the Yellow Sea might be the type of Sha Ship(沙船).

Geographic characteristics of the east coast of Tang were similar to those of the west coast of Silla. Therefore, we can assume that the Jiao Yi Ship's(交易船) type might be Sha Ship(沙船) which was the flat bottom type ship.

It is no wonder that Sha Ship(沙船) was the peculiar model in Unification Silla age because the excavated ship of Wan Do-Gun and Dalli Do was flat bottom type ship.

Because Sha Ship(沙船) could sail against winds, it is convenient for the Sha Ship(沙船) to sail on the north sea route. But the Sha Ship(沙船) is inconvenient on the South Sea route because it was flat bottom type ship.

Therefore, the Sha Ship(沙船) is regarded as ship type well accommodated to the geographical characteristics of the navigation course including the downstream of the Chang Jiang River(長江), Zhe Jiang Sheng(浙江省) and the west sea of Silla.

Chang Po Go's Jiao Yi Ship(交易船) exerted a great influence on the shipbuilding techniques of early Koryo(高麗), Early Koryo was devoted to carrying and used Shao Ma Chuan(哨馬船), the carrier capable of loading 1,000 dans(石), when it ships grains from the rich grain district of the west coast through a sea route.

4.2 Jiao Yi Ships of Ming Zhou Sea Route

In Unification Silla, Jiao Yi Ships(交易船) started from Deng Zhou(登州) of the Shandong Peninsular and used the crossing route of the Yellow Sea, not the sea route of Lao Tie Chan Si Dao(老鐵山水道). The sea route which local merchants of Quan Zhou(泉州) and Silla merchants used was route of yellow sea route of Hsieh Tuan(黃海斜斷航路).

The sea route of Ming Zhou(明州) can be regarded as the one of Yellow Sea route of Hsieh Tuan(黃海斜斷航路) which connects Ning Bo(寧波) and Quan Zhou(泉州). Jiao Yi Ships(交易船) using the sea route of Ming Zhou(明州) voyaged Tang, Unification Silla and Japan taking advantage of the seasonal winds in summer and fall.

It is proved that private Jiao Yi Ships(交易船) used the Yellow Sea route of Hsieh Tuan(黃海斜斷航路) before the establishment of Chang Po Go's Qing Hai Zhen(清海鎮).

The north-west current of the South Sea at the ebb is faster than the south-west current at the flow, because it joins the north-east warm current of Taiwan(臺灣).

Wan Do Island, where Qing Hai Zhen(清海鎮) was located, was in the Taiwan warm current district.

Therefore, those who freely voyaged the Taiwan warm current district were the people of Silla living in Tang and they might use Silla Jiao Yi Ships(交易船).

In spring or summer, seasons of wind, they could voyage faster than in other seasons.

Leaving Quan Zhou(泉州) or Ning Bo(寧波), which were at the south of Shang Hai(上海), rather than leaving Shang Hai(上海) was easier to approach the Taiwan warm current region.

Which ship type Chang Po Go's Jiao Yi Ship(交易船) for how own private trade in the sea route of Ming Zhou(明州). ?

Chang Po Go's Jiao Yi Ship(交易船) being sail ship, voyaged the sea route of Ming Zhou(明州) for private trade and took advantage of the rough Taiwan warm current region.

Because the type of the Jiao Yi Ship(交易船) was the sea ship, there was a possibility that it might be the Silla Jiao Yi Ship(交易船) which had the flat bottom type ship of round bottom type.

We restored the Duck Pan Ship of Ji Zhou Island(濟州道) and the Ke Ju Island Ship(可居島船) as traditional ancient Han Ship(韓船).

The restored Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship were the flat bottom type ship of round bottom type.

Though we think of the flat bottom type ship as river ship, the sea ship of round bottom type is a kind of the flat bottom type ship.

It is peculiar that the structural form of the duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship is the flat bottom type ship of round bottom form.

The stern part of the Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship is sharply curved at the rear and is similar to the form of the traditional transom stern of China's ancient ship.

Besides, the Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship are Two Sail's Sail Ship(唐道里船) with two masts set up.

The bottom form of the Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship is the flat bottom type ship of round bottom type, different from that of the Sha Ship(沙船) of the flat bottom type ship used for the crossing route of the Yellow Sea.

5. Characteristics of Hull Structure of Jiao Yi Ship

Compared Han Ship(韓船) to Chinese Junk Ship, both had Flat Bottom Planking and no frame, but Han Ship had a different structure method in other parts from Chinese and Japanese types.

It mean that the unique structure method of Han Ship(韓船) was already established in the former term of Koryo(高麗) Dynasty, and that the method was to combine Ga-Rong-Mok(駕龍木) with Flat Bottom Type and to joint Bottom Planking to Garboard Strake.

Koryo Ship had Flat Bottom type. It's Keel Planking used Bottom Planking was strong and connected Transverse Scantling Member. As Ga-Rong-Mok(駕龍木) was unfit to V-Bottom Type(尖底型) structure with curved hull section form, Hull Type was considered as Flat Bottom Type.

