the limits of a species. They are thus a safer indication of both likenesses and differences in two faunas. Mr. Sclater, some years ago, proposed the term of "lipo-type" to express a negative state of affairs; a genus or species which was, as it were, unaccountably absent from a given region was thus denominated.

There is no doubt that this expression was wanted and that it did emphasise important zoogeographical fact. Nevertheless, it must be used with care, especially with regard to smaller and less conspicuous creatures. The Drs. Sarasin instance the case of the land planarians of Celebes. It was written so recently as 1891 that not a single species of this group of Platyhelminthes had been found in Celebes. Now we are acquainted with quite a number of forms, so much so that Celebes is the second richest island of the whole Malayan archipelago in these worms. We are glad to notice that the authors carefully distinguish between artificial introduction of species and introduction by natural means. To this matter attention has not, perhaps, been sufficiently drawn, and the wide range of many small creatures which has been used as an argument for their antiquity and has been generally made use of by the zoogeographer has not always the real value that has been attached to it. After due sifting of such fraudulent claimants to indigeneity the authors are, roughly speaking, disposed to do what has been mocked at—to demand a continent to explain the range of a beetle. Avoiding exaggeration, we can assert that the authors are not at all impressed by the floating *log deus ex machinâ*; they think that similar inhabitants on opposite sides of a sea generally imply a former land connection.

It will be noted from the few observations made that the authors preface their detailed consideration of the fauna of Celebes and neighbouring islands with some remarks of a general nature, which might perhaps have been rather more expanded if the work had not been of so special a character. The animal groups made use of by the authors are chiefly the molluscs, reptiles and amphibians; birds, mammals and land planarians are not neglected. The fact that there are more peculiar species of molluscs than of reptiles and amphibians is commented upon; this the authors attribute to the greater mobility of the two vertebrate groups. In discussing all zoological characteristics of Celebes it must be borne in mind, as is duly pointed out on p. 128, that the island itself first rose from the waves after Eocene times, for a great mass of the solid rock of which it is built is Eocene chalk. The view of its subsequent history which the fauna appears to indicate is that it first showed itself above the water in the Miocene and that during the Pliocene it was in connection with neighbouring islands, from which it became subsequently and at different times detached. It is justly described, therefore, as a "fragment of a Miocene continent." One important exception, however, exists to the statement that Celebes has been in the past in connection with the other islands of the surrounding seas. The authors point out that there is not a single species of animal known to be common to Celebes and Borneo and not at the same time found in some of the other islands; this, as is justly inferred, seems to indicate that Celebes can never have been connected by a land bridge with Borneo directly,

though, of course, it probably was indirectly by way of Java, on the one hand, and possibly (though the authors think not) the Philippines on the other. The Macassar strait thus represents a tract of ocean which has been water before and since the appearance of Celebes upon the earth's surface. On the other hand, the supposed deep channel on the south intervening between Bali and Lombok is, as it appears from Prof. Max Weber's soundings, to be given up, since the greatest depth then ascertained to exist was merely 312 metres. This volume is of extreme interest as a detailed attempt to reconstruct from a comparison of faunas the past geological history of a group of islands. It is abundantly illustrated with maps, and concludes with an historical review of the literature of the subject and a list of memoirs and books.

F. E. B.

ENGINEERING EDUCATION.

Proceedings of the Eighth Annual Meeting of the Society for the Promotion of Engineering Education held in New York City, July 2-3, 1900. Vol. viii. Pp. xxviii + 377. (New York: Engineering News Publishing Company, 1900.) Price 2.50 dollars.

WHEN technical education is so much in the air, and so many consider that it is a cure for all our industrial troubles, it is interesting to see what another nation thinks of its own system of education. In America there exists a society for the promotion of engineering education, and we have the pleasure of reading their eighth volume of *Proceedings*—that of last year. The members of this association are those who are, or have been, engaged in responsible positions in the work of engineering instruction. There is a regular meeting for several days once every year, the whole of the papers which are read dealing with education as applied to industry.

The association seems to be most prosperous, both financially and in point of numbers; it is clear that meeting together of teachers is most useful to both teachers and students, and it is to be hoped that in this country a similar society may be formed, which would do much to educate public opinion as to what technical education exactly means. At present very few people understand what is wanted to be taught and whom to teach it to; an individual, even of the most impressive powers and personality, cannot speak with the same authority as a society which has only one end, namely, to improve our educational methods.

The presidential address of Prof. Ira D. Barker, dealing with the position of engineering education in the United States at the end of the century, is most instructive in showing what a strong hold technical instruction has on the other side of the Atlantic.

At the end of 1899 there were eighty-nine institutions offering full courses in engineering, in some cases seven different courses being open to students, the numbers attending full courses being 9679; of these colleges no less than 98 per cent. require the four years' course before graduation.

