

Research on the Calcination Craft and Artistic Styles of Chinese Jun Porcelain

Huihuang Jiang^{1,*}

¹School of Art, Soochow University, Soochow, Jiangsu, China

*Corresponding author. Email: dhl2011@163.com

ABSTRACT

Chinese ceramics has a long history, and it has very outstanding results in the ceramic calcination craft. This article mainly combines the development of Jun porcelain in the Song Dynasty, and expounds the properties, structural features and artistic styles of different types of Jun porcelain in various stages, including excavating and analyzing the calcination craft of Jun porcelain in the Song Dynasty to get the development of Jun porcelain. At the same time, this article also attempts to analyze the calcination craft of Jun porcelain kiln, in order to show the style and features of Jun porcelain in the firing process, and provide a powerful reference for the existing research on Jun porcelain.

Keywords: Jun porcelain, calcination, craft

I. INTRODUCTION

Ceramics is a great invention in the history of China. The original celadon was fired as early as the Shang Dynasty. The superb skills and long cultural tradition of ceramics are worthy of inheritance and continuous development and broadcast. In the history of ceramics, the most mysterious and eye-catching period is undoubtedly the Song Dynasty. As one of the five famous porcelains in the Song Dynasty, Jun porcelain was first burnt with red copper glaze using reduced flames in its processing, forming a dignified, majestic, bizarre, mysterious and changing artistic style, which is unique among porcelains.

II. OVERVIEW OF CHINA JUN KILN

Jun kiln is one of the five famous kilns in the Song Dynasty in China. Jun porcelain was created and burned in the Tang, flourished in the Song Dynasty, restarted to fire in the Jin and Yuan Dynasties, and continued to be imitated until the Ming and Qing Dynasties. Jun porcelain is dignified, beautiful, and the colors are gorgeous and various. The fetus is delicate, firm and dense. The knock sound is strong, crisp and beautiful, round and sweet, just like metal. The glaze is shiny and smooth, simple and elegant, and beautiful, especially in a variety of fames that are inferior to other kiln products. The glaze is purple in red, blue in purple, white in blue, and red in white, which is colorful. The ancients used the verse of "绿如春水出生日, 红似丹霞欲出时 (green as spring water just born, red as when rosy clouds is about to emerge)" to describe the changeable glaze color and the subtle beauty of fames.

In terms of nature, Jun kiln has two systems: official kiln and folk kiln. Jun official kiln produce ceramics for the court, and Jun folk kiln is mainly for private use. The former products are mostly furnishing porcelain, arty, for the purpose of viewing, and the products do not enter the market. The latter mainly produces household appliances, which is purely commodity nature.

Jun official kiln was developed on the basis of folk kiln. Jun kiln has been generally mature in technology from the creation of firing in the Tang Dynasty to the beginning of the Northern Song Dynasty. The successful firing of Jun porcelain copper red glaze was loved by the court. It was also popular among the public. Therefore, the kilns competed to imitate. During the Huizong period of the Northern Song Dynasty, the folk kiln workshop near the ancient Juntai were monopolized to be the official Jun kiln. From then on, the kiln exclusively produced imperial Jun porcelain according to the needs of the palace. Mainly furnishing craft porcelain and the Four Treasures of the Study, the shape is more simple and dignified. When the official kilns of the Northern Song Dynasty flourished, it was also the time when the folk kilns declined. On the one hand, the Jun kiln monopolized high-quality raw materials; on the other hand, it concentrated private craftsmen, and prohibited private production, and the official kiln products were not allowed to be scattered among the people. All of these restrained the promotion and popularization of Jun kiln technology.

