includes an excellent summary of the history of geology. Part 2 is a rather superficial discussion of the internal structure, composition, and origin of the earth. This is followed by a section devoted to a description of primary structures in sedimentary and igneous rocks and of secondary structures (including folds and faults) in deformed rocks. The treatment is standard, but the examples are largely Russian. In part 4 (200 pages) Beloussov develops the principal theme of the book—that is, the significance of vertical oscillatory movements of the earth's crust and their absolute control of the deposition of sediments. In the following section he discusses tectonic movements that produce folding. He begins with a too brief section on stress and strain; this is followed by a lengthy but rather narrow treatment of discontinuous (supratenuous) folding, and he concludes with a general discussion of the relation of folding to geosynclinal theory. In part 6, which deals with rupture, the author describes some very interesting Russian experimental work. Part 7 is a much too cursory treatment of the relation of igneous activity to geotectogenesis. In the following 70 pages he summarizes geotectonic processes and sketches the present tectonic structure of the earth—a rather stupendous undertaking.

In the final section Beloussov reviews and dismisses all Western theories of geotectogenesis. He has made a serious attempt to digest Western geologic thought and literature (the bibliography has 519 entries), but Western contributions made during the last 20 years are treated rather lightly. Beloussov seems convinced that most geologists outside of Russia are married happily to the contracting earth hypothesis. He criticizes other Western theories for inadequately demonstrating causal mechanics, but he admits his own oscillation theory is based upon imperfectly understood processes (he favors differentiation resulting from unequal distribution of radioactive heat). Western geologists may be dismayed by Beloussov's somewhat dogmatic approach, but his underestimation (we hope) of us is not very different from our tendency to underestimate Russian progress.

Excellent volumes like this one will stimulate geologic thought throughout the world.

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Astronomy

The Distribution and Motion of Interstellar Matter in Galaxies. Proceedings of a conference held at Princeton, N.J., April 1961. L. Woltjer, Ed. Benjamin, New York, 1962. xiv + 330 pp. Illus. $11.75.

Within the past 15 years interstellar polarization and the 21 cm radiation from interstellar hydrogen have been discovered, the Palomar Sky Survey has been completed, the 200-inch Hale and the 120-inch Lick reflectors have swung into action, colliding galaxies have been discovered and studied (by radio and by optical techniques) out to distances of more than a billion light years, and use of the synchrotron mechanism has shown that radiation from the Crab Nebula is heavily polarized. It has also become increasingly evident that stars not only condense out of the interstellar medium but that they also contribute to it; thus, the great questions of the evolution of the stars and galaxies are directly related to the subject matter of the book. In consequence, studies of interstellar matter have assumed a new importance and are increasingly engaging the attention of astronomers and astrophysicists.

There were 27 participants at this conference which was held at the suggestion of Bengt Strömgren. The papers, with essential parts of their discussions, have been published in this book about as they were presented at the conference. There are twelve papers on the characteristics of interstellar matter in our galaxy, three on the characteristics of interstellar matter in other galaxies, five on small-scale dynamics of interstellar matter, and ten on large-scale dynamics of interstellar matter. Following these 30 papers is a report of the concluding session, with summaries by Strömgren and Woltjer, and 11 pages that report the general discussion, with J. H. Oort presiding. Although some fundamental considerations concerned with the physics, and especially with the chemistry, of interstellar matter are not covered, the discussions are nevertheless extraordinarily wide ranging and at an advanced level.

This book is for the serious astronomer, not the casual reader. It gives a useful, authoritative summary from many points of view of our present knowledge and speculations, of observational programs recently finished or still to be completed, and of many still unanswered questions related to the four components of the interstellar medium: the gas, the dust, the cosmic rays, and the magnetic fields. Dust, one of the four components of interstellar matter, is almost always found in connection with the spiral arms that are characteristic of multiple-arm galaxies, such as the one shown on the cover of this issue.

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Nuclear Radiation

Radiation Effects on Organic Materials. Robert O. Bolt and James G. Carroll, Eds. Academic Press, New York, 1963. xvi + 576 pp. Illus. $13.50.

Radiation Effects on Organic Materials contains essays written by scientists from industrial and government laboratories and is concerned with the effects of nuclear radiation on the properties of organic liquids, gases, and solids. The editors state in their preface that the book is intended for those in research and development who are conversant with the fundamentals of physics, chemistry, and engineering. Consequently, very little effort is made to cover the basic underlying principles, although the first four chapters—an introduction and a treatment of the interaction of radiation with matter, the chemical effects of ionizing radiation, and the radiation chemistry of pure compounds—summarize the fundamental principles. No derivations of equations are given, but principles and the results are stated as a matter of course. In general, the book is well referenced, so the reader can easily expand his background on any particular subject.

The remaining chapters treat radiation effects on polymers, plastics, elastomeric materials, nuclear reactor coolants, lubricants, adhesives, textiles, coatings, films, dielectric fluids, fuels, fluid shielding materials, coal, wood, and explosives.

