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The archaeometric, formal and stylistic analysis of a black-glazed fish-plate from the National Museum in Poznań

Abstract

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This paper presents the results of the XRF, formal and stylistic analyses of a black-glaze fish-plate from the National Museum in Poznań. A non-invasive portable X-ray fluorescence spectrometer (pXRF) has been used to determine the chemical composition of the plate. Analysis of the shape and decoration provided data on the chronology, typology and provenance of the vessel. The obtained results were used to determine the possible region of the fish-plate's production. The form of the fish-plate represents features characteristic for the early stage of Italian black-glaze production, which is combination of Athenian traditions with new solutions in terms of proportion and shape. The analysis of X-ray fluorescence spectrometry data and comparative studies with already known results of the Italian black glaze pottery chemical analyses allowed the fish-plate to be identified as an example of the Campania A group from ancient Naples workshops, dated to the second half of the 4th century BC.

Key words: black-glaze pottery, X-ray fluorescence spectroscopy, provenience, multivariate analyses, museum collections

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History of the artefact

The history of some of the museum artefacts have their origins in the collections of the Kaiser Friedrich Museum in Posen, which was established in 1902 as a result of the transformation of the Prussian Provinzial Museum which had been founded earlier in 1894. Artefacts forming antique collections were brought to the Prussian museum from several collections in Berlin (1899, 1902, 1903). In addition, private collectors also contributed their gifts to the collection of Emperor Frederick's museum: in 1900, a gift from Kurt Schottmüller, in 1903 and 1904 a gift from Alfons Hugger, also in 1904 a gift from James Simon and in 1909, Józef Kantorowicz. Documentation regarding the above-mentioned collections is not always complete and detailed, hence it is difficult to indicate from which set the vessels described in the article originated. The vessels that became parts of the collection in the last decades of the 20th century came from purchases from private individuals (Szymkiewicz 2004, 103–107; Głuszek 2018, 7). In recent years, fish-plates from the National Museum in Poznań have also been the subject of studies by junior researcher (Kajzderski 2014).

Characteristics of the morphological features of fish-plates

The term fish-plate is related both to its function, as it was used to serve fish, and to the iconography of this kind of red-figure pottery, where fish were a common theme in the images decorating dishes of this shape (Sparkes, Talcott 1970, 147–148; McPhee, Trendall 1987, passim). The production of vessels of this shape began in Athens. These vessels were relatively popular in production in the red-figured

technique in Attica, and were also widespread in Italian workshops, in both the decorated version and a simpler one with black glaze only. The characteristic features of the shape of this type of vessel, irrespective of the method of decoration, is a wide disc of the plate descending to a centrally placed round dip, the lip of the vessel is turned outwards and downwards, while the foot has the shape of a fairly high, massive ring. According to the abovementioned scholars, vessels decorated with the black-glazed technique appeared relatively late in Athens, with their production developing around 400 BC (Sparkes, Talcott 1970, 147; McPhee, Trendall 1987, 18). However, in light of later studies, this chronology can be moved back to the last decades of the 5th century BC (Rotroff 1997, 147) but the popularity of this type of pottery certainly increased in the Hellenistic period. In the series of Attic fish-plates in the black-glazed technique, the foot of the vessels changed significantly from the form with a profiled outer wall to one with a straight outer wall and a concave inner wall. A characteristic feature of the forms dated to the second half of the 4th century BC is the modelling of the resting surface of the foot provided with a circumferential groove running near the inner edge of the foot. On the external side of the plate, grooves appear around the edge of the central depression and near the lip of the vessel. The surface of the disc is covered with glaze both on the outer and inner sides. In the case of early forms of Attic fish-plates, the underside was covered with glaze witha reserved ring near the base of the foot. At the next stage, decoration appeared in the form of a reserved surface covered with a sequence of concentric rings of various widths made with black glaze with a dot marking the centre of the vessel. In vessels thus decorated, the inner wall of the foot was also covered with glaze, with the resting surface left in the colour of clay. Such a solution can be observed on the vessel from the collection of the National Museum in Poznań. Subsequent, later Attic ceramics have the underside of the vessel completely covered with glaze. The forms decorated with concentric circles and entirely covered with glaze functioned together for some time around the middle of the 4th century BC, while vessels from the Hellenistic period are in most cases entirely covered with glaze (Rotroff 1997, 147).