III. STRUCTURAL FEATURES OF CHINESE JUN PORCELAIN KILN

Jun porcelain kilns have large kilns and small kilns, with volumes ranging from 20 cubic meters, 7 cubic meters, 1 cubic meter, and half cubic meters. From the appearance, they are divided into round kilns, square kilns, cave kilns and duck egg kilns. The bottom of the kilns generally has three types: Bagua bottom, centipede bottom and Dawo circle. Chimneys are divided into two types: round and square. Fire gates include flat gates, vertical gates, and square gates. In many different Jun porcelain kilns, through talking with the kiln workers, the following structure is relatively reasonable, (taking 6-7 cubic meters as an example) the chimney is 12 meters high, and the flue is about 50cm × 70cm; The chamber is about 90cm × 120cm; the flue should be straight or slightly curved, with a length of about 5-7 meters and a certain inclination; the bottom of the kiln should be Bagua bottom, and the fire hole can be enlarged or enlarged according to the specific situation. Only in this way can it be well ventilated, add fire and save effort, and it is convenient to discharge the ash. In the firing method, there are generally two types of fast firing and slow firing. The so-called fast firing means that the time between adding the fuel is short, the fuel added is little, and the number of times is more. In the mid-reduction stage, the gate should be appropriately increased, but it should not be too fast in the later stage. Slow firing means adding more fuel at one time, with a long time between adding fires, and lowering the ram in the middle stage. It is easier than controlling faster firing. In general, fast firing is suitable for small kilns.

In the process of firing the kiln, the time to cover the sky eye is also a link that cannot be ignored. Generally, when firing Jun red glaze, the time to cover the sky eye should not be too early. Especially when the chimney pull is not strong, it is not suitable to do it too early, because when the cover is too early, it will easily increase the temperature difference between the upper and lower parts and cause the exhaust gas in the lower half can not be emitted, causing the condition that the glaze becomes black. The best time is generally to cover the sky eye when the kiln bottom is red. Because of the different conditions of each kiln, the glaze color is different, and the pulling force is different, the time to cover the sky eye is either early or late, depending on the situation.

IV. CHINESE SONG JUN OFFICIAL KILN DOUBLE FIRED WOOD KILN FIRING TECHNOLOGY

A. Archaeological excavation of Jun official kiln in Song Dynasty

In the porcelain area near Juntai kiln, archaeologists have unearthed seven kilns for firing Jun porcelain. The kiln bodies of the Song Dynasty that have been discovered are round, horseshoe, and rectangular. The kiln chamber is small in size and simple in structure. It consists of four parts: kiln door, fire chamber, kiln chamber and chimney. Two of them are relatively complete. One is a steamed bun kiln (inverted flame kiln) that is common in the north, and the other is a rectangular kiln with a double breast-shaped chamber ("Fig. 1"). This kiln has a special design and is unique in the history of kilns in China and foreign countries. The kiln body is dug and built on the spot, with a south-to-north kiln room, and the kiln room is east-west rectangular, with two breast-shaped fire chambers side by side on the north side of the kiln room. There is a circular fire hole in the east fire chamber and a kiln door in the west fire chamber. There is a square chimney above the fire chamber, and a kiln door is provided on the back wall of the kiln room. There are chimneys on the left and right corners. The academic circles believe that this design has a special function for the burning process from oxidizing flame to reducing flame. It is also conducive to the control of reducing flame atmosphere and the formation of multi-color kiln glaze. The biggest feature of ancient Jun porcelain kilns was the earthen kiln dug deep in the flat ground. This kind of underground kiln not only has strong heat preservation performance, but also its firing system is easy to control. It is an ideal kiln for burning reduction flame. This performance is very beneficial to the blue opalescence effect caused by the liquid-liquid phase separation during cooling.



Fig. 1. A rectangular kiln with a double breast-shaped chamber.

From the perspective of the firing of Jun glaze, Jun porcelain is fired in a reducing atmosphere of about 1250 Celsius degrees, and its firing temperature is higher than that of the kilns in the same period in the north. The firing process requires the transformation of

oxidizing atmosphere and reducing atmosphere. Compared with dragon kiln in the south, its temperature rise and cooling are slower, which is beneficial to the liquid-liquid phase separation in the cooling process. However, the long firing time increases the difficulty of firing control. This difficulty mainly means that the color development of copper oxide is particularly sensitive to changes in the atmosphere in the kiln, and changes in the concentration and purity of the atmosphere will have an important effect on the color of the glaze. In the longer firing process, if the atmosphere changes slightly and deviates from the required standard, all previous efforts will be lost. Therefore, Jun porcelain kiln is precious in firing.

