Copper-based artefacts from Virginian sites: microstructures and compositions

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ABSTRACT: The purpose of this study is to correlate chemical compositions and metallographic observations from archaeological artefacts discovered at Virginian Native American sites dated between the 16th and 18th centuries AD and expand the dataset available for this type of material. The compositional analyses were carried out using LA-ICP-MS and EPMA, and visual observations were conducted using SEM-EDS and optical microscopy. The presence, absence and types of inclusions in the metal are correlated to the nature of the copper-based metal (native copper, European smelted copper and brass) as defined by chemical composition. In addition, the techniques used to shape the objects have been deduced from metallographic observations and variations in the processes according to the type of the metal have been identified, suggesting that Native American peoples adapted their techniques to the new materials imported by the Europeans.

Introduction and previous work

Native peoples from the northern part of North Eastern America began using copper (Martin 1999) to make utilitarian or ornamental objects from about the middle of the 6th millennium BC. Nuggets of native copper taken from the Great Lake deposits, and also from other minor deposits in the area stretching from Georgia to Labrador (Levine 2007a and 2007b; Rapp et al 1990 and 2000), were shaped by hammering and annealing. No melting, smelting or alloying technologies were developed and, according to Vernon (1985), the abundance of native copper rendered the use of more complex technologies unnecessary. In the 16th century AD Europeans introduced smelted copper and brass artefacts that progressively replaced native copper (Fox et al 1995; Ehrhardt et al 2000). Copper and brass cooking pots were among the items involved in the European-Amerindian fur trade. These cooking pots or kettles appear to have been valued for their metal and were recycled and used as raw materials to make copper-based artefacts, replacing native copper (Moreau 1998; Fitzgerald et al 1993). The presence at a Native site of smelted copper or brass is therefore a good indicator of direct or indirect contacts with Europeans. Studying copper-based artefacts used by Native Americans reveals how these contacts impacted on them, how these new materials were integrated, and how they transformed the Native American tradition and technology (Childs 1994).

Identifying uncorroded yellow (high zinc) brass is straightforward as this alloy is visually distinct from copper. However, corrosion often masks the colour of the metal and scratching the surface would be necessary to see the underlying metal (Fitzgerald and Ramsden 1988). American native copper and European smelted copper are visually similar but two methods can distinguish between them. The first consists of examining their metallographic features.

Observations of the copper microstructures can reveal whether they are made of native or smelted copper, and may also give information about the manufacturing processes used (Franklin et al 1981). Generally,