According to archaeological sources, it appears that the first fish-plates started to be produced in Magna Graecia in Sicily or southern Calabria. In these areas, numerous whole vessels, and above all, vessel fragments have been found: Locri, Amantea, Gela. The stylistic similarities between some of the plates from Sicily and others found in the area of Paestum or Cumae suggest that, like other red-figure pottery, the fish-plates from Campania and Paestum were also produced under a strong Sicilian influence. It can be assumed that some of the Campanian vessels, including fish-plates, were made by expatriates from Greece itself. These vessels can, like other examples of red-figure pottery from these workshops, be assigned to various (already existing) painters, groups, and stylistic workshops. The South Italian fish-plates can be divided into four main group: Sicilian, Campanian, Paestan, and Apulian (McPhee, Trendall 1987, 54). The first fish-plates appeared in in Sicily or southern Calabria in the first quarter of the 4th century BC, with the production of these types being expanded in the middle of the century in Campania, Paestum and Apulia, with the peak in production being assigned to the third quarter of the 4th century BC (McPhee, Trendall 1987, 58). It seems that production of the black-glaze examples developed in a slightly different manner to those with red-figured decoration.

At the end of the 5th century BC, workshops in southern Italy began to imitate and export black-glazed pottery, while the first products from Etruria date to the end of the 4th century BC. The production of fish-plates was most extensive from the late 4th to the early 2nd century BC. It should be noted that the first phase of the development of black-glazed ceramics production is characterised by strong connections to the forms, decoration techniques and technological solutions represented by the products of Attic workshops. Local products with a different character of vessel morphology and individual production features appeared only during the subsequent stages of production, essentially being characteristic of vessels from the mid-4th century BC (Hayes 1984, 21; McPhee, Trendall 1987, 58).

Regarding the shape of the fish-plates, the differences between the dishes from Attica and southern Italy can be observed in the area of the foot of the plates. Among the Attic plates, starting from the second quarter of the 4th century BC, the outer edge takes the shape of a convex arc, while in the case of the South Italian plates it is modelled (strongly rounded – convex in the shape of a roll), and sometimes the ring foot consists of two modelled levels. In the South Italian plates, the foot is usually low except for a few late Apulian examples, where its height reaches up to 5 cm. The curvature of the former plates is greater but the transition between the disc and the downwards-turned lip is not as sharply defined as in the case of Attic vessels. The widths of the downwards-turned lips are different, sometimes to the extent that they almost cover the whole profile of the vessel (McPhee, Trendall 1987, 54–56).

A black-glazed fish-plate from the collection of the National Museum in Poznań – formal analysis

The fish-plate (MNP A 844) has a height of 8 cm while the diameter of the vessel is 29.8 cm, and the diameter of the foot is 12.5 cm. The clay from which the plate was made is light orange 5YR 6/3–7.5YR 6/3. The colour of the retouch applied to the groove around the depression the plate is bright red 10R 5/6–4/6, while the glaze is black with a hint of dark brown. The glaze is a little dilute and semi-matte. The vessel is preserved in its entirety, with a few traces of damage on the external surface. The vessel surface covered with glaze has a slightly gritty texture. The plate from the museum has a thickened edge extending downwards and a flat top. There is a shallow groove around the central depression for sauce, a similar groove runs along the outer edge of the dish. The foot is high, rectangular in section, with a flat resting surface. In the case of the vessel studied, its most prominent features are the shape and proportions of the disc and the centrally located depression. In the place where the disc of the plate passes into the depression and where the base of the foot is affixed, the wall of the vessel is considerably thickened, which contrasts with the thinner wall of the central part of the vessel (Fig. 1). The fish-plate from the National Museum in Poznan is an example of a South Italian vessel.

