the discharge of the condenser is exceedingly rapid, it has entirely passed before the commutator segment has left the brush leading to the primary. In other words, the condenser brush leaves its commutator segment when both are at 220 volts, and the coil brush leaves its commutator segment when both are at zero. Hence no sparking need occur on the commutator except the slight spark of making circuit.

The great increase in voltage at the terminals of the secondary over that given by the same coil when operated in the ordinary manner is probably due to the exceeding rapidity of discharge of the condenser, and hence the rapid change in the number of lines of force enclosed by the secondary. For each discharge of the condenser there must be a rise and fall of the current in the primary of the induction coil; but, since we get a uni-direction discharge at the secondary, one of these alone, either the rise or fall, must be effective. The reaction of the secondary of the coil tends to increase the rapidity of rise of current in the primary, but tends to retard the fall, moreover, at the instant the condenser is connected to the coil we have 220 v., the potential of the condenser, applied to a circuit of exceedingly low resistance and very small induction, and from this we must get an extremely rapid rise of current. From these considerations alone it appears probable that the secondary discharge is due to rise rather than to the fall of current in the primary.

The volume of the discharge is so great that the ends of the secondary bristle with brush discharges, even when the terminals are within sparking distance of one another, and great care must be taken in insulating the primary from the secondary. There seems, moreover, to be a continual brush discharge from turn to turn of the primary, the nature of which we are unable to determine. If the iron wire of the core be put in a glass tube, and the primary be wound in a single layer about it, and the whole inclosed in a second larger tube, and the space between the tubes be filled with oil, the needed insulation is given.

CHARLES L. NORTON,
RALPH R. LAWRENCE.
ROGERS LABORATORY OF PHYSICS,
MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
BOSTON, March 5, 1897.

NEW YORK STATE SCIENCE TEACHERS' ASSOCIATION, II.

[*Continued from p. 468.*]

WEDNESDAY evening was devoted to the Earth Sciences. Dr. Frank M. McMurry, of the Buffalo School of Pedagogy, read the following paper, written by Professor Ralph S. Tarr, of Cornell.

Place of the Earth Sciences in the Secondary Schools.

The question is raised again and again, shall the earth sciences (geology and physical geography with their subdivisions) have a place in the curriculum of the secondary school? and this has been variously answered. Many schools have properly omitted them from the course, and others are thinking of doing so. I say properly, because, as the subjects have been taught in the majority of cases, it is better to omit than to continue them.

Then again, when the question is under consideration, which of the natural sciences shall have a place in the schools, we very often find the earth sciences excluded, though this was certainly not the case in the report of the Committee of Ten. The reasons given for the exclusion of these subjects from the proposed curriculum are usually two: first, that they are not disciplinary subjects; and second, that for their proper understanding they need too much knowledge of other sciences. The first grows out of a failure to appreciate that there has been progress in the methods of teaching the earth sciences, a progress which the critics have evidently not yet learned about, but which nevertheless has been most marked and important. The second conclusion of the critics is based in part upon this misunderstanding, and in part upon the misinterpretation of the possibilities embraced within the earth sciences. There is no subject of natural science which, for study of an advanced character, does not require a knowledge beyond the present ability of the secondary schools to give. We do not find it necessary to omit these sciences for this reason, but merely the part that presents the difficulty. Why does not the same principle apply to the earth sciences? Even when this exclusion of parts has been made, there is enough left.

It is my belief that no science is better adapted for the beginning in science study in the secondary schools than physical geography. There are two reasons for this belief. In the first place, of all the criticisms made against the science instruction in the schools, the one that appeals most strongly to my mind is that there is too much smattering and jumping about from one thing to another, before any real knowledge of any science has been gained. There is an effort to obtain wide information on various topics, with the result that almost no training is gained, and so much information is poured in that the mind of the student is necessarily confused. Physical geography is a direct extension of the geography study which has been carried on for years before in the lower grades. With this geography properly taught, and physical geography made an advanced continuation of this, there is at least one year added to the consecutive study of what may be properly considered closely allied subjects belonging to the same group.

