from a distance. It is because they receive stimuli from and make possible reactions to a wider environment that these sense organs of the head dominate the whole system of phasic reactions; it is for the same reason that the cerebrum is dominant.

Bringing as it does the methods of minute and continued observation and of close reasoning into a field where the casual has been the rule, the book deserves, and requires as well, attentive study. Its importance to the physiologist is evident. The physician will find a number of special topics, such as the nervous symptoms of strychnin poisoning, of tetanus, and of shock, made the subject of careful investigation. The psychologist also will find a number of points of special interest, such as a study of certain fundamental aspects of binocular vision, an experimental test of the James-Lange theory of the emotions, and suggestive analogies between certain laws of spinal reflexes, such as reciprocal inhibition and successive induction, and familiar facts of attention and of sensation.

R. S. WOODWORTH

COLUMBIA UNIVERSITY

SCIENTIFIC JOURNALS AND ARTICLES

THE contents of the June number of *The American Journal of Science* are as follows: "Determination of the Molecular Weight of Radium Emanation by the Comparison of its Rate of Diffusion with that of Mercury Vapor," by P. B. Perkins; "Paleozoic Formations in Trans-Pecos, Texas," by G. B. Richardson; "Rectification Effect in a Vacuum Tube," by H. A. Perkins; "Life of Radium," by B. B. Boltwood; "New Occurrence of Proustite and Argentite," by F. R. Van Horn; "Occurrence of Gedrite in Canada," by N. N. Evans and J. A. Bancroft; "Iodometric Determination of Arsenic and Antimony Associated with Copper," by F. H. Heath.

THE editors of *The Botanical Gazette* announce that the price is to be advanced from $5.00 to $7.00 a year on July 1, 1908. They say: "You will easily realize that the financing of *The Botanical Gazette* has always been a problem, and you will not be surprised to hear that the University of Chicago has been obliged to contribute about $2,000 annually toward its support. It is not probable that the amount of this subsidy can be increased in the future, and at the same time the cost of production has been growing greater year by year. An interesting comparison has been instituted between *The Botanical Gazette* on the one hand and five leading botanical journals of Europe on the other in the matter of size and prices. It appears that on the average these journals give their readers 648 pages a year each, 12 plates, and 122 text figures, and the average price is $6.50. The *Botanical Gazette* on the other hand gives 945 pages, 45 plates, and 182 text figures, and its subscription price has been $5.00 in spite of the greater cost of manufacture in this country. The advice of numerous botanists has been sought and freely given, and with great unanimity their opinion favors the maintenance of the present standard of size with an increased subscription price; for it seems evident that the pressure of publication is increasing rather than diminishing. In view of the whole situation, it has been decided to increase the annual subscription to $7.00, in the belief that this represents a fair charge for the service rendered. The new rate will be applied to subscriptions begun or renewed with the July number, 1908, and thereafter."

SOCIETIES AND ACADEMIES

THE CHICAGO SECTION OF THE AMERICAN MATHEMATICAL SOCIETY

THE twenty-third regular meeting of the Chicago Section of the American Mathematical Society was held at the University of Chicago, on Friday and Saturday, April 17–18, 1908.

Professor G. A. Miller, vice-president of the society and chairman of the section, presided at all of the sessions. In opening the meeting he referred to the great loss of the society in the recent death of Professor Heinrich Maschke and appointed a committee, consisting of Professors E. B. Van Vleck, Alexander

Ziwet and H. E. Slaught, who presented the following resolutions on behalf of the section:

Whereas, in the death of Professor Heinrich Maschke the Chicago Section of the American Mathematical Society suffers the loss of one of its most honored, influential and beloved members, your committee on behalf of the section hereby expresses its deep appreciation of his services and character.

From the first organization of the Chicago Section until the present session Professor Maschke has been one of its most active and inspiring members. By his genial qualities, his unusual sympathy as a teacher, his integrity and intellectual honesty, he has won and held the affection of those who have known him. By his ability as an investigator he has contributed greatly to the development of productive mathematical scholarship in the formative period of the society, and in his own person he has exemplified the influence of German scholarship which has contributed so potently to this development. In the death of Professor Maschke the section for the first time feels the loss of one of its leaders.

The following papers were read before the section:

Dr. C. H. Sisam: "On a locus determined by concurrent tangents."

Professor W. B. Ford: "On the integration of the equation

$$a_0(x)u(x+2)+a_1(x)u(x+1)+a_2(x)u(x) = 0."$$

Professor D. R. Curtiss: "On the real branches of implicit functions in the neighborhood of multiple points."

Mr. L. L. Dines: "A method of investigating numbers of the forms $6\kappa \cdot s \pm 1$."

Professor L. E. Dickson: "Criteria for the irreducibility of a reciprocal equation."

Professor L. E. Dickson: "On reciprocal abelian equations."

Professor L. E. Dickson: "On the congruence $x^n + y^n + z^n \equiv 0 \pmod{p}$."