A similar shape and proportions can be observed in the 1075 plate from the Athenian Agora (Sparkes, Talcott 1970, fig. 10. 1075). However, the Attic vessel has a flat surface for its sauce container and the bottom of the plate has a pointed shape, with a characteristic omphalos in the centre. The foot of the vessel from Poznań is high and simple, which suggests the later production from the first quarter of the 3rd century BC, but the vessel is relatively shallow, which could indicate the early phase of the production of plates (referring to the Athenian vessels), related essentially to the 4th century BC. Similarly, the sharp angle of the bend of the plate edge and the downward-facing edge, and the concentric circles on the bottom of the vessel point to late classical production. In case of the vessel from Poznań, the characteristic distinct angular bend

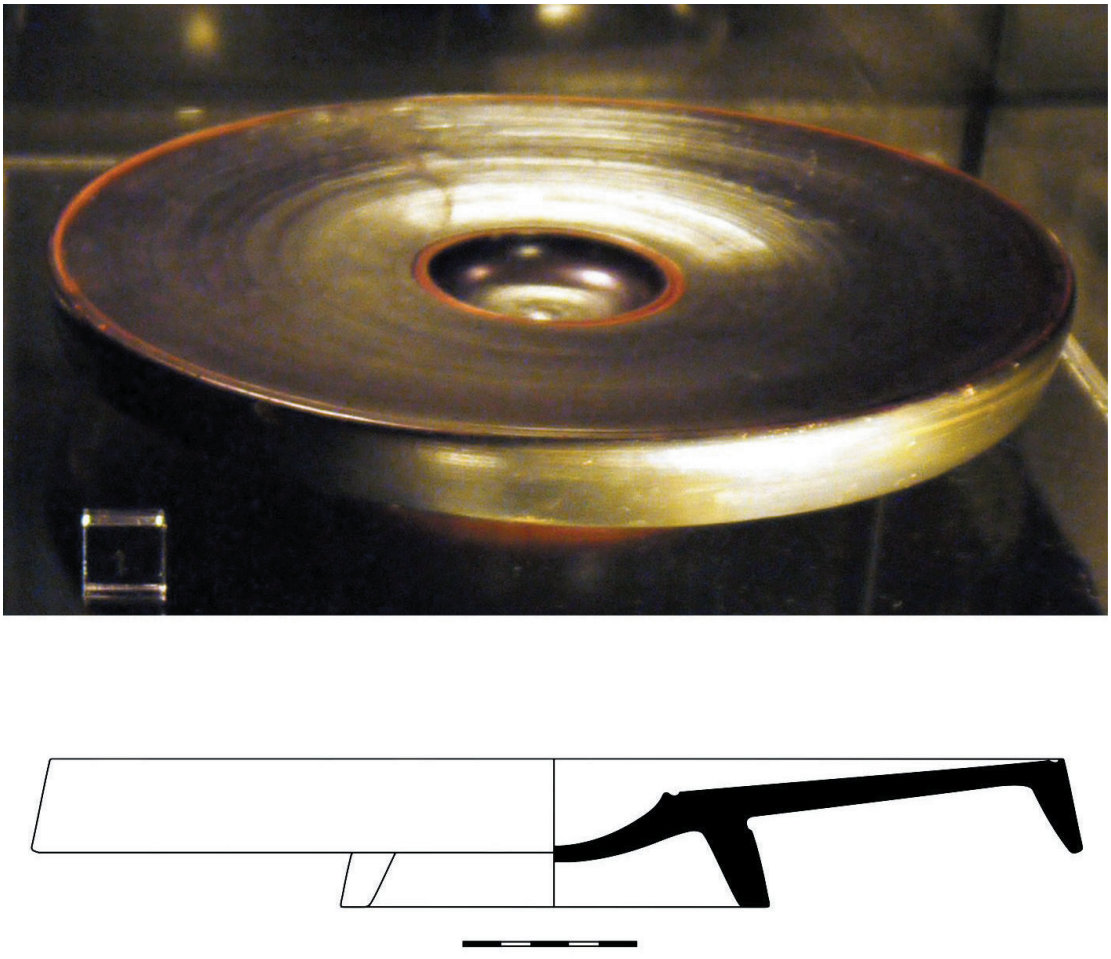

Fig. 1. A drawing of the MNP A 844 fish-plate, drawing I. Głuszek, phot. M. Krueger.

of the edge of the disk of the vessel passing into the vertical lip, the large diameter of the vessel and the use of two circumferential grooves on the disk indicates the imitation of the Athenian prototypes. In contrast, the characteristic ring-shaped foot, high, with straight walls and a flat base, a model repeating the solutions known from plates and bowls of the early Hellenistic period, indicates the later chronology of the vessel (Pedroni 1990, 28, 43–44, no 868, 909; Morel 1965, pl. 18, 271).

