

seems consistent with Western thinking on this subject. What these particular papers lack is a strong critical sense regarding the barriers to effective pollution control that have arisen in Soviet society, including such criticisms as can be found in the Soviet periodical press and the recently translated *samizdat* work by Boris Komarov (*The Destruction of Nature*), as well as the works of numerous Western authorities such as Goldman, Powell, Kelley, Gerner, Lundgren, Ruble, and others. Though the factual material here is interesting, these chapters seem directed largely at convincing a Western audience that all is well. They read too often like pieces from *Soviet Life* and lack even the critical bite of many articles on these topics that can be found in the Russian-language Soviet press. Our credulity is stretched particularly by the assertion of E. K. Fyedorov that "if mankind were totally embraced by the socialist social system, the social aspect of the problem of optimizing the interrelationship between man and nature would disappear." In other words, only Soviet-style systems with centrally planned economies are, in his view, able to cope effectively with environmental problems. Since 1975, he writes, when the state plan for the development of the economy first incorporated a special section on environmental protection, pollution levels in the U.S.S.R. have stabilized. It would be nice to think that this is so, but given the inability of Western experts to check on such claims a certain skepticism is in order.

In general, the writers in this volume are quite optimistic about the ability of new scientific discoveries, technological progress, and greater efficiency to solve most of the problems of resource shortages and environmental degradation. Soviet writers are consistently critical of pessimistic Western studies, such as those of the Club of Rome, and of "doomsayers" such as Garrett Hardin and Paul Ehrlich. Soviet social scientists in particular (such as the philosophers and economists represented in this volume) often remain distinctly different in mentality and approach from many of their Western counterparts: not only more optimistic about the ability of science and technology to solve the world's problems but more convinced that science can only flourish as an institution under a system of centralized planning where the emphasis is on conscious control by state organs. Certainly the enormous growth of resources and manpower devoted to science and technology in the U.S.S.R. over the past several dec-

ades reflects this belief. But one can be permitted a modicum of doubt regarding the efficacy of Soviet science, given the problems of low productivity and relative lack of creativity in many areas, problems frequently discussed in the Soviet press but never alluded to in this collection.

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Historical Inquiries

The Analytic Spirit. Essays in the History of Science. In Honor of Henry Guerlac. HARRY WOOLF, Ed. Cornell University Press, Ithaca, N.Y., 1981. 366 pp. \$25.

In his distinguished academic career, nearly all of which he has spent (like his father) at Cornell, Henry Guerlac has earned the unqualified respect of colleagues and students alike. Among his many achievements is a major recasting of the historiography of the chemical revolution of the 18th century; it was he who 20 years ago demonstrated the importance of the "crucial year" of 1772 in which Lavoisier turned decisively to the problems of combustion in general and of the calcination of metals in particular. Since Guerlac has always successfully married the gifts of a scholar with those of a teacher, his standards of precise yet imaginative scholarship have been passed on, year by year, to younger historians of science fortunate enough to have worked with him at Cornell. It is the high quality of this continuing tradition that makes *The Analytic Spirit* an uncommonly impressive festschrift. The work of 16 of Guerlac's former students, it is a collection imbued with a real flavor of what historians of science throughout the world will recognize as the Guerlac style.

It is no reflection on Guerlac's brilliant book-length work to suggest that he has always been preeminently the master of a different genre—the intricately argued scholarly article. He has shown time and again that the minute examination of a text need not be synonymous with pedantry. That particular lesson is implicitly repeated here by Margaret Jacob, who builds on her chance encounter with a manuscript in the British Library to illuminate a clandestine network of Continental freethinkers, the Knights of Jubilation, and thereby to raise a hornet's nest of problems concerning the relations between free thought, Protestantism, Freemasonry, and the infant En-

lightenment in the age of Bayle, Toland, and Bolingbroke. (Interested readers should refer to her recently published book, *The Radical Enlightenment*, for an extension of the argument.)