The Rabbetted Clinker Joint Method between the stern part and middle part is gradually converted to shiplap joint method between the middle part and the fore part. By the shiplap joint method, the upper part of the shell planking is fastened to the lower part of the shell planking

Because of no frame and no Bulkhead made of Flat Planking in the structure of Han Ship(韓船), Ga-Rong-Mok(駕龍木) played the role in preserving Transverse strength and dividing the section of Hull instead of Beam, Frame and Bulkhead.

The number of places equipped with Ga-Rong-Mok(駕龍木) was different according to the ships, but was not large. Beam should be equipped on Ga-Rong-Mok(駕龍木) too and the intervals of Beam were generally far. It was considered as Strength Scantling Member equal to Web frame.

The structure method of shipbuilding can be the same as the type of Han Ship(韓船) structure in principle of China Ancient ship.

The building processes such as establishing bottom planking, fixing up shell planking, positioning transverse bar of both sides shell planking, reinforcing the ship body, setting up the strong beam on which installs the deck house are nearly the same as the Han Ship(韓船) structure processes of fixing garboard strake to the bottom planking on which making shell planking upward, setting up Ga-Rong-Mok(駕龍木) to the both sides shell planking, giving transverse strength to ship hull, establishing beam of Ga-Mok(駕木) at the upper end shell planking, on which fixes deck house.

5.1 Flat Bottom Keel

The keel is the important scantling member to maintain the longitudinal strength of hull. The Sha Ship(沙船), used for trade in 8th-9th Century, was the flat bottom type ship.

The characteristic of the type of the Sha Ship(沙船) was the structure of flat keel which enabled the ship to go beyond the sand bank. The keel of flat type was embedded between two narrow thick boards at the center line of the ship, and the keel of the center was wide in breadth. This is called flat keel of center bottom.

It is surprising that the form of bottom structure in the Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship is similar to the characteristics of the type of the Sha Ship(沙船) mentioned before. When we examine the characteristics of the bottom structure type of the Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship, the Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship are the flat bottom type ship.

The bottom has two or three sheets of flat keel attached, and three sheets of flat keel are general.

5.2 Watertight Bulkhead

The installment of watertight Bulkhead was one traditional Shipbuilding technique exclusive to ancient China.

These watertight Bulkhead separated the ship into many independent and interlinked cabins.

- One was enhancing the crosswise strength and preventing the ship body from being twisted and deformed by the linked partitions,
- The other was enhancing its sinking resistance by these watertight cabins.

In case one single cabin leaked and had water inflow, sea water won't flow into other cabins. Taking a look at the watertight bulkhead of the Stem part used for special purpose in China's ancient ship like the shipwrecked ship of shin An(新岸), we can see that the shell plate of the fore peak spaces was perforated in order for the fore peak tank of the stem to meet the sea and water was allowed to flow in and out freely.

When sailing, it played a role of damping equipment which could not only bring about pitching damping effect but also decrease pitching.

5.3 Poop Deck and Forecastle Deck

The poop deck and the forecastle deck are the superstructures of the ship, and enabled the seamen to see the foreward and were used as space for seamen's work and living.

The stern part in the Duck Pan Ship of Ji Zhou Island and Ke Ju Island Ship is sharply curved, and this kind of structure is similar to the traditional structure of Chinese poop deck.

The stem and stern form of Ancient Chinese Ships doesn't advantage for sea going, the vertical transom stern is ready for establishing slung type axial vertical rudder, making effective in fixing slung type axial vertical rudder and direction stability because of its height of stern part.

Slung type axial vertical rudder which is figured from the stern part structure type like most the ancient oriental ships make, effect in driving efficiency against the winds because it is established in slide toward the front of bottom planking, preventing the rudder from being damaged in the case of navigation on collision, and also keeping the ship from going astray of direction draft resultion from the irregular wind direction and wind force.

6. The Sea Trade Activity of Chang Po Go's Jiao Yi Ship

The aspects of the sea activity in Korea changed after Silla had conquered all the Three Kingdoms(三國時代). While there had been an activity of Silla navy force against

Gao Gou Li(高句麗) and Bai Ji(百濟) before the unification, its sea activity turned its aims into the economic and cultural purpose.

So Silla's trade with China began at that time. As a result of the political unification of Unification Silla, the production of goods increased, and the demand of the Chinese goods rose. Trade by the merchant ships become very active between Silla and China to perform the official trade(官貿易) with the Qian Tang Shi Ship(遣唐使船) and the civil trade(私貿易). A new village of the Silla people went up on the Chinese coast sites, San Dong area and Jiang Su(江蘇) area, which were called Silla Bang(新羅房). In order to manage the village Silla established Silla Cheo(新羅焦) there.

We can not closely examine whether Chang Po Go's Jiao Yi Ships(交易船) were modelled on the peculiar ship of Unification Silla, were modified by the shipbuilding method of Silla and Tang, or were modelled on the Tang Ship.

How the people of Gao Gou Li(高句麗), Bai Ji(百濟), and Shilla(新羅) could build the ships ?

Since we can't find the exact record of it, we can assume its model from the Chang Po Go's ships.

We can presume that there were two types of Jiao Yi Ships(交易船) which Chang Po Go's built in those days.

