5. *A love of Nature.* Associated with a teacher enthusiastic in the study of Nature and natural phenomena, thoroughly imbued with a love of truth for its own sake, the pupil can scarcely fail to catch something of the teacher's spirit. A true appreciation, however, of the works of the Creator can come only when he, by means of scalpel and microscope, if need be, is given an insight into their *real* beauty, structure, harmony and wonderful diversity. In this most important respect they differ from the works of man,—the best of which must be viewed from this or that standpoint, in certain lights only or from a distance squinted at through a tin funnel. Nature may thus be given a new charm for the pupil, his walks to and from school, or into the country yield an added pleasure, his happiness has been multiplied by a factor, the value of which depends upon his teacher and himself, but which is always greater than unity. He now really

> "Finds tongues in trees, books in running brooks,
> Sermons in stones, and good in everything."

His mind engrossed in the contemplation of a plant, animal or pebble, or absorbed in the interpretation of some natural phenomenon, has little time for evil thoughts. He must grow wiser, better and more loving. I cannot agree with Professor Chapin that the collection of animals and plants and, if necessary, the "picking them to pieces" lessens in any way, the pupils' "regard for God's creatures." On the other hand, in this way is such regard most certainly developed and maintained, a bird in the hand being worth a *dozen* in the bush. This does not imply that the pupil is to *continue* his killing and picking to pieces, and my experience with boys is that those who have acquired the most intimate insight into the wonders of Nature hesitate longest before *wantonly* destroying any of her forms.

Instruction in the so-called "Natural Sciences" is peculiarly adapted to the lower grades. 1. The materials are, on every hand, directly associated with the pupils at all times, and constantly appealing to their intelligence. 2. These sciences are, for the most part, "observational," and their study admirably adapts itself to the natural development of the child's mental faculties. 3. The child takes a more active interest in everything that has been produced by Nature—that has "growed"—and especially is this true if the object is *"alive."* Were it not for this the *scientific* study of jack-knives or hairpins would serve a good purpose. 4. The collection of material takes the pupil into the open air. 5. The supplies cost nothing beyond a few lungs-full of this luxury, a brisk walk, an increased circulation and a healthy cheek-glow. 6. The information obtained contributes to the general culture of the pupil, is, at times, vital to his happiness and physical well-being, and has the advantage, *to him*, of having, in certain cases, a money-value aspect. In view of all that has been said, I would place this instruction not only in the primary grades, but into the kindergarten as well—I would go a step further and have the child make a feeble beginning while he is still tottering about his mother's knees. He is then, in reality, more of a scientist than he is given credit for. With the true inductive spirit of an original investigator he is discovering, with his spoon and ball, the laws of energy and the properties of matter—a veritable "Newton in petticoats."

Wide-awake teachers and superintendents experience no insurmountable obstacle to introducing some instruction of this nature into the already crowded curriculum. The time devoted to other subjects may be shortened by a few minutes each and fifteen to thirty minutes secured daily. It is confidently believed that the time lost in each subject will be more than made up to it through the discipline secured and the refreshed minds and spirits.

If it is not deemed wise to have daily lessons weekly exercises of thirty minutes each may be given Friday afternoons, some of the lighter subjects, as spelling, reading or penmanship giving way. This exercise may take the place each week of some one of the regular studies, changing from one to another, so that the loss to any one is imperceptible. Were I in a school where none of these methods could be put into practice, I would make the work optional and give it after school hours.

It is, perhaps, needless to remark that the entire course from kindergarten to high school should be unified and systematized. The observational sciences should come first and the experimental later. A portion only of each year should be devoted to any one science; zoölogy, botany and geology in the spring and fall, and physiology, chemistry and physics in the winter.