The second reason for considering physical geography adapted, above all the other natural sciences, to first year study is that, when properly handled, it arouses a general interest which no other science does so well. That this point is correct I have long known, but never before have I so fully realized it as when, a few weeks ago, I visited a number of the Chicago high schools, where physical geography is being taught in the modern way. The eager interest, the evidence of acute observation and clear thinking, and the intelligent questions asked by boys in knickerbockers and girls just fresh from the grammar school, was the best proof I have ever seen of the truth of this conclusion. The teachers, forty in number, assured me in conference that no other subject aroused so much interest as that of physical geography, and this came from teachers most of whom were especially interested either in biology or physics.

This fact of interest I make a central point of the argument, because it is the means for obtaining an end. The old instruction in physical geography has for its object the imparting of information. The new school endeavors to make it a subject of disciplinary value. Observation is encouraged and, in fact, insisted upon. The results of these observations and of other groups of facts are placed together to make explanations. Weak arguments are tested and overthrown; fallacies are discovered and pointed out, and the subject is hence made to train habits of the mind which every high school pupil will need, if he lives by even a partial use of his mental powers. We need to know how to use and discover facts, and then to understand what they mean. The proper study of physical geography helps to train these habits of mind. No better means for gaining such a discipline can be found than to arouse the interest of the pupils. With interest, or, better still, with enthusiasm, the pupil observes and thinks beyond the requirements of the study and plies his teacher with questions, sometimes of great ingenuity.

Incidentally, however, he gains information; and I believe that much more of this is obtained by this means, and that this is much more firmly rooted in the mind than is the case when the main idea is the accumulation of the mere information which anyone can get from an encyclopedia or a dictionary.

If we are willing to grant that the earth sciences have a claim for a place in the secondary schools equal to that of the biological and physical groups, the question arises, how shall they be taught? This is, of course, a question which cannot be answered in a few words. We are confronted at once with the difficulty that the ideal at present seems impracticable. Nevertheless, I am going to dwell especially upon the ideal, believing that if this is set, and an effort is made to reach it, more progress will be made than if we are content to be held down to what seems to be practicable.

This matter is treated mainly from the standpoint of the colleges, though not without recognizing the fact that but a small number of the high school pupils enter the college; but in the belief that what is desired by the college is also best for the boy whose systematic education ends in the high school; and also because it seems that the college, by setting the standard, can mould and lead public opinion even in a new direction, provided, of course, there is also hearty sympathy and support from the teachers in the schools. If between us we can decide upon something, we can in time carry our point; but if we act independently, and along different lines, progress will be slow, indeed.

I am certain that I voice the sentiment of most of the college scientific teachers who have thought upon the subject when I say that the prime need in education today is some change in the college-entrance subjects which have so long served as standards. The world has been progressing, and even the college, one of the slowest of institutions to depart from tradition and precedent, is beginning to take cognizance of this. Natural science instruction is demanded by the people who support the schools, and so far the colleges have retarded the proper fulfillment of this demand, by so occupying the time of the student with other subjects, that natural science has been possible only in very small doses. The attempt has been made to supply the demand for information, but in most cases there has been but little more.

The science teacher of the college also needs and asks for more adequate science in the secondary schools. For my own part I am obliged every year to teach college students the simplest habits of observation, which might better have been learned in the kindergarten. To turn a boy out into the world trained in Latin, Greek and mathematics, and yet unable to use his own eyes or think with his own brain, is not treating him fairly. He is very poorly prepared to compete with the keen, shrewd intellect of some business man whose boyhood days were spent not in school, but in gaining a mental training from nature on a farm, or from men in that great, heartless school of affairs. To me it seems that the parents are demanding a knowledge of science; the pupil, whatever his chosen vocation, needs the training, and the college science teacher needs to have his students come to him with a better preliminary training.

