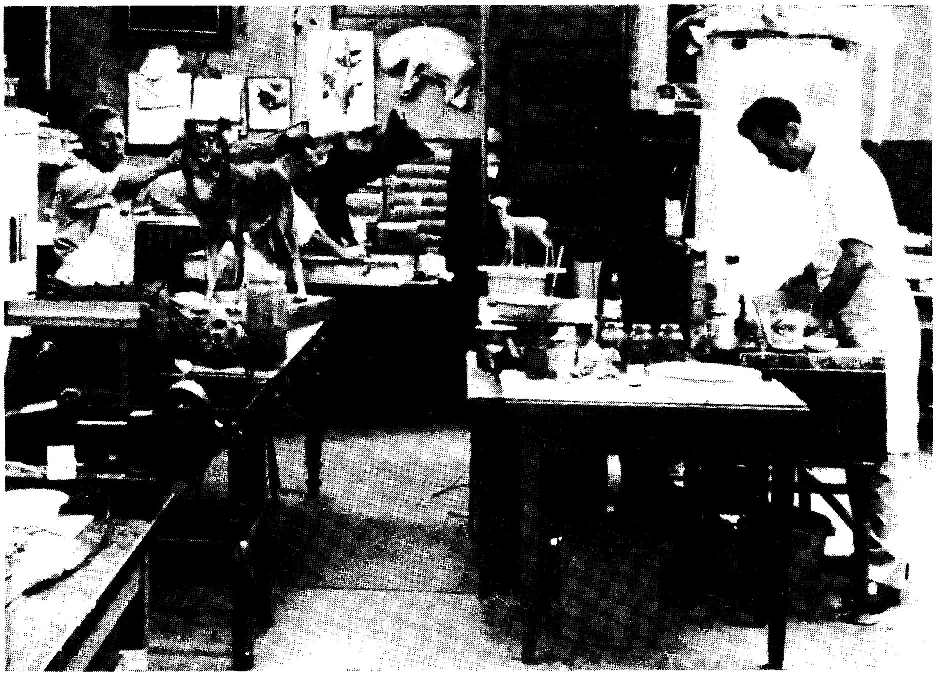

The National Museum of Natural History's taxidermy shop around 1957. Left to right, Charles R. W. Aschemeier, Watson M. Perrygo (partially hidden between two wolves), and William Goodloe. [From *The National Museum of Natural History*]

substantial part of the scientific staff are not employees of the museum or even of the Smithsonian Institution, but of other government bureaus—such as the U.S. Geological Survey, with which the author was affiliated.

Many features of the museum's history are typical of large museums—the crowding and consequent competition for space, crash programs to meet exhibit deadlines, insufficiency of funds, extensive reliance on volunteers, and the tradition of staff members continuing their work after retirement. Examples of all these are provided. The author's long familiarity with the museum and its traditions have enabled him to produce an unusually interesting history of this important institution.

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The Hubbard Brook Ecosystem

An Ecosystem Approach to Aquatic Ecology. Mirror Lake and Its Environment. GENE E. LIKENS, Ed. Springer-Verlag, New York, 1985. xiv, 516 pp., illus. $49.

Hubbard Brook flows through a second-growth, hardwood forest in the mountains of north central New Hampshire; one of its tributaries drains Mirror Lake. In 1963 G. E. Likens and F. H. Borman, in cooperation with the U.S. Forest Service, began a detailed study of the biogeochemistry and ecology of the forest and associated aquatic ecosystems in the Hubbard Brook Valley. Their ongoing measurements of the chemical composition of atmospheric deposition and stream water are the longest such continuous records available in North America. Their experimental manipulations of headwater drainages are paradigms for ecosystem analysis. Mirror Lake, though not suitable for manipulation as a whole system or studied continuously for two decades, provided Likens and his talented students an opportunity to address fundamental limnological questions and to compare and combine results from the terrestrial and lotic ecosystems with those from a lacustrine environment in the same watershed. Furthermore, the sediments of Mirror Lake record the climatic and ecological conditions in the Hubbard Brook Valley for the last 14,000 years, which permits the modern research to be put in a temporal perspective.

