have had to wade through the verbal thickets of the "new archeology" is the fact it is on the whole well written, even though at points it recalls in its somewhat mechanical presentation the dissertation that was its ancestor.

A work that draws from so many potential models and attempts to explain relatively briefly complex cultural processes is bound to be subject to objections. I find the model for Hallstatt change on the whole convincing. However, in stressing the Hallstatt–Massilia axis the author may simplify a process of contact that involved more deeply other Celtic groups. Also, he does not define clearly enough the nature of the goods exported to the Mediterranean from the Celtic centers. I believe that these were probably portable luxury goods such as slaves or furs and that more concentration on anthropological analogies for both the fur and slave trade in other cultures would have made the sections on trade processes more convincing. The different nature of La Tène contacts is clear both from the archeological and the historical record. However, the use of a model that has La Tène youth seek their fortune in the expanding centers of north Italy gives an anachronistic, *Gastarbeiter* image to a very different cultural scene.

Such disagreements normally arise when an author reaches out intellectually, especially in dealing with material as difficult as that presented by European prehistory. They should not detract from the fundamental quality of this study. Wells belongs to a growing school of Continental, British, and American scholars who are moving European prehistory into the modern archeological mainstream. This volume is an excellent contribution to that development.

STEPHEN L. DYSON
Department of Classics,
Wesleyan University,
Middletown, Connecticut 06457

Molecular Clouds

Interstellar Molecules. Papers from a symposium, Tremblant, Quebec, Canada, Aug. 1979. B. H. ANDREW, Ed. Reidel, Boston, 1980 (distributor, Kluwer Boston, Hingham, Mass.). xl, 704 pp., illus. Cloth, $76.50; paper, $34. International Astronomical Union Symposium No. 87.

About ten years ago, only a few diatomic molecules were known to exist in the interstellar medium, and they were of only occasional interest. Since then, the development of more sensitive observational techniques, especially in radio astronomy, has led to the discovery of roughly 50 molecules, and their central importance in the interstellar medium has been established. These proceedings are the record of 139 papers given at a 1979 symposium, and even for the nonspecialist they give a good sense of the range of current studies and the vitality of the field. It is remarkable that not much more than a decade ago the results described here were, for the most part, not even imagined.

Within the interstellar medium molecules can be destroyed by ultraviolet light, so they are mainly concentrated into clouds, where they are shielded by dust grains. The clouds are usually cold ($T \lesssim 100$ K), so that radio and infrared wavelengths are the natural spectral region for the study of these species. However, there are some important observations that can be made only in the visible or ultraviolet.

Many of the observational programs presented in this volume survey and identify molecules in different directions; the species range from the quite simple CN to the more complex HC_9N. The main building blocks are carbon, nitrogen, oxygen, and hydrogen. However, even very rare isotopes such as ^{17}O are measured, and, as discussed in papers by Penzias and others, the relative abundances of different isotopes provide valuable information about the history of nucleosynthesis in different regions of the Galaxy. One of the most interesting recent developments is the detection of thermally excited molecular emission from mass-losing regions of individual stars, discussed by Zuckerman and a large group mainly from Caltech.

Once a molecule is detected, many observational questions follow, and they are discussed extensively in this book. How much of the species is present? How is the molecule excited? What other molecules are present? By what chemical pathways are the molecules formed and destroyed? A wide range of phenomena from shock waves (discussed by Hollenbach and by Beckwith) to cosmic ray ionization are important, and they result in a striking variety of effects from masers to high velocity flows. The large numbers of studies described in this volume indicate that considerable progress toward a quantitative understanding of the gas-phase chemistry and physics of individual clouds has been made.

Finally, one tries to use the studies of individual regions to develop an integrated picture of the interplay between the interstellar gas and the evolution of the Galaxy as a whole. Clouds are massive, yet cold, so they can and sometimes do collapse to form stars. Since we understand very little about the details of star formation, much of the ultimate rationale for the study of molecular clouds is that we may learn more about the origin of stars and planets, including our own solar system.

MICHAEL JURA
Department of Astronomy, University of California, Los Angeles 90024

Marine Mineral Deposits

Underwater Minerals. D. S. CRONAN. Academic Press, New York, 1980. xvi, 362 pp., illus. $57.50. Ocean Science, Resources and Technology.

David Cronan has written the first comprehensive volume on the marine minerals of the global ocean, with emphasis on those mineral deposits that hold promise for early exploitation. This book covers marine placers, aggregates, authigenic minerals, phosphorites, manganese nodules, metalliferous muds, and certain sub-sea-floor lode and sedimentary deposits. Cronan has also included brief chapters on exploration and exploitation methods. His extensive research experience with nodules and metalliferous muds has resulted in an obvious emphasis on these two major mineral types. Nonetheless, the book does provide a desirable balance between the shallow water placers and aggregates, deposits that are already being mined economically, and the deep-sea nodules and metalliferous muds, deposits that are still waiting to be mined. I applaud Cronan's effort to concentrate on the scientific and technical aspects of finding and recovering these much-needed deposits and avoid the pitfall of succumbing to discussion of the international political problems that, at present, constrain the development of these industrially important metal and mineral reources. Given the international disagreement over who owns the deep sea floor, the chapters on nodules and metalliferous muds may be of secondary importance to the global industrial community, while the information on marine placers and aggregates (both shallow-water deposits) will surely be the focus for readers of this book in the more immediate future. Obviously, the entrepreneur will seek economic reward where there is the least political conflict and disagreement; hence, the decade of the 1980's will be one of increasing mining of the sea floor on the continental shelves of the world.