B. The restored Jun porcelain calcination craft of Song Dynasty

The Jun Porcelain Kiln Museum in Yuzhou City restored the double-fire chamber kiln of the Song Dynasty ("Fig. 2"). The imitated Song Jun double-fire chamber wood-fired Jun porcelain kiln was designed and built completely according to the wood-fired kiln unearthed from the Song Jun official kiln site. Its shape, internal structure, and firing principle are all the same as the original kiln. The furnace body is 2.2 meters long, 1.4 meters wide, 1.6 meters high, and has an internal capacity of about 4 cubic meters. The double chimney is 6 meters high. It is an inverted flame wood-burning kiln.



Fig. 2. Restored double-fire chamber kiln of the Song Dynasty.

The successful trial firing of this kiln solved some academically controversial issues. For example, some people think that this kind of kiln is used to make low-temperature crock pottery, not to make Jun porcelain. Researchers holding this view generally believe that firewood burning does not reach the temperature required to make Jun porcelain. In addition, the previous firing methods of this kiln were only theoretical inferences. The inferred burning method is: when installing the kiln, first it needs to fill the auxiliary fire chamber with wood and then paste the fire chamber to fire. When the fire chamber is hot, the temperature of the sagger near the fire chamber gradually rises, and smoke gradually emerges from the

chimney closest to the fire chamber. In the process of heating up by adding firewood, the flow of fireworks in the kiln is adjusted by blocking the chimney opening. When the temperature reaches a certain level, the firewood stored in the other firebox gradually turns into charcoal due to lack of oxygen. In the "tapping fire" stage, these charcoal can produce a large amount of carbon monoxide, strengthening the reducing atmosphere in the kiln. This method can better solve the problem that the reduction fire is not easy to heat up in the high temperature stage, and generate a good atmosphere to promote a good "fambe". On the one hand, the time from ignition to burning and stopping the fire is generally about 20 hours. Firewood must be added every few minutes. In this way, the firewood filled before burning will burn out in a short time, and it will not last for the high temperature stage. On the other hand, during the kiln firing process, the concentration of carbon monoxide in the reduction stage is not released by incomplete combustion of a small amount of wood. In addition, in the kiln firing process, it requires a combination of fast and slow. When the temperature is reached, it needs to stop the fire and keep the neutral flame to burn flat. The double-fire chamber and double-burner design is to increase the combustion area on the one hand, and on the other hand to alternately add firewood to prevent excessive cold air from entering the furnace to cause a sudden drop in furnace temperature. The firewood burning is long, the fire is mild, the heating process is tortuous, and the characteristics of the kiln itself are conducive to the formation of the natural fambe effect. The glaze of the works fired in this kiln is thick and dignified, with crystal-clear jade ("Fig. 3", "Fig. 4"). Compared with coal-fired and gas-fired Jun porcelain, it is more beautiful and elegant, solemn and simple, naturally shaped, with a unique artistic style.



Fig. 3. The glaze of the works.

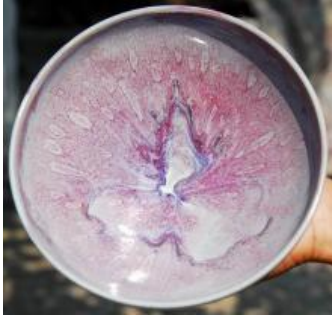


Fig. 4. The glaze of the works.