Whether or not our educational systems have made the failure ascribed to them by President Elliot, it is certain that much is to be placed to the debit side of the account, and it is gratifying to teachers of science to learn that the discipline he prescribes as a remedy, as well as much in addition, is fully covered by genuine science work. Pupils come from our schools with the verbal memory well trained and, if the school is of the best, some literary culture, but the majority are perfect imbeciles, as far as the use of their perceptive and reasoning faculties is concerned. In this particular they have gained but little, if any, over their childhood, while with an acquired amount of superstition, they fall a prey to imposters, quacks and sharps. A single one of the Detroit dailies carries from five to eight paid advertisements of clairvoyants who are presumably making a living upon the gullible people of that enlightened community. Some three weeks ago one of them, advertising to cure a long list of diseases, including all of a "strange and mysterious nature," was called upon to treat a boy supposed to be *bewitched*. Think of it! In this enlightened age, in a state which boasts of its educational system and almost within shouting distance of its great university. Upon the stand she admitted having no knowledge of medicine, and it required the coroner's jury to determine that she is a "fraud."

Give science a place in the grades along with the so-called "practical studies" and then shall we soon have a "survival of the fittest."

W. H. Sherzer.
Michigan State Normal School, Ypsilanti, Oct. 17, 1893.

BOOK-REVIEWS.

Text-book of Geology. By Sir Archibald Geekie. Third edition, revised and enlarged. London and New York. Macmillan & Co. 1893. pp. xvi, 1147, figs. 471, frontispiece.

The promised revision of this well-known work has just appeared in this country. The first edition came out in 1882 and the second in 1885. As stated in the preface, the book has been increased by about 150 pages. The value of the work has been further increased by the insertion of copious references to important memoirs and papers.

The arrangement of the matter treated is that followed in previous editions, the natural relations of the several subjects of which might well have been brought out by an introductory discussion of the philosophical classification of geological phenomena proposed by Gilbert. The sections on the characters of rocks have been largely revised and new and improved illustrations introduced. The reproduced photographs of porphyritic and orbicular structure on pp. 99 and 101 constitute a departure in text-book illustration which ought to be adhered to in

the hand-book of the future. In the matter of terminology, one notes with satisfaction the author's precision in the use of such terms as "slate," for instance, as characteristic of argillaceous rocks possessing slaty cleavage. The microscopic structure of the clastic rocks is fully up to date. The igneous rocks are treated in the light of the studies of the most advanced petrographers. Prof. Geikie, we think, rightly adheres to a simple classification of the igneous rocks into an acidic, intermediate and basic series, since he deems it inexpedient to divide them as does Rosenbusch into an ancient and modern series. Zirkel's error in mistaking plagioclase for sanidine in the andesites of the 40th Parallel Survey, made known by the work of Hague and Iddings, is noted.

Prof. Geikie thinks the geological evidence demands "an amount of time not far short of the hundred millions of years originally granted by Lord Kelvin," and he has evidently read Mr. King's admirable paper published this year (see p. 60).

In the section on Denudation, the competency of meteoric agencies to reduce lands toward a base-level is ably discussed, but the American student who has followed the advanced studies in geographic evolution published by Davis and others within the past five years will be somewhat disappointed in the retention of the phrase "plain of marine denudation" for the term "peneplain" adopted by G. M. Dawson and other writers on the great base-level of erosion in North America. Prof. Geikie maintains that the finishing touches in these table-lands of erosion are given by the horizontal planing action of the sea.

The action of bacteria in producing decay and soils is not mentioned, but this recently discovered geological agent is scarcely missed in the interesting discussion of the geological action of plants and animals. The work accomplished by cryptogamous plants is carefully reviewed and fully presented. In the discussion of coral-reefs, the views of Darwin, Murray and A. Agassiz are thoroughly presented. Prof. Geikie completes his review of the subject with the statement "that the wide-spread oceanic subsidence demanded by Darwin's theory cannot be demonstrated by coral-reefs must now, I think, be conceded."