Really valuable discipline in science, properly comparable to that gained from the classics or mathematics, cannot be obtained from courses of fourteen weeks each. Nor can it even be gained by courses of a year each. This is one of the points that prevents the science teacher of the college from making progress in his efforts to introduce science into the list of college-entrance requirements. He is immediately confronted by the query whether the science instruction is really comparable with that of the stock entrance subjects; and he is forced to admit that it is not.

The reason why he must make this admission, which is fatal to his efforts, are first, that time enough is not given to any one subject or group, and that the method of teaching is generally not equally good. To be really comparable with Latin in disciplinary value, some one of the sciences, or group of allied sciences, should be taught consecutively for at least two or three years by means of laboratory methods, which call for expensive apparatus.

This is the ideal, but there are practical difficulties. The parents call for more than one science, and the committeemen are not willing to furnish the money for the necessary equipment. I have considered these difficulties elsewhere, and proposed a plan of compromise,* which is briefly to have *all* sciences represented in the course, but to have some *one* taught as a major subject, according to the best methods, and as a consecutive study covering not less than two years. Ultimately, when the benefits of a proper study of one science are shown, the school may see its way clear to the introduction of similar study of others; but I believe that one science properly taught is better by far than several poorly handled, as, of necessity, so often happens at present.† Which group is chosen seems to me of little importance.

I feel certain that the larger colleges of the country will stand ready to accept a properly taught science as an entrance alternative fully equivalent to advanced Latin, Greek or mathematics. There is no reason why it should not be considered an equivalent; and if the colleges can be assured that proper teaching and discipline is possible in the schools, the move can certainly be made. However, having set what seems to me the ideal, I must say that I think we shall find it necessary to start far short of it, though always moving toward it. One cannot change radically and suddenly; there are many questions to be considered, not all of which are familiar to the college teacher. Hence I believe it will be necessary to adopt a compromise course, with the distinct understanding that we are moving toward the higher end. Let us have four years of science taught as nearly as possible by laboratory methods. It would not be necessary for all students to take four years, but insist upon *everyone* having not less than one year of genuine science instruction. For those who, by choice, take a course which allows of consecutive study for four years it would, perhaps, be better to have this kept along the line of some allied subjects; but, as this is hardly possible, the instruction should be confined within as narrow limits of subject-matter as possible.

Because of the interest which it arouses in science subjects, and the training which it furnishes to the important powers of observation and reasoning, physical geography is the best adapted of the sciences for the basal study. Moreover, numerous experiments have proved that it fits admirably into the first-year curriculum. It would be well if this could be supplemented and continued during the second year by a study of geology, which is so closely allied to it; but, perhaps, in most cases the demand for instruction in the biological and physical sciences will be so great that this will not be possible.

*Educational Review.

†I have recently had an application for a teacher of physical geography; and when it become known, a number of students have come to me; one of them, a former teacher, when I said that a real knowledge of physical geography was needed, replied, that she had taught nearly everything, and could do so in the future, and that she would be ashamed of herself if she could not teach so simple a subject as physical geography.

If the schools will offer genuine science instruction the colleges will no doubt accept it, and thus lend encouragement to the schools in their effort to give such instruction. Why should not a minimum science *entrance requirement* be set by the college, leaving the subject elective, but demanding that every student on entrance shall have had at least one year of *genuine disciplinary* science instruction; then, as one of the alternative requirements, allow the acceptance of advanced science study in the place, let us say of Greek or advanced mathematics, etc. Four years of properly conducted science study gives as valuable a training and culture, even though this be of a somewhat different kind, as an equal time spent in the study of German, Latin or mathematics. The colleges which permit election of studies are practically committed to the theory that each subject well taught in the college is as valuable as any other.