Leslie Burlingame's eye for a subject is no less keen than Jacob's. She penetrates the murky obscurity of Lamarck's chemistry, treating it refreshingly as a worthy topic in its own right and not simply as a possible explanation for the rejection of his evolutionary ideas. She traces Lamarck's eclectic Stahlism (which involved the retention of a four-element matter theory and a resolute opposition to Lavoisier's chemistry) to the influence of the Rouelle brothers and, more originally, places it in the context of Lamarck's comprehensive hostility toward speculative system-builders in all branches of science. Burlingame makes it very plain that Lamarck's chemistry was in no sense a peripheral aberration surviving from his youth, but rather was the foundation of a unified view of nature that explained, with equal ease, the history of the earth and the origins and continuance of life. Though it has never been properly explored by historians, the point was not lost on Cuvier, who, in 1832 in his *éloge* of Lamarck, chose to argue in detail against Lamarckian chemistry. Burlingame's paper, together with Carleton Perrin's careful study of the determined strategy of the "antiphlogistians" between 1785 and the early 1790's, serves the useful purpose of making the victory of the new chemistry appear far less inevitable than is commonly supposed. In this respect, it is particularly refreshing to see Perrin paying overdue attention to De La Méthérie's rearguard action in favor of phlogiston, launched from a powerful base in the monthly *Journal de Physique*.

Appropriately, more than half the papers in this volume treat Guerlac's favored theme of French science in the Enlightenment. Some break new ground, like Rhoda Rappaport's immaculately researched study of the "liberties" of the Paris Academy of Sciences in the 18th century; in tracing the shifting response of academicians to the attempts by the royal bureaucracy to sway the outcome of elections and promotions, she points astutely to a growing rigidity and unimaginativeness in the acknowledged citadel of the French scientific establishment. Other papers, like Roger Hahn's caution against the lingering belief that Laplace was an atheist, take a fresh look at familiar received opinions. It is in this latter spirit that L. Pearce Williams reviews the literary and scientific evidence

for supposing that the Crab Nebula originated with the brilliant "guest star" observed by the Chinese and Japanese in A.D. 1054; if, as Williams suggests, the nebula could equally well have originated in the first half of the 12th century, one of the most satisfying tales in the history of science will have to be rewritten.

A good festschrift should, above all, give pleasure. This one will be read with delight, the more so as its contributors display their learning with a grace and lightness of touch that their mentor will surely appreciate.

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A Fossil Group

The Ammonoidea. The Evolution, Classification, Mode of Life and Geological Usefulness of a Major Fossil Group. Proceedings of a symposium, York, England, Aug. 1979. M. R. HOUSE and J. R. SENIOR, Eds. Published for the Systematics Association by Academic Press, New York, 1981. xvi, 594 pp., illus. \$86.50. Systematics Association Special Volume No. 18.

Ammonoid cephalopods hold pride of place in late Paleozoic and Mesozoic biostratigraphies, and their chambered shells provide some of the most instructive material for evolutionary studies to be found among the shelled invertebrates. As a consequence, research on ammonoids is vigorous and the literature is immense and widely scattered. Insight into the entire group comes largely from summaries like those in part L of the *Treatise on Invertebrate Paleontology* (R. C. MOORE, Ed., Geological Society of America and University of Kansas Press, 1957) or "Molluski-Golovonogie I" of the *Osnovy Paleologii* (V. E. RUZHENCEV, Ed., Izdatel'stvo Akademii Nauk SSSR, 1962). *The Ammonoidea* supplements and updates those volumes by summarizing principal research accomplishments of the last 20 years.

The Ammonoidea is divided almost equally into three parts. The first six papers deal with classification and evolutionary development; the second six with organization and mode of life; and the final eight with biostratigraphy and distribution. The individual chapters are keynote addresses given at a 1979 Systematics Association symposium on ammonoidea. They vary in style, philosophy, and coverage, but all are authoritative.

