interacting electrons in solids, treating the band model, magnetic properties associated with collective electrons, and ligand field effects on localized electrons. He then thoroughly covers the theoretical models and physical properties of magnetically ordered phases, dealing with ferromagnetism, antiferromagnetism, ferrimagnetism, and parasitic ferromagnetism.

In the last half of the book Goodenough describes the interactions of atomic moments in general in the various types of crystal structures commonly encountered in inorganic crystals and minutely examines specific experimental examples from the point of view of the models. Listing a few of the topics that are considered—band structure, magnetic coupling, Jahn-Teller distortion, conductivity, and second order transitions—may give some idea of the theme that runs through the discussion of the different crystal structures.

Although this book is certainly not a textbook, I feel that it could be used as the basis for a very worthwhile course at the second-year graduate level in physical chemistry.

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Geological Oceanography

Submarine Geology. Francis P. Shepard, with chapters by D. L. Inman and E. D. Goldberg. Harper and Row, New York, ed. 2, 1963. xviii + 557 pp. Illus. $11.50.

This revised and enlarged edition of Shepard's *Submarine Geology* records the great progress made during the last 15 years. In material and organization the volume parallels the first edition. It will remain valuable as a textbook for introductory courses in geological oceanography and for single courses in other areas and as a reference source. Shepard has synthesized a vast amount of material excellently; there are 46 pages of references.

Two introductory chapters cover history, methods, and instrumentation. Three chapters cover waves, currents, the physical properties of sediments, and the mechanics of sedimentation.

The two new chapters by D. L. Inman, on sediments and the mechanics treated in 12 pages and the complex applications of modern fluid mechanics of sedimentation, were a necessary addition. Unfortunately, in these chapters Inman attempts too much. Textural properties of sediments, including the statistics of size distributions, are to sediment transport problems in only 32 pages. A student with an adequate background for understanding the remainder of this book will find Inman's presentation so difficult that he will skip this important material. It would have been better to cover fewer concepts in greater detail.

Logically the two chapters on shoreline classification and beaches and related processes should follow the introductory chapters. The material on nearshore processes and the mechanics of sedimentation, which was presented in the introductory chapters, could have been used to greater advantage in discussing shore and beach development.

Five chapters are devoted to the following topics: the description, origin, and sediment distribution of the continental shelves and slopes; submarine canyons and valleys; and coral and other organic reefs. Shepard's descriptions of the features and sediment distributions are more complete than those in any other single source. Discussion of the origin and history of such features must be highly speculative; the author can be complimented for his objective consideration of many hypotheses.

Three chapters cover deep ocean topography, deposits and stratigraphy (a particularly praiseworthy treatment), suboceanic layers, and the origin of basins. Shepard has completely recast, into a more usable form, the classification of marine sediments, and he lucidly presents the distribution of deep-sea sediments and deep-sea stratigraphy within this new classification.

E. D. Goldberg's chapter on the mineralogy and chemistry of marine sedimentation is a worthwhile addition. Goldberg maintains an excellent balance between discussion of the entire field and details. The problems of using our knowledge of present marine environments as a means of interpreting the origin of sedimentary rocks are discussed in another new chapter.

I recommend this book to anyone who is interested in submarine geology at any level. The second edition has a greater diversity of material presented at a higher technical level, but always in very readable style.

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Nuclear Reactions

Direct Interactions and Nuclear Reaction Mechanisms. Proceedings of a conference held at the University of Padua, 3–8 September 1962. E. Clementel and C. Villi, Eds. Gordon and Breach, New York, 1963. xlix + 1187 pp. Illus. $39.50.

Rapid technological advances in precision high voltage accelerators and solid state detectors have brought about a revolution in the field of nuclear reactions. The proceedings of the conference on direct interactions and nuclear reaction mechanisms, held at the University of Padua in September 1962, provides considerable evidence of the rapid progress in this field. More than 400 physicists, representing 28 countries, attended and 177 papers which were read at the conference are published in this volume.

No sensational breakthroughs are apparent. The meeting was characterized by a steady stream of interesting and competent research, which, in its entirety, results in a considerable advance in our knowledge about reaction processes and nuclear structure. The following are a few of the contributions that I find particularly interesting.

The (p, 2p) and (p, pd) experiments being performed at Orsay promise to provide us with a good deal of information about some rather complex problems such as the structure of the deeper shells in nuclei. Riou reported on the results of (p, pd) experiments on H^2 and Li^6. Comparison of the yield curves indicate that the probability of having quasi-free scattering of protons on deutrons in Li^6 is greater than 30 percent. Thus there is finally some direct experimental evidence on the old theoretical problem of the applicability of the cluster model to the structure of this lithium isotope.

A considerable amount of discussion is concerned with the use of electrons in probing nuclear level structure. This work combined with the usual large number of investigations with heavy particles provides a sizeable amount of new information about nuclear levels. Garvey's detection of collective states in C^{12} is perhaps one of the more interesting.