The science instruction, both in the elementary and the advanced study, must be of the best if it would meet this requirement, and the teacher must know and have an interest in the subject which he teaches. No one can have an adequate knowledge of all the natural sciences, and it is unfair to ask a teacher to give instruction in them all. As time goes on this will be remedied, provided we can inaugurate a movement to improve science instruction; for such an improvement all along the line means, of necessity, more teachers. Therefore, it seems well for the present that the science teacher should be selected with special reference to his ability to give good instruction in *one* subject; and this he should be allowed to develop, as far as he can, with the constant effort to obtain higher grade work in at least one line of natural science. Well trained in one subject he will be a better teacher of the others than if he was equally well prepared in all sciences.

Very little has been said of physical geography, because it has seemed to me that there is a more important point pertaining to all sciences. I feel that it matters little whether the science instruction be in physical geography, physics, chemistry or biology, so long as it is genuine science instruction. That physical geography has a claim equal to the others can be demonstrated. To teach it in such a way that I would be willing to accept it as a subject for entrance to Cornell University there must be very much more than book work. The attempt to gain information must be subordinated to the effort to train the powers of observation, the habit of inquiry and ability to reason out valid conclusions from an assemblage of facts.

This training must in large part be gained by practice in the laboratory and in the field. The air, earth and water, the natural laboratories of physical geography, are accessible to all. They have lessons to teach, and furnish means for discipline of the nature suggested. The natural laboratory is not always accessible, nor are all features of physical geography capable of illustration in every instance. Hence, out-of-door work must be very decidedly supplemented by work within doors. We cannot, for instance, take many classes to a glacier. Models, maps, photographs and lantern slides must take the place of some features of the actual land. These are not so good as the real out-of-door examples, but, skillfully handled, they illustrate the facts well, and serve well as a means of gaining important training. In geology the same means may be used and these may be supplemented by the study of specimens of various kinds. Much material for this instruction is accessible and cheap, and schools that would make the study of physiographic subjects of disciplinary value must equip a laboratory with these materials. It is now no more possible to teach physical geography properly by means of mere recitations than it is to give desirable instruction in chemistry or physics in this old-fashioned way.

The entrance examination in physical geography should then not be merely a set of questions upon the subject matter of a book, but also questions concerning the physical features of the neighborhood, and others which should prove the ability of the student to observe and to think. This should be supplemented by a note-book containing the record of the laboratory work actually done.

This is a statement of my conception of the results which we are to aim to obtain. How we shall reach the desired end is quite another matter, and one which certainly cannot be considered here. If we can become agreed concerning the goal, the means of approaching it, or even reaching it, will be found. I believe that we should first of all lay down a wise plan, and then try to follow it. A committee should be appointed to consider various suggestions and decide upon the best; then bring it before the society. After the plan is finally decided upon, the concentrated effort of our members will make it a success, provided it is a wise plan.

I have, therefore, spoken rather concerning the principle at large than concerning the particular claims of physical geography, or the means by which instruction in this can be given. The subject has claims which in any wisely made plan of procedure must be recognized. If it seems necessary to go over these claims it can be done. The subject offers a means of furnishing valuable discipline. Already enough has been written upon this subject to serve as a basis to guide the teachers along the proper line of advance in the mode of instruction in physical geography.

Discussion—The Earth Sciences. By RICHARD E. DODGE.

The Earth Sciences, including meteorology, geology and physiography, should most emphatically have a prominent place in the curriculum of the secondary and grade schools, for many reasons. They are capable of arousing the best mental faculties; they train observation and reasoning; they bring the child more closely in contact and sympathy with the world about him than do any other group of sciences. Once love for nature is aroused, the stimulation for deeper study follows without fail.

In the study of this group of sciences, as well as in all other sciences, the training should be largely by the laboratory method, and the laboratory should be out of doors as far as possible. In the progress of the work, the study of facts and the representations of facts should be augmented by a series of developmental exercises designed to lead up to and develop principles.