The fabric of clay and features of glaze suggests Italian provenance and are characteristic of Campania ware. Plates of a similar shape come from the museum collections of the Czech Republic (Bažant *et al.* 1997, pl. 69. 8). The vessel from the Charles University collection is compared to the form classified by J. P. Morel as 1121d1, described as an imitation of Athenian types dated to the second half of 4th century BC. Another example is from the Michigan University collection (Ingen 1993, pl. 18. 13) representing a vessel of presumably of Pozzuoli or Cumae provenance dated to the 4th–3rd century BC. The features of the shape of the vessel and the characteristics of the glaze indicate that the vessel was produced in Italy, while the visible features indicate the imitation of Attic vessels and supplemented with new solutions deviating from Attic standards. This allows the artefact to be dated to the second half of the 4th century BC (Głuszek 2018, 19).

Chemical analysis of the fish-plate using an X-ray fluorescence handheld spectrometer

Many specialists were involved in the study of various ceramic complexes from Italy in order to develop basic of typological distinctions (for those of greatest importance and diffusion, see Lamboglia 1952, 1958, 1960, 1961; Morel 1969, 1981, 1987, 1990). The distinctions of archaeological sources were made on the basis of the observed morphology and style of finds. Artefacts from the pottery production sites were examined, as well as the vessel distribution process; however, the identification of a single production site is sometimes ambiguous or uncertain. The combination of factors such as the heterogeneity of finds in terms of morphology, widespread production and distribution, and the presence of countless imitations of local forms coming from other production centres, significantly complicates the study of this class of pottery. These ambiguous sources hinder research into the provenance of the artefacts and technologies of their production. Such studies are even more difficult due to the poor recognition and identification of only a few production centres.

Answers to such numerous questions can be sought through long-term research using archaeological methods and techniques. Nevertheless, many examples of pottery produced in workshops have been described and analysed in the context of provenance studies. Numerous studies have already been done on black ceramic ceramics from the areas of southern Italy (Prag *et al.* 1974; Prag 1984; Maggetti *et al.* 1986, 1998; Picon 1988; Morel and Picon 1994; Mirti *et al.* 1995; Pasquinucci *et al.* 1998; Preacco Ancona 1998), southern Etruria and Lazio (Morel, Picon 1994; Olcese 1998; Picon 1988, central and northern Etruria (Lasfargues, Picon 1982; Harari, Oddone 1984; Maggetti *et al.* 1986, 1998; Schneider 1992; Frontini *et al.* 1995; Pasquinucci *et al.* 1998; Mazzeo Saracino *et al.* 2000), eastern and northern Italy (Maggetti *et al.* 1986, 1998; Frontini *et al.* 1995, 1998; Oddone 1998; Bonini, Mello 2000; Mazzeo Saracino *et al.* 2000; Schneider 2000).

The reference groups established in the course of these studies have provided new research directions to a certain extent, supplying fresh data that facilitates the study of the provenance of artefacts. However, differences in sample preparation and the analytical techniques adopted (optical microscopy, scanning electron microscopy, X-ray diffraction, X-ray fluorescence, inductively coupled plasma optical emission spectroscopy and neutron activation analysis) can provide such divergent and uncorrelatable results that further comparative testing becomes impossible to conduct. These problems are well known in archaeometry (Galetti 1994).

The analysis of the chemical composition of the surface of the fish-plate was performed using a Bruker Tracer III SD handheld X-ray fluorescence spectrometer. One of the basic advantages of conducting tests with a spectrometer is its non-invasive nature, rapidity and the relatively low cost of analysis. It is a method that, due to the small size of the apparatus, allows tests to be conducted outside the laboratory, for example in museum exhibition halls. The disadvantages include a lower degree of precision, the ability to analyse only the surface of the examined artefacts and the semi-quantitative nature of the data.

The methodology of the identification of chemical elements in archaeological ceramics involved multiple analyses of various parts of the same artefact. The focus was on the analysis of the black-glazed surface, but measurements were also made of parts that were not covered with the glaze.

During the measurements the „Major Mud Rock" analytical mode was used, whose analytical parameters are as follows: a voltage of 15kV, an intensity of approx. 25 μA. The time of a single analysis was 15 seconds.

These settings enable the identification of the following elements: Mg, Al, Si, P, S, K, Ca, Ti, V, Cr, Mn, Fe, Co, Cu, Zn, Ba.

