A Chelsea porcelain (London, mid-18th century) P-Pb repair glaze: results of analogue firing experiments and implications for in situ analytical authentication studies

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The crazed glaze on mid-18th century phosphatic (bone ash) porcelain sherd excavated from the Chelsea factory site is coated with a novel P-Pb repair glaze evidently derived from a mixture of nearly equal proportions (wt.%) of red lead and dicalcium phosphate. The composition of the crazed glaze (e.g., 36% PbO, 52% SiO_2) is typical of those used on artificial porcelains, but the repair glaze, with little silica (1.9% SiO_2) but abundant phosphate (27% P_2O_5) and lime (21% CaO) as well as lead (49% PbO), is highly unusual. Its low model calculated viscosity accounts for the infilling of micron sized craze cracks in the inner glaze. Analogue firing experiments demonstrate the propensity of the repair glaze to take up components (notably alumina) from the ceramic substrate, and to lose components (notably lead) to the kiln atmosphere particularly at elevated temperatures (T> 900 ^{o}C). The red lead-dicalcium phosphate mixture resisted melting even at temperatures exceeding those (800–1000 ^{o}C) generally thought to have been used in 18th C glost kilns, suggesting that either fluxing components originally present in the repair glaze mixture were volatilized during firing, or that the glaze was fired at unusually high temperatures. The uptake of ceramic substrate components and volatilization of lead presents serious challenges for those seeking to authenticate intact high-fired ceramics using glaze compositions.

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