Scientific examination of zinc-distillation remains from Warmley, Bristol

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ABSTRACT: Recent archaeological recording at William Champion’s zinc and brass manufactory at Warmley (NGR ST66927283) has allowed the investigation of materials related to the distillation of zinc. William Champion obtained a patent for the production of zinc by a distillation process in 1738 and was producing zinc on an industrial scale from the 1740s. The Champion process enabled the production of zinc-rich yellow brasses which were widely used by the Birmingham ‘toy’ industry. The materials examined include a fragment of a refractory vessel and a residue from zinc distillation. The results highlight the limitations of many patents of this period but provide some indications of how the distinctive process residues generated by zinc distillation can be recognised.

Introduction

Zinc has been used in the manufacture of copper alloys for over two thousand years (Bayley 1998; Craddock 1998; Day 1998), but before the 18th century the metal was rare in Europe. Metallic zinc is difficult to obtain from its ores because of the chemical and physical properties of the metal: it boils at 907°C and is easily oxidised in air or carbon dioxide. The reduction of zinc oxide to metallic zinc can be easily achieved in a variety of furnaces but the zinc is generally lost as a fume. Nevertheless, brasses (alloys of zinc and copper) were manufactured in Europe from at least the late 1st millennium BC by a cementation process (Craddock 1978; 1998). Copper was heated in a sealed vessel with zinc oxide and charcoal; the charcoal reduced the zinc oxide to metallic zinc and this was absorbed by the copper producing brass. Experimental reconstructions of this process (Newbury et al 2005; Werner 1970), and analyses of Roman (Dungworth 1997) and medieval (Cameron 1974) brasses, suggests that the cementation process could not be used to produce brasses that contained more than 28wt% zinc. Nevertheless, by the 18th century it was appreciated that brasses with a high zinc content were desirable, not least because they had a colour more closely approximating to that of gold. In 1723 Nehemiah Champion patented (No 454) a method for making brass in which the copper was first granulated by casting in water. The increased surface area of the copper improved the absorption of zinc resulting in brasses with up to 33wt% zinc (Day 1991, 172). The nature of the cementation process was such that it was not possible to produce brasses with more zinc; high-zinc brasses could only be made by adding metallic zinc to copper. Small amounts of zinc were available but this was expensive. In Europe it was recovered from the flues of some furnaces (Hoover and Hoover 1950, 394) while in India a process had been developed in which zinc was smelted using retorts (Craddock et al 1998). It was in this context that William Champion began the manufacture of zinc in the mid 18th century.

William Champion and his Patent

William Champion (a son of Nehemiah Champion) appears to have followed his father into the brass business in the 1730s and in 1738 he patented a method for the manufacture of zinc. Near contemporaries (eg Angerstein and Watson) were in little doubt that Champion had developed a method for producing...