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Composition and technology of 18th century high magnesia faïences from Fulda

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ABSTRACT

In 1996, archaeological excavations close to the ancient Fulda faïence manufacture site unearthed a rich deposit of faïence wastes (biscuits, faïences, technical ceramics). The manufacture was founded in 1741 by Prince Abbot Amand von Buseck and closed down in 1761. This first archaeometric study of a German faïence manufacture included 31 samples produced between 1742 and 1760. Analytical techniques were optical microscopy, X-ray fluorescence, X-ray diffraction and scanning electron microscopy, coupled to an energy-dispersive X-ray spectrometer. Biscuits and faïences are MgO- (5–13 wt.%) and CaO-rich (9–20 wt.%), easily distinguishable from the two French Mg-rich productions of Granges-le-Bourg and Lunéville that we know today. Three samples show high P_2O_5 (2.6–3.3 wt.%). Such unusual concentrations are not due to the admixing of crushed bones to the clay during processing, or to one of the well-known post-firing secondary contamination processes, but are caused by the presence of sharp edged, rhomboedric grains with sizes around 20–30 μm and an overall chemical composition of apatite. These fragments are interpreted to be remnants of primary phosphoritic elements, present *ab initium* in the clay, and give some hints as to the origin of the raw materials used. Phosphoritic layers can be found in the German Trias, mostly in dolomitic marls of the Middle Keuper. Such marls form the basement on which Fulda is built and could easily have been extracted by the Fulda manufacture. The high MgO values of the faïences can therefore be linked to the presence of dolomitic grains in the plastic raw material, corroborated by the positive MgO/CaO correlation. Firing temperatures of the faïences were, according to their XRD patterns, mostly between 950 and 1050 °C.

1. Introduction

1.1. German faïence manufactures

Faïence is a tin-glazed pottery, i. e. a type of earthenware covered with a lead–alkali glaze to which tin oxide (cassiterite, SnO_2) has been added as an opacifier. According to Rosen (2009, p. 83) the term "faïence" appeared for the first time on May 25, 1601 in archival sources of Nevers as "vessele de fayance" (crockery in fayance). In 1604, the ceramist Jean-Baptiste Conrade was labelled "sculpteur en terre de fayence" (sculptor of fayence earth) (Rosen, 2000). The oldest faïence manufacture in what is presently Germany is Hanau (Fig. 1), founded in 1661 by Dutch protestant fugitives, forced to leave their homeland on the account of their religion (Merk, 1979; Stasch, 2005a, 2005b). Five other manufactures were set up before 1699, and more than 80 new ones in the 18th century (Klein, 1962, 1975; Frégnac, 1976). The manufacture in Fulda was started in 1741 by Prince Abbot Amand von Buseck who reigned from 1737 to 1756, from 1752 as Prince Bishop (Steen, 1994; Stasch, 2005a, 2005b). The ultimate goal was not to make faïence, but porcelain, as clearly claimed by the Prince Abbot ".. habe 1742 eine Porzellanfabrik in der Residenzstadt angefangen und dort die nötigen Öfen installiert" (I founded in 1742 a porcelain manufacture in the town of residence and built there the necessary kilns). Adam Friedrich von Löwenfinck (1714–1754), painter in porcelain in Meissen (1727–1736), became the first director of the Fulda manufacture; he left Meissen in 1736 first for the Bayreuth manufacture and then for Ansbach. This is where, around 1737–1740, he successfully transferred the technique of porcelain overglaze enamel painting, invented in Meissen and applied since 1710, onto faïence objects (Stasch, 2005b). In Fulda, the early ceramic products decorated with the inglaze technique are easy to recognize because of their ink blue colour lined with manganese (Stoehr, 1920, pp. 329, 375) painted by Christian Müller (Stasch, 2005b, p. 25), cf. Fig. 2a. Certain objects, by the quality of their onglaze polychrome hand decoration, can be attributed to A. F. von Löwenfinck, even though the signature is missing (Wark, 1956; Ducret, 1971, 1983; Rückert, 1990; Surhone et al., 2010), such as the famous vase with lid (Klein, 1993, plate XI) or the table-centre with the "von Fechenbach" coat of arms (Fig. 2c). A. F. von