The concise use of terms which characterizes the larger part of the work is further illustrated in the case of "laccolite" proposed by Gilbert for igneous intrusions which "have spread out laterally and pushed up the overlying strata into a dome-shaped elevation." The laccolites are thus contrasted with the simple "intrusive sheets" or "sills" which have the appearance of interbedded masses. This last term for the first time appears as a convenient designation for the numerous thin, interbedded rocks which are sometimes erroneously called laccolites. Prof. Geikie also carefully adheres to the generally accepted use of the term "*monocline*" as used by the geologists of our western surveys. The part dealing with metamorphism ought to be read by every student of geology. The section on Regional Metamorphism has been much expanded so as to embrace the advances recently made in this important branch of geological science. It is clearly pointed out that igneous rocks as well as clastic beds have been altered into gneisses and schists; and the effects of great pressure are carefully discriminated.

The chart of geological periods naturally differs in its main divisions from the plan recently proposed by the U. S. Geological Survey. The pre-Cambrian, including the Algonkian and the Fundamental complex, or all that has up to within a few years been called Archæn, is placed under the head of Primary or Palæozoic, a position which is still an undecided matter at least in this country. It seems clear that the Algonkian as now constituted is Palæzoic, as Dana has urged; but the "Fundamental complex" may yet be proved Archæn in the sense in which the word was originally intended. The Quebec group has been dropped, as it should be. The North American Pleistocene glacial periods are described under the head of Champlain, as in the previous edition, a summary which seems strange to the student of glacial geology in this country.

The book on Stratigraphic Geology is particularly enriched by abstracts setting forth the recent accessions to our knowledge of the ancient and usually metamorphic

rocks. The work of Van Hise and his collaborators and Walcott on the Algonkian and Cambrian has been freely incorporated in the present work. The author does not enter into the discussion as to the extent or importance of the supposed glacial period based upon the Baccus Marsh, Dwyka and Talchir conglomerates. The Dwyka (Africa) beds are, it is suggested in accordance with the work of a recent observer, of volcanic origin. Although Professor Geikie has made the freest use of the correlation papers recently published by the U. S. Geological Survey, it is evident that he was debarred from reference to the admirable résumés of Messrs. Clark and Dall on the tertiary and of Dr. White on the Cretaceous, since these are not referred to.

In the description of glacial deposits one misses the distinction made in this country between kames proper and eskers, as proposed by Chamberlin. No explanation of eskers is given, though American and Scandinavian geologists are generally agreed that they owe their peculiar shape to deposition within the ice-sheet, explanations varying only in regard to the place in the ice where the stream originally flowed. The question of succession of glacial epochs in North America is hardly up to date, but one could scarcely expect a writer not familiar with the ground to hazard a succinct statement in view of the present diversity of opinion in America. The evidence advanced on p. 1051 as a means of dividing the glacial period, pertains to moraines, both of which it has for some time been held are far more recent than the most ancient drift accepted by any geologists who have studied the deposits. The pit-falls into which the most careful correlators are apt to fall find an illustration in the implied magnitude of the glacial deposits on the land skirting the New England Coast. It is hardly known even in America that in the highest part of Martha's Vineyard, for instance, Cretaceous clays may be pulled up in the grass-roots, since the bulk of the larger of these islands consists of upturned Cretaceous and Tertiary strata.

In the list of authors quoted the reader gains a ready measure of the influence of American geologists on the thought of their fellow-workers abroad. The familiar names of more than a score of American geologists need not be mentioned here. The index has been much extended and includes several scientific terms not found in the last edition. The whole shows the good, readable press-work of a well known publishing house.

While the American student will find the recently published correlations papers of the U. S. Geological Survey the most valuable hand-book for this country, this great work of Prof. Geikie will be indispensable both to the teacher and the professional geologist. Not the least important part of the book consists in the bibliographic references without which a text-book can now hardly be recommended to the advanced student. It may be objected to the work that is encyclopedic rather than didactic, but in so far it is a faithful exponent of the concensus of opinion of a host of geological workers. J. B. W.

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