In total, ten measurements of the plate were made: six measurements (824–829) of the external surface (Fig. 2) and four measurements (830–833) of the inner surface (Fig. 3). Two measurements of unglazed places were made: the edge of the foot (824) and the middle part of the inside of the foot (825). The most representative measurements for black glaze are from 826 to 833 (Tab. 1). The analysed areas covered with black glaze have the highest content of silicon (28.7–29.9%), aluminium (24.1–26%), and magnesium (9.5–14.3%). A distinctive feature is the very high content of potassium (5.4–7.1%), iron (5.7–6.9%) and also aluminium (24,1–25,8%). Differences in the chemical composition between the black-glazed surface and the places that are not covered with glaze are evident. The black-glazed surface has a lower content of calcium (1,3–3,7%), manganese (0,031–0,040%) and barium (0,219–

Table 1. Elemental composition of the analysed plate, values are in percentages, M. Krueger.

File #	Mg	Al	Si	P	S	K	Ca	Ti	V	Cr	Mn	Fe	Co	Cu	Zn	Ba
824	6.994	11.763	30.272	0.361	0.828	3.631	6.554	0.353	0	0.003	0.044	3.521	0.001	0.011	0.013	0.412
825	14.025	15.686	27.712	0.424	3.221	3.794	8.924	0.358	0	0.006	0.057	4.567	0.002	0.008	0.009	0.452
826	9.518	24.126	29.160	0.171	0.380	5.404	3.203	0.333	0.001	0.012	0.040	5.915	0.003	0.012	0.018	0.343
827	7.069	24.923	28.886	0.166	0.398	6.824	3.314	0.320	0.002	0.011	0.033	6.050	0.002	0.011	0.017	0.230
828	12.698	25.137	28.798	0.183	0.469	7.130	3.560	0.339	0.010	0.010	0.037	6.000	0.002	0.013	0.015	0.219
829	14.315	25.837	28.448	0.142	0.177	6.458	3.759	0.354	0.003	0.010	0.039	5.786	0.002	0.011	0.015	0.311
830	13.890	25.025	29.961	0.131	0.117	6.488	1.317	0.323	0.010	0.014	0.031	6.973	0.003	0.015	0.024	0.224
831	13.360	25.703	29.555	0.113	0.112	5.776	1.539	0.334	0.014	0.016	0.039	6.920	0.003	0.012	0.024	0.257
832	13.685	25.424	29.266	0.110	0.152	5.874	2.499	0.313	0.004	0.014	0.036	6.680	0.003	0.012	0.023	0.312
833	14.218	26.095	29.332	0.155	0.289	7.008	1.774	0.330	0.014	0.015	0.033	6.722	0.003	0.012	0.023	0.246

Fig. 2. Measurements of the external surface. Fish-plate from the National Museum in Poznań, MNP A 844, phot. S. Obst.

Fig. 3. Measurements of the inner surface. Fish-plate from the National Museum in Poznań, MNP A 844, phot. S. Obst.

0,343%) than the ceramic body and higher content of phosphorus (0,36–0,42% versus 0,11–0,18%) and sulfur (0,82–3,22% versus 0,11–0,18%). Differences between unglazed and glazed surfaces are visible also in case of trace elements: vanadium (not detected in unglazed areas), chromium (0,003–0,006% versus 0,010–0,016%), cobalt (0,001–0,002% versus 0,002–0,003%) and zinc (0,009–0,013% versus 0,015–0,024%).

It is commonly known that vitrified clayey coatings as black-glaze were worked from selected and refined clays such as illitic clay (Mirti, Casoli, Calzetti 1996, 103–104). This is the reason for the higher amount of aluminium in the slip than in the ceramic body. At the same time, the black-glazed surface is very low in calcium (compare with Chaviara, Aloupi-Siotis 2016, 515) commonly rich in unglazed ceramic materials. This may be a consequence of the refinement of black slip from impurities (Scarpelli *et al.* 2017, 7). It should be highlighted that the unusual enrichment of aluminium (Fig. 4), potassium (Fig. 5), and to some extent also iron (Fig. 6), and the parallel deficiency of calcium (Fig. 7) is the fingerprint of the black-glaze pottery in question. This outcome is in good agreement with the results obtained by R. Scarpelli, R. J. H. Clark,A. M. De Francesco (2014, 63 and 66) who studied the black-coated pottery from Pompeii dated back to the 4th and the 1st centuries BC. Together with typological features as the homogeneity of forms and decoration, these are also considered to be characteristic for Campania A ware, a group of pottery currently associated with the production workshops of ancient Naples (Bonis De *et al.* 2016, 437 and 457 with references).

