Evidence for carburized steel and quench-hardening in the ‘Celtic’ oppidum of Manching

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ABSTRACT: The first results of on-going metallographic and analytical investigations show specialized skill of blacksmithing technology in a continental pre-Roman settlement. The proven use of scrap metal also reveals a probable temporary lack of steel, and illuminates the economic situation prevailing in the crumbling late La Tène Celtic world in continental Europe.

Introduction

The oppidum of Manching in Bavaria, with 380 hectares of settlement area, formerly surrounded by a typical Celtic ‘murus gallicus’ and later by a so called ‘Pfostenschlitzmauer’, is one of the largest oppida in Central Europe. The modern site is some distance away from the river Danube, but recent geological investigations showed that this was not the case when the oppidum was occupied (Sievers et al 2000, 386-90). Its situation on the banks of the river during the ages of settlement seems to have been the lifeline of the culture. Excavated imported goods like Mediterranean pottery and glass give insight into far-reaching economic connections (Gebhard 1995, 112). The import of wine in amphorae is known and, as the last excavations showed, salt-water fish in form of ‘garum’ was common as an exotic delicious food for the inhabitants of the oppidum (Sievers et al 1998, 664). The oppidum’s exchange system seems to have included a much wider range of goods than previously assumed.

It was the famous German archaeologist Paul Reinecke (1917, 36–7) who directed attention to the presence of bog ores and slag in the Feilenmoos, a former swamp area outside the settlement. Excavations carried out in the nearby Donaumoos revealed furnaces. This was interpreted as sound evidence for a Celtic ‘iron industry’. Until now there has been some doubt about the La Tène date of the finds, but recently this has been supported by the excavation of bloomery furnaces in the Rothtal, a branch of the Danube, and their ^4C dates range from 400–100 BC (Wischenbarth et al 2001, 23–7, 143–46).

Metallographic examinations of weapons and tools by Radomir Pleiner and the author gave a first insight into the quality of ironworking technology of the oppidum, now large scale investigations on the subject have started at the Institute of Archaeometry in Freiberg. The work is focused on objects from the excavations of 1996–1999, and its aims are the characterization of technological and material differences as well as provenance studies. The first step was the application out inside the oppidum. Tools, nozzles and, above all, slag are found nearly everywhere, but there is no evidence that smelting was done inside the walls.