

The Development of Japanese ceramic ware (pottery and porcelain) Technology as Revealed by EPMA

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Introduction

The quality of Japanese ceramics ware has improved dramatically since the importation of advanced ceramics, especially porcelain technology from the continent in the 17th century. In particular, Old Imari, (Ko-Imari), made after the 17th century using highly refined continental techniques, was loved by celebrities not only in Japan but around the world [1]. Of course, even before the 17th century, ancient Japanese pottery techniques had developed and many potteries were produced.

This report describes an observation and analysis of the development of medieval ceramics in Japan before and after the high level of ceramic ware technology was introduced.

Methods

The samples for analysis were pieces collected from the Chita kiln site [2] of Paleo-Tokoname, old pottery ware (early Sengoku period (late 800s)), the Komizo kiln site of early Arita porcelain ware (early 1600s), and the Kakiemon kiln site (late 1600s) [3] where ceramic porcelain technology was established. Thin sections were created by gluing a small piece of pottery onto a glass slide, and then grinding it. The thin sections were observed and analysed with an electron probe microanalyser (JEOL JXA-iHP200F).

Results

The backscattered electron (compositional) image (BEI) and the panchromatic cathodoluminescence (CL) image and Si mapping analysis results are shown in Figure 1. The upper part of the BEI shows the glazed part of the ceramic surface. The glazed width of the paleo Tokoname piece (Very initial period) (a) is thin and contains many impurities. Also, the Komizo piece (early period) (b) contains many impurities in the glaze, whereas the Kakiemon piece (established period) (c) contains fewer impurities. The panchromatic cathodoluminescence (CL) images show strong luminescence in the glazed areas of the Tokoname piece and the Komizo piece. On the contrary, no CL luminescence is observed in the Kakiemon piece glaze part. Also, the base of Tokoname piece shows stronger CL luminescence than the Komizo and Kakiemon pieces. Si mapping results show that the impurities in the glaze of the Tokoname piece and Komizo piece include Si-particles (Single arrows in the figure), indicating that many quartz fragments are still present. On the other hand, in the Kakiemon piece, these mineral particles are not found.

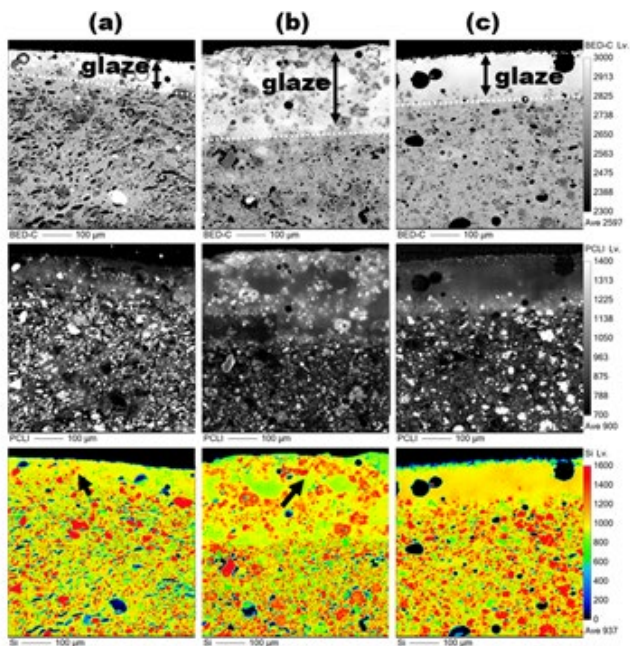
Conclusion

The BEI and CL images and Si maps show that the glaze width of the Tokoname piece is thin and contains many impurities, indicating that the glaze firing technique is immature. Normally, pottery are made from low-glassy materials, while porcelain is made from high-glassy materials. Strong CL luminescence in the base of Tokoname piece indicates a high content of crystalline quartz fragments. The glaze width of the Komizo piece is well present, on the other hand Si and CL strong luminescence is observed in the glaze area, suggesting that early Arita ware glaze still contains unmelted quartz. In the Kakiemon, glaze width is sufficient and these mineral particles are not found. These results suggest that the Kakiemon ware was produced at higher temperatures with better quality glaze than the Tokoname ware and Komizo ware was due to the development of pottery techniques. In other words,

Japanese ceramics technology has improved at a very fast pace in just 100 years since the importation of pottery technology developed from the continent in the early 1600s.

Figure 1. BEI, CL images and Map analysis results. (a) Paleo Tokoname piece. (b) Komizo piece. (c) Kakiemon piece. Si grains with strong CL luminescence are identified in the Tokoname and Kamizo glaze parts (single arrows).

Graphic:



Keywords:

Old Imari, Map Analysis, CL

Reference:

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- [2] Tokoname Ceramics Magazine, Tokoname City Magazine, Supplement Volume, 422.
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