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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