In chapters on origin, classification, and evolution, authors of Devonian, Carboniferous, and Triassic contributions treat the Ammonoidea as a subclass, whereas Permian, Jurassic, and Cretaceous workers regard the group as an order. Major ammonoid taxa (orders or suborders) are largely the same as in part L of the *Treatise*, but concepts of several are changed through addition, subdivision, or rearrangement. For example, HOUSE regards bactritids as primitive ammonoids and includes them as a suborder of the Anarcestida, noting that this moves the question of ammonoid origins back a step, probably to straight orthocerid nautiloids with ventral siphuncles. Authors dealing with Jurassic and Cretaceous ammonoids introduce welcome changes through abandonment of the concept of iterative "replenishment" of the Ammonitina by successive homeomorphic waves from the conservative Phylloceratina and Lytoceratina. Origin of Carboniferous ammonoids from cheiloceratacean Prionoceratidae, the only group to survive the Devonian, seems well established, as is origin of most Triassic ammonoids from the Xenodiscidae. TOZER notes that the Phylloceratida provide the only clear link between ammonoids of the Triassic and those of the Jurassic. DONOVAN, CALLOMON, and HOWARTH, however, reject the idea that all Jurassic ammonoids developed from the Phylloceratina, but they cannot identify lines of descent by which early Jurassic forms developed from Triassic predecessors.

In the section on organization and mode of life, BIRKELUND concludes from her consideration of shell structure and siphuncular morphology that economy of mass was a primary factor governing shell construction and that differences in siphuncular construction reflect ecologic differences. WIEDMANN and KULLMANN emphasize the importance of sutural ontogeny, show that sutural phylogeny is related, and conclude that the law of recapitulation applies. CALLOMON shows that evidence of dimorphism is widespread in Jurassic ammonoids but has not yet been systematically assembled for Cretaceous ones. LEHMANN reviews interpretations of aptychi and anaptychi and discusses jaw apparatuses, radulae, crop contents, and ink sacs. CHAMBERLAIN summarizes studies of the relationship between hydromechanical design and adaptive locomotor strategies; and KLINGER speculates on buoyancy control and ecology in certain heteromorphs. Some of these studies are obviously more advanced than others, but all the features considered have obvious sys-

tematic and evolutionary significance.

Because ammonoid biostratigraphy and distribution have been so thoroughly studied, the final section of the book adds little conceptual novelty. However, ZIEGLER's comments about potential infirmities in Jurassic ammonite biostratigraphy, coupled with earlier comments by DONOVAN, CALLOMON, and HOWARTH on the difficulty of identifying notoriously homeomorphic Jurassic ammonites, should caution those who cite Jurassic ammonite biostratigraphy as the ideal.

The book is well made, has few typographic errors, and is a fitting tribute to the late Bernhard Kummel, to whom it is dedicated. The contents suggest that the revised version of part L of the *Treatise*, in preparation by the same authors, will be a substantial improvement over the first edition.

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Marine Ecology: Status Report

Analysis of Marine Ecosystems. A. R. LONGHURST, Ed. Academic Press, New York, 1981. xxii, 742 pp., illus. \$125.

The study of ecosystems as such, rather than simply of component species, is still in a formative stage in which investigators are exploring in many directions with no generally agreed-upon approach. LONGHURST has taken up the challenge of assembling and editing a thick volume on the state of the science that encompasses many of the active lines of research on marine ecosystems today. A section of the book is devoted to particular geographical types of ecosystems: high and low latitudes, upwellings, continental shelves, and coral reefs. A second section is devoted to functional aspects of marine ecosystems, such as autotrophy, grazing and predation, and variability in space and time. A final section deals with simulation and experimental studies, in other words with models of all kinds.

Although the book is written by 30 authors, writing more or less independently, a number of themes run through it, giving us insight into what the collective authorship views as important. The integration of physical and chemical oceanography with the study of the biological aspects of ecosystems is impressive. Ecologists clearly recognize that they must understand and reckon with the physicochemical regime. Within that