Book Reviews

A History of Metals. vol. 1 and vol. 2. Leslie Aitchison. Interscience, New York, 1960. xxi + xvii + 648 pp. Illus. $30.

These two large volumes, with 8½- by 11-inch pages, contain "a biography, not of men but of a family of substances" (page v, vol. 1). The author "first took industrial employment" in 1909 in a factory where an old-fashioned tilt-hammer "was functioning with complete satisfaction" (page 310), and he has seen and made contributions to many changes in the industry of metals. On the foundation of his own experience, Aitchison now describes the history of metals from the earliest times to the discovery of the transuranium elements. He narrates in a pleasingly readable style the complex cultural, political, economic, and technological aspects of metals in history.

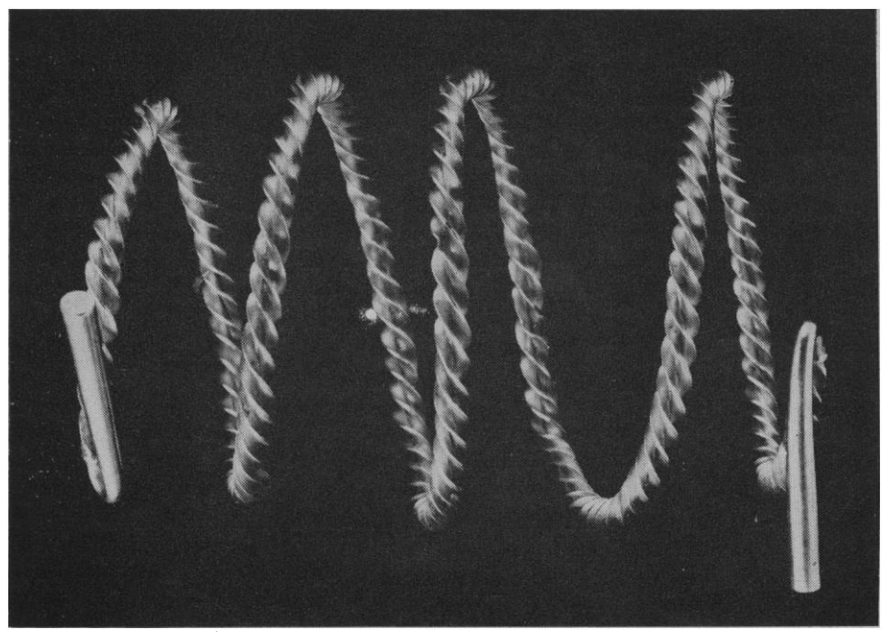
The impact of metals on cults and on cultures went so deep that ancient religions included such figures as the Egyptian Ptah (in the third millenium), the "master of the gold-smiths and gold-smelters," who had among his priests the "great wielder of the hammer" and one "who knows the secrets of the gold-smiths" (page 263); Hephaistos, "the lame god of the forge and smithy"; and the Roman god Vulcan. In many old legends, the smith was endowed with magic powers. Gold was used in religious art—for example, in the magnificent necklace from Ur (about 2600 B.C., frontispiece, vol. 1), and copper was used for the bull's head from Al 'Ubaid (2800 B.C., Fig. 6).

But Aitchison reminds us that metals were also used for making weapons. In the 5th century B.C. Herodotus deplored woeful applications of iron. The elder Pliny called iron "the best and worst servant of humanity" (page 1). More cheerful was the outlook of Bartolommeus Anglicus, the Franciscan friar who lived around 1250: "Without yron the comminaltie be not sure against enemies . . . no field is eared without Yron, neither tilling crafte used, no building builded without yron . . ." (page 345).

Political influences altered the rate and the course of developments. The disintegration of the Roman Empire threw metal businesses back to the stage they had attained about 1000 years earlier. The conquests in the New World were largely inspired by the hope of gaining precious metals. Large amounts of gold and silver from the new sources, estimated at the equivalent of almost $500 million, entered Europe by way of Spain; consequently, the purchasing power of these metals fell, so that "at the end of the sixteenth century Spanish prices had rocketed to about two and a quarter times the level for the years 1521 and 1525" (page 370). Henri Sainte-Claire Deville was encouraged in his search for a commercial production of aluminum by Napoleon, who hoped the new metal would provide lightweight armament.

Technologically, some of the main problems were to obtain high temperatures and power. As recently as 1632, Jordan obtained a patent for replacing wood fuel by coal, peat, and turf in certain smelting operations (page 432). The new system in chemistry and the great discoveries of elements in the 18th century brought many changes in the history of metals. A new "age of alloys" started about 1890 (page 583). And yet, the method of making hollow castings by the lost-wax process, which stems from "well before the middle of the third millenium" (page 197), is still "the most satisfactory method so far developed for fabricating engine components in some of these special alloys . . ." (page 602).

The historian trying to recreate the great story of the metals has to solve problems in organizing and selecting his materials. Aitchison has organized his story well, but his selections, especially for the latter part of his book, will scarcely find general approval. He could have shortened the rather well-known stories of atomic theory and of the periodic system of the elements to make room for an account of the chemical properties and uses of metals and their alloys. It is not adequate to the scope of this book to say of stainless steels only that "now everybody knows them in the forms of sink-units and kitchen equipment" (page 583). Besides, when Harry Brearley is mentioned as an inventor, it would be only just to name Strauss instead of, or together with, "Krupps at Essen."



Twisted gold torc from Grunty Fen (near Ely, Cambridgeshire, England), about 1600 to 1500 B.C. [Courtesy University Museum of Archaeology and Ethnology, Cambridge University, from *A History of Metals*].

