such sophisticated technologies as ICBM's. The evidence assembled in the two long chapters on defense suggests, however, that the institutional arrangements in the defense sector have much in common with those in the civilian sector—similarity in the R & D cycle, in organizations, and in incentives—and defense plants often also produce civilian products. Thus, spontaneous innovation in the defense sector tends to be hampered by factors that retard innovation in the civilian sector. Since defense is to be viewed "as an integral, if special, part of Soviet industry," its comparatively greater innovativeness can be ascribed largely to the presence of a single, demanding customer, the armed forces, to the sector's unwavering priority claim on scarce labor and high quality materials, but perhaps most of all to a competitive race with foreign states, which have presented Soviet military planners with a constantly moving target. Even so, the study concludes, Soviet military technology tends to suffer by comparison with that of the United States in quality and level of sophistication. To compensate, and because it eminently suits the system's modus operandi, the Soviets have stressed quantity goals—"vastness of deployable stocks."

Through the revealing perspectives of these case studies, both the strengths and the weaknesses of socialist central planning as an engine for promoting technological progress are clearly portrayed. Two fundamental conclusions seem unassailable. First, contrary to the assertions of many socialists, the system of socialist central planning as a replacement for a private-enterprise, market-oriented system has proved to contain serious systemic fetters, both on indigenous technological dynamism and on the ability efficiently to absorb and diffuse technologies imported from abroad. Second, an industrial development strategy based on an all-out concentration of resources on key objectives and sectors leaves serious, perhaps fatal, legacies as neglected sectors and objectives become constraints in an increasingly complex and interdependent industrial structure.

In the past 15 years the Soviet government has launched numerous economic "reforms" and reforms of these reforms, in an effort, among other objectives, to remove some of the systemic obstacles to innovation. These changes, many of them described in the study's concluding chapter, aptly entitled "Innovation for innovation in Soviet industry," have included: setting up "science-production" associations to eliminate the rift between R & D and production; new incentive arrangements for R & D scientists and engineers geared to the utility of their work to customers; the extension to the civilian sector of program-goals planning and management, an approach long used in the defense sector; revised success indicators for producing enterprises intended to mitigate their risk aversion; a product-quality certification scheme intended to eliminate the common phenomenon of pseudoinnovations in product design; and many, many others. The reviewer readily endorses the author's conclusion that these many innovations have not resulted in any fundamental change and that much "bolder leaps" will be needed if technical lags are to be overcome, but would add that these "leaps" must alter the economic system itself, something that none of the reforms has even approached up to now.

GERTRUDE E. SCHROEDER
Department of Economics, University of Virginia, Charlottesville 22901

Prices of Books

Average per-volume prices of books reviewed in *Science* 1978–1982. Data are for hard-cover books except where books were available only in paperback; books priced only in foreign currencies were excluded from the calculations. The average prices per page of the technical books in the natural sciences for the years covered were 7.8¢, 8.6¢, 9.0¢, 11.3¢, and 11.1¢.

Category	Price (dollars)				
	1978	1979	1980	1981	1982
All books	29.65	30.33	35.52	42.22	44.05
Technical books in the natural sciences	36.04	39.18	42.61	52.76	51.70

Urban Environmental Efforts

The Healthiest City. Milwaukee and the Politics of Health Reform. JUDITH WALZER LEAVITT. Princeton University Press, Princeton, N.J., 1982. xviii, 296 pp., illus. $22.50.

Garbage in the Cities. Refuse, Reform, and the Environment, 1880–1980. MARTIN V. MELOSI. Texas A&M University Press, College Station, 1982. xvi, 268 pp. + plates. $21.50.

During the late 19th century, American society was transformed by urbanization and industrialization. In the years 1850 to 1900, Milwaukee's population increased from 20,000 to nearly 300,000 as what had once been a pleasant wheat-trading center became a congested factory city. The urban population explosion posed grave health problems. The poor were herded into small, squalid houses without running water or indoor toilets. Factories belched their noxious wastes into the air and slaughterhouses threw animal carcasses onto the streets. Milk was obtained from emaciated and diseased cows housed in manure-littered barns. Inadequate housing and unsanitary conditions provided a nursery for communicable diseases. Tuberculosis, pneumonia, and infectious diseases of childhood were endemic and caused the most deaths. However, it was the unexpected epidemics of smallpox and influenza that caused the greatest fright.

