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Metallurgical activities at a pre-location settlement at Opatovice in Prague-New Town

ANNOTATION

Archaeological excavation of the deserted pre-location settlement at Opatovice revealed evidence of extensive domestic and craft activities, which vanished during the 1st half of the 13th century. Further analyses confirmed existence of a developed workshop for the production and processing of iron, as well as the production of non-ferrous metals and their alloys.

SUMMARY

In 2018, archaeological excavation was completed in Křemencova Street No. 164 in the New Town of Prague (Fig. 1). The excavated area is located in the centre of one of the deserted pre-location settlements, which developed in this part of Vltava right bank especially during the 12th and 13th centuries. The earliest written evidence of the Opatovice settlement with St. Michal's church dates to 1115, and current archaeological research provides evidence of extensive domestic and craft activities. The excavation revealed more than 150 sunken features from the 12^{ve} to the 1st half of the 13th century on an area of over 500 m² (Fig. 2). These include mainly remains of five timber (timber-clay) houses with sunken basements and a total of nineteen different pyrotechnological features. In fifteen cases, these were shallowly sunken features of oval or rectangular groundplan, which are often associated with iron processing, although their exact purpose remains unknown (Fig. 3). Their backfill contained heat accumulating stones (diabase and minet), as well as numerous pieces of iron slag (total of 300 pieces with a total weight of 46.6 kg). Their character indicates both the production of iron from ore, as well as forging iron sponges or iron (Fig. 10: A). The findings of lateritic iron ores also indicate primary metallurgical production (Fig. 10: B). Also two simple shaft furnaces of circular plan and funnel-shaped profiles were revealed (Fig. 4), one small torso of a furnace with slightly undercut walls, and a small furnace with dimensions of 1.02 × 0.56 m, cut into the side of a 2 m deep pit (Fig. 5: E). The movable evidence of non-ferrous metal metallurgy included a total of 52 small fragments of ceramic crucibles. These belonged to at least 14 specimens of the bag-like (boat shaped) type with a short horizontally placed handle for the tongs (Fig. 10: C). Fragments of common kitchen pottery with slag coatings were also found (Fig. 10: D), together with fragments of clay daub from the furnaces (Fig. 10: E), as well as a touchstone (a sericite metasiltit of 47 mm length and a bore hole for hanging, Fig. 10: F). The assemblage also contains 91 small objects of non-ferrous metals, consisting of drips, chips, plates or sticks – scrap metal for secondary smelting (Fig. 12: A). A total of twelve selected samples were analysed by the EDS – SEM method – three fragments of crucibles, coating on a common pottery bowl shaped sherd, furnace wall daub, three samples from a scrap metal set, three irregular lumps of nonferrous metal (Fig. 12: B) and the touchstone. Coatings containing copper and fluctuating amounts of other non-ferrous metals (lead, tin, zinc, arsenic), preserved on the inner walls of the crucibles, indicate the production of copper alloys – brass or gunmetal. Copper melting was also evidenced by analysis of a fragment of the furnace wall. Increased iron concentrations were detected, indicating that there was not only a remelting of scrap, but the batch could also include ore, a metallurgical semi-product, or iron in the form of sawdust, dross or slag. The analysed scrap metal fragments were of copper, brass and tin bronze. Also, the two analysed lumps of the alloy were of brass, and the third of tin bronze (Figs. 14, 15). A streak (abrasion) was recorded on the surface of the touchstone, left by an object from silver with a copper admixture (Fig. 16). The evaluation of archaeological finds as well as the results of the analyses proved the existence of a metallurgical workshop which, in addition to the production and processing of iron, also produced non-ferrous metals and their alloys (copper, brass, bronze, possibly silver to a limited extent). The craft and settlement activities on the surveyed area ceased to exist not later than the mid-13th century, i.e. approximately 100 years before the foundation of the New Town of Prague.

Fig. 1. Prague 1-New Town No. 164, Křemencova 18, plot no. 858, 859/1, 3–6 and 872/2. In **hatched red**, the total extent of the excavated area (compiled by M. Vyšohlíd, J. Růžička, 2019).

Fig. 2. Prague 1-New Town, Křemencova No. 164. Overall plan of the revealed features. Legend: **a** – areas excavated earlier or damaged (19th–20th centuries); **b** – post-medieval features and constructions; **c** – late medieval features and constructions; **d** – sunken houses (12^{ve} to 1st half of the 13th century); **e** – pyrotechnological features

and furnaces (12^{ve} to 1st half of the 13th century); **f** – surface of the soil horizon; **g** – other sunken features (12^{ve} to 1st half of the 13th century). (Compiled by M. Vyšohlíd, J. Růžička, 2019.)