The method to be employed depends largely upon the personality and ability of the teacher, and no one method can be prescribed as a sure panacea for all ills of science teaching. Each teacher must aim to bring out scientific principles by some method demanding reasoning on the part of the pupil and causing advance from the simple to the complex. My experience has shown that such aims can well be accomplished if the facts be given by making the pupil solve a progressive series of related problems, each problem being solved through a similar series of related questions. The advance is thus by steps toward the end sought, each step being secured by a focalization of ideas toward the point in mind. Such a method of presentation is rational and scientific and is as capable of application in the grades as in the higher schools.

The simpler facts and principles should be crowded back from the high into the lower schools, and we cannot better the work in the higher schools until we have made the proper beginnings in sciences in early youth. In such introductory work, we should aim for intensive and not extensive work, to give the ability to gain further information rather than mere knowledge of unrelated and incomplete facts, as is so often done.

Considering these as our aims, what should we aim to give for subject matter in each of the sciences under consideration?

In meteorology we should aim to give an understanding of the winds, precipitation, insolation, weather, climate, etc., and the dependence of life on climatic conditions. This work should be by the laboratory method, making use of the ever-present weather conditions and of maps, charts, weather maps and instruments of measurement.

In geology we should devote most attention to observational study of dynamical geology. Minerals, rocks and fossils should be studied only so far as they give a better understanding of the fundamental characters of the rocks themselves, except in those localities where there are fossiliferous rocks, where, of course, more stress can be laid on those subjects. The life processes of the earth and their results are the most rational, interesting and helpful features of geology to the beginner. In this science, as in any other, if function be made the causal condition and form the result, we have a rational arrangement of subject, and we at once elicit the confidence and sympathy of the pupil. The inorganic becomes alive and the dead sciences are no longer dead, but equally alive with the organic sciences.

In physiography earth forms should be studied, their origin, their relations and the dependence of life upon them. This is a broad and ever broadening field, and in it we can come more closely in contact with the world about us than in any other sciences. The application of the principles to the understanding of human history and progress offers a possible field of study that is almost inexhaustible and inspiring to the highest degree. Descriptive, political and commercial geography gains its greatest value when some understanding of the climatic and topographic determining conditions has been gained previously. Descriptive geography with no knowledge of the origin of land forms is like anatomy with no knowledge of the skeleton, which is the basis of anatomy. In this study a mere study of geographic distributions is not enough. The study should largely be one of comparison and of relation.

The science—for physiography is a science—thus becomes not only of value for itself, but also because of the light it casts upon the study of other subjects in the curriculum.

Such are some of the possibilities of the earth sciences if they be studied in a common-sense way. We must acknowledge that at present most teachers are not prepared to treat these sciences, so commonly called easy, in a scientific and broad way. One of our tasks is to see what can be done to give the secondary school and grade school teachers a better ability to teach the earth sciences with a scientific understanding.

Professor Albert P. Brigham, of Colgate University, emphasized the lack of training in observation on the part of students coming to the earth sciences in the upper years of the college course. This is more to be regretted since the subject is capable of graded presentation in all stages of education. Interest is absolutely to be depended upon in children or adults when earth facts are explained in a rational and simple manner. It is a grave loss if that great company who never go above the grades must go out ignorant of the common facts of out-of-door nature and of the earth materials upon which our daily life is dependent. Let us insist that geography is a genetic science, vital, causal, evolutionary. Nor may we neglect the moral and æsthetic value of these studies. This is the work of the teacher who knows, who has a horizon, who can arouse and inspire.

Professor Charles S. Prosser, of Union, advocated the thorough teaching of geography in the grammar schools, suggesting the use of such a work as Frye's which should be followed in the high school by physical geography. The class-room work should be supplemented by excursions to localities in the neighborhood affording illustrations of some of the features of physiography.

It is now found that a portion of the college students when taken on geological field trips are indifferent to the illustrations of geologic structure. The early interest of boys in objects to be found in field and forest seems to have become atrophied, a condition of mind said by Professor Shaler to be due to super-civilization. This is more apparent in the students coming from large cities than in those from the smaller cities and villages. It was stated by the great teacher of geology—Professor Dana—that as a rule the students who mastered geology were those who had spent a considerable portion of their boyhood in the country. It was emphasized that this power to observe would be greatly developed by a high-school course, using such a work as Tarr's Elementary Physical Geography.