To meet the challenges presented by the rapid, unplanned growth experienced by Milwaukee and other American cities municipal health departments were established and were entrusted with responsibility for control of infectious diseases, sanitation, and regulation of the food supply. Leavitt provides case studies of each of these concerns to illustrate the work of the Milwaukee Health Department. The three subjects she has chosen for intensive examination—smallpox, garbage, and milk—illuminate her special concern with the politics of health reform.

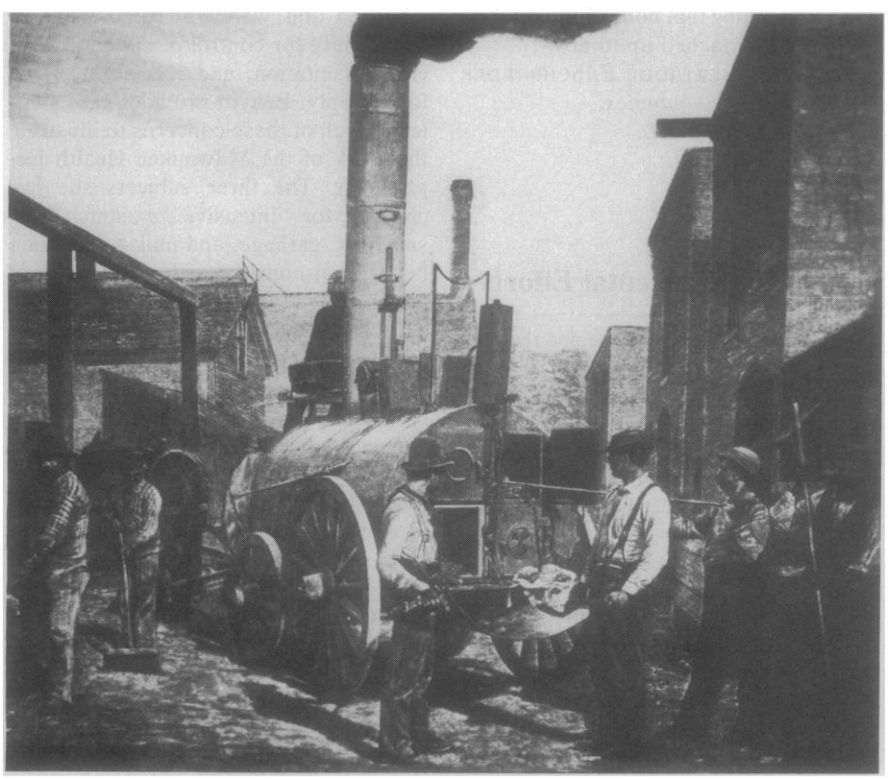
Leavitt's analysis demonstrates that improvements in public health depended as much on the support of politicians and community leaders as they did on advances in medical knowledge. At first public health officials were insensitive to the politician's need to dispense patronage and the immigrant's fear of government intrusion in family and neighborhood matters. It was not until they learned to educate the urban poor about the need for vaccination, disinfection, isolation of the sick, and other such matters that they began to gain their objectives. In time health officials learned to work with community activists and political leaders in establishing neighborhood health centers and health education programs.

Though Leavitt's case studies illustrate the politics of public health, they are not as revealing of the health problems themselves. Smallpox was absent from Milwaukee in most years and killed few persons. Tuberculosis, by contrast, yearly was responsible for about 10 percent of the city's mortality. Garbage attracted a lot of attention, but for the most part garbage disposal had little effect on the city's health, and, as Leavitt acknowledges, "a study of sewage or water instead of garbage would have provided a more dramatic illustration of the connection between sanitary reform and improving mortality."

Leavitt derives her book's title from the fact that Milwaukee was the repeated winner of the national Health Conservation Contest sponsored by the U.S. Chamber of Commerce and American Public Health Association beginning in 1930. But these contests did not begin until ten years after the end of the period her study is mainly concerned with. In the years 1895 to 1918, Milwaukee's record in public health was not as good as that of other progressive cities. The health department did not establish a bacteriological laboratory until 1906, 12 years after this major innovation was pioneered in New York City. Its efforts to insure a safe, wholesome milk supply were largely unsuccessful. Finally, the city had taken no action to improve the housing of the poor, to reduce the frightful toll of industrial accidents and sickness, or to combat venereal disease.