Fig. 3. Prague 1-New Town, Křemencova No. 164. East section of C3 trench (through the fill of the demolished houses, see Fig. 2: 1, 2; drawing by J. Růžička, M. Vyšohlíd, 2019).

Fig. 4. Prague 1-New Town, Křemencova No. 164. South section of B5-011 feature in B5 trench (drawing by J. Růžička, M. Vyšohlíd, 2019).

Legend to Figs. 3 and 4: **a** – 19th–21st century; **b** – 18th century; **c** – 2nd half of the 13th – 1st half of the 14th century; **d** – before and around the mid- 13th century; **e** – end of the 12^{ve} – 1st third of the 13th century; **f** – soil horizon; **g** – geological subsoil (fine sandy alluvia and gravely sands of the river terrace).

Fig. 5. Praha 1-New Town, Křemencova No. 164. Range of pottery rims from selected situations in a chronological diagram. **a** – the earliest contexts covering the soil horizon (C2-060 + C2-062); **b** – the earliest forge (C2-056), cut by a later forge (C2-050); **c** – two earliest layers in the fill of a house nr. 2 (see Fig. 2: 2); **d** – two later forges cut into the fills of houses (C3-016 into the fill of house nr. 2). Identification: P14/2013 = Exc. No., C2 = Sector No., 062 = Deposit No. (drawing by V. Čermák, 2019; graphic design by S. Babušková, 2019).

Fig. 6. Praha 1-New Town, Křemencova No. 164, plot no. 858. Superposition of shallowly sunken pyrotechnological features in C2 trench (photo M. Vyšohlíd, 2016).

Fig. 7. Praha 1-New Town, Křemencova No. 164, plot no. 858. Sunken parts of shaft furnaces revealed between trenches C4, C5 and D5 (photo M. Vyšohlíd, 2016).

Fig. 8. Prague 1-New Town, Křemencova No. 164, plot no. 859/1. **A** – torso of a smaller furnace preserved in the side of a large pit in B5 trench (photo by M. Vyšohlíd, 2016); **B** – auxiliary section of the furnace B5-037 (Fig. 2: 14) in the side of the pit B5-011 in the B5 trench (see Fig. 4; drawing by J. Růžička, M. Vyšohlíd, 2016).

Fig. 9. Praha 1-New Town, Křemencova No. 164, plot no. 859/1. Pottery fragments from the earliest layers at the bottom of the pit B5-011 (drawing by V. Čermák, digitalised by S. Babušková).

Fig. 10. Prague 1-New Town, Křemencova No. 164. **A** – examples of metallurgical (C2-015) and blacksmith (C3-012) slags; **B** – laterite iron ore from D9 trench, stratigraphic context D9-011; **C** – an example of a boat shaped crucible, stratigraphic context B5-010; **D** – fragments of slag-coated common pottery from stratigraphic context C5-017; **E** – small fragments of clay daub from the furnaces, stratigraphic context B5-016; **F** – touchstone found in a shallowly sunken feature in A5 trench, stratigraphic context A5-020 (**A**, **B**, **C**, **E**, **F** – photo by M. Vyšohlíd, 2018; **D** – photo by J. Zavřel, 2018).

Fig. 11. Analysis of crucibles A5-033 (Nos. 1–6), B5-020 (Nos. 7–9) and C5-016 (Nos. 10 and 11); data in wt. % normalized to 100 %.

Fig. 12. Analysis of globules and slag coating on the inside of the bowl shaped sherd C5-017; data in wt. % normalized to 100 %.

Fig. 13. Analysis of a lump of baked and smelted clay B5-016 permeated with green-blue salts; data in wt. % normalized to 100 %.

Fig. 14. Prague 1-New Town, Křemencova No. 164. **A** – a small fragment of a bell? with apparent re-cutting, stratigraphic context C3-025; **B** – three irregular metal lumps from B5 trench, stratigraphic context B5-010 (photo by J. Zavřel, 2018).

Fig. 15. Analysis of three metal lumps from bag B5-010; data in wt. % normalized to 100 %.

Fig. 16. Praha 1-New Town, Křemencova No. 164. Tescan Vega 3 Electron microscope images, back-scattered electron (BSE) mode. **A** – microstructure detail of the largest metal lump analysed from bag B5-010; **B** – grinding surface of the middle size lump of sample B5-010; **C** – abrasion marks (streak) by a silver object with copper ingredient on the touchstone A5-020.

Fig. 17. Analyses of two line streaks on the surface of A5-020 stone and on one of the metallic micro flakes; data in wt. % normalized to 100 %.

Translation by Linda Foster