Four of the conference papers are printed in this volume (two others are on the way to becoming books themselves), and the remaining chapters were solicited specifically for the volume. Thus, this immensely useful collection may be said to represent the state of the art in regard to Philoponus, and its editor announces a forthcoming series of translations that will make Philoponus's scientific thought available to a wider circle of readers. Both occasions call for as heady a celebration as academics can manage.

To the editor's and the contributors' great credit, the religious motives and circumstances of Philoponus's anti-Aristotelianism are fully laid out, both in individual essays (especially Henry Chadwick on Philoponus's theology, but also in Sorabji's two papers and in the essay by Lindsay Judson on generability and perishability) and in the general tone of the treatment of specific topics (dynamics, place and void, space, and self-awareness). Philippe Hoffman provides a learned and important analysis of Simplicius's polemic against Philoponus, so that (with Chadwick's essay) we can see precisely how Philoponus appeared to both pagans and Christians. There are essays on Philoponus in the Arabic tradition (Fritz Zimmermann) and in the sixteenth century (Charles Schmitt). There is an extensive bibliography and an index locorum to the writings of Philoponus, as well as a general index. The book is remarkably free of errors.

Moreover, this volume is also the occasion for a very intelligent rehearsal of some of the conventional ideas in the history of science. Michael Wolff's essay "Philoponus and the Rise of Preclassical Dynamics" contains an important review of the nature and history of impetus theory. David Sedley and David Furley provide, respectively, a text-illustrated account of Philoponus's conception of space and a vivid summary of Philoponus's corollaries on place and void. Wolfgang Bernard argues cogently for Philoponus's place in the history of psychology. Richard Sorabji's two essays are characteristically learned and lucid, ranging widely over Philoponus's life and thought and his doctrines of infinity and creation. Christian Wildberg offers a pathbreaking analysis of Philoponus's Contra Aristotelem. This is exactly the sort of many-handed volume one needs to approach a thinker as complex and important as Philoponus. Obviously crucial to the history of science, it will serve a far wider circle of readers, and it will serve them well.

EDWARD PETERS

## Far East

Joseph Needham. Science and Civilisation in China. Volume V: Chemistry and Chemical Technology. Part 1: Paper and Printing, by Tsien Tsuen-Hsuin. xxv + 485 pp., illus., figs., app., bibls., index. Cambridge/London/New York: Cambridge University Press, 1985. \$89.50.

Tsien Tsuen-Hsuin, professor emeritus of the University of Chicago, is responsible for this long-awaited volume in Joseph Needham's *Science and Civilisation in China*, as is immediately evident from the now-famous format. And it is distinguished, as have been all of the preceding volumes, by its bulk, accounted for by an ample treatment of the subject coupled with a more than adequate discussion of the history of the topic in other cultures.

Unlike some of the earlier volumes, this one does have worthy predecessors in English, notably the writings of Dard Hunter on paper (comprising small volumes on oriental papers, published in the 1930s, and his large *Papermaking* of 1943) and T. F. Carter's *The Invention of Printing in China* (1925). But as usual these contributions are overwhelmed by the encyclopedic treatment in the Needham series.

And of course the treatment here is more up to date. The date of the invention of paper is now carried back "several centuries before the start of our era" (p. 2; Hunter had placed it the first century A.D.), and that of printing earlier (but not by much) than the long-familiar eighth-century Buddhist charm from Japan.

These claims are supported by recent archaeological discoveries, but the chronologies remain somewhat vague and are less interesting, except to fanatical priority seekers, than detailed information typical of the Needham history. What was paper used for before the invention of printing? For writing, of course—but first, apparently, for wrapping, for the mold and sizing, without which paper was worse than imperfect for writing, are here dated between A.D. 200 and 300. Thereafter, paper fans and umbrellas, clothing, kites, lan-



Nineteenth-century Japanese woodblock cutters and typesetters

terns, playing cards, and money followed, the last by about 800 (150 years earlier than the date assigned by Carter).

Similar detail is given on the printing of books (the first is still the Diamond Sutra of 868 found by Aurel Stein at Tunhuang in 1907). In the early fifteenth century 30 percent of the books in the Royal Library at Peking were printed. The illustrations include a photograph of the 81,258 wood blocks carved between 1237 and 1251, and still preserved in "southern Korea," for the printing of a Buddhist Tripitaka.

It is especially appropriate that the transmission of paper and printing to the West is dealt with, for so much of the evidence for the whole history comes from late or foreign sources. The oldest extant description of papermaking is that in the *Tien-Kung K'ai-Wu*, an encyclopedia of 1637 (available in an English translation by Sung Ying-Hsing, Pennsylvania State University Press, 1966). The earliest description of printing is in an Arabic book of 1317. The oldest examples of printing have been found in Korea and Japan, and the oldest extant printed book is now in the British Museum.

The world of letters, as George Sarton

used to call it, will wish Joseph Needham the immortality to which the Chinese literati aspired, not only for having begun and carried on this great work, but, since the realization of the wish cannot be assumed, for having made it, through his colleagues, as certain as can be that the work will be completed.

ROBERT P. MULTHAUF

## Seventeenth Century

**Allen G. Debus.** Chemistry, Alchemy and the New Philosophy, 1550–1700. (Collected Studies Series, CS249.) xii + 332 pp., figs., index. London: Variorum Reprints, 1987. £32.

Fourteen of Allen Debus's papers on alchemical philosophy in the sixteenth and seventeenth centuries, originally published over the last two and a half decades, are reprinted in this collection. A few (though by no means all) misprints have been corrected, but no attempt has been made to revise the articles or to update them bibliographically. The author has added a threepage preface to the collection, and the publishers have contributed a quite comprehensive index. Since the original pagination of the papers has been retained, those who are reluctant to pay the steep price demanded for the volume will be tempted to photocopy the index and the table of contents, and to refer to the originals. With three exceptions, these are readily available in widely distributed journals.

The appearance of a volume such as this provokes reflection on the lasting value of the author's work. The conclusion is not likely to be entirely flattering to his reputation. Debus's method is to explicate a series of texts, usually with substantial quotations; and this works best when the focus is sharply defined. Of Debus's papers, those that seem to me of continuing importance are on the development of methods of chemical analysis and on certain aspects of the work of his favorite author, Robert Fludd. His more synthetic pieces, which describe a Paracelsian or "Hermetic" alchemical "tradition," surviving even to the end of the eighteenth century, founder because of insufficient attention to the historical context of the writings he surveys. Debus suggests the sustained importance of alchemical philosophy in the