The presented results of spectrometric analyses may be useful as basic data. At this stage of research, there is no coherent database that has collected the results of the chemical analyses of black-glazed ceramics in Polish collections and this study should be treated as the first step in this direction. Only after obtaining research results of other black-glazed vessels it will be possible to carry out statistical analyses that may show differences in the composition of chemical artefacts originating from different production centres.

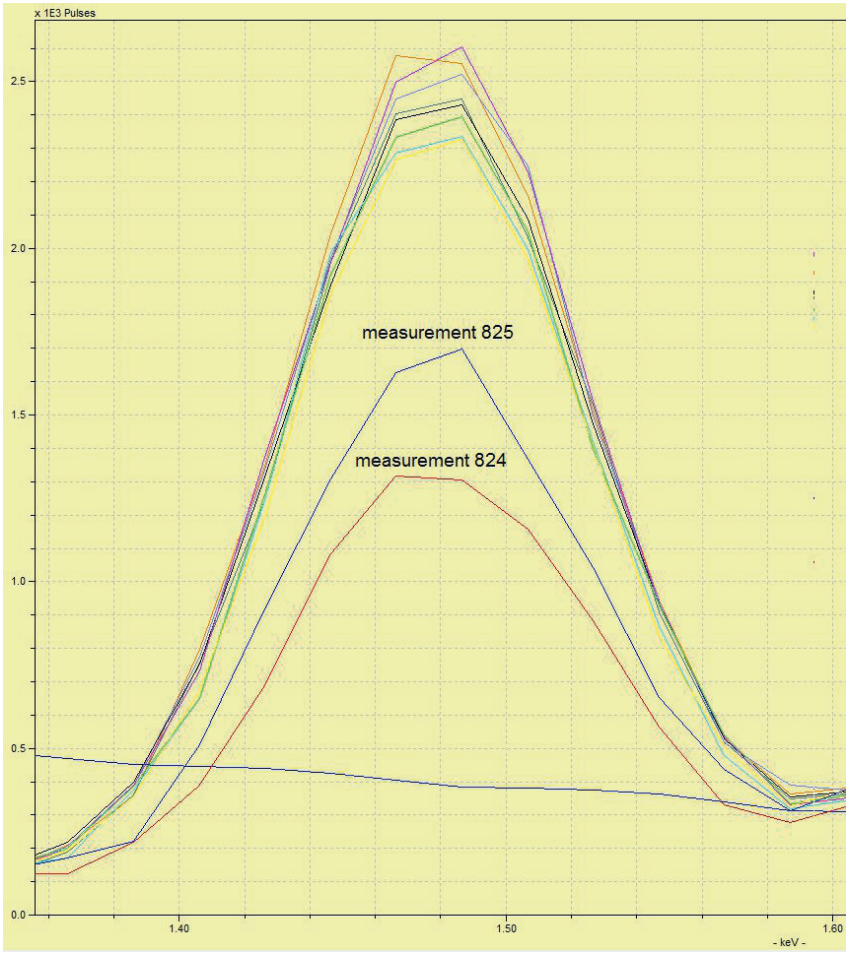

Fig. 4. Comparison between X-ray fluorescence spectra of aluminium by unglazed areas (measurement 824 and 825) and black-glazed surface (remaining spectra).

