

A Chinese jar – 6th or 7th century AD



When Chinese porcelain first arrived in Europe in the fourteenth century, people were amazed by it and it was treated as a luxury item. It was thin-walled, white, translucent and hard and it was difficult to see any connection with the earthenware and stoneware pottery being made in Europe. However, in China porcelain had been developing gradually over centuries, from advances in stoneware clays and firing at increasing temperatures. Not all stoneware clays will make porcelain if fired at a higher temperature – the clay mustn't contain more than a tiny amount of iron oxide or other colouring oxides, or it won't fire white, and you need to be able to achieve a high proportion of vitrification (i.e. glass formation) without the pot softening and slumping. To form the glassy component the clay actually has to melt, so to avoid slumping it needs the right chemical and mineral formulation so that it melts relatively slowly as it is heated up, the molten glass that is formed needs to be very viscous so it only flows very slowly and, importantly, the small proportion that isn't glass needs to form a mesh-like network of long crystals (mullite) that can form a sort of scaffolding.

The development of porcelain in China was so gradual that there was never a point where they considered they had created something completely different, so they never gave it a name of its own, they just used the name they used for high-fired and well vitrified stoneware ('ci'). This has caused a bit of confusion in the technical literature as the Chinese term 'ci' is sometimes translated as porcelain even when it is referring to the earlier stonewares.

As early as the middle of the second millennium BC the potters of northern China were making unglazed high-fired (up to 1200°C) stoneware vessels, probably for use in religious rituals. Then, for some reason, they stopped and for about 1800 years they made little or no stoneware, only low-fired earthenware, though stoneware continued to be made in southern China. Although stoneware pottery has been found in northern China in tombs from this 1800-year period, chemical analysis

indicates that most or all of this was imported from the south of the country. When the potters of northern China began making stoneware again in the sixth century AD they pursued a path of development that led, by early in the seventh century, to the world's first porcelain.

The simple pear-shaped jar (27 cm tall) in the photo above, with four small lugs at the rim, is a typical shape for northern stoneware of the sixth and seventh century AD. It probably originally had a lid (held on by tying it to the lugs) and may have been used for storing wine, though it is possible that it was made specifically for use in a funeral and burial in a tomb. It is heavily potted and there has clearly been no attempt to make it thin and delicate.

It is not obvious why the northern potters stopped making stoneware for such a long time. Maybe it is because in northern China, stoneware clays are not as easy to find as the ubiquitous earthenware clays which were used for everyday pottery. Also, the earthenware clay used in the north would not survive heating to stoneware temperatures, whereas the clays used for earthenware in the south made good stoneware when fired at higher temperatures, making southern stonewares a natural development as kiln technology advanced. Maybe the imports of southern stoneware were sufficient for specialist ritual uses in the north. Clays which could make stoneware were present in northern China though, and some of them were surprisingly pure, with low levels of the metallic oxides which would colour them, so that when they were fired they were often a pale buff or cream colour. In comparison, the stonewares from the south had dark bodies and were usually given green or brown glazes. Maybe it was seeing their own pale stoneware that gave the northern potters of the sixth and seventh centuries the idea that white glazed stoneware was achievable, and their efforts to achieve this led to development of porcelain.

My jar was made on the cusp of this momentous development. It was probably fired to around 1200°C. Jars similar to mine have been analysed chemically and it has been found that the body material would have made porcelain if it had been fired to a higher temperature. The stoneware clays in north China were rather refractory and needed to be fired to high temperatures (1300°C or even 1350°C) to get the levels of vitrification needed for porcelain. It needed a development in kiln technology to achieve this – they changed the design of their kilns so that the flames and hot gases moved more slowly through the pots, allowing more effective heating.

The potters who made my jar were clearly trying to make it as white as possible – much of the pale buff-coloured body is coated with an even whiter, cream-coloured, slip. This slip was probably made from a scarce, particularly white, stoneware clay kept specifically for use as a white coating. The remnants of glaze on my pot, however, have a greenish yellow cast due to small amounts of iron in the glaze. Later, in the seventh century, the northern potters succeeded in developing almost pure white glazes.



Bare clay body bottom right, white slip coating top, remnants of glaze on left and on slip

A technical barrier to making glazed stoneware was the need to find a suitable glaze that would mature at the same high temperature as the body. As they had previously only been making earthenware pottery, when they started making high-fired stoneware in the 6th century the northern potters initially tried a lead glaze, similar to that used on their earthenware. Quite soon the potters switched to high temperature glazes made by mixing the body material with wood ash, but these were prone to running down the sides of the pot at high temperatures. Many of the jars from the sixth century were made with moulded, and sometimes elaborate, horizontal ridges to catch any glaze that was flowing down the jar during firing. Another way of mitigating the problems of running glazes was to apply them very thinly. The result of this can be seen on my jar where, sadly, much of the glaze has eroded away over time.

Another problem with these early glazed stonewares was crazing of the glaze. In principle this can be avoided by ensuring that, on cooling after firing, the body material wants to shrink more than the glaze, keeping the glaze in compression. Unfortunately, the high proportion of clay minerals in these northern-Chinese stonewares made that difficult to achieve. On my jar, in the few areas near the rim where the glaze is still relatively thick, you can see that the glaze is badly crazed, and this crazing probably hastened its erosion over time. This problem with crazing of northern-Chinese porcelain wasn't resolved until the 10th century, when the potters adjusted the glaze composition (in particular by adding magnesium oxide) to reduce the shrinkage of the glaze during cooling.



Areas of thicker glaze near rim, showing crazing

The porcelain that arrived in the West in the fourteenth century came from southern, not northern, China, where it did not start to be made until the tenth century. The southern potters also found a local material with just the right composition to make porcelain, though it was completely different from the clays the northern potters used.

Although the development of porcelain allowed many beautiful and practical ceramic objects to be made, it did have its negative side as well in my view. For me, one of the greatest pleasures in viewing and handling pottery is to feel in touch with the people who made it and used it. Often, looking at a pot, I can see how the potter made it and decorated it. I can envisage their hand movements as they shape it, as they hold it to dip it in glaze, as they wield a brush with a decorative flourish. The development of perfect smooth white surfaces on porcelain encouraged a focus on perfect form and elaborate detailed decoration, often eliminating or smothering the traces of humanity arising from simple gestures and chance variation.

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P.S. Writing this note I found myself repeatedly referring to Nigel Wood's superb book 'Chinese Glazes'. If you are interested in the subject I strongly recommend it.