Spacetimes, edited by Joan Centrella (Cambridge University Press, 1986). The present collection is a worthy successor, and indeed the two books make an interesting comparison.

Although there is a considerable overlap among the contributors to the two books (more than 70% of the papers in the Centrella volume have authors who have written for the present one), there is a noticeable change of emphasis. The Centrella volume caught the field at a turning point, when the simplest axisymmetric problems had been studied and new supercomputers were beginning to make three-dimensional problems look tractable. It was very much concerned with code tests and analytical guides to calculations, and it introduced a number of areas in which numerical work was only just beginning.

The present volume reflects a great increase in activity in many directions. There are more than twice as many papers as in Centrella's book. A third of them report numerical results for three-dimensional problems. Others continue new directions that emerged in the Centrella volume, such as numerical studies of cosmic censorship and null-cone relativity. Several use the increased computing power now available to put better physics into earlier calculations: radiation hydrodynamics, magnetohydrodynamics, cosmological nucleosynthesis. There are a number of valuable papers on techniques: multigrids, adaptive meshes, spectral methods, finite elements, smooth-particle hydrodynamics, even a "pde compiler" to automate the generation of complicated code.

There are many other interesting papers, on perturbation techniques, analytical methods, solving the initial-value constraints, black-hole interactions, and gravitational radiation. The variety of activity reflected in this volume is in part a tribute to the wisdom of the National Science Foundation in establishing its supercomputer centers, and it is no coincidence that the meeting was hosted by Larry Smarr's National Center for Supercomputing Applications: Smarr was one of the founders of numerical relativity and one of the prime movers behind the supercomputer centers. However, the meeting was genuinely international, and the strength of the Japanese work in this field is particularly evident in this volume. The computing power available to some of the Japanese groups will probably make them the pace-setters over the next couple of years.

This collection is the best review of the state of numerical relativity currently available. It is the place to start if you want to get into the field or if you want to see what is known about the main problems. If your library contains the Centrella volume, you should certainly get this one too. And if your library doesn't, maybe it is time it caught up with this rapidly developing subject.

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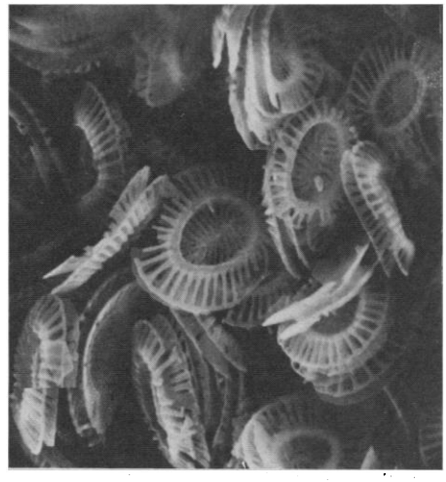
Biogenic Minerals

Biomineralization. Cell Biology and Mineral Deposition. KENNETH SIMKISS and KARL M. WILBUR. Academic Press, San Diego, CA, 1989. xiv, 337 pp., illus. $69.95.

On Biomineralization. HEINZ A. LOWENSTAM and STEPHEN WEINER. Oxford University Press, New York, 1989. x, 324 pp., illus. $57.

Biogenic minerals are amazingly varied and highly complex components of living organisms and of the earth's surface. In addition to their crucial biological functions, they play a major role, through enormous sedimentary deposits in the oceans, in biogeochemical cycling and the composition of both land and seas, with important environmental and economic consequences. More than 60 different biogenic minerals have been found, and the list is not yet complete. "Biomineralization" is the term now used for the processes by which organisms form or regulate the formation of minerals. The study of these processes has certainly come of age in the past decade, and they are now the subject of intense worldwide research activity embracing many disciplines and perspectives.



Mineralized plates, or coccoliths, from the alga *Emiliania huxleyi*. "Viewed from the side [these coccoliths appear] to be composed of two superimposed plates. In fact, the basic building blocks are not the plates but individual anvil-shaped segments that fit together side by side. . . . In a very elegant study, Watanabe (1967) showed by electron diffraction that one entire segment behaves as if it is a single crystal." Coccolithophorid species, of which *E. huxleyi* is the most abundant, "are undoubtedly *the* major contributors [of calcium carbonate] to the ocean sediments." [From *On Biomineralization*]

The two books reviewed here are quite similar in organization, opening with general comments on the nature of the processes involved in biogenic mineral formation, moving on to more detailed discussions of the processing in specific phyla, and ending with rather sweeping discussions of the global, environmental, and evolutionary aspects of biomineralization. However, reflecting the diversity of the field, they have very different emphases and perspectives. All four authors have made notable individual contributions to the field, and the melding of concepts and insights one finds throughout both books suggests that writing them must have been intellectually stimulating.

With both books in hand, which to read first? After skimming both, this reviewer chose to read Simkiss and Wilbur first, and in retrospect this was a good choice. *Biomineralization* places its emphasis on how organisms move ions from one intracellular compartment to the next and how the accumulation of ions is regulated. These topics are introduced in chapters 3 and 4, and the principles are referred to in each of the 11 chapters on specific cellular organizations. Each of these chapters describes in detail the biology of the system it is concerned with and attempts to present what is known concerning the intracellular ion movements. A major strength is the summaries at the ends of the chapters. Individual chapters get a bit bogged down in detail, but a consecutive reading of the summaries provides a coherent overview of the general features of cellular regulation of biomineralization and of the importance of the concept of compartmentalization of mineral deposition. The place of vertebrates in biomineralization studies, in the minds of the authors, is evidenced by the fact that all vertebrates are dealt with in a single chapter of only 20 pages, and bone is given a rather shallow discussion in less than 10 pages. The volume ends with a consideration of global processes governing biomineral deposition and generalizations on the cellular organization required. *Biomineralization* is profusely illustrated, but the figure legends, particularly for the drawings and diagrams, are not as informative as one would like.

In *On Biomineralization* Lowenstam and Weiner eschew much discussion of cellular processes and the biochemical problems of moving the mineral ions to the correct compartments. Instead they focus on the processes whereby matrix macromolecules initi-

ate and control the nucleation of the mineral and the crystal form. Chapters 2 and 3 examine the diversity of the mineral forms, and the role of matrix macromolecules in the process, in a very interesting and sophisticated way. These chapters, along with the three final chapters, on nonskeletal functions in biomineralization, environmental influences on biomineralization, and the evolution of biomineralization, are worth the price of the book by themselves. The authors give the most coherent analysis of the evolutionary development of biominerals this reviewer has had the pleasure to read. The intervening chapters on the specific systems are well done and beautifully illustrated. The emphasis is on matrix components and their ultrastructural distribution, and on the nature of the mineral phase. I think it is fair to say that I appreciated these chapters more because of having read the comparable chapters in Simkiss and Wilbur.

Both of these books are major feats of scholarship, and they are truly complementary. Both belong on the bookshelves of every scientist interested in biomineralization.

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Adolescent Mothers in Later Life. Frank F. Furstenberg Jr., J. Brooks-Gunn, and S. Philip Morgan. Cambridge University Press, New York, 1989. Paper, $14.95. *Reviewed* **240**, 1060 (1988).

Darwin and the Emergence of Evolutionary Theories of Mind and Behavior. Robert J. Richards. University of Chicago Press, Chicago, 1989. Paper, $17.95. *Reviewed* **239**, 198 (1988).

Psychology in Twentieth-Century Thought and Society. Mitchell G. Ash and William R. Woodward, Eds. Cambridge University Press, New York, 1989. Paper, $15.95. *Reviewed* **241**, 1837 (1988).

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