Copper smelting from Xinjiang, NW China. Part I: Kangcun village, Kuche county, c18th century AD

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ABSTRACT: A selection of glassy copper slags from Xinjiang, NW China were analysed by optical microscopy and SEM-EDXA. The results indicate that a very rich copper ore was smelted, probably pure copper sulphide with a gangue rich in feldspar and quartz. The slag is dominated by silica, lime and alumina, which together contribute 90–95wt%. The redox conditions are discussed, including the formation of metallic iron and iron phosphide within the copper metal, and the melting temperatures are estimated to be at least 1300°C, based on the bulk composition of the glass. The combination of redox conditions and high temperature indicates that the smelting would have taken place in a blast furnace, probably bellows-blown. A single radiocarbon date from charcoal trapped in the slag places the operation in the 18th century AD, well after the widespread adoption of blast furnaces in China. Despite the apparent large scale of the operation there are no historical records or local memories of such an operation.

Introduction

The rich ancient metallurgical remains scattered in the Kuche-Baicheng region of southern Xinjiang (Fig 1) became known to local archaeologists decades ago, but no systematic surveys or investigations were carried out until recently. In 1986 a brief investigation of some smelting sites was carried out by archaeologists from the Xinjiang Institute of Archaeology and archaeometallurgists from the Archaeometallurgy Group, University of Science and Technology Beijing. Many slag samples were gathered at these sites and some of them were then subjected to laboratory analysis, but the results have yet to be published (Zhang 1999, 63). In the summer of 2002, a survey project, aiming to systematically document the ancient metallurgical remains in the Kuche-Baicheng region, was initiated by the Institute of Archaeology, Chinese Academy of Social Sciences. The survey team investigated 18 metallurgical sites and collected a large number of samples for further laboratory study. Some but not all sites yielded materials that could be dated, such as pottery sherds, tuyeres or clay moulds (Li 2003, 16–26). According to Chinese historical records of the 1st–4th centuries AD, the Kuche-Baicheng region, where the ancient Kingdom of Qiuci was located during the Han Dynasty (c200 BC–AD 200), became known as a metallurgical centre in southern Xinjiang as early as the 2nd century BC when it supplied many oasis kingdoms surrounding the Tarim Basin with copper, iron and lead. In Han Shu – Xiyu Zhiuan [The History of the Han Dynasty – the Memoir of the Western Regions], it is recorded that the Kingdom of Qiuci ‘is capable of casting and smelting’. In Wei Shu – Xiyu Zhiuan [The History of the

Figure 1: Map of Xinjiang showing the location of the Kangcun site.