In my opinion, one of the book's most valuable characteristics is its broad coverage of the literature, much of which is often not conveniently available. There are frequent references to reports published by the Atomic Energy Commission and the Air Force, to journals that cover a large number of disciplines, and to other similar sources. Certainly the objective of summarizing the literature and its background ap-

pears to have been well met, and this broad coverage makes the book a guide for interpreting future data on radiation effects. The book is well edited, very readable, and appears to be free of any serious errors. It will be useful not only to engineers who are concerned with design problems and need information on radiation effects, but also to any scientist who is interested in having readily available a good literature summary of the field.

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Astronomy

Evolution of Stars and Galaxies. Walter Baade. Cecilia Payne-Gaposchkin, Ed. Harvard University Press, Cambridge, Mass., 1963. xiii + 321 pp. Illus. $6.75.

An increasingly accented characteristic of modern science is the building of very large instruments such as electronic computers, particle accelerators, and optical and radio telescopes. The scientists who use these expensive devices must necessarily accept the heavy responsibility of efficiently exploring the new scientific frontiers made accessible for the first time by the instruments.

The late Walter Baade, who was astronomer at the Mount Wilson and Palomar Observatories, met this challenge in a uniquely successful fashion, and those of us who were privileged to hear him speak of his work and its ramifications could only describe him as "incandescent." He was a superb observer with access to the finest telescopes, and he had a remarkable knowledge of the literature. The present book is based on a series of lectures given by Baade at Harvard in 1958, and they represent the final thoughts of a great observer on the subject to which he had devoted four decades of research.

Cecilia Payne-Gaposchkin has done an excellent job of editing the original tape recording of his lectures, and we are indebted to her for seeing this exciting book through press and thus bringing Baade's ideas permanently to the attention of a wider audience. I heartily recommend the book and believe especially that it should be read and studied by graduate students in astronomy, so that they can learn how exciting observational research can be. Of special interest are chapter 4, where Baade tells the inside story of his resolution into stars of the Andromeda nucleus and the nearer elliptical galaxies, with the consequent formulation of the idea of two stellar population types, and chapter 8, on the distance to galaxies and the leading part that Baade played in a rather drastic revision of the distance scale. Chapter 17, on the Magellanic clouds, is a remarkably good discussion of those unique southern galaxies which Baade himself never actually worked on. His discussions are far ranging and provocative and his opinions are often emphatically expressed in his own inimitable and racy style.

Baade's last sentences are: "I hope I have brought home sufficiently how little we know, and how large the gaps are. In many ways I envy those who will have to fill the gaps. I only wish that I were young, and could start all over again."

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Buddington Volume

Petrologic Studies: A Volume in Honor of A. F. Buddington. A. E. J. Engel, Harold L. James, B. F. Leonard, Eds. Geological Society of America, New York, 1962. xii + 660 pp. Illus. $12.

This unusually interesting book, dedicated to A. F. Buddington and written by his former students, contains 23 articles on petrologic subjects. The high quality of the articles furnishes an impressive tribute to Buddington as a teacher who instilled into his students the importance of both originality and thorough documentation. The volume is also a tribute to Princeton University as a place to study petrology, and to editors Engel, James, and Leonard for their careful preparation, editing, and indexing of the book.

The opening pages contain a brief appreciation of Buddington's work, by Harry Hess. The point is made that Bud's "bibliography of scientific contributions is not long . . . but among [his papers] there is none which is trivial, and there are many with outstanding contributions to petrology or geology." Also stressed are Bud's capabilities as a field geologist. The tabulation (on p. ix) of 41½ seasons spent in active field work shows that during all but two of those seasons Buddington was engaged in studying and mapping metamorphic and plutonic rocks and that a little over half of his total field activity was concentrated in the Adirondacks.

This concentration of interest on problems of metamorphic and plutonic terranes—and especially on such Adirondack-inhabiting rocks as anorthosites, amphibolites, skarns, granulites, and granites—is mirrored in the subject matter of the book. Of the 23 articles, 16 deal almost exclusively with metamorphic and plutonic areas, with mineral groups characteristic of them, or else with isotope studies directly applicable to their problems. The exceptionally complete subject index (it contains nearly 1500 separate entries) lists 21 entries for anorthosite, 24 for amphibolite, and 8 for granulite. By contrast, the common igneous rock andesite has only 2 entries, and of the 13 entries under basalt all but 2 refer to the relation of basalt to such metamorphic derivatives as amphibolite or eclogite. The large and growing group of petrologists who specialize on the sedimentary rocks will look in vain for articles devoted to their specialty, and they will find only a few citations to sedimentary rocks in the index. Careful perusal of the volume, however, reveals considerable new information on such topics as the metamorphism of "iron formation", and the diagenetic changes in volcanic sedimentary rocks, as well as valuable new data on several mineral groups characteristic of metamorphosed carbonate and clastic sedimentary rocks.

Some of the articles in this volume fully merit the high praise that Hess gave Buddington for papers that contain "outstanding contributions to concepts of petrology or geology." Without in any way implying that other papers in the Buddington volume do not also deserve such mention, I would cite two papers for special commendation: William T. Pecora's "Carbonatite problem in the Bearpaw Mountains, Montana" (pp. 83–104) and R. S. Cannon, Jr., A. P. Pierce, J. C. Antweiler, and K. L. Buck's "Lead-isotope studies in the northern Rockies, U.S.A." (pp. 115–131).

The Buddington volume deserves a place in every petrologist's library.

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