

of human life, and of the misery and destitution that followed it, asked their fellows if this ought to be part of the price to be paid for coal, and the answer was given in no uncertain tones. Government inspection was insisted upon, and, in spite of persistent opposition, eventually obtained. In the outset, the character of the inspection was not always what it should be; but, little by little, this has improved. We have a better trained class of men sent out by the Home Office now than formerly, and their hands have been gradually strengthened by the Legislature, although, perhaps, not to the extent that is desirable.

Statistics show that this intelligent inspection is gradually making its influence felt. Tested by the ratio of fatalities to number of men employed, and to amount of material raised, there is a slow but decided improvement. Of course, even under the most ideal system of inspection, coal-mining will continue to be a hazardous occupation; but this at least we may hope, that the steady sacrifice of 1000 victims a year, which that ruthless potentate, Old King Coal, seems to demand, shall not continue to be augmented by catastrophes that ought to be considered as preventable.

Mr. Stuart's book is to be welcomed, therefore, as adding one more link to the chain of evidence which establishes the fact that coal-dust may be the most important and, at times, even the only agent in bringing about a colliery explosion. About a year ago an explosion occurred at the Camerton Collieries in Somersetshire, the significant feature of which was that it took place in a mine wholly free from fire-damp. All the circumstances connected with this explosion were brought to the knowledge of Mr. Chamberlain's Commission by Mr. Garthwaite, the general manager, and were fully inquired into by H.M.'s inspectors. Mr. Stuart's examination was made independently of the official investigation, and it is satisfactory to note that as regards the main conclusion there is absolute unanimity on all sides. There can be no possible doubt, therefore, that the explosion of November 14, 1893, at the New Collieries, Camerton Court, was due to coal-dust, and to coal-dust alone, initiated by a gunpowder shot, and most probably by what is technically known as a "blown-out shot." Mr. Stuart's examination showed that there were no "extraordinary circumstances" present; the shot-firing was an ordinary operation, the presence of coal-dust was a normal circumstance, and the work was being done by a competent man. "The angle and declivity of the hole were such, that if the gunpowder were expelled, it would directly strike the dust; but it was so placed in the judgment of an experienced miner. . . . In the presence of this explosion, therefore, conjecture upon the supposed innocuousness of a gunpowder shot in a dry and dusty non-gaseous mine is at an end."

Whilst we wholly agree with Mr. Stuart in this conclusion, we are not altogether at one with him in regard to his explanation of the chemical process of a coal-dust explosion. Mr. Stuart appears to be of opinion that a coal-dust explosion is in reality only another form of a gas explosion. The action of the heated products of the exploded gunpowder is, he assumes, to cause the dust to experience a kind of destructive distillation whereby

hydrogen and gaseous hydrocarbons are formed, which at the high temperature combine explosively with the oxygen of the air of the mine. Whether there is any necessity to invoke this distillatory process as an explanation of the phenomena, is extremely doubtful. Without expressing any final opinion on this point, it may be pointed out that no definite relation between the bituminous character of the dust and its "sensitiveness" as an explosive agent has been established. The dry mines of South Wales, where some of the most formidable explosions of recent times have occurred, yield a dust which is relatively rich in carbon, and which affords no very large quantity of gas on distillation.

We would commend this book to the thoughtful attention of every colliery manager, with, however, the reservation that Mr. Stuart's theories are not to be accepted as of the same value as his facts. So long as he confines himself to the orderly arrangement and analysis of these facts he is on perfectly safe ground. The weakest portion of the book is that in which the author seeks to elucidate the chemical and physical phenomena of a coal-dust explosion, by the application of imperfect thermal data and of irrelevant chemical observations.

THE MODE OF LIFE OF MARINE ANIMALS.

Die Lebensweise der Meeresthiere. Beobachtungen über das Leben der geologisch-wichtigen Thiere. Von Johannes Walther. Zweiter Theil einer Einleitung in die Geologie als historische Wissenschaft. (Jena: Gustav Fischer, 1893.)

THIS is the second part of Prof. Walther's projected extensive geological treatise, the first part of which—on the Bionomy of the Sea—appeared some time ago. Of the three titles given, the second, or subsidiary one, seems best to describe the scope of the present book. It is not, as might be supposed from the primary title, a treatise on the physiology of marine animals—would that it were! that is still a great desideratum in biology—but is rather some observations on certain points in the life-relations, or mode of occurrence, of certain marine animals, viz. those which are of importance to the geologist [and no less to the biologist] as being the present-day representatives of former animals now preserved as fossils. Walther's idea is that we must study the relations of organisms to their environment at the present day, before drawing deductions from fossil remains as to the physical conditions of past geological periods. His object is to lay a sound foundation of fact, as to the mode of occurrence of particular sets of animals, upon which to base an account of the history or development of the events chronicled in the rocks. The idea is a sound enough one, if not very original—it must surely have been present, consciously or not, in the minds of various geological and biological writers—and the conclusions arrived at, if really based upon a sufficiently large accumulation of statistics, will no doubt be a valuable guide to the geologist in forming his opinions. The book, if very complete in its series of facts, would also be a useful reference work to the zoologist; but it may be doubted, on an examination of the lists given by

Walther, whether they are a sufficiently exhaustive compilation to inspire thorough confidence.