This book opens with a scholarly introduction by Likens and Borman to the analysis of ecosystems in general and of Mirror Lake in particular. They emphasize that the lake must be examined in the context of its modern watershed and airshed and its history. The second, third, and seventh chapters are detailed accounts of climate and biogeochemistry of the Hubbard Brook Valley and of the paleoecology of the lake and its watershed. Hydrologic and solute data collected over two decades provide a rare and illuminating example of long-term trends and temporal variability. The rigorous determination of sedimentation in the lake and the use of a full complement of microfossils (diatoms, chrysophytes, cladocera, and pollen) and chemicals (pigments, organics, and metals) provide a superb illustration of how a watershed's history is deduced.

The core of the book is a remarkably comprehensive treatment of Mirror Lake's physics, chemistry, and biology (chapters 4 and 5). Taxonomic composition, abundance, and productivity are summarized for bacteria, phytoplankton, periphyton, zooplankton, aquatic macrophytes and vertebrates, and zoobenthos; only protozoans and fungi are not included. Though synthesis is offered as an input-output budget of organic carbon and as a carbon cycle within the lake, Likens prudently states that we are still far from a complete quantitative understanding of the sources and metabolism of organic carbon in lakes. Perhaps this awareness has deterred him from attempting a simulation model of Mirror Lake and will be a warning to others that such models may be premature for most ecosystems.

Air-land-water interactions and air and watershed management are dealt with in chapters 8 and 9.

Less satisfying than other parts of the book is the treatment of ecologic interactions in chapter 6. Most ecosystem analyses lack the experimental studies required to determine cause-and-effect relationships among species rigorously. With the solid descriptive biological foundation now available for Mirror Lake one hopes that future research will attempt to tie ecosystem processes to populations and therefore to help bridge a schism in modern ecology.

It is worth mentioning a few topics that have been omitted in hopes that they will be considered in the continuing research at Mirror Lake. Physical processes such as advective and dispersive currents, eddy diffusion, and boundary layer shear are pertinent to ecological processes such as nutrient supply, photosynthetic rates, zooplankton feeding, and sediment resuspension. And microbes play a basic role in nutrient regeneration and as a source of methane, sulfide, or nitrous oxide.

Likens and his students prepared much of the text, with considerable contributions from M. B. Davis and her students and Borman. The crisp, clear text is augmented by numerous excellent figures, tables, and photographs as well as by indexes of taxa, lakes and rivers, and general topics and a thorough set of references.

The book is recommended to ecologists and graduate students engaged in limnological research. It is rich in numbers and is a model of careful data analysis and interpretation. Likens successfully blended many facets of ecology and biogeochemistry and attained his abiding objective, to focus on the ecosystem as a whole.

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Chemical Oceanography

Geochemistry of Organic Matter in the Ocean. EVGENII A. ROMANKEVICH. Springer-Verlag, New York, 1984. xvi, 334 pp., illus. $59. Translated from the Russian edition (1978).

Marine scientists accustomed to searching through dozens of journals and multiauthored volumes for one rare, authoritative summary publication will perk up when they see in print a monograph with this title by one of Russia's most eminent oceanologists. Will the book satisfy the expectations raised by the title? To a great extent, yes. It is a welcome attempt to sum up and put into a global perspective the accumulated results of work on the distribution, composition, and cycling of organic matter in the ocean. The data were gathered over the past 25 years or so and are largely based on the voluminous work done at the P. P. Shirshov Institute of Oceanology of the Academy of Sciences, U.S.S.R. The monograph is worthwhile reading for sedimentologists, geochemists, chemical oceanographers, and generalists of marine science.

The first half of the book deals with the sources of organic carbon in the ocean. It includes a systematic treatment of primary production estimates. Notable here is a discussion of chemosynthetic production, though it does not yet cover the role of mid-ocean ridge ecosystems. It is surprising to learn that marine chemists still do not agree on a global estimate of total dissolved organic carbon in the ocean because methods for measuring such carbon have not been standardized.