Professor Jacob Westlund: "Note on the equation $x^n + y^n = nz^n$."

Mr. F. H. Hodge and Mr. E. J. Moulton: "On certain characteristics oi orbits for a general central force."

Professor G. A. Miller: "The central of a group."

Dr. A. E. Young: "On the problem of the spherical representation and the characteristic equations of certain classes of surfaces."

Dr. A. C. Lunn: "A continuous group related to von Seidel's optical theory."

Dr. A. C. Lunn: "A minimal property of simple harmonic motion."

Dr. A. C. Lunn: "The deduction of the electrostatic equations by the calculus of variations."

Mr. A. R. Schweitzer: "Remark on Enriques' review of the foundations of geometry."

Mr. A. R. Schweitzer: "On the calculi of relations, classes and operations."

Professor E. J. Wilczynski: "Projective differential geometry of curved surfaces, fourth memoir."

Dr. G. D. Birkhoff: "Irregular integrals of ordinary linear differential equations."

Professor R. D. Carmichael: "On the general tangent to plane curves."

Professor R. D. Carmichael: "On plane algebraic curves symmetrical with respect to each of two rectangular axes."

Professor O. D. Kellogg: "Note on the geometry of continuously turning curves."

Dr. I. Schur: "Beiträge zur Theorie der Gruppen linearer homogener Substitutionen."

Mr. W. D. MacMillan: "On the character of the solutions of homogeneous linear equations with periodic coefficients."

Mr. A. R. Schweitzer: "On the quaternion as an operator in Grassman's extensive algebra."

The next meeting of the section will occur in December, 1908.

H. E. Slaught,
Secretary of the Section

The New York Academy of Sciences. Section of Anthropology and Psychology

In conjunction with the American Ethnological Society, a meeting was held on March 23, at the American Museum of Natural History.

Professor Arthur O. Lovejoy spoke on "Fire Cults: their Distribution and Characteristic Features, with a Hypothesis Respecting their Origin and Meaning." While the most wide-spread of the observances relating to the sacred fire is the custom of maintaining, either upon the domestic hearth or in a communal shrine, a fire that, except upon periodic ceremonial occasions, is never permitted to go out—a practise which by itself might be regarded as a mere convenience or necessity, invested in the course of time

with supernatural or magical import—there are other fire-observances, occurring usually among the same peoples, which also have a bearing on the significance of the fire-cult. Especially significant is the annual or cyclic ceremony of extinguishing the old fire and kindling new by some archaic method, as the central and most solemn rite in the transition to a new year—*e. g.*, at the planting of the first seed or the first eating of the new crop (Rome, Celtic Ireland, Eskimos, Iroquois, Muskoki, Aztecs, Ouichuas and others). Widely diffused are also the customs of passing new-born children over or around the fire (*cf.* Greek myths of children rendered immortal by this means); of leaping through fires at certain seasonal festivals, as the Roman Palilia, the Johannisfeuer celebrations, etc.; of employing fire as a fertility charm for crops and herds; of celebrating essential parts of the marriage ceremony before the household fire; of using fire in initiation rites. An analysis of these observances and a consideration of the reasons actually given for certain of them by Iroquois and Maori makes it probable that the sacred fire was by many races conceived, not as a practical convenience, nor as an unmotivated ancient custom, nor as a device for frightening away demons, nor as a negative purifying agency merely, but as a vehicle of life force or magical energy—*manitou, wakonda* or *mana;* that the health and prosperity of the household or tribe were believed to depend in part on the fire's perpetuity, vitality and purity; and that the fire, like all natural forces, was thought of as subject to periodicity, to a tendency to grow old and weak, and accordingly as in need of periodic renewal.

In a paper on "The Psychology of Dreams," Dr. Robert H. Lowie called attention to the services which scientific dream psychology can render to the ethnologist. A knowledge of the investigations carried on in this field will enable him to view critically the plausible but inaccurate dicta of popular psychology. Knowing, for example, the theory of dreams advanced by Delage, the ethnologist will not naïvely accept the assumption of Wundt and Radestock that dreams of recently deceased relatives have largely influenced the development of belief in a hereafter. A positive benefit is derived when mythological figures of obscure origin, such as dwarfs, gorgons, etc., are derived from the distorted images of some dreams—Wundt's Fratzenträume—as a conceivable source. From a purely psychological point of view, the speaker urged the desirability of fuller dream-records, especially in regard to varieties of hypnagogic experience.

R. S. WOODWORTH,
Secretary

THE GEOLOGICAL SOCIETY OF WASHINGTON

AT the 293d meeting of the society, on March 25, 1908, Mr. Willis T. Lee spoke informally regarding the "Local Upturning Sedimentary Rocks at their Outcrop." Grand Mesa in western Colorado rises 5,000 feet or more above the general surface to the south and west, and is surrounded by a steep escarpment. The general dip of the beds is 2.5°, but where they crop out in the sides of the mesa for a distance of 75 miles or more, the dip is often 5° to 8° or more. It is usually greatest in the projecting points and becomes less inward or toward the mesa, flattening to the general inclination of 2.5° within a distance varying from a few hundred feet to a quarter of a mile.