"Sanitary officer placarding a home with 'MUMPS WITHIN' sign, Milwaukee, 1922." [Reproduced in *The Healthiest City*, courtesy of City of Milwaukee Health Department]

Whereas Leavitt looks at one city's response to a variety of health problems, Melosi follows the opposite course in his study of garbage in America, focusing on American attitudes toward and methods used for dealing with one problem.



"This traveling garbage burner meandered through the alleys of Chicago in 1893. It operated at a total cost of about twenty dollars a day." [Reproduced from *Scientific American* in *Garbage in the Cities*]

In the mid-19th century, refuse was regarded simply as a nuisance. The heaps of garbage, rubbish and manure that littered streets and alleys were an annoyance, but they were not thought to pose a danger to the community. The refuse was disposed of by dumping on land or in waterways or by using the organic components for fertilizer and animal feed. At this time, the public attitude toward garbage can best be described as "out of sight, out of mind."

In the decades following the Civil War, garbage came to be viewed as a health menace, as serious as water or air pollution. Reliance on private contractors to pick up and remove solid wastes had never worked very well, and now that it was widely held that filth caused disease cities began to do the work themselves. With the triumph of the germ theory of disease in the early 1900's, health officials began to pay less attention to environmental sanitation, and the refuse problem was turned over to municipal engineers. Several different methods of garbage disposal were attempted, of which the most important were reduction and incineration. Each new method that was adopted went through a similar evolution: enthusiastic acceptance, severe criticism when the new technology failed to work as expected, and reevaluation. Gradually the sanitary landfill began to supplant other methods of garbage disposal, though it was recognized that there was no one best solution, since the problem was different in each community.

If Melosi's book has a major flaw it is that he has a tendency to view his subject through the prism of contemporary ecological concerns. Like most environmentalists, he has adopted as an article of faith the idea that environmental degradation is the unavoidable end product of large-scale urbanization and industrialization. Yet, as Melosi knows, American cities are far healthier and cleaner today than they were in 1900, despite larger populations, bigger factories, and much greater production of wastes. The environmental degradation that characterized American cities at the beginning of the 20th century was a product of the unique social, political, and economic forces of that period. As new technology became available, and as concern about the dangers of pollution was converted into legislation, the urban environment was transformed and improved. Clean-burning natural gas was substituted for soot-producing soft coal. Zoning ordinances prohibited the establishment of slaughterhouses near population centers. Asphalt pavement made street cleaning

easier. And the growth of suburbs made it possible for millions of Americans to live in a semirural environment.

Melosi notes with approval that in the 1960's and 1970's Americans began to think about limiting the generation of refuse rather than simply attempting to devise more efficient methods of solid waste management. But if refuse creation is a function of consumerism then it will require nothing short of a revolution in American values for this new approach to succeed.

Both books are based on exhaustive research in primary and secondary sources. They each contain numerous helpful tables and evocative photographs and are written in a lively style that keeps the reader's attention throughout.

STUART GALISHOFF
Department of History,
Georgia State University, Atlanta 30303

Ores

Ore Genesis. The State of the Art. A Volume in Honour of Professor Paul Ramdohr on the Occasion of His 90th Birthday. G. C. AMSTUTZ, A. EL GORESY, G. FRENZEL, C. KLUTH, G. MOH, A. WAUSCHKUHN, and R. A. ZIMMERMANN, Eds. Springer-Verlag, New York, 1982. xx, 804 pp., illus. $65.

This volume dedicated to Paul Ramdohr, the father of modern ore microscopy, on his 90th birthday has "special reference to his main scientific interests," ore minerals and their origins. A collection of 74 papers by 126 authors, the book illustrates the current state of thinking on the genesis of a wide variety of ore deposits and ore mineral occurrences. Also present are some phase equilibria, some crystal chemistry, and a few broad-brush thoughts on metallogenesis in general.

The book is organized on the basis of modes of ore genesis, ranging from weathering and diagenesis to subvolcanic and plutonic emplacement.

