

De Re Metallica: The Uses of Metal in the Middle Ages, Robert Bork, Ed., Ashgate, Burlington, VT, 2005, xxii+401 pp. ISBN 0 7546 5048 0, \$99.95.

This volume is a collection of papers that examine metal objects and technical writings on metallurgy from Western Europe from the early Middle Ages to the Renaissance. *De Re Metallica*, not to be confused with Georgius Agricola's treatise with the same title, is divided into five sections: 1) "metal for secular display," that discusses metal bodily decoration and other personal metal objects; 2) metal objects that possess a religious significance; 3) "metals for everyday use;" 4) metals used in buildings and architecture; and 5) treatises about metal production. The final section is likely to be the most interesting to historians of science, because of its analysis of how metallurgical knowledge was conceived, explained, and transmitted. The detailed descriptions of metal objects and reconstructions of medieval technologies from the book's earlier archaeological and art historical sections also give us a richer understanding of the material history of medieval science. The level of scholarship in this work is high; the authors almost uniformly rely on careful examinations of physical and documentary evidence and refrain from speculative conclusions. The argumentation is precise and thorough. Someone hoping to gain a comprehensive knowledge of medieval metal production and other metallurgical topics, however, would be advised to turn elsewhere. General assessments are shunned in favor of investigations into particular objects, texts, and locales.

The first four articles of the first section consider bodily ornaments from early medieval northern Europe. Gale R. Owen-Crocker uses metal remnants found in fifth- to seventh-century Anglo-Saxon graves as a means to discuss wealth and its display in that society. Brooches, pendants, and other metal objects are often the only surviving artifacts of these graves and, therefore, offer important clues to the material culture of Anglo-Saxons. Thus Gabor Thomas applies ninth-century metalwork as evidence for determining the Northumbrian style of metalwork found in strap ends and concludes that Viking influence in Anglo-Saxon Northumbria was not as great as previously thought. Nancy L. Wicker discusses the social significance of bracteates found as pendants in Scandinavian graves from the Migration Period. Niamh Whitfield describes in detail a tenth-century "kite" brooch excavated from the Temple Bar West site in Dublin. Michèle Hayeur Smith continues the examination of

Scandinavian subjects by using experimental trials to recreate Viking Age mold-making techniques. The last two articles of the section change the geographical setting and move into the later Middle Ages. In one of the more fascinating articles of the volume, Elisabeth Antoine decodes the magical inscription on a signet ring owned by Guillaume de Flouri, a Frenchman who was the Viscount of Acre during the 1270s. John Cherry's piece closes the section by interpreting the metal decoration found on the Savernake Horn, a carved elephant's tusk from fourteenth-century England.

The following section limits itself to objects relevant to religious life that were composed of metal. The articles range widely through time and space. Michael Ryan concludes that, in Ireland in the years around 1000, as a result of economic factors, more effort was expended in decorating Eucharistic vessels than in architecture. Karen Blough analyzes a gold plated sculpture of the Virgin and Child that was likely commissioned by Mathilde, a Princess-Abess from Essen. Sally J. Cornelison, by deducing its originally intended location, skillfully reconstructs the inspirations for a bronze casket that Lorenzo Ghiberti made for the church of Santa Maria degli Angeli in Florence.

The third section is called "Mundane Metals: Metals for Everyday Use in War and Peace." Finding a common theme among these three disparate yet strong pieces is challenging. Kevin P. Smith describes how iron was produced at a farm in Háls, Iceland during the Viking Age, making sober estimates about the workforce, the scale of production, and methods and materials used. David Starley provides a starting point for further investigations into the materials and efficacy of quarrel-point arrowheads from late medieval England. And Julia Lea-Jones gives a detailed account of a water conduit built of lead during the fourteenth century in a Carmelite friary in Bristol, England.