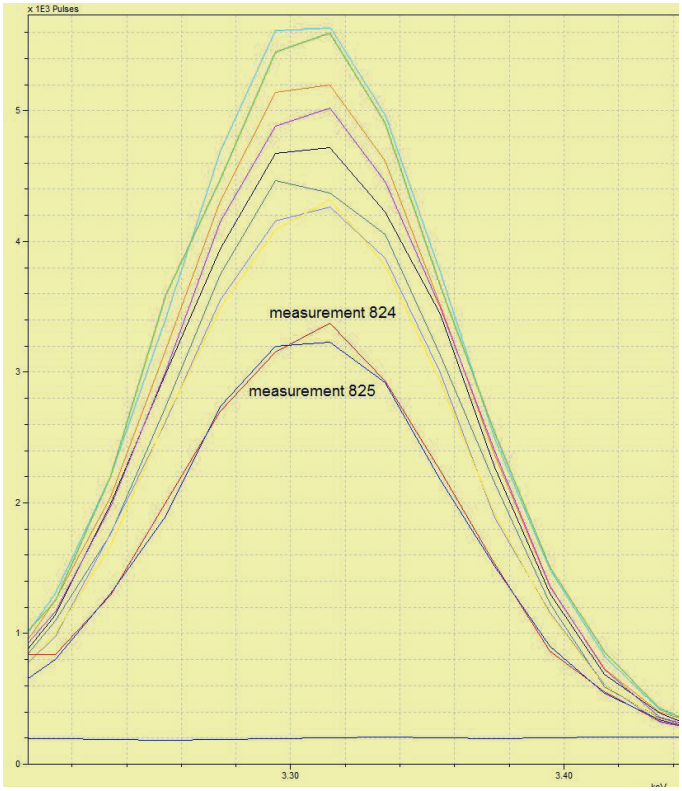

Fig. 5. Comparison between X-ray fluorescence spectra of potassium by unglazed areas (measurement 824 and 825) and black-glazed surface (remaining spectra).

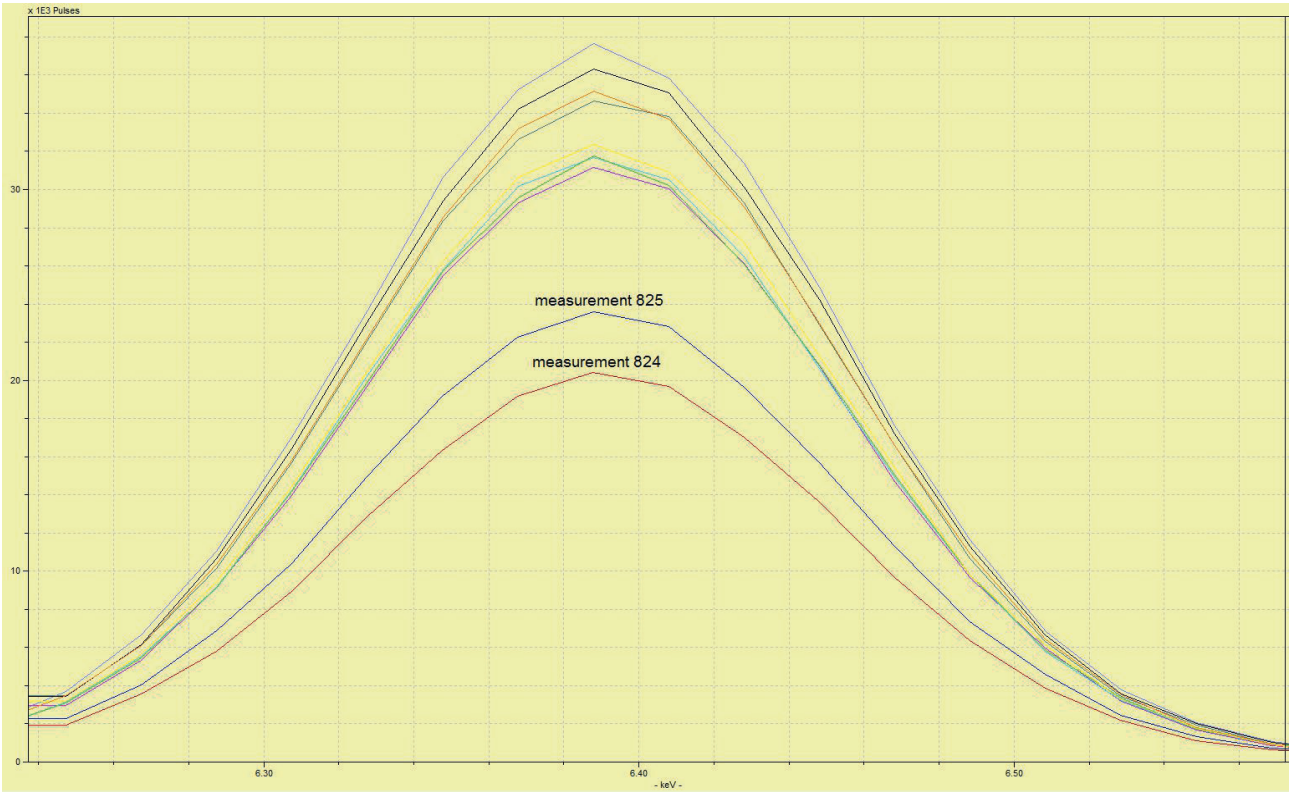

Fig. 6. Comparison between X-ray fluorescence spectra of calcium by unglazed areas (measurement 824 and 825) and black-glazed surface (remaining spectra).

