

with the question must be chagrined to think that a solution so obvious should have escaped them. The author tells us that when he

"first began to read on this subject, he had a preconceived opinion of the cause, which to him seemed so reasonable that he wondered why others had not come to the same conclusion."

Ah, but that is always the way! It is only after the riddle is solved that it seems so simple—but the apparent simplicity of the solution should not detract from the merit of its perspicacious discoverer.

We give, in a few words, Dr. True's inspired "theory":—Up to and during part of the Tertiary period, the earth had so far cooled and the crust had become so thickened that it was just able to support itself.

"But finally the point was reached when it could sustain it (the pressure) no longer. The last grain of sand broke the camel's back."

Suddenly the floor of the ocean settled down, while the mighty north and south mountain ranges of the globe were ridged up. Concurrently with these movements, the polar regions were elevated into dry land, and their supply of warm water from the south being cut off, the formation of ice-fields forthwith began and finally culminated in the Glacial period. The Arctic lands then existed as plateaus—miles in height—an amount of elevation

"amply sufficient to produce almost any degree of cold, and also a slope extending several hundred miles, sufficient to account for the motion of the ice in a southerly direction. Here is where the northern elevation, which nearly all geologists say must have accompanied the Glacial period, comes in. The great wonder is that they have not seen what caused it."

It is needless to say that under such conditions the ice continued to accumulate until not only all N. Europe and N. America, "but the whole bottom of the N. Atlantic, as far south as the southern border of the telegraph plateau," were covered with an ice-sheet. While this mighty ice-sheet overwhelmed those regions, N. Asia escaped glaciation. Why? Simply because it was deeply submerged at the time, and so the polar ice advancing southwards broke off in icebergs and floated over north and south Siberia. The withdrawal of so much water from the ocean and the piling of it up in the form of ice on the western hemisphere naturally disturbed the earth's equilibrium. We should not be surprised, therefore, to learn that all of a sudden the earth "tipped" or "toppled over," in order to bring about "a readjustment of matter to the stationary axis."

"N. America and W. Europe moved down out of the cold region, while N. Siberia, on the opposite side of the earth, moved up into it."

Of course, these changes produced a cataclysm—"great tidal waves, perhaps miles in height," sweeping the ice-sheet out of the N. Atlantic and flooding much of the continents.

And so the Glacial period came to an end in N. America and Europe. But, as our author remarks,

"it is plain that when the west side of the earth warmed up, the east side became cold, and it is also plain that the transition was sudden."

This is shown by the admirable preservation in N. Siberia of the carcasses of mammoths and woolly rhinoceroses—"the congeners of those now inhabiting a tropical climate."

"It seems that when the east side of the earth tipped northward, the reaction caused a great tidal wave that caught the animals which roamed over the regions south of and adjacent to the then northern ocean, and carried them away as drift, to become frozen in ice, and there they have remained ever since."

Who will not sympathise with glacialists? Their occupation, alas! is gone; no more difficulties are left for them to encounter; with a wave of his magic pen, our inspired doctor has banished darkness and laid bare every secret of the Ice Age. He knows the past of our globe so well that one cannot wonder he should be equally confident as to its future. His theory is a true "open sesame." The same succession of remarkable changes which he has unveiled for us will, we are assured, again supervene; and his readers may well shiver and shudder at the "gloomy picture" he presents for their contemplation. They are advised, however, by the considerate author not to be "uneasy" because of that dismal future—it is still a long way ahead. "They will not be here when it comes."

J. G.

PROPERTIES OF MATTER.

A Text-Book of Physics. By J. H. Poynting, Sc.D., F.R.S. and J. J. Thomson, M.A., F.R.S. Properties of Matter. Pp. vi + 228. (London: C. Griffin and Co., Ltd., 1902.)

THIS volume is to be regarded as the opening one of a series forming a text-book of physics, of which the second part, namely, "Sound," was published some two years ago and is now in its second edition. The remaining volumes, dealing with "Heat," "Magnetism and Electricity," and "Light," will be published in succession, it may be hoped at somewhat shorter intervals.

The book is not intended for elementary students on the one hand or for mathematicians on the other, and the authors make a welcome innovation in entirely omitting the more purely mathematical side of mechanics with which text-books on the properties of matter are usually encumbered. After a brief preliminary chapter dealing with the experimental evidence for the constancy of weight and mass, about fifty pages are devoted to a most interesting and complete account of the experimental work on the measurement of the acceleration of gravity, the figure of the earth and the constant of gravitation, introducing the student to a number of most instructive physical methods, described with the discrimination of a practised experimentalist who has made a special study of the subject. The next seven chapters (60 pp.) deal with the elasticity of solids from an experimental standpoint, mathematics being introduced only so far as is necessary to permit a comparison of theory and observation in a few simple cases, which serve to illustrate the physical principles involved. Many comparatively recent experiments are described, such as those of Ewing on the yielding of crystalline substances by slipping along the cleavage planes. The remainder of