Several annoying errors in chemical history could easily have been avoided. Basilius Valentinus is treated as a real person, although, even in this book, mystery surrounds him; he is supposed to have preceded Paracelsus by about a century (page 291) and yet to have survived to publish work in 1650 (page 482). The phlogiston theory is described as having been "exploded by Lavoisier and his English contemporaries" (page 294), of whom Priestley and Cavendish, those stout phlogistonians, are specifically named (page 476). It is not true that "during the first half of the eighteenth century, the halogen elements were discovered, as were also boric and phosphoric acids" (page 479).

There are a few more such minor blemishes, but instead of listing them here, the great value of this book should be emphasized. Its skillful and many-sided description of the history of metals is greatly enhanced by profuse illustration. This includes maps of the ancient world, clear outline drawings and pictures, 262 in all, placed right on, or very close to, the page on which their story is told. Some of them are dramatically confronted—for example, the iron-carbon equilibrium diagrams (Figs. 246 and 247); a sculpture by Rodin and the propeller for the liner R.M.S. Queen Elizabeth (Figs. 256 and 257).

In addition to references at the end of each of the 15 chapters, there are 6 pages listing "some sources." Studying all these references brings to mind Peter Guthrie Tait's remark in the introduction to his "Sketch of thermodynamics" (1877) about "the old absurd British contempt for all things foreign. . . ." Aitchison cites very few American books, only two German, and no French or other "foreign" publications. The old French works by Hassenfratz, the newer ones by Léon Guillet and Bertrand Gille, Sten Lindroth's Swedish book on Stora Kopparberg, and the many German ones—by Beck, Osann, Tammann, and others—do not appear in this bibliography. At least, John Webster's *Metallographia or an History of Mettals,* first published in London in 1661, should be listed in a second edition of Aitchison's work, and, in view of its great merit and beauty, a second edition should soon become necessary.

EDUARD FARBER
4530 Brandywine Street, NW, Washington, D.C.

Anthropological Papers. Numbers 57–62. Bulletin 173, Bureau of American Ethnology. Smithsonian Institution, Washington, D.C., 1960 (order from Supt. of Documents, GPO, Washington 25). iv + 498 pp. Illus. $3.25.

Bulletin 173 is a collection of six papers on specialized topics. Three papers (Nos. 57, 58, and 62) discuss restricted archeological manifestations in the United States. Paper 57, C. G. Holland's "Preceramic and ceramic cultural patterns in northwest Virginia," is an excellent example of the useful results obtained by pooling amateur and professional efforts: Holland, the amateur, contributed an intimate knowledge of the area and several years of careful collecting, and Clifford Evans and Betty Meggers of the Smithsonian Institution provided the systematic framework which makes the report a valuable first approximation of the cultural sequence in northwestern Virginia. Paper 58 is "An introduction to Plains Apache archeology—the Dismal River aspect," by James H. Gunnerson, who concludes that the group of sites, chiefly in western Nebraska, comprising the aspect represent the final phase (about A.D. 1700) of Apache domination of the High Plains. Gunnerson further suggests from archeological evidence that the southwestern Athabascans (Apache and Navaho) came to the southwest via the High Plains around A.D. 1525. The third archeological paper (No. 62) is "Stone tipi rings in north-central Montana and the adjacent portion of Alberta, Canada: their historical, ethnological, and archeological aspects," by Thomas F. Kehoe. Kehoe concludes that most of the circles of stones in the area (and probably elsewhere in the Plains) are in fact tipi cover weights, although this explanation will not serve for all types of configurations of stones. The remaining three papers are a miscellany including No. 59, "The use of the atlatl on Lake Patzcuaro, Michoacan," by M. W. Stirling; No. 60, "A Caroline Islands script," by Saul H. Riesenberg and Shigeru Kaneshiro; and No. 61, "Dakota winter counts as a source of Plains history," by James H. Howard. Stirling's paper describes one of the few survivals of the spear thrower, a device of Paleolithic antiquity. Howard describes nine hitherto unpublished "winter counts"—annual pictographic records of outstanding events drawn on hides or cloth—and comments on their consistency and chronological reliability. Riesenberg and Kaneshiro present an interesting study of cultural innovation—the development by stimulus diffusion of a syllabic system of writing derived from European writing through an American missionary and native intermediaries.

ALBERT C. SPAULDING
National Science Foundation, Washington, D.C.

The Physiology of Crustacea. vol. 1, *Metabolism and Growth*. Talbot H. Waterman, Ed. Academic Press, New York, 1960. xvii + 670 pp. Illus. $22.

This is a valuable book, comprising 17 reviews of aspects of crustacean physiology by a well-chosen group of authors and coauthors; the whole is well edited, unified, documented, and indexed. In its general level and approach it may be compared with *Insect Physiology*, edited by K. D. Roeder (Wiley, 1953), although the completed *Physiology of Crustacea* (two volumes are planned) is scheduled to have twice as many contributors as the earlier work.

Naturally, the treatment accorded the various topics in this first volume is as diverse as one might expect from its 18 contributors. The length of the chapters varies with the scope of the selected topics from as little as 12 pages in chapter 12 ("Ecology and metabolism," by Florkin) to 57 pages in chapter 2 ("Respiration," by Wolvekamp and Waterman), and the number of references per chapter also varies, from 56 to 257, averaging 109. Some idea of the extensiveness of the review coverage might be gained from the fact that the author and coauthor index includes 1208 names, many of which represent more than one paper. Since each chapter has its own bibliography (unlike the single bibliography of *Insect Physiology*), there is repetition of titles, and I did not attempt to determine the actual number of separate papers cited; as a guess, I would say over 1400.

One aspect of the excellent editing of this work is seen in the extensive indexes, which total 78 pages (about 12 percent of the book). There is an author index, indicating by page and superscript numerals each point at which an author is cited; in most instances authors are not cited by name in the text.