Professor E. C. Quereau, of Syracuse University, spoke on the need of correlation of the university and the secondary school work in physical geography. The geography taught in the lower schools has been too much descriptive and locative, the pupil being required to memorize geographical features, while the work which has been taken up in the college and university in later years has been a study of the origin and progressive changes of the surface features of the earth and their vital relations to the needs of man. A better correlation of the work, from the secondary school up to the college, would be an advantage.

Dr. Frank McMurry, of Buffalo, argued that mental discipline is not the highest aim in the study of the earth sciences in the high school curriculum. The great object to be emphasized in teaching literature, history, and nature study in the common school is inspiration. They arouse the whole mind, develop life-long tastes or loves, and hence become permanent sources of energy and mental life. The ability to arouse a great love for nature is the greatest object in bringing physical geography into the curriculum. It is a much nobler, higher purpose than discipline or information. This study can excite this love, because in it inductive work can be done; it can be concrete, and the laws involved can be reached through abundant data. Then, too, these data stand related in a causal way; they can fall into a causal series, a series in which function can take the lead and be more prominent than form. Further than that, as said by Professor Dodge, the whole subject can be approached through *problems*, and one series of problems can lead to another and higher series.

It is plain, then, that this is a science in which the subject matter is so arranged that it can be a source of great mental life; that is why this subject is so valuable. Life is controlled by loves, by tastes, and this subject is able to generate a great love for one field of nature.

Careful consideration of this science and proper teaching of it will ultimately influence greatly the teaching of geography in the grades. If we can once establish the conviction that the earth is alive and changing and active it can affect the teacher's attitude toward the grade work. Possibly at last physical geography can precede the book work in geography. This, then, is also a reason for urging the importance of the earth sciences as a proper high school study.

Professor I. P. Bishop, of the Buffalo Normal, spoke of the importance of geology in the teaching of geography. Whether it be included in the school course or not, there is no doubt that it should form an essential part of the geography teacher's outfit. For it is manifestly impossible to teach the detached facts of physical geography so as to give them much educational value without knowing the causal relations upon which the significance of these facts depends.

It is not so difficult to obtain material for this kind of nature work as is often imagined ; the true way is to study the material nearest at hand. Every gravel bank is a museum. Every stream, even to the tiny rivulet formed by a shower, illustrates the carving of a river valley or a Niagara gorge. In almost any village we can show how a hard layer of rock in the bed of a stream has made a waterfall, cascade, or rapid ; how by the aid of a dam this has been utilized to run a saw or grist mill ; how this has then naturally become a favorable spot in time for the location of a store, blacksmith shop, hotel, churches, schools, and the other interests of such a community. Thus the material available almost anywhere serves to illustrate the mutual relation between a country and its people.

Professor B. G. Wilder, of Cornell, recalled with dissatisfaction the time and energy expended by him during his earlier school days in the memorizing of many geographic names of comparatively insignificant localities, and held that in a natural order physical geography should precede rather than follow the ordinary political geography. He also believed that if, between 1860 and 1870, the study of physical geography had been carried even as far as at present, so that the public, and especially the clergy, could have realized that the apparently stable earth is really a sort of cosmic organism still in process of development, the acceptance of evolution might have required only a decade instead of the quarter of a century.

The discussion turned upon the best means of conducting excursions for the study of the earth sciences. It was admitted that in most schools too little attention is paid to this phase of the work. Teachers are too apt to strive for an interest in far-away matters, glaciers, trade winds and ocean currents, while they neglect the means that are nearest at hand for arousing and developing an interest in the earth. At the same time there were many expressions of warm appreciation of the work in some of our secondary schools, and in the grades as well. Reference was also made to the great assistance rendered by the American Museum of Natural History in its distribution of lantern slides to the schools of the State.