While metal objects are often the only matter that survived in Anglo-Saxon graves and, therefore, essential to reconstructions of what is no longer extant, frequently the opposite prevails in medieval buildings, where stone has endured the centuries, but metal structures have corroded, are inaccessible, altered, or looted. It is in this light that the authors in the fourth section examine the employment of metals in medieval architecture, in both famous cathedrals and more modest structures. Carl F. Barnes, Jr. shows that Villard de Honnecourt was not an architect and that his interest in the role of metal in architecture was limited. Jennifer S. Alexander looks at

the use of lead, as well as other substances, in joints in medieval masonry, primarily in England. Sabine Lepsky and Norbert Nussbaum examine how lead was used in clamps, ties, joints, brackets, and window bars in a Cistercian Church in Altenberg, near Cologne. A. Richard Jones reconstructs the original ironwork in the highest parts of the Spire in Salisbury Cathedral through a careful consideration of both physical evidence and documentary sources. Phillippe Bernardi and Phillipe Dillmann wish to diminish the dichotomy between stone and iron skeletons in their treatment of the Papal Palace at Avignon. Charles R. Morscheck, Jr. shows how the various kinds of pegs, rods, templates, and rings gave structural strength to the seemingly stone Milan Cathedral.

The final section of *De Re Metallica* is dedicated to metallurgical writings. Ricard Córdoba de la Llave shows how a fourteenth-century Spanish vernacular treatise, the *Liber que enseña ensayar cualquier moneda*, explained the techniques needed to assay silver, a topic common among many vernacular arithmetic books of this era. Because of the ubiquity of debased coins during this period, assaying was of great value to both states and merchants. Córdoba de la Llave recreates the steps described in the treatise, demonstrating that assayers had not only numerous technical skills, honed through experience, but also used sophisticated methods of quantification and measurement in their practice. David E. Connolly gives a linguistic analysis of the “rhetorical

practice of restatement” (i.e., the use of “and” and “or”) in Ulrich Rülein von Kalbe’s *Bergbüchlein*, a theoretical and empirical account of metals that was printed repeatedly during the sixteenth century. In a separate article Connolly provides a detailed research bibliography on the *Bergbüchlein*, which, while useful, would benefit from the inclusion of alchemical treatises. Even if von Kalbe was at times dismissive of alchemists, he shared a theory of the creation of metals with them. Peter L. Siems summarizes the laws for the Schlackenwald (in present-day Czech Republic) tin mines enacted by Ferdinand I in 1548. He then discusses Ferdinand’s motivations and the effects these laws had on miners and their communities, judging that these laws probably improved working conditions slightly, changed the status of miners to that of paid workers instead of independent cooperatives, and did not greatly increase royal revenue.

The editor, Robert Bork, should be commended not only for bringing together a group of meticulously argued papers, but also for the quality of the book as a whole. Numerous figures and images clarify the articles and inform the reader. The copyediting is excellent; translations are written in a clear style, and the thorough index is more than welcome. These articles will be key for future research on the individual topics they treat and, in themselves, demonstrate the variety of ways that metal artifacts can be used as historical evidence. *Craig Martin, Oakland University.*

Creadores de la Ciencia Moderna en España y América: Ulloa, los Delhuyar y del Río descubren el platino, el wolframio y el vanadio (Creators of Modern Science in Spain and America: Ulloa, the Delhuyar and del Río discover Platinum, Tungsten and Vanadium). Manuel Castillo-Martos, Muñoz Moya Editores Extremeños, Seville, 2005, 293 pp.

The relationship and exchange of technological and cultural ideas between Spain and the American continent have been the focus of many books authored and edited by Manuel Castillo Martos; in this particular work, the chemistry of minerals is the central theme, and, more

specifically, both the role played by Spanish scientists on the discovery of platinum, tungsten (wolframium), and vanadium and the impact of these scientists on mineralogy in America and Europe.

The book is clearly divided into two halves. The first one takes up a third of the book and has a general character which positions the reader in the historical framework where the four scientists operated. The second part presents their respective contributions to the discovery of the above cited chemical elements alongside detailed biographical information on each of the four scientists.

The first part of the book is titled “Historical Framework where Ulloa, the Delhuyars and del Río Operated”