The contributions, necessarily brief because of the large number of them, are quite readable and well illustrated. Although there are accounts of deposits worldwide, the majority of papers describe lesser-known European localities. The absence of descriptions and discussions of the classical well-known deposits is at first disappointing but may actually enhance the value of the volume, for omission of such papers has permitted inclusion of papers that provide the first descriptions available in English of many of these lesser-known but mineralogically interesting localities.

The volume does contain good review papers on a few major deposits, especially the conglomeratic uranium-gold ores. Papers by Saager *et al.* and Hallbauer and Kable summarize previous findings and offer new insights into the diverse origins of the Witwatersrand gold-bearing conglomerates. The former workers report the finding of carbonaceous matter, believed to be indicative of primitive life forms, in the 3200 million-year-old pre-Witwatersrand conglomerates. The latter workers document different provenance areas for the detrital quartz pebbles and pyrite on the basis of chemical signatures and types of inclusions. These data strongly support a view of multiple sources for the uranium and the gold in the Witwatersrand.

A study of the similar quartz-pebble conglomerate uranium ores at Elliot Lake, Ontario, by Meddaugh *et al.* traces the multiple-stage loss of lead and demonstrates that the actual age of the uraninite is greater than 2100 million years and thus is consistent with a syngenetic detrital origin for the uraninite. This work overcomes the heretofore troublesome apparent young age of the uranium in very old sediments.

Klemm and co-workers have reexamined the mechanisms of formation for the massive chromite and magnetite layers in the Bushveld complex. They, like some previous workers, conclude that the precipitation of these monomineralic layers resulted from a rise in oxygen fugacity. Their belief, however, is that the rise in oxygen was due to volatile exhalations, from the underlying rocks, which were transmitted rapidly to the crystallizing magma through fractures in the previously solidified cumulates. This is an interesting concept; it overcomes some explanatory problems caused by the slowness of gas diffusion in melts but requires field testing and laboratory verification.

Frutos has prepared an excellent synthesis of the development of the Andean metallogenic belt that provides a framework for the several papers on South American deposits. He traces the Mesozoic-Cenozoic history of the orogen and relates the spatial setting of different types of ores to the evolution of the crust in western South America. Papers of this type would certainly be welcome on all of the world's major metallogenic provinces.

The title is a bit of a misnomer in that most of the papers are actually classical, but modern, geological and mineralogical descriptions of deposits. There is little in the way of "cutting edge" treatment of ore genesis, a shortcoming that is recognized by the editors. Nevertheless, the descriptions and discussions are interesting and useful and do provide information valuable to workers who are attempting to contrast and compare deposits. Notably absent are papers dealing with the solubility of ore minerals and with the transport and deposition of ores by hydrothermal solutions. The index is weak in that localities are not listed by name and only sometimes by country or metal contained; thus, pertinent data are often found only by reading through the table of contents or by thumbing through the pages.

This book is a useful source of data on many types of ores and should be examined by all workers in ore deposits and ore minerals, but it is unlikely that it will become a major reference.

JAMES R. CRAIG
Department of Geological Sciences,
Virginia Polytechnic Institute and
State University, Blacksburg 24061

Synapsids and Evolution

Mammal-like Reptiles and the Origin of Mammals. T. S. KEMP. Academic Press, New York, 1982, xiv, 364 pp., illus. $44.50.

The mammal-like or synapsid reptiles lack the popular appeal of the dinosaurs, but they make up for it by providing us with a fossil record that is unsurpassed in documenting patterns of large-scale evolutionary change. The earliest synapsids were barely distinguishable from the most primitive reptiles, whereas those of 100 million years later differed from mammals only in small details. Here, then, in the words of T. S. Kemp, is "the one example known where the evolution of one class of vertebrates from another class is well documented by the fossil record" (p. 1). One of Kemp's main purposes in this book is to use the fossil record of the mammal-like reptiles as a model from which to derive generalizations about the patterns and processes of large-scale evolution.

Following the introduction and a chapter on methods of functional and phylogenetic analysis are ten chapters dealing with the main groups of synapsid reptiles and early mammals. Each of these chapters reviews the systematics, morphology, and stratigraphic distribution of a group, aided by numerous illustrations and, usually, a cladogram showing the relationships of the included subgroups; and each chapter ends with a section on functional anatomy that presents the author's interpretation of feeding and loco-