C. Research and new exploration of Jun porcelain furnace firing

Furnace Jun process is a unique process method developed during practice. The process is characterized by the use of a simple small bellows kiln and the method of covering the fire with coke for rapid firing. Its products are simple and vigorous, the glaze is crystal clear and gorgeous, and the imagery is novel and unique. The Qing Dynasty kiln ("Fig. 5") is a rising flame structure, with an inner diameter of about 40 cm and a depth of about 50 cm. Using coke as fuel, it requires adding fuel all at once until it is finished. It has strong firepower, pure anger, long-lasting endurance, and the entire firing cycle is about two hours. When firing the kiln, it needs to first spread firewood on the bottom of the kiln, add about three centimeters of coke after being ignited, and add another 20 centimeters of coke to the kiln and tamped properly. It also needs to put a sagger on the top, and add coke around the sagger, which the height is at level of the sagger. Then it is to connect the bellows for ventilation. Firing in furnace kiln in the Qing Dynasty was very difficult. There are several problems. The fuel is added at one time. Because the kiln is small and the fuel needed at a time is small, the quality of the fuel directly affects the amount of heat generated, so scientific calculations cannot be made. If the fuel quality is poor or the addition is insufficient, the heat will be insufficient, the temperature will not rise, and the glaze will not be burned. On the contrary, if the temperature is too high, foot flow is easy to occur, and if the temperature is too high, it is easy to deglaze. The speed of the blast directly affects the burning speed of the fuel. The firing of Jun porcelain should start to reduce fire when the temperature reaches about 980. As the carbon monoxide atmosphere in the reduction stage gradually increases, the temperature rise becomes difficult. As a result, the control of the ventilation volume becomes relatively complicated. The final neutral flame flat firing stage is the last process for glaze stabilization. If the flat firing time is too long, it will cause foot flow, and if it is too short, the glaze will not be burned. It is difficult to control the carbon monoxide atmosphere

required in the reduction stage. In the reduction stage, as the shutter is closed, the concentration of carbon monoxide continues to increase, and the fuel cannot be fully burned, resulting in a slow rise in temperature at this stage. And this stage is the most critical stage of color development, but because the heat that the fuel can provide cannot be estimated, it is difficult to balance the time of reduction and the final temperature required.



Fig. 5. Qing Dynasty kiln.

D. Improved furnace firing characteristics

Based on the above problems and the performance of the kiln itself, the staff of Jun Porcelain Kiln Museum made a scientific improvement to this furnace. The improvement plan combines the advantages of both the Qing Dynasty kiln and the Northern Song Dynasty double-fire chamber wood kiln according to the actual situation to adjust the original structure. ("Fig. 6") On the basis of the original kiln structure, a fire chamber was added at the bottom of the kiln. The improved kiln is easy to operate and free to add fuel, and firewood, coal, charcoal, etc., can be used as the fuel for this furnace. The temperature can be burned above 1300 Celsius degrees. And it has good airtightness, and the atmosphere in the kiln can be well adjusted by controlling the kiln atmosphere. However, because the fire chamber is located at the bottom, although it is still an inverted flame structure, the temperature difference between the upper and lower sides cannot be avoided. Since this kiln only contains one sagger at a time, if only one piece of work is fired, the temperature difference between the upper and lower sides can be clearly seen in the fired work. If the temperature is high, foot flow is easy to occur. The best way to solve this problem is to increase the thickness of the upper and lower glaze layers. Or it can fire two smaller works. In short, the use of kilns requires flexible operation according to actual conditions.



Fig. 6. Modern kiln.

V. CONCLUSION

Jun porcelain is a comprehensive product of art and technology. It has extremely high artistic value, scientific value and archaeological value. It is not only a material product, but also spiritual wealth. Its internal quality and external form make it not only the national style of the Chinese nation, but also a strong contemporary and distinctive artistic personality. Any culture, any excellent traditional art, no matter how brilliant it has been in history, if no one inherits and develops, it is just a silent historical relic. Therefore, it is necessary to let people understand Jun porcelain, cherish Jun porcelain, and carry forward Jun porcelain to adapt to the development of modern civilization.

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