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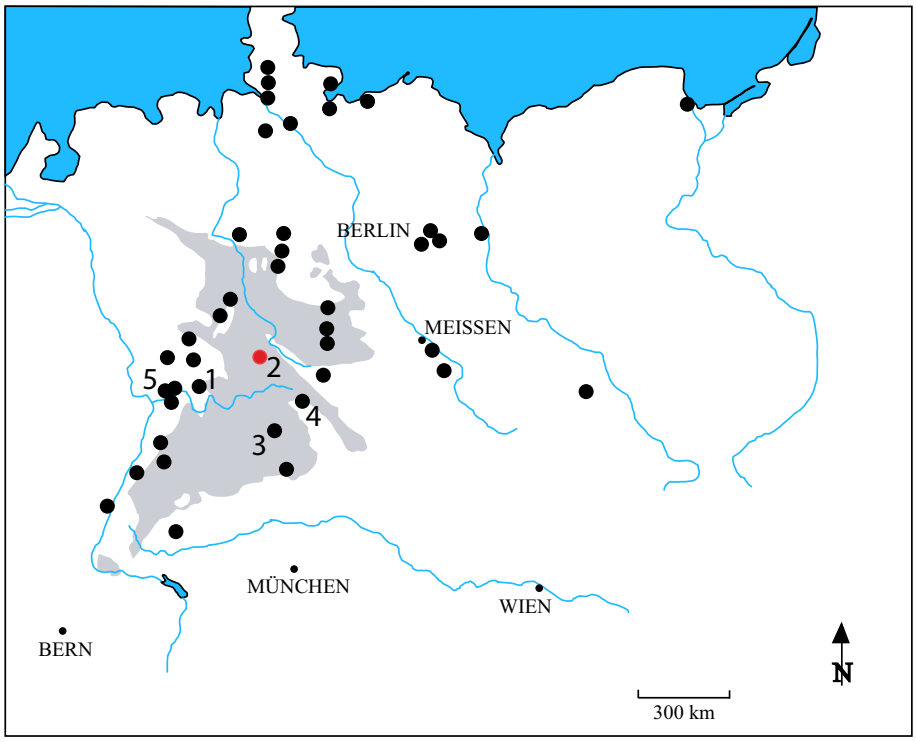

Fig. 1. Map of important German faïence manufactures (large dots) of the 17th to 19th centuries, redrawn from Klein (1975). 1 = Hanau, 2 = Fulda, 3 = Bayreuth, 4 = Ansbach, 5 = Höchst. Triassic terrains (Bederke and Wunderlich, 1968) are shown in grey. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Löwenfinck left the manufacture in 1744 to go to Höchst (Ducret, 1971). Fulda kept up its excellent reputation thanks to the commitment of other painters such as Josef Philipp Dannhöffer, Georg Friedrich Hess, and Ignaz Hess. The faïence production came to an end in 1760 because of the Seven Years' War (Stasch, 2005a). Four years later, in 1764, a porcelain manufacture was set up in the buildings occupied by the former factory by Prince Bishop Heinrich von Bibra (active from 1759 to 1788). It was shut down in 1789 (Ducret, 1971; Fritzsche and Stasch, 1994; Ullrich and Ballmaier, 2002; Stasch, 2005a, 2005b).

1.2. Production technique

There is no archival documentation about Fulda's faïence production technique or about the site of the extracted clays. The first director of the manufacture (1741–1744), A. F. von Löwenfinck, probably learned the faïence technique during his stay in the manufactures of Ansbach and Bayreuth. Summaries of the faïence technique used in 18th century France and the Netherlands, most probably applied in Germany too, were published by Rosen (1995, 2009), Maggetti (2007, 2012) and Lambooy (2013).

The following short resumé is taken from Heimann and Maggetti (2014, chapter 13): tin-glazed pottery is manufactured from CaO-rich clays in several production steps. After forming and drying, the green ceramic body will be fired in a kiln at maximum temperatures of 900–950 °C (bisque firing). During firing water and other volatile compounds will evaporate. The so-called bisques or biscuits will then be dipped in aqueous glaze slurry. The still porous ceramic body soaks up water from the adhering powdery glaze layer and thus fixes the latter to its surface. If a white product is desired, the ware will be contained, after a short second drying step, in tightly fitting refractory capsules (saggars) and glaze (glost)-fired at approximately 950–1050 °C. For decorated ware, the so-called inglaze colours are painted directly on the dry tin glaze layer prior to glaze firing. This is a rather tricky process as the painted decoration can be corrected only with difficulties since the colour pigments are readily absorbed by the dry, white glaze powder. When corrections are required the faulty part must be carefully scraped off and the glaze including the colour pigments reapplied. The inglaze colour pigments consisting of powdered crystalline matter or frit glass will be ground together with water and a binder, for example starch. During glaze firing the pigment particles are being coated by a thin sheath of molten glaze and subsequently either dissolved in the glaze, remain as insoluble crystallites, or precipitated as colloidal phase. Since only selected metal oxides survive the high temperatures of the glaze firing the colour palette are blue, brown, yellow, green, red, black, pink and white.

After glaze firing the white or coloured ceramic can be further decorated with differently coloured overglaze (enamel) pigments, i. e. coloured glassy powders. In this case necessary corrections can easily be accomplished since the enamel colours are suspended in volatile oils such as mixtures of turpentine and linseed oil that are applied with a brush to the smooth glaze surface. Overglaze colours generally possess a lower melting temperature compared to the inglaze colours. The enamel pigments are fixed to the glaze surface by a third firing step, also called as colour firing in a muffle kiln at 600–800 °C whereby the pigment particles sink only slightly into the carrier glaze. Since many more metal oxide pigments will be stable at the low temperature of the third firing the colour palette becomes substantially richer.

1.3. Archaeometric analyses and aim of this study

No archaeometric studies were undertaken on German faïences up to now, with one exception: a single blue, black and white decorated shard from Fulda, studied with scanning electron microscopy, which revealed its richness in silica and calcia (Steen, 1994). The present study was therefore undertaken to: (1) define the chemical characteristics of a corpus which would be representative of the Fulda faïence in order to create the first reference group for German faïence; and (2) define the mineralogical and technological characteristics of this same corpus in order to circumscribe the technique used in Fulda.