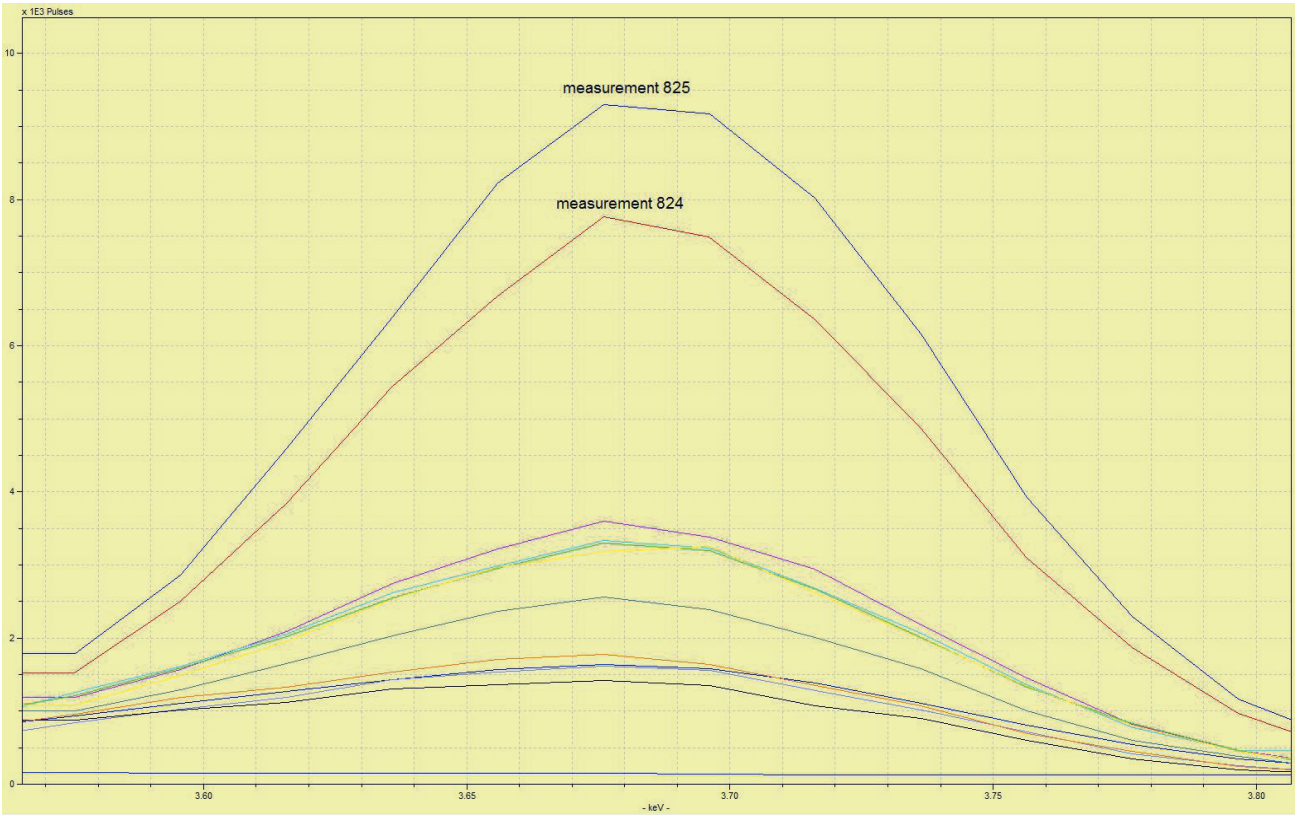

Fig. 7. Comparison between X-ray fluorescence spectra of iron by unglazed areas (measurement 824 and 825) and black-glazed surface (remaining spectra).

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