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In defence of Rome: a metallographic investigation of Roman ferrous armour from Northern Britain

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Abstract

Metallographic examination of seven different types of Roman ferrous armour from northern Britain dating between the late first and the early third century has revealed a complexity and variety of structures. Five specimens were made of iron hardened by warm or cold working. One fragment was of medium-carbon steel and one was of iron carburised to steel on the outside surface. Four pieces were made from folding sheets of iron or steel, variously the same piece or different metals, each with a thickness of <1 mm. Hardnesses ranged between 187 and 438 Hv. There was no evidence that the specimens had been quenched hardened or quenched and tempered.

Keywords: Metallographic examination; Roman ferrous armour; Iron; Steel; Hardness; Britain

1. Introduction

The army was central to Rome's rule and Roman military equipment has been much studied from typological and chronological perspectives (for recent surveys and *corpora*, see Refs. [4,5,12,17,18,24,31,30]). There has also been research on the organisation of the production of Roman military equipment [3,16]. Study of the materials from which this equipment was made, on the other hand, has been comparatively limited with research concentrated on the analysis of weapons, particularly swords, but also edged tools more generally [19,20,32,34]. More recently this has been complemented by work on the technology of manufacture of Roman weapons [26,27]. All of this work has given significant insight into the complexity of the structures of materials and the sophistication of the forging techniques required to create a range of artefacts. In contrast to the work on weapons, Roman protective armour, not least because of its poor survival in an uncorroded state in the archaeological record, has so far not received comparable attention. Williams, however, [34] has examined one piece of *lorica* from Risstissen in Germany which proved to be of a medium-carbon, but unhardened, steel. This study has, therefore, focused on the metallographic study of Roman ferrous armour. This material can helpfully be broken down into individual categories in respect of the different part of the body, viz armour to protect the head (*galea* or helmet), the torso (*lorica hamata* or mail armour, '*lorica segmentata*' or strip armour, *lorica squamata* or scale armour), the sword arm (*manica*), the shield hand (shield boss) and the legs (*ocreae* or greaves).

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With certain exceptions, such as the iron helmet and the gold-decorated iron cuirass from the late fourth century BC tomb attributed to Philip II at Vergina, northern Greece ([1]: 137–44), until the late Republic protective armour normally appears to have been of copper alloy or leather, with iron first appearing in the form of helmets in late Iron Age Gaul, on the fringes of the Roman world, from about the mid-1st century BC ([24]: 42–3). From the Augustan period onward an increasing range of armour types is attested in ferrous materials, though the production of armour in copper alloy continued in parallel throughout the Principate (1st and 2nd centuries AD) and later ([5]: 65–121; [24]). The continuation in use side by side of two very different materials is a further stimulus towards gaining a better understanding of their materials and technology of manufacture. The introduction of a new material suggests a number of possibilities: that it was more effective as a protective medium, that it was significantly cheaper to produce than bronze equivalents, or that it was favoured for a combination of both economic and technical factors. However, whatever the reason(s) for its partial introduction, unlike the late medieval and early modern period when ferrous armour prevailed in Europe, these were not sufficient for the new ferrous material to eclipse the use of copper alloy. On *prima facie* grounds it would seem that to draw out helmets (including the elaborately formed masks of cavalry sports helmets), shield bosses and body armour from single sheets of ferrous metal, as appears to have been the case with early imperial examples, requires a material of a quality that can be worked without splitting and, at the same time, can compete in effectiveness, weight and price with bronze equivalents. At the very least it has to compete with the ability of bronze armour to protect against penetration ([6,28]: 40, fig. 39 for comparative hardness of steels and copper-tin alloys).

To begin to investigate the reasons for the use of ferrous material for Roman armour, this paper focuses on the metallurgical investigation of six examples of ferrous armour, representing five different types of equipment (helmet, arm guard (2), scale armour, chain mail and shield boss). All the specimens are drawn from the northern frontier of the Roman province of *Britannia*, from the auxiliary forts of Carlisle, Halton Chesters and Vindolanda on, or adjacent to, Hadrian's Wall and from the auxiliary fort of Newstead in the hinterland between the Antonine Wall and Hadrian's Wall (Fig. 1). There is further contextual information from two sites: the Carlisle material derives from a collection or hoard of armour fragments excavated in 2000 from a second century building close to the *principia* ([8]: 337; [22]), while the Vindolanda fragment was found in 1992 on the floor of a room in what was probably a barrack building of Period IV date, *c.* AD 105–20 (pers. com. R. Birley). The Newstead piece was found in the early twentieth century excavations of James Curle which produced evidence of successive Flavian and Antonine forts [11], but is not more closely provenanced. There is no further contextual information for the fragment from Halton Chesters. Thus, while not all the specimens are well provenanced and dated by context, with one possible exception, they belong to a period spanning the late first to the late second or early third century AD. At the very least this evidence provides a *terminus ante quem* for manufacture, given that armour could have a long life, handed down through successive generations ([5]: 46).

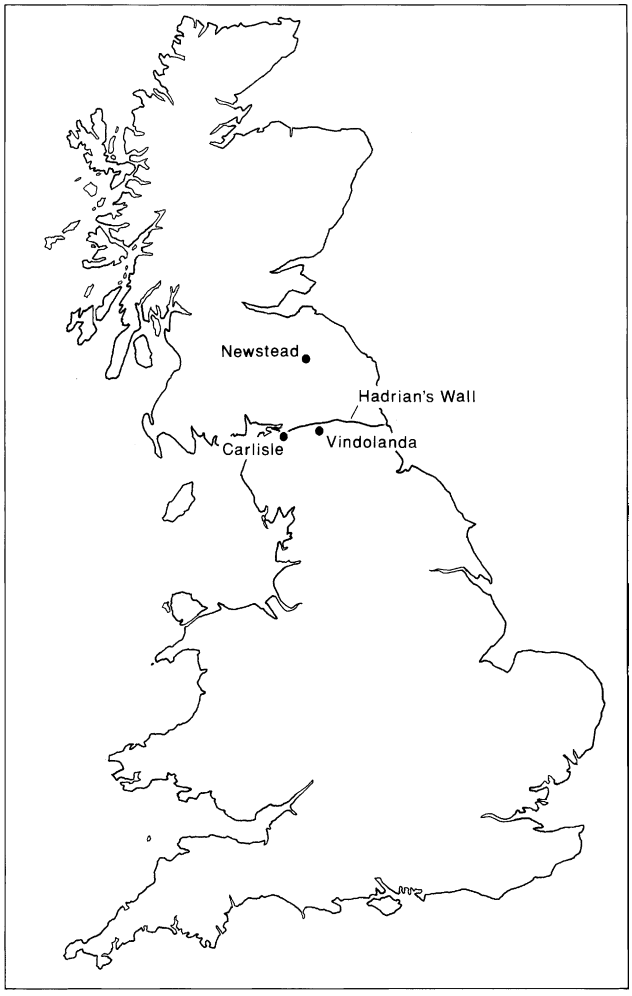

Fig. 1. Location of the armour samples.

This paper reports on the first stage of a project funded by the AHRB to research the metallurgical properties of Roman ferrous armour of all periods from Britain and, in due course, from elsewhere in the Roman empire.

2. Methodology

With the exception of the large and well preserved fragment of shield boss from Newstead (Fig. 2, No. 5),