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

correlation charts, and 2 maps showing the distribution of the Mesozoic and Cenozoic igneous rocks of Eastern China.

Unfortunately the promising research of these Chinese geologists came to a halt in 1966 because of the "proletarian cultural revolution." This halt does provide an opportunity for Western geologists to catch up with the progress in tectonic thought that Chinese geologists made in the ten years prior to 1966.

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Nitrogen Source

Urea as a Protein Supplement. MICHAEL H. BRIGGS, Ed. Pergamon, New York, 1967. xii + 466 pp., illus. $18.

This book includes 23 chapters written by authors from 11 countries, including such notable nutritionists as J. Brüggemann from Munich and A. I. Virtanen from Helsinki. The book is divided rather arbitrarily into four sections entitled History, Manufacture and Role of Urea in World Food Problems; The Effect of Urea on Ruminant Physiology; Urea as a Supplement for Ruminants; and Urea in Diets for Non-ruminants.

The first chapter, on the history of the use of urea in ruminant feeds, by H. J. Stangel of Allied Chemical Corporation, gives an excellent review of the literature reflecting the thorough knowledge its author gained from editing, initially with D. F. Green, the book *Urea and Non-protein Nitrogen in Ruminant Nutrition.*

H. K. Hendrickx compares by in vitro methods the effectiveness of urea with that of other non-protein nitrogen (NPN) compounds and reports the findings from his laboratories and others that urea is second only to certain ammonium compounds and acetamide in utilization in the rumen.

Chapter 4 states that the most serious nutritional lack in the world is protein (although it is probably energy) and implies that urea will provide alleviation of this world protein shortage. The author seems unnecessarily and unrealistically intrigued with the practical usefulness of leaf-protein foods and the supplementation of the residues by urea for ruminant feed. Workers in Africa and elsewhere have suggested, much more practically, that supplementation of tropical forages with urea is productive of more animal protein for human consumption, an observation not mentioned in this chapter. The statement that there is no way of measuring the adequacy of diets for the adult is in disagreement with many years of research in quantitative nutrition.

The second section of the book is devoted primarily to the subject of urea and protein synthesis via rumen microbial fermentation. The excellent initial chapter by H. M. Schwartz points out that under non-urea dietary conditions there are a number of natural NPN sources, including urea from saliva and the bloodstream, which are converted to protein in the rumen. Ammonia is perhaps one of the most important NPN compounds discussed because it is the principal source of nitrogen utilized by the rumen flora and arises from both dietary protein and NPN sources. The retention by the ruminant of blood urea under low protein intakes as investigated by Livingston *et al.* and by Schmidt-Nielsen is discussed in the chapter on ureolytic rumen bacteria. This is a very important factor in tropical nutrition. The chapter by Brüggemann on the effect of urea on rumen microbiology and metabolism is one of the most thorough chapters, with an extensive bibliography. A chapter on the endogenous urea cycle in the ruminant by H. Le Bars follows logically. Nobel laureate A. I. Virtanen discusses experiments from his own laboratory on the production of milk by cattle on protein-free rations containing urea.

Part 3 covers some of the more applied aspects of urea as a feed supplement for ruminants. It contains a chapter by Rys from Krakow presenting a thorough review of urea utilization by dairy cows, a matter over which there has been a great deal of controversy because of the high protein needs for milk production. There is a short chapter on the feeding of urea to buffalo and zebu cattle, and a long chapter on urea in rations for fattening lambs, plus chapters on beef cattle. One of the best and most interesting chapters is one by E. C. Owen dealing with relationships among urea and other dietary constituents. Of particular importance and significance is the relationship between nitrogen source and cellulose digestion. A chapter on additives includes a discussion of much-advertised ethanol, which apparently has no useful effect. The important idea of the addition of urea to silage is discussed by J. W. Ryley. The final chapter in this section establishes, with certainty, the lack of any relationship between dietary urea and vitamin A nutrition, laying to rest another in the multitude of dietary interrelationships, almost all of which turn out to be indirect or nonexistent, leaving some few, like protein-energy and thiamine-carbohydrate as realities firmly based on biochemistry.

The last section, devoted to urea in diets for non-ruminants, discusses the demonstrated ability of urea to provide the nitrogen required for biosynthesis of nonessential amino acids when added to a diet low in protein but adequate with regard to all the essential amino acids. This experiment was discussed at the University of Wisconsin as early as 1939 and was reported by Lardy and Feldott in 1949.

While unevenness and considerable overlapping among chapters are evident, many chapters are very thorough, well-written, critical reviews. I believe the book will prove of real value to all people working in the field of ruminant nutrition, particularly those in countries that are just developing an active animal agriculture and wherever protein sources for ruminant feeding are scarce or costly.

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Improving Farm Animals

Genetics and Animal Breeding. IVAR JOHANSSON and JAN RENDEL. Translated from the Swedish edition (Stockholm, 1963) by Michael Taylor. Freeman, San Francisco, 1968. xii + 489 pp., illus. $17.50.

After World War II new books and journals appeared in almost every field of science. In the field of animal breeding, however, comparatively little has been published. The texts of Winters and Rice are far out of date, and though the works of Lush, Lerner, Falconer, Hutt, and Lerner and Donald offer good reference material in their specialized fields, there has been a great need for a textbook on animal breeding. Johansson and Rendel's new text therefore is most welcome, since it summarizes the development of animal breeding over the past 40 years and supplements it with new theories and concepts. Now that