reached by his scientific papers or even his numerous lectures in so many countries.

In the first chapters the sea is regarded as a habitat for plankton, nekton and benthos, ranging downward from the photic zone above through the twilight and deep sea zones. Later the reader is taken from the intertidal with its diverse wealth of life progressively lower over the floor of the continental shelf and slope eventually to the profound depths of the ultra-abyssal or hadal zone.

Gunnar Thorson is happiest in these depths among members of the level bottom communities to our knowledge of which he contributed so greatly. The reader constantly encounters illuminating comments from the wealth of unique experience. Only when dealing with coral reefs, where he had minimal experience, is this personal touch missing. But the sole error noted—*Lima excavata* does not swim or form abyssal nest—concerns an inhabitant of the Norwegian fjords.

Particularly notable are the illustrations, both drawings and photographs. Some of the more delightful of the former will be recognized by the numerous recipients of Gunnar Thorson's Christmas cards, made by Kai Olsen of the Helsingør Marine Laboratory, largely of invertebrates there observed.

The economy of marine life is presented in terms of its contributions to human nutrition. Professor Thorson is none too optimistic about future prospects but emphasizes the extent of our ignorance and the need for more marine biologists, many of whom may find first stimulation in the reading of this most admirable book.

C. M. YONGE

African Butterflies

Tropical Butterflies: The Ecology and Behaviour of Butterflies in the Tropics with Special Reference to African Species. By D. F. Owen. Pp. xiv + 214 + 40 plates. (Clarendon: Oxford; Oxford University: London, November 1971.) £4.25.

THE introductory chapter of *Tropical Butterflies* is written with a casual enthusiasm that stimulates further reading. The author has spent several years studying butterflies in East and West Africa and has drawn together his own studies and presented them in a more general biological context in an up-to-date summary which emphasizes ecology, genetics, evolution, and behaviour. Other subjects covered include classification and zoogeography, life histories, species diversity, seasonal abundance, mimicry, and migration, together with one chapter each on

methods of study, agricultural implications, and conservation. The book focuses on African species. The population ecology of *Acraea encedon* raises many important questions, and suggests that man's activities in reducing the complexity of the African environment through overpopulation and excessive agriculture may be unbalancing the sex ratio of the species, a subtle road to possible extinction.

Much of the impact of the author's points is based on colour differences which are obscured by black-and-white photographs; only one of the forty plates is in colour. Figs. 6 and 9 of plate 29 are switched, and the omission of identifying labels on Fig 9.1 makes correlation with Fig. 9.2 difficult; but the layout is excellent and the quality of the figures is high.

The main contribution of this book is in bringing together a great deal of African butterfly natural history and combining it with a summary of recent research on the more important aspects of tropical butterfly biology. The author does not develop new generalizations, nor does he delve critically into many of the subjects discussed, largely as a consequence of limiting the references almost solely to work done on a single group of organisms. Nevertheless *Tropical Butterflies* is an important contribution with appeal to amateurs and presents several aspects of interest to professional biologists.

LINCOLN PIERSON BROWER

Transuranium Elements

The Chemistry of the Transuranium Elements. By Cornelius Keller. Vol. 3. Pp. xv + 675. (Verlag Chemie, Bmbh: Weinheim/Bergstr, 1971.) 188 DM.

THESE 675 pages of carefully and concisely worded prose are a monument to the progress that has been made in understanding the properties of the transuranium elements during their short thirty-year history. They present a remarkably complete, up-to-date compendium of the chemical properties of these elements. More than that, they include much on their physics, history, methods of production, and practical uses.

The book is divided into two parts. The first part includes a comparative treatment of the chemical and metallic properties of all of the actinide elements—thus including thorium, protactinium and uranium. The properties of the actinide elements are correlated to some extent with their lanthanide (rare earth) homologues. Also treated briefly are the physics of nuclear synthesis, structure, and radioactive decay; the electronic structures; the methods of small- and

large-scale production and purification; and some of the practical applications.

In the second part, the chemical properties of each of the 13 transuranium elements (neptunium to hahnium) known at this time are discussed individually in a systematic way. Descriptions of the discovery, isotopes, methods of purification and metallic properties (where known) are included.

Predicted electronic structures and chemical properties of transactinide and the projected superheavy elements, and periodic tables—with a fascinating one extending up to atomic number 218—are included. Such useful information as the masses (and related information) of the isotopes of elements from lead to element 108, X-ray energies of all the actinides, and maximum permissible concentrations (from the health viewpoint) of radium and the actinides are listed in the appendix. A total of nearly 2,000 references covers the more recent literature on the chemistry of the transuranium elements quite well.

As is inevitable in a comprehensive work of this type, the experience and predilections of the author lead to greater emphasis and better treatment in certain areas. Thus the chemistry is on the whole much better than the physics, as might be expected from the title of the book. The crystal structure, coordination compounds and the metallic state of the actinide elements are treated exceptionally well. The oxidation-reduction reactions and equilibria between ions, and in general the chemistry of the ions in aqueous solution, are covered less completely. The treatment of the electronic and magnetic properties and the correlation of trends in the chemistry of the elements from the viewpoint of changes in the electronic structures are likewise less adequate.

There are a number of minor errors, more in the physics than in the chemistry, but not enough to detract from the overall excellence of the book.

This book should be of value to the non-specialist and student of chemistry. It should also be of value to the laboratory chemist. Methods and conditions for oxidizing lower oxidation states (with corresponding colour changes) and optical spectra useful for identification of various oxidation states are given, as well as detailed methods for the separation and purification of the elements. Even the relatively recent field of the organometallic chemistry of the actinides is covered.

This book fulfils a definite need. The last comprehensive book on the chemistry of the actinide elements was published 15 years ago. The translation from the German is excellent, as are the illustrations and the quality of the paper on which the book is printed.

GLENN T. SEABORG