assumes new importance, although the author estimates that about three billion cubic feet are still lost to the atmosphere each year in burned natural gas.

The book is a good narrative account of the development of the production of helium by the Bureau of Mines, although it is disappointing in certain respects. The scientist or historian of science will find no account of the research responsible for the progressive understanding of helium's unusual properties, nor even a satisfactory explanation of them. The historian of technology must be content with a one-paragraph description of the helium-extraction process without learning the details of its evolution. The economic historian will search in vain for any cost analysis of helium production, and no inkling is given as to the economic efficiency of the government-owned plants. Finally, there is no bibliography, particularly of the government documents examined by Seibel, which might have been useful in any future study. Nevertheless, this book should serve to focus public attention on the important work of the Bureau of Mines in the production of one of the least advertised resources of the United States.

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Northern Life

Ecological Development in Polar Regions. A Study in Evolution. M. J. DUNBAR. Prentice-Hall, Englewood Cliffs, N.J., 1968. viii + 119 pp., illus. $4.95. Concepts of Modern Biology.

The title of this book is perhaps a little pretentious. Its author is a marine zoologist with most of his experience from Arctic Canada, and this explains why plants, terrestrial animals, and the southern polar region receive comparatively little attention. Within its limits the treatment is quite interesting, and some of the author's conclusions have general application beyond the material serving as primary objects of study.

The delimitation of the Arctic and the Subarctic regions (in the northern hemisphere) presents certain difficulties. In the sea, the Subarctic is defined as the zone with mixed Arctic and non-Arctic water; for land, the author follows the usage of Kimble and Good (1955), which implies that the southern limit of the Subarctic is that of "the full boreal forest" and that the inhabitants of Edmonton, Winnipeg, and Quebec City in North America and of Oslo, Stockholm, and Helsinki in Europe barely escape the fate of living in a "subarctic" country. The Old World practice is entirely different, and Hustich (1949), among others, has eagerly stressed the desirability that in North America, too, the term "subarctic" be restricted to the forest-tundra area.

The determination of the southern limit of the Arctic is more important and not purely academic. Dunbar (p. 51) uses the current definition: the 50°F (10°C) isotherm for July, or the timber limit, with which it largely coincides. It is therefore surprising that, later on (p. 97), a close dependence of the tree line upon climatic factors is denied in favor of "the process of soil increment." However, during the postglacial climatic optimum, notably in Scandinavia, the tree limit was situated much farther north than it now is, a fact which seems to corroborate a major influence of climatic factors.

One of the author's main theses is that the importance of low temperature as the primary biologically acting factor in the Arctic has been exaggerated; this is expressed in its sharpest form on page 92: ". . . the low temperature of the polar regions is the least important of the various polar characteristics. . . ." The reader's attention is drawn instead to three groups of other factors characterizing the Arctic: large seasonal oscillation, low production of nutrients (except in the Antarctic), and the youth of ecosystems. Here, again, examples are drawn largely from marine animals, and the conclusions, as far as these are concerned, seem sound enough. And, to do the author justice, he admits, in several contexts, that for terrestrial organisms the thermal factors are more important, especially in connection with hibernation. The author thinks that adaptation to low temperatures (influencing metabolism, growth, reproduction, and so on) is more easily achieved than is usually assumed and that the "difficult" taxonomy of many Arctic animals (terrestrial as well as marine) is an expression of continuous adaptive processes going on simultaneously in many taxonomic groups. My own experience with insects shows that certain taxonomic groups may be entirely Arctic or Arctic-Subarctic, in which case adaptation to a cold environment must have taken place long ago, in pre-Pleistocene time, no doubt in the alpine zone of mountains. And this may very well have been the history of entire ecosystems. Therefore Dunbar's leading principle, that Arctic ecosystems are young, "immature," "non-saturated," which apparently holds true in the sea, is not necessarily valid for terrestrial organisms. The author's final remark, that perhaps ecosystems may "act as units of selection," could therefore, under certain terrestrial conditions, be translated to mean that they act as "units of dispersal," at least in the Beringian region, where the influence of Pleistocene glaciations was slight.

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Anatomist of the Small

Jan Swammerdam (12 February 1637–17 February 1680). His Life and Works. A. SCHIERBEEK. Translated from the Dutch edition (1947). Swets and Zeitlinger, Amsterdam, 1967. vi + 204 pp., illus. $7.

Jan Swammerdam needs little introduction to historians of biology. He was, according to F. J. Cole, the historian best qualified to evaluate him, "the greatest comparative anatomist of the seventeenth century." He developed a number of new dissection techniques for the study of anatomy, especially of minute structures of insects. He was the first to observe a number of organs in invertebrates and in vertebrates, and the first to describe the cleavage of the egg. But perhaps his greatest importance was, as Cole tells us (and Cole expresses debt to Boerhave for the judgment), that "he was . . . one of the first anatomists to develop the *technique* of research." His principal work, the *Biblia Naturae,* completed around 1675, was published only in 1737–1738, through the good graces of Boerhave.

It is astonishing, in view of Swammerdam's excellence, that no modern biography of him exists; the chief source of information about his life remains Boerhave's introduction to the *Biblia Naturae.* Schierbeek's book is an English version, somewhat abbreviated, of a volume published in Dutch in 1947. It gives an account of Swammerdam's life, leaning heavily on Boerhave, and of his somewhat eccentric personality, and then it discusses his work. The content is very awkwardly arranged within the chapters, and the analysis difficult to follow. An attempted bibliography of Swammerdam's works is included. There

is also a two-page list of works about Swammerdam in which the entries are arranged apparently at random, presented neither alphabetically nor chronologically. A number of plates, reproduced fortunately on glossy paper, give an idea of the quality of Swammerdam's dissections and observations. Thus in spite of its defects the book will be of value to young students. It represents a long labor of love on the part of its author, and deserves respect as such.