the book deals with the compressibility of liquids and gases; and the phenomena of capillarity, diffusion and viscosity. In discussing these subjects, the molecular theory of matter has of necessity been very freely introduced, but the detailed account of the theory has been reserved for the volume on heat. Among the subjects incidentally discussed in the present volume are Van der Waals's equation for the relation between the pressure and the volume of a gas, reversible thermal effects accompanying alterations in strains, effect of temperature on surface tension, change of vapour-pressure under stress, osmotic pressure, vapour-pressure of solutions, lowering¹ of the boiling point of solutions, lowering of the freezing point of solutions, variation of viscosity with temperature, and explanation of viscosity and diffusion on the kinetic theory. An elementary knowledge of heat may reasonably be expected of the student, but it would seem preferable to have reserved some of these subjects until the kinetic theory and the second law of thermodynamics had been discussed.

It is hardly necessary to say that the book is of a thoroughly practical character, and will commend itself both to the teacher and the student. The book is written from the point of view of the experimental physicist, and the subjects selected for illustration are those most useful and instructive to the student. The mathematical methods employed are generally of a simple character. In many cases, these may appear cumbersome and difficult to the student who possesses a knowledge of more advanced mathematical methods. But even for such fortunate students, there is some compensation in the fact that the more elementary method compels attention to the physical meaning of the processes employed. In the case of many of the subjects discussed, it would be difficult for the student to find an equally concise and clear account of the theory and the experimental methods in any other book at present accessible, and we are confident that the present volume will be found to be a useful addition to the text-books available for advanced students of physics.

H. L. C.

ZITTEL'S TEXT-BOOK OF PALÆONTOLOGY.

Text-book of Palæontology. By Karl A. von Zittel. Translated and edited by Charles R. Eastman. Vol. ii. Pp. viii + 283. (London: Macmillan and Co., Ltd., 1902.) Price 10s. net.

NEARLY three years have elapsed since we received the first volume of the English edition of Prof. Karl A. von Zittel's well-known "Grundzüge der Palæontologie." We therefore open the newly published second volume with some fear lest the long delay in its production be due to a complete remodelling, such as that which we criticised on the last occasion. This new instalment, however, is a welcome surprise; for, while the sections with which it deals have been judiciously edited and somewhat brought up to date, the author's original plan is strictly followed, and it still remains essentially the work of the Munich professor.

¹ This is evidently a misprint for "raising of the boiling point," which is the term used near the end of the section, but the sign of the change is not clearly brought out in the analysis.

The present volume deals with Pisces, Amphibia, Reptilia and Aves, and extends only to 278 pages—a slight increase on the original text from which it is translated. The Mammalia will form a third and concluding volume, to be issued later. This plan of subdividing the text-book into instalments of convenient size for ready reference will be appreciated by all who have been compelled to use the ponderous German edition, which is a volume much too bulky for comfortable handling.

The section on Pisces, occupying 114 pages, has been translated and revised by Dr. Smith Woodward. The author's original classification has only been slightly modified to incorporate Dr. Traquair's recent descriptions of Upper Silurian and Lower Devonian fishes, and the translator's own observations on the Pycnodonts and some of the Teleosteans. These changes are evidently approved by Dr. von Zittel himself. Traquair's figures of *Drepanaspis*, *Birkenia* and *Lasanius* appear for the first time in a text-book and his remarkable discoveries are now made accessible to an elementary student. The revised account of the Teleostei is also the first condensed synopsis of recent discoveries which has been published in a general treatise.

The section on Amphibia, occupying twenty-five pages, has been translated and revised by Dr. E. C. Case. There are no new figures, and the changes consist merely in a few allusions to recent discoveries.

The revision of the section on Reptilia, now occupying 116 pages, was begun by the late George Baur, whose untimely death prevented his accomplishing more than part of the chapter on Chelonia. Most of the present translation has been done by Dr. E. C. Case. The chapters on Squamata and Pterosauria have been revised and extended by Prof. S. W. Williston, who has also contributed notes on Plesiosauria and Chelonia. The chapter on Dinosauria has been brought up to date by Prof. H. F. Osborn, Dr. O. P. Hay and Mr. J. B. Hatcher. Dr. Case himself appears to be responsible for the removal of the Clepsydroidæ from the Theromorpha to the Rhynchocephalia. The revision, on the whole, is a distinct improvement on the original work. The supplementary details concerning the fossil reptiles, especially of North America, will prove very useful for reference; while a few new figures of restorations by Williston, Smith Woodward and Hatcher add to the educational value of the book.

The section on Aves has been doubled in extent by Mr. F. A. Lucas and now occupies twenty-three pages. No new figures are given, but the text is well up to date, and it is especially valuable as being a critical summary combined with original observations.

The volume concludes with a good index to the names of genera, and forms the most exhaustive work of reference on the extinct cold-blooded vertebrates and birds which has hitherto been published in the English language. Dr. Eastman and his colleagues are, indeed, to be congratulated on the successful completion of this new instalment of their undertaking, which will prove of the greatest service to all English-speaking students both of geology and zoology.