- 1) A case that Chang Po Go's used Tang Ships while taking office as Wu Ning Jun Jie Du Shi(武寧軍節度使) in Tang because he exerted himself for trade with Tang.
- 2) A case that the ship was built by blending the peculiar shipbuilding technique of Unification Silla with Tang.

The sea route was the shortest one connecting San Dong Peninsula with Yo Dong peninsula as in the fourth picture, which sailed along a series of islands in the vicinity of No Chol San Soo Do(老鐵山水道).

The marine soldiers of the Han(漢) and Sui(隋) Dynasty utilized the sea route in order to Invade Gao Gou Li(高句麗) in the late 6th Century and in the beginnings of 7th Century. The marine soldiers adopted Tower Ship(樓船) as marine ships. The ships might have more simple structure than the Tower Ship(樓船) like 「武經總要」 of the Song(宋) Dynasty. Like these ships the ships which were useful to Chang Po Go's might have been a Tower Ship(樓船).

But we can also assume some possibilities of devices which Chang Po Go's Jiao Yi Ships(交易船) might be equipped with.

- 1) A possibility that Chang Po Go's Jiao Yi Ships(交易船) might be a type of Tower Ship(樓船) which was equipped with a cabin on the upper part.

Tower Ship(樓船) was developed as a military ship at first in China. But Silla people could grope the model of Tower Ship(樓船), for the Chinese invaders came to Korea in the ships.

Gradually the Tower Ship(樓船) was available in sending Envoy Ship(使臣船) or Jiao Yi Ship(交易船) as well as military purpose. The Jiao Yi Ship(交易船) of the Koryo(高麗) age was regarded as Tower Ship(樓船) type with the board cabin, which can be divided into two models: Pung Jun Shun(平駿船) and Ru Jun Shun(樓駁船). Chang Po Go's merchant fleet must have set up accommodation cabin for the merchants in order to sail against the gale around the sea of the three countries Silla, Tang, and Japan.

- 2) A possibility that Chang Po Go's Jiao Yi Ships(交易船) might be flat bottom type ship

As we wrote up in the previous pages, his ships cannot have been a v-bottom ship(尖底型船).

It is because the ships were coast liner by way of northern sea route from Shandong Peninsula(山東半島). Since the Tang dynasty in the 9th Century was declining Sha Ship(沙船) was developed, utilized for the domestic transportation, the foreign trade, and Envoyes Ship(使臣船).

- 3) A possibility that Chang Po Go's Jiao Yi Ships(交易船) might be equipped with two oars and masts or more.

His ships sailed back and forth through the sea of Silla, Tang and Japan. It is impossible for them to sail on the sea without a superior skill of navigation and handling sails. So we call it Multi - Sails Ship(多檣帆船)

7. Conclusions

As stated previously, we can sum up the type of Chang Po Go's Jiao Yi Ships(交易船) used for marine activities in the Yellow Sea in the age of Unification Silla of 8th-9th Century.

- 7.1 When Chang Po Go's was engaged in official trade in the sea route of Chi Shan(赤山), he used the sea ships of sail-oar as the flat bottom type ship.

It is guessed that when he was engaged in private trade, his Jiao Yi ships(交易船) were the sea ships of sail oar(櫓) as the flat bottom Jiao Yi Ship(交易船) of round bottom type.

Therefore, Jiao Yi Ships(交易船) which Chang Po Go's used for marine trade are judged as the type of Unification Silla's Jiao Yi ship(交易船).

- 7.2 Chang Po Go's Jiao Yi Ships(交易船) are mostly the sea ship of sail-oar as the flat bottom type ship and are used in the area as like the crossing route of the Yellow Sea from Shandong Peninsular(山東半島) through Tang and Silla to Japan.

Jiao Yi Ships(交易船), which voyaged the Yellow Sea route of Hsieh Tuan(黃海斜斷航路) connecting Ming Zhou(明州) and the adjacent seas of Ji Zhou Island(濟州道), Qing Hai Zhen(淸海鎮) in Wan-Do Island (莞島), and Japan, are considered to be the sea ships of sail-oar(帆檣) as the flat bottom type ship.

- 7.3 We can say that Chang Po Go's Jiao Yi Ships(交易船) might have the bottom structure of the flat bottom type and adapted the method of the flat bottom type ship which Tang(唐) used for shipbuilding of the Sha Ship(沙船).

It is also true that the shipbuilding technique of Unification Silla adapted the type of ship of the Sha Ship(沙船) of Tang dynasty.

It is viewed that the flat bottom type ship of round bottom type appears in the Duck Pan Ship of Ji Zhou Island(濟州道) and Ke Ju Island Ship(可居島船).

- 7.4 Jiao Yi Ships(交易船) of Unification Silla had Ga-Rong-Mok(駕龍木) installed on the shell planking and was the flat bottom type ship with the shell planking of bottom fixed with Chang Shou(長槳).

The type of ship is a grooved clinker type ship. The Tang ship(唐船) had the structure of watertight bulkhead without frame, and its bottom type was the flat bottom type ship of round bottom type with flat keel established. It is presumed that the type of ship was a rabbetted clinker type ship.

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