# TECHNOLOGICAL EXAMINATION OF 18TH to 19TH CENTURY COBALT-BLUE DECORATIVE CERAMICS FROM TRANSYLVANIA (ROMANIA)

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The so-called "cobalt-blue ceramics" are elegant and decorative type of pottery with white incisions on dark blue base. This pottery (mostly jugs and plates) was produced between 1766 and 1840, mainly from 1785 to 1815 in Transylvania, most probably in Saschiz (Szászkézd) (VIDA, 2011).

The production technology, particularly the method used to form the decorations has been the matter of debate from the 1880s both among the Transylvanian and the Hungarian researchers. Some technological details have not yet been clarified up to this day. It is generally accepted that the reddish body of the ceramics was covered by a white engobe. Then a blue layer was applied, which is regarded as glaze or mixture of engobe and glaze/blue smalt. White decorations were made either by removing the blue layer with scratching (sgraffito technique) or by making drawings using wax, to which the blue layer does not adhere (wax-resist/batik technique). Finally a transparent (lead) glaze was applied over the object. Based on electron microscopy analysis of the glaze Horst Klusch questioned the order of layers suggesting that the transparent glaze was applied first, then it was covered by the blue layer (see recently ROŞKA & KLUSCH, 2010). The use of white tin glaze (instead of engobe) and blue-coloured tin glaze was suggested by KATONA (1976). Therefore archaeometric analysis should answer the following technological questions: (a) what is the actual order of layers? (b) what is the blue layer? (c) was tin glaze applied? (d) at what stage did firing occur? (e) how were decorations made?

Detailed analysis was performed on two cobalt-blue plates of the Ceramic Collection of the Ethnographic Museum in Budapest. Detached glaze pieces represent blue areas, white decorations as well as their transitions, and also contain the light-coloured engobe. Microtextural and chemical analysis was performed on glaze pieces in cross section using an electron microprobe coupled with an energy-dispersive X-ray spectrometer. Crystalline phases of the glaze and the engobe were determined by X-ray powder diffraction analysis.

The lower and upper parts of the blue glaze pieces contain different amounts of inclusions and their vitreous matrix has different chemical composition. The lower, inclusion-rich (e.g. newly formed cristobalite) part of the glaze is strongly coloured with cobalt and contains low amounts of lead, while the upper part of the glaze is more enriched in lead and less coloured. The lower and the upper glaze parts meet with more or less sharp boundary indicating that two glaze layers were applied. Going towards the decorations the glaze becomes thinner and contains only one layer: the blue, cobalt-rich part disappears and a colourless or slightly coloured, lead-rich glaze covers the light-coloured engobe.

According to its chemical composition and microstructure the blue layer is proved to be glaze and does not contain engobe [e.g. the blue layer is very poor in Al ($\leq$ 1 wt% $Al_2O_3$), while the engobe has elevated Al content ($\geq$ 30 wt% $Al_2O_3$)]. Nickel-cobalt-rich particles and arsenate inclusions, the latter crystallized during the firing and subsequent cooling, indicate the use of zaffre cobalt pigment for colouring. The blue layer is actually a glaze rich in potassium and silicon, poor in lead (maybe originally lead-free?) and coloured with zaffre. Tin above detection limit or tin oxide particles were not found in the blue glaze, therefore it is not a blue-coloured tin glaze.

The light-coloured layer under the glaze is proved to be fine-grained engobe containing quartz, K-feldspar and a small amount of titan oxide (anatase ± rutile). High-temperature phases or relicts of decomposed clay minerals were not detected by XRD analysis most probably due to the very small amount of samples. Usage of white tin glaze can be unambiguously denied.

Based on the above results, layers were applied in the following order: engobe, then blue (cobalt-rich) glaze, finally transparent lead glaze. Accordingly the generally supposed layer sequence is appropriate, while our analysis did not confirm the layer sequence determined by Horst Klusch. Firing might have occurred after applying the engobe, then after applying the transparent lead glaze. During the last firing the chemical composition of both glaze layers was modified through element diffusion.

Future microstructural investigations on glazes of tentatively produced vessels will help to determine the technique (sgraffito or batik method) used for making the decorations.

**References**

KATONA, I. (1976): A habán kerámia Magyarországon. 2. kiadás, Képzőművészeti Alap Kiadóvállalata, Budapest, 227 p.

ROŞKA, K. & KLUSCH, H. (2010): Keramik aus Siebenbürgen. Keramikerzeugnisse der Zünfte, der Manufakturen, der Habanerwerkstatt aus Siebenbürgen. Honterus Verlag, Hermannstadt, 328 p.

VIDA, G. (2011): Néprajzi Értesítő, 93: in press.