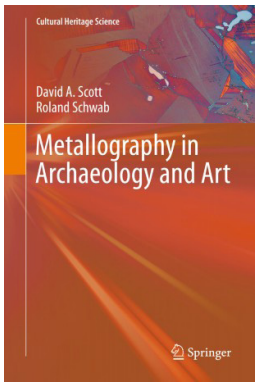
Book review

Metallography in archaeology and art by David A Scott and Roland Schwab. *Cham, Switzerland: Springer Nature, 2019. 294pp, 241mm x162mm, 193 figs (half in colour), index, ISBN 978-3-030-11264-6 (h/b) £99.99, ISBN 978-3-030-11265-3 (eBook) £79.50, doi.org/10.1007/978-3-030-11265-3.*



Since it was published by the Getty Conservation Institute in 1991, David Scott's *Metallography and Microstructure of Ancient and Historic Metals* has been the go to book for archaeologists and conservators starting out to explore the microstructures and properties of metals and what they mean. This gave rise to a desire for more metallurgical content and greater depth, especially for the many users of the book who did not have easy access to the current metallurgical literature.

Now, after nearly thirty years, the long-awaited successor has appeared and, by and large, it delivers. There are some quirks that make the book rather harder to use than is ideal and these may be down to the format. The first is encountered very quickly and that is the system of referencing, which is something of a hybrid. The references are placed at the end of each chapter in alphabetical order of author and are also numbered from 1 in that sequence. In the text the author's name is given, as might be with a Harvard reference, but instead of a date there is the number of that reference in the bibliography. Some would find a consolidated bibliography, Harvard style, to be of greater utility, but I am sure opinions will vary.

The volume starts with two short introductory chapters, the first an introduction to metallography which has an historical perspective, and the second an historical introduction to the development of metallurgy. Within the space allotted they are very helpful but, in particular, the second chapter stops short and does not take the story on to medieval and later periods which would have continued the story of innovation. We then move into the meat of the book with a chapter on metallography itself, from sample taking and preparation through to scanning electron microscopy and quantitative metallography techniques. The section on sample preparation is aimed at the use of cold mounting resins and effectively shows how you could take and prepare samples at home. The introduction to methods such as image analysis and electron back scatter diffraction should open some readers' eyes to what results can be obtained and may ensure that the methods are applied more widely. Perhaps the next edition will include some review of the possibilities of transmission electron microscopy and of X-ray and neutron diffraction techniques.

The real meat of the book is in the chapters on The Structure of Metals and Alloys and The Metallurgy of Pre-industrial Metals and Alloys. These aim to provide the reader with a basic grounding in the metallurgy they need to know to understand the structure and properties of the metals and alloys encountered in archaeological and historical contexts. This is an impossible task in so small a compass, but the authors succeed in covering all the important topics. The first of these starts with a section delightfully entitled The world of microstructures and phase diagrams which leads the reader into a survey of phase diagrams, cast structures, intermetallic and non-metallic inclusions, wrought structures, and solid state transformations such as martensites and precipitation. Most microstructural features which are likely to be encountered by the users of this book are there, but I am still seeing new things after five decades of metallography.

In contrast, the second core chapter has some problems. One is due to the format of the book which prints the micrographs at a rather small size (this can be dealt with if you are using a pdf or eBook version where on-screen magnification helps a lot. The authors have chosen to use colour tint etching on a high proportion of their samples; while useful in many contexts it can obscure some features and reduce contrast. The content is based on the authors' own samples and this may have led to omission of some structures. Two areas where I would have liked to have seen a wider range of structures are brasses and silver-copper alloys. For an apparently simple eutectic system silver-copper can produce an incredible variety of structures, not all fully understood.

The final chapter on plating, patination, and corrosion, topics worthy of a book in their own right, is relatively weak as it does not illustrate a sufficiently wide range of structures, for example in tinning or hot-dipping. Related to this is the question of soldering, brazing, and welding which, except in iron, is barely discussed, and which is an area where a newcomer to the subject can struggle to understand and interpret.

The book concludes with useful appendices on etching and colour metallography, although some details could be added, such as the strength of the hydrogen peroxide to be used in ammonium hydroxide/hydrogen peroxide. There is a useful glossary and an index which has some imperfections, such as the absence of precipitation which is both a section heading and in the glossary.

Nonetheless, this is a tremendous achievement and will be of great benefit to students of archaeological and historical metals and alloys but there is a snag; the cover price is £84.78 on Amazon, and £80.54 for a Kindle edition. The doi link will take you to the Springer website where you can purchase a copy, though if you have an institutional login, for example via Athens or Shibboleth (provided your institution has a subscription), you can download a pdf or eBook, or buy a print-on-demand softcover copy for £24.99.

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