Mr. William F. Langworthy, of Colgate Academy, speaking of the teachers of geography in our grammar schools, said that their failure to accomplish better results in the direction of modern methods is not so much their own fault as the fault of those who have trained them, of those who have charge of our courses of study. Much time is lost in the lower grades upon some parts of arithmetic. If some of the more advanced portions of arithmetic were taken up in the later years of the high school course, or in college, it would leave more time for geography in the grades ; but it is not advisable to crowd any more work into the grammar school course. It is better to enrich the grammar school course than to enlarge it.

The other speakers were Dr. D. L. Bardwell, of the Cortland Normal ; Professor H. J. Schmitz, of the Geneseo Normal; Dr. T. B.

Stowell, of the Potsdam Normal; Professor William Hallock, of Columbia; Professor C. C. Wilcox, of Starkey Seminary; Professor Henry L. Griffis, of the New Paltz Normal; Miss Sherman, of Ithaca High School; Professor E. R. Whitney, of Binghamton; Mr. Charles N. Cobb, of the Regents' Office; Principal S. G. Harris, of Baldwinsville; Dr. Charles W. Hargitt, of Syracuse University; Mrs. S. H. Gage, of Ithaca; Professor Warren Mann, of Potsdam Normal; Principal Henry Pease, of Medina; Professor O. D. Clark, of the Boys' High School, Brooklyn, and Principal Henry S. Purdy, of Brewster.

FRANKLIN W. BARROWS.
BUFFALO, N. Y. *Secretary.*

(*To be Concluded.*)

CURRENT NOTES ON PHYSIOGRAPHY.

TENNESSEE VALLEY REGION, ALA.

A RECENT report for the Geological Survey of Alabama by Henry McCalley, on 'the Tennessee valley region,' contains a general description of the paleozoic area in the northern part of the State, excepting the Coosa valley district, which is reserved for a later volume. Account is given of the level sandstone uplands, or 'barrens,' in the northwest corner of the State; and of the rolling limestone lowlands with rich red soil in the valley of the Tennessee river; these two districts being the higher and lower parts of the dissected uplands which enter from Tennessee. Next to the east rise the table mountains of the dissected Cumberland (Allegheny) plateau. The waters of the tables often disappear in sinks, and reappear in large springs at the head of coves on the flanks of the 'mountains.' South of the Tennessee, Little and Sand mountains are monoclines or cuestas, with steep and ragged escarpments to the north and gentle slopes to the south. The broad flat 'Moulton and Russellville' valley lies between them, trending east and west. The Sequatchee valley of Tennessee is called Brown Valley in Alabama, and limits the preceding divisions on the east; it is excavated on an unsymmetrical anticline. An outline map locating these areas would have added much to the ease of interpreting the text. Most of the report is concerned with stratigraphic and economic geology; the illustrations are chiefly of quarries.

THE PREGLACIAL KANAWHA AGAIN.

REFERENCE should have been made, in a recent note on the Preglacial Kanawha, to the studies of Professor W. G. Tight, of Granville, Ohio, and of Professor I. C. White, of Morgantown, W. Va., regarding the changes in river courses of Pennsylvania and Ohio on account of obstructions by ice and drift. An article by the last named writer (Origin of the high terrace deposits of the Monongahela river, Amer. Geol., XVIII., 1896, 368–379) should have been cited, along with the note regarding Leverett's work from the Report of the Director of the United States Geological Survey; for both are concerned with identical problems. White describes several channels among the hills of the Allegheny plateau, where the waters of the impounded Monongahela for a time ran over cols; one of these channels being permanently adopted in the present course of the Ohio. When this region is mapped and studied in detail it promises to reveal features of peculiar interest in connection with the rearrangements of river courses by glacial action.

STAGES OF APPALACHIAN EROSION.

ALTHOUGH this series of notes cannot pretend to completeness, it has been the writer's intention to report here on all the more important American essays, and on certain foreign essays that are relevant to modern physiography. It was entirely by oversight that an abstract of Keith's brief