Theoretical contributions are by no means lacking. The dominant development here seems to be the distorted-wave Born approximation, and there are fine review papers by Macfarlane and Satchler. Other reviews on theories of

considerable interest are those by Rosenfeld (optical model), Breit (nucleon transfer reactions), and Blair (inelastic excitation of collective modes).

The conference discussions appear to be well reported, and there is a fine conference summary by Blair. Professional nuclear physicists will find this volume a necessity.

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Hydrobiology

Biology of the Seas of the U.S.S.R. L. Zenkevitch. Translated from the Russian by Sophia Botcharskaya. Interscience (Wiley), New York, 1963. 955 pp. Illus. $25.

Although Russian hydrobiologists established a high degree of competence and began a systematic study of the marine and brackish waters of the seas of their land before the Revolution, and have kept up this tradition to the present day, the vast bulk of the published literature has been inaccessible to most of us outside the Soviet Union. Not only is the language barrier formidable, but many of the journals and monographs are not in our libraries. One suspects that, with the great expansion of work in marine biology, access to this literature may be difficult in the Soviet Union too and that this well may be one of the reasons Zenkevitch undertook this unique summary of the literature. This book is not simply a review of literature; it is a critical, well-balanced analysis of a prodigious quantity of information, and its like is not to be found in any other country. It was originally published in 1947 as volume 2 of *The Fauna and Biological Productivity of the Seas.* A revised edition, *Biologiya Morei SSSR*, was published in the Soviet Union in 1963, the same time that the translation of the English edition was underway. This English version therefore is not an exact translation of the 1963 Russian edition (the arrangement of some parts and the tables and illustrations selected for use are not the same in the two versions), although both volumes have essentially the same scope and coverage.

The book is organized geographically, with accounts given of the northern (the Baltic and Arctic seas, including the Chukchi Sea), the southern (including the Caspian and Aral seas), and the far eastern seas (including the Bering Sea), in that order. Each section begins with a treatment of the general characteristics and the geological history of the area, followed by detailed discussion of the separate seas, with particular reference to quantitative studies. There is a wealth of information on numbers of species and specimens and biomasses of phytoplankton, zooplankton, and benthos for the various regions studied in detail, as well as data on physical and chemical factors. As the author regretfully notes in his preface, many theoretical and general matters relating to marine biology and ecology generally had to be omitted from this version. Also lacking is a discussion of the quantitative methods themselves. All Russian references in the 52-page bibliography have been translated.

This volume is so useful and welcome to English-speaking marine biologists that it seems impolite to complain about the quality of the translation. However, the translator is obviously not versed in the field, and there are spots which are more literal than necessary; indeed they are occasionally obscure. There are not too many typographical errors for a book of this size, and most of them will be obvious to the reader.

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National Clay Conference

Clays and Clay Minerals. Proceedings of the Tenth National Conference, held at Austin, Texas. Ada Swineford and Paul C. Franks, Eds. Pergamon, London; Macmillan, New York, 1963. xii + 509 pp. Illus. $15.

This excellent volume contains the papers presented at four symposia plus those presented at a general session of the Tenth National Clay Conference in October 1961. The first symposium was concerned with bentonites and Texas uranium deposits. Unfortunately, there is only an abstract of the first paper, which was concerned with Wyoming bentonites. The second paper, by Iiyama and Roy, gives the results of controlled syntheses of mixed-layer minerals; the results indicate that at pressures below 0.5 kb and 1 kb, mixed-layer structures with a random stacking result, whereas, at pressures of 3 kb, highly ordered mixed-layer phases can be obtained. In the third paper Weeks and Eargle consider the mode of origin of uranium deposits in the Southeast Texas Coastal Plain. In the final paper, Konta describes some improvements in his imbibometric method for identifying clay minerals.

Seven papers on the occurrence and origin of vermiculite were presented at the second symposium. Other papers consider the composition of vermiculites, and an excellent paper, by Norrish and Rausell-Colom, presents the results of a low angle x-ray diffraction study of the swelling of montmorillonite and vermiculite.

The third symposium was concerned with clay-organic complexes: the mechanics of the reactions leading to the formation of clay mineral-organic complexes, the structural aspects of the inter-layer complexes, and the hydration and swelling of such complexes.

At the final symposium eight papers on the industrial application of clay mineralogy were presented. They contain excellent summaries of the various industrial uses of kaolinite, montmorillonite, and attapulgite clays. Further, there are specific reports on the use of clay minerals in the ceramics and petroleum industries.

The 13 papers presented at a general session cover topics that range from the radiation damage of kaolinites to the occurrence and origin of the properties of various clay minerals. Finally, in an appendix, there is a history of the National Clay Mineral Conferences and a discussion of the plans that have been developed for future conferences.

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Engineering

Electronic Instrumentation. Sol D. Prensky. Prentice-Hall, Englewood Cliffs, N.J., 1963. x + 534 pp. Illus. $13.35.

Most of the important instruments used in technical laboratories today are considered in Prensky's very complete, logically presented, qualitative discussion, which those who have a minimum knowledge of electronics will find easy to follow. Thus, the book will serve as an excellent reference source for technicians and possibly could be used as a textbook in technical training courses.