The author's treatment of particulate organic carbon generally relies on data from standing stock. Dynamics of organic matter sedimentation includes some data from sediment traps. For all the sections, I find the large data tables particularly informative. At various points it appears that the author thinks that there is a dynamic equilibrium, although not a perfect one, between dissolved and particulate organic carbon, which is ultimately controlled by primary production. The data are vaguely supportive of such a thesis, but a mathematical treatment is lacking.

The highlight of the book is a section on "the absolute masses of organic carbon in the sediments"—in more familiar terms, the flux rates of organic carbon sedimentation. This section is comprehensive and deep. It includes "a concise history of the problem," which I think is intended—rightly—to establish the early leading role of the Russian scientists Arkhangelsky and Strahkov in developing this method for quantifying carbon and sediment accumulation. Romankevich's treatment is intriguing because it seems to skip over the tremendous usefulness of changes in rates of carbon accumulation as a function of climate and productivity (that is, the absolute mass of carbon accumulated during selected time slices for paleoceanographic interpretation). Instead, it favors a more static, long-term, integrative approach aimed at establishing as accurately as possible the size of organic carbon reservoirs in the ocean and sediments. This section also discusses the preservative effect of organic carbon during sedimentation and culminates in a present-day annual organic carbon balance for the ocean that is thorough and appears to be the best available at this time.

There is a transitional chapter on the meaning of nitrogen-to-carbon and phosphorus-to-carbon ratios. Here the status and limitations of the classical geochemical approach are documented. Lack of information on the individual chemical compounds or groups of major nitrogen- and phosphorus-containing organics continues to be a problem. The author hints that the carbon-to-nitrogen ratio of sediments might be inherited from the organics produced at the ocean's surface, which is hard to believe given that the role of preferentially clay-sorbed, nitrogen-rich organic matter is not taken into account. Even the role of inorganic ammonia, which is fixed to certain clay interlayers, is only mentioned in passing.

The second part of the book, which deals with amino acids, carbohydrates, lipids, and humic compounds in the ocean and sediments, would not measure up to the standards and expectations of organic geochemists. It is hardly possible for a single author to complete such a monumental undertaking successfully, for it requires immense diversity and specialization. Romankevich's treatment of these subjects is therefore necessarily at the level of background information.

The final chapter is an excellent summary of the significant conclusions reached throughout the book. It identifies current problems and presents a compartmentalized general cycle of organic matter in the world ocean. Many exchange processes between reservoirs in this super-detailed cycle remain unquantified, but surely this should motivate the curiosity of any worker in the field.

Romankevich has produced an informative book that guides the reader through a tremendously complex subject. Yet the book makes evident that a full explication of the subject would require the efforts of many specialists.

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Northern Waters

The Nordic Seas. BURTON G. HURDLE, Ed. Springer-Verlag, New York, 1986. xiv, 777 pp., illus. $69.50.

"Nordic seas" is a term coined by the authors of the papers in this volume to cover the Norwegian and Greenland seas, the seas around Iceland, and the western Barents Sea. Scientific exploration of these seas began around the turn of the century with the pioneering expeditions of physical oceanographers from Norway, who made measurements of ocean temperature and salinity with standards so close to those of today that their results still remain useful.

The Nordic Seas contains ten chapters each reviewing the application to this region of a particular discipline, including climatology, physical oceanography, ice science, marine geology, and marine geophysics. The review approach is especially useful in the cases of marine geology and geophysics, which were the subjects of close study during the 1970's when seismic profiling and refraction, aeromagnetic mapping, and deep-sea drilling produced a particularly thorough set of data on crustal and sedimentary structure. The field studies coincided with a revolution in geological theory wrought by the concepts of plate tectonics, and data were gathered and interpreted in light of that theory. The last two chapters, which make up more than half the book, contain a treatment by Peter Vogt of the results of the field studies of the '70's that will likely be a landmark reference for solid-earth scientists working in this region for many years to come. The chapters