

subjected to rather high temperatures. This leads to cracking some of the richer constituents, and so again reducing the calorific value of the gas finally available.

The material of which the retorts are made requires careful consideration, and Lander and McKay deal with this and other practical points in a chapter headed "Some Difficulties Encountered." In high temperature carbonisation the use of refractory materials for the retorts is necessary, but these are poor conductors of heat, and retorts made from them are difficult to keep gas-tight at "low" temperatures. Metal retorts give better heat transference and are more easily kept gas-tight, but unless care is taken as to the composition of cast iron, where such is used, there will be trouble from "growth." Mild steel can be used up to temperatures of 600° C., but above that the material softens; alloy steels can be made to stand higher temperatures, but they are at present expensive and this naturally hinders their adoption.

Attempts have been made to increase the rapidity of carbonisation by keeping the coal moving so that fresh surfaces are continually being brought into contact with the hot sides of the retort, but this results in the coke being broken up to a degree which renders it unsuited for use as a domestic fuel.

(1) Messrs. Wellington and Cooper's book might be improved by an extension of the chapters dealing with laboratory work and theoretical considerations. The work carried out by the Fuel Research Board has been strangely ignored. The book contains an interesting chapter on the generation of electrical power, and the possibility of recovering the oil from the coal used for this purpose.

(2) Dr. Lander was formerly assistant to Sir George Beilby, and succeeded him when Sir George retired from the position of Director of Fuel Research under the Department of Scientific and Industrial Research, and Mr. McKay is his colleague in the Department. This fact, as Sir George points out in a foreword, places the authors in an almost unique position when writing a book on this subject. The result is an excellent, comprehensive, and judicial book which must be considered as the standard work on this important subject.

The Teaching of Palæontology.

Outlines of Palæontology. By Prof. H. H. Swinnerton. Pp. xii + 420. (London: E. Arnold and Co., 1923.) 30s. net.

THE "Palæontology" of the title would more correctly have been "Palæozoology," but Prof. Swinnerton doubtless chose the former intentionally

because he declines to regard his subject as a mere division of zoology. He does indeed deal with his material in the order of the zoological system, from Protozoa to Primates; but instead of that museum-like arrangement under orders, families, and genera which deadens the usual systematic text-book, he selects in each phylum or class certain characters and traces their origin, progress, and decline. The declaration by a professor and a potential examiner that it is more important for a student "to recognise the evolutionary stage attained by one or more of the individual features in his fossil" than to identify its species or even genus deserves cordial welcome, for a facility in winning marks by fossil-spotting argues a misspent youth.

Here then are no pretty pictures of fossils, but plenty of diagrams reduced to the simplest elements, with some interesting charts and graphs. Thus, for palæozoic echinoids we are shown seven stages in the evolution of ambulacral plates and areas, four stages for interambulacral areas (the lettering unfortunately reversed), and a graph contrasting three genera; and we are then invited to construct similar graphs for the other genera and to decide for ourselves how far the classification is a natural one. In this way the study of each group is made to bring out some broad principle, and all these principles of structural change are summed up in a concluding chapter, which would be improved by the insertion of references to the pages on which the evidence for its assertions has been detailed.

All this is excellent, for a study of the changes passed through by any one structural element is an illuminating method peculiar to palæontology. But to speak of such a series of changes as "the palæontologist's independent unit" (calling it by the hybrid term "Bioseries"), and to emphasise repeatedly "the independence of structural elements," is surely to go too far. By his concluding section on "The Co-ordination of Bioseries," Prof. Swinnerton proves himself alive to the danger of regarding a race as a bundle of distinct and possibly warring tendencies; but the student of fossils should always have before his mind the concept of the living organism, a concept that embraces, not merely its own structures and internal tendencies, but all that part of external creation which is in relation with the apparently isolated creature. The environment is not indeed ignored in this interesting book, but it does not appear in many places where one looked to find some mention of it; and the environment of a single organ includes all the rest of the body. Neither in the macrocosm nor in the microcosm is there such a thing as independence.

F. A. BATHER.