For example, the information as to the geographical distribution of species is rather unequal, being detailed in some cases, and decidedly meagre in others, as when for *Lagena sulcata* is given only "im Mittelmeer," and when for *Crania anomala* the only north-west European locality is the Clyde! While, on the other hand, such minute local detail is given as that *Globigerina bulloides* is not uncommon in the brackish water of the Dee from Chester to Hilbre Island. A number of detailed criticisms of this kind might be made, such as the extraordinary entry "*Lafoëa*, 450 faths." when several species of the genus are found in quite shallow water. But probably enough has been said to show that the lists are by no means complete.

The plan of the book is, briefly, as follows: first, the gaps in the palæontological record, and their causes, are discussed; then the following groups are treated in succession: Foraminifera, Radiolaria, Spongia, Anthozoa, Crinoidea, Asteroidea, Echinoidea, Holothuroidea, Bryozoa, Brachiopoda, Lamellibranchiata, Gastropoda, Cephalopoda, and Crustacea. A few general questions are discussed. The author alludes to the well-known fact that some of the most abundant groups in the sea are almost unrepresented in the fossil series, and that even amongst animals with hard parts the fossils of a particular bed might inadequately represent what had been the living assemblage at that spot. He quotes Edward Forbes' account of the natural history of a shell-bed off the north-west of the Isle of Man, and his later observations in the Ægean Sea, to show that even the fresh dead remains of organisms on the sea-floor do not always correctly show the relative abundance of the living species.

In each group, after a short account of the characters, mode of occurrence, &c., there follows a list of genera and species, with an indication of the distribution and range in depth, compiled from *Challenger* reports, monographs, and other sources; but there is a want of correlation and digestion of the facts, the nomenclature is not up to date, and the same species sometimes occurs several times under different names; e.g. on p. 303, *Ophiothrix fragilis* appears three times under the names *Ophiocoma rosula*, *Ophiothrix fragilis*, and *Ophiothrix rosula*, with a different range in depth each time. Occasionally an animal is found in the wrong group altogether, as, a Holothurian amongst the Asterids, and an Ascidian in the Gastropods. However, Prof. Walther has brought together a considerable amount of material which those who are interested in the distribution of animals in the sea, and the association of species to form "faunas" characteristic of particular regions, will have to utilise. For this the marine zoologists and the geologists will no doubt be grateful, and will, with profit, consult the lists; but I fear they will also sometimes regret that the author had not taken more pains to digest his facts and to correct his proofs. Many odd pieces of interesting information are given; but there is still room in some book on marine faunas for a detailed account of characteristic assemblages of animals with as full a description as can be given of their physical surroundings and their variations.

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OUR BOOK SHELF.

Elementary Qualitative Chemical Analysis. By Prof. Frank Clowes, D.Sc., and J. B. Coleman. Pp. 180. (London: J. and A. Churchill, 1894.)

Tables and Directions for the Qualitative Chemical Analysis of Moderately Complex Mixtures of Salts. By M. M. Pattison Muir, M.A. Pp. 44. (London: Longmans, Green, and Co., 1895.)

Laboratory Exercise Book for Chemical Students. By E. Francis, F.C.S. (London: Blackie and Son.)

THE first of these books is an abridgement of Prof. Clowes' text-book on qualitative analysis, adapted for use in the laboratories of schools and colleges. For the most part, the book is like a host of others of the same kind. It differs from many of them, however, in the fact that the first fifty pages is devoted to instructions on the preparation of apparatus, to experiments illustrating the preparation and properties of certain gases and liquids, to descriptions of analytical operations, and directions for the performance of ordinary processes of chemical manipulation. Work of this character forms by far the best introduction to a course of practical chemistry, and it has an educational value, which is more than can be said for mere test-tubing. On account of this and one or two other notable features, the book will probably take a permanent place among laboratory guides.

"These tables and directions" (writes Mr. Pattison Muir) "are intended for the guidance of students who are acquainted with the principles of qualitative analysis, and who are able to make a qualitative analysis of a simple salt, and of a mixture of salts containing not more than a single metal in any one group, and three or four of the common acids." The student who has passed through an elementary course of practical chemistry is frequently puzzled how to conduct an analysis of moderately complex mixtures of salts and the commoner metals and acids, or an analysis of metals and alloys. Mr. Muir's book tells exactly what to do in such cases. By following the directions given, it would hardly be possible for the young analyst to go wrong. The processes described are easily carried out, and are concisely stated. A point worth noting is that the formulæ of solids are printed in heavy type; of liquids or substances in solution, in ordinary type; and of gases, in italics. This method of indicating the physical states of substances certainly possesses advantages. Altogether the book is a handy and trustworthy manual for analytical chemists.

The exercise book arranged by Mr. Francis has apparently been designed to take the place of the laboratory note-book. It opens with a few exercises in practical chemistry, the experiments being briefly—sometimes too briefly—described; and blank spaces are left for the entry of results. Then come a set of analytical tables, and a number of blank forms in which all the steps in the analysis of a mixture of two simple salts are indicated, spaces being left for the student to fill up with his inferences. The average student of practical chemistry works like a machine now, and we have no doubt that these tables will be after his own heart, for they only leave him to fill in his observations as if he were answering the questions in a census paper. The book may serve to drill the student into carrying out his tests in the proper order, but it will not benefit him mentally.

Elements of Astronomy. By G. W. Parker, M.A. (London: Longmans, Green, and Co., 1894.)

THIS is one of the books in which astronomy seems to be regarded as a subject which is to be studied much in the same way as one would take up an additional book of Euclid. It abounds in definitions, propositions, and