These schools must not in any way be considered as falling into the same category as our technical schools, which mainly address themselves to evening work for the

artisan class. No doubt our technical schools do excellent work, but they in no way give that thorough and systematic instruction which is given in the American colleges, which do not wish to produce workmen, but to train successful leaders of industry. The trade school, which seems to have become inevitable in all countries under the stress of modern industrial competition, is evidently making its way in America, but, unlike us, no attempt is made to teach a boy a trade in his spare hours during the evening, but attendance is required during his entire time. The course really forms a part of the high school curriculum, and, while not developed to the same extent as in Germany, it is clear that Americans look to some such school to give that training which was in olden days given to the apprentice, but which will soon have become impossible to acquire in a modern works.

Perhaps the most interesting paper in the *Proceedings* is one by a committee on American industrial education. Great prominence is given to the manual training method, not only for kindergarten work, but for all grades of education up to the highest; as is there stated, the system is costly, but the results are said to be calculated to astonish those who have never seen the manual training system in operation.

The agricultural and mechanical colleges, founded in the first instance by land grant bills, are evidently the backbone of American education as regards applied science. Some colleges, such as Cornell, have developed in all directions, while others have confined their scope to purely practical subjects.

In all cases the instruction is based on a wide basis of those pure sciences which are the foundation of all technical knowledge. The Americans go further than we do, and give up a part of the course to purely literary subjects in order to give a broader education.

The correspondence technical schools are probably peculiar to America and are of quite a recent date; they are purely private concerns, which offer to give complete instruction by a course of papers. As the committee remark, the majority of students who commence soon drop the courses, but the convenience of learning by post is considered so great that these correspondence classes will probably become permanent.

The night school system is condemned by the committee in a most positive manner. The learner starts to learn after a heavy day's work, and after the classes are finished mind and body are alike exhausted.

No systematic course of study is possible owing to lack of time, while the whole atmosphere of the school is said to be very far from stimulating and encouraging. We are quite in agreement with this committee on this subject, and wish that people would not place so much reliance on the work of evening classes.

We conclude with an extract from some remarks made by Prof. Alderson, of Lafayette, Miss. :—

"Those who have had an opportunity to look into this matter probably know full well that to-day the industrial decadence of England is due to her failure to recognise the proper status of engineering education."

Such remarks are not pleasant reading, but often a dose of bitter truth is beneficial. Let us hope that it may not be too late for the warning to be of service.

F. W. BURSTALL.

OUR BOOK SHELF.

Chemical Technology; or, Chemistry in its Applications to Arts and Manufactures. Edited by C. E. Groves and W. Thorp. Vol. iii. *Gas Lighting.* By Charles Hunt. Pp. xviii+312. (London: J. and A. Churchill, 1900.) Price 18s.

THIS, the third volume of a well-known work on chemical technology, gives a history of the manufacture of gas and its application to the purposes of illumination. After a short historical introduction, about three-quarters of the remainder of the book is occupied with a description of the mode of manufacture, purification and distribution of coal gas as carried out in this country. The consideration of gas burners then takes some fifty pages, the questions of the testing, analysis and determination of the heat of combustion of gas occupying about twenty pages. The apparatus used in the manufacture of coal gas is described in great detail, chapters being devoted to the construction and use of retorts, furnaces (several regenerative furnaces being described in this section), stoking machinery, condensers and scrubbers, purifiers, the measurement and storage of gas—the numerous forms of gasholders being very fully given—governors, distributing mains and pipes, and gas meters.

The mode of treatment throughout is that of an engineer, or rather a gas engineer, writing for gas engineers, and as representing the wide experience of the author in this respect the work will doubtless be found necessary on the bookshelves of every manager of a gasworks. The only criticism which may be offered in this respect is that the question of water-gas manufacture and distribution is not treated with the fulness which the growing importance of the subject deserves, a defect which may perhaps be attributed to the fact that it is only within the last year or two that public attention has been drawn to this subject by the agitation of certain public authorities against the use of this gas, and the subsequent appointment of a committee of the Board of Trade to consider the matter. From the absence of any mention of this, and from other indications, it is clear that the book was completed some two years before the date of publication. Thus the limits of sulphur impurity allowed in the metropolis are incorrectly stated, and no mention is made of the complete alteration in the method of testing London gas prescribed by the London Gas Referees in 1898.

But a more serious objection is the mode of treatment of the subject as a whole. As one of a series of chemical handbooks, it is natural to expect that the subject would be treated from a chemical, or at all events from a scientific, as opposed to an empirical, point of view, and this is by no means the case. The growth of gas manufacture in this country has been essentially empirical, and, although dealing with a chemical manufacture, has been developed almost exclusively by engineers without any special chemical knowledge. This is faithfully mirrored in the work under notice, in which mechanical details are given with minute accuracy, but chemical details are alluded to very briefly. Incidental references are made to the modes of analysing coal gas at various stages of its purification, although even here preference seems to be given in gasworks to rough and empirical apparatus. It is noteworthy that whilst the title of the book is "Gas Lighting," the question of photometry is altogether omitted; and although, as mentioned in the earlier chapters, the temperature at which the coal is distilled is of supreme importance as regards its quality and quantity, no mention is made of the use of any form of high temperature thermometer, nor, judging from the present work, does the pyrometer seem to be regarded as an essential part of the equipment of a gasworks.

There is still room for a work on coal gas which shall treat of the subject from a scientific as opposed to the empirical standpoint.