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Geological Contributions from China

Chung-kuo ta-ti kou-tsao wen-t'i (Problems of Chinese Geotectonics). CHEN KUO-TA *et al.* Science Press, Peking, 1965. 183 pp., illus. 2.60 yuan.

Kou-tsao ti-chih wen-t'i (Problems of Structural Geology). Edited by Academia Sinica, Geological Institute. Science Press, Peking, 1965. 193 pp., illus. 2.40 yuan.

Hua-pei hua-nan chung-sheng-tai hsin-sheng-tai ti-chih kou-tsao fa-ch'ang t'e-cheng (Characteristics of the Geological Structure of the Mesozoic and Cenozoic in Northern and Southern China). Edited by Academia Sinica, Geological Institute. Science Press, Peking, 1966. 105 pp., illus. 1.90 yuan.

In the past ten years, a large percentage of Chinese geological articles have been devoted to tectonics. Chinese geologists are using tectonics, especially on dislocations of the Chinese platform, as the basis for predictions required in the search for economic minerals. A number of recent discoveries of economic mineral deposits and petroleum and gas fields are attributed to these recent advances in tectonics.

Problems of Chinese Geotectonics consists of eight articles written by 17 authors. The articles are devoted to tectonics of the folded Caledonian geosyncline of southern China, to tectonics of Archean rocks of eastern China, to the relationships between tectonics and petroleum-bearing Mesozoic and Cenozoic basins, and to the general tectonics of China. One of the articles devotes 52 pages to the term *tiwa*, a tectonic term proposed by Chen Kuo-ta which means "reactivated platform." This controversial term is not accepted even by other authors of the same volume. Chen Kuo-ta *et al.*, in an article entitled "Fundamentals of the tectonics of China," present a series of seven simplified paleotectonic maps, ranging from the Precambrian to the late Mesozoic. The article by Hsieh Chia-yung on the "Major geotectonic features of southwest China" has appeared in English in *Scientia Sinica* (1963). Hsieh has expressed his view on the tectonics of China in his earlier article "On the geotectonic framework of China" (*Acta Geol. Sinica*, 1961; an English version appears in *Scientia Sinica*, 1962). He bases his analysis on the evolution of geosynclines. Hsieh suggests that the tectonic framework of China consists of a central Chinese platform encircled by a Paleozoic (Caledonian and Hercynian) geosyncline in the central dismembered parts and around the northern and southern margins of the platform. The Mesozoic and the Cenozoic geosynclines are developed in the southeastern and the northeastern margins of the continent. The geosynclines and other major structural zones assume certain prevailing directions, either east-west (Paleo-Mediterranean Sea or Tethys), or northeast-southwest to approximately north-south (the Pacific Ocean coast).

Nine articles contributed by 18 authors present a wide array of topics in *Problems of Structural Geology*. The first three deal with the dynamics of a "sawtooth" fault, a morphological term suggested by Chang Wen-yu and Chung Chia-yu, the dynamics of joints, and optical elastical studies of structurally deformed geological features. There are three articles on regional geology: one on eastern Yangtze gorges, accompanied by a geological map (1:500,000) and six geological cross-sections; one on the geologic structure of the eastern Kunlun geosynclines in Szechuan and Sikang provinces (this welcome article and its accompanying geologic map will help to fill the information void for this area); and one on the tectonic framework of the Tibetan plateau. The volume is concluded by two review articles on work done outside China (on propagation of seismic waves in the crust and on methods of paleotemperature recording), and an article on paleomagnetism in the red beds of Hopeh and Honan provinces. Paleomagnetic research had been carried out extensively in the study of Chinese Mesozoic red beds.

Characteristics of the Geological Structure of the Mesozoic and Cenozoic in Northern and Southern China consists of ten articles contributed by 17 authors. Two of the articles are on the relationship between the tectonics and the Triassic magmatic activities of northern and southern China and the chemistry of the Mesozoic volcanic rocks of eastern China. The authors of this book follow the same approach to the tectonics of China that was suggested earlier by Huang Chi-ching (Huang, T. K.) and Chang Wen-yu. Huang based his synthesis on the paleogeographical analysis of sedimentary formations. In 1954, he published a book on *Principal Tectonic Units of China* together with a 1:12,000,000 tectonic map of China. Two of his later articles have been translated into English and published in *International Geology Review* ("New studies on the geotectonic subdivisions of eastern China and their characteristics," 1959; and "Basic features of the tectonic structure of China: preliminary conclusion," 1963, translated from a Russian translation). An excellent translation of the second article from the Chinese has been issued by the Linguistic Section of the Aeronautical Chart and Information Center at St. Louis, Missouri (ACIC-TC-1262, Dec. 1967, 75 pp.). Huang's tectonic divisions consist of (i) a Chinese platform, (ii) a western fold zone, (iii) a Tibet- western Yunnan paraplatform, (iv) a Himalayan fold system, and (v) a Taiwan fold system. Chang Wen-yu used the same approach as Huang for his tectonic map prepared in 1957. Two years later, this map was included in the book *Outline of the Geotectonics of China* prepared by the Geological Institute of Academia Sinica, Peking (320 pp.). This book was reviewed by E. C. Y. Chao (*Intern. Geol. Rev.*, 1962). The Russian edition (527 pp.) appeared in 1962 and now is more easily obtainable than the Chinese. An English translation of the foreword and the table of contents of the Russian edition was published in *Internatonal Geology Review* in 1963.

Perhaps the most useful features of the three recent books are their illustrations. These consist of 4 lithofacies maps, 10 geological maps, 97 structural sections, 15 paleotectonic maps, 44 stratigraphic columns, 4 stratigraphic