The upturned parts may represent the bases of eroded anticlines, monoclines or domes, but this suggestion is apparently invalidated by the occurrence of dip only toward the mesa and practically at right angles to the outcrop; or the phenomenon may be due to weathering of the exposed sediments combined with relief of pressure as the superincumbent rocks were eroded away. This finds support in the observation that the rocks are often most steeply upturned in the projecting points of the cliffs. On the other hand, it is not certain that relief of pressure would have any influence on the inelastic rocks, or that the shales underlying the beds in which the upturning is most conspicuous would expand on exposure to the weather. It is probable that hydration and carbonation of the rocks may account for the upturning.

Mr. D. B. Sterrett described the discovery of meerschaum in New Mexico, which is of interest since the world's supply, coming chiefly from Asia Minor, scarcely meets the demand. A chemical analysis, by Mr. George Steiger, of material from the Dorsey claim, twelve miles northwest of Silver City, corresponds very closely with the composition required by the formula generally given for meerschaum, that is, $2H_2O + 2MgO + 3SiO_2$. The mineral occurs in fissures, joints and seams in a magnesian limestone formation, probably of Ordovician age. Two varieties were observed, massive and nodular meerschaum. Only surface material was available for examination. This possessed many of the properties of ordinary meerschaum, including the important one of absorbing a mixture of wax and nicotine. On the other hand, the majority of the specimens examined were heavier than meerschaum ordinarily used for carving, and some of them contained tufts of fibrous material which made it difficult to work and polish.

Regular Program

The Intrusive Rocks of Mt. Bohemia, Michigan: Mr. Fred. Eugene Wright.

Mt. Bohemia is located near the end of Keweenaw Point, Michigan, and consists in large part of lava flows and interbedded conglomerates of the Keweenaw formation. On its south flank a peculiar intrusive rock mass is exposed which is unique in character and has long attracted the attention of geologists. Two rock types occur within this intrusive body—a dark, granitoid rock consisting chiefly of red, idiomorphic oligoclase (Ab_9An_2), pyroxene and magnetite in such proportions that chemically the rock is practically identical with the Keweenaw ophites. This rock was originally called *orthoclase gabbro* by Irving in his monograph on the copper-bearing rocks of the Lake Superior region, but the name *oligoclase gabbro* seems preferable in view of the fact that practically no free orthoclase is present in the rock. The second rock type is entirely surrounded by the first, and is brick red in color; qualitatively it consists of minerals identical with those of the enclosing oligoclase gabbro, its essential constituents being quartz and red idiomorphic oligoclase with subordinate amounts of the colored constituents. The alteration of the different constituents in the two rock types is characteristic and in every way similar, and substantiates the inference that they are genetically closely related, and that the red rock is an aplitic phase of the oligoclase gabbro. It may, therefore, be termed *gabbro aplite.* The position of the two rocks in the quantitative classification of Cross, Iddings, Pirsson and Washington is: for the oligoclase gabbro, Class III., Order 5, Rang 4, Subrang 3; in short, *Bohemial Auvergnose;* for the gabbro aplite, Class II., Order 4, Rang 3, Subrang 4 (*Bohemial Tonalose*). The geologic relations of the two rocks were discussed in detail with a view to a possible eutectic relation of the constitutents in the aplite which would then be the last to crystallize, and by a process of fractional crystallization be forced toward the center. By actual experiment, however, it was found that, on heating powder of both rocks in an electric resistance furnace for one hour at 1,132° C., the aplite had just begun to melt, while the oligoclase gabbro had only sintered slightly; while at 1,150°, under the same conditions, both the gabbro aplite and the oligoclase gabbro showed signs of fusion. (These temperature measurements were made by Dr. W. P. White, of the Geophysical Laboratory. His courtesy is herewith gratefully acknowledged.) This temperature range is so slight that the idea of eutectic relations in the dry melt is at least not strongly substantiated by experiment. The objections to any inference which might be drawn from the behavior of rocks of this type in the dry state were pointed out and the means for attacking such problems briefly indicated. The contact relations of the aplite to the oligoclase gabbro (change in granularity, etc.) were also briefly considered, together with the contact metamorphism of the adjacent ophites by the intrusive oligoclase gabbro.

Some Structural Details in the Pittsburg Region: Mr. G. C. Martin. (No abstract furnished.)

The Mapping of Landforms: Mr. F. E. MATTHES.

An attempt is offered in this paper to place the mapping of landforms on a more rational basis than has obtained hitherto, and to establish such fundamental principles as may serve to guide the topographer in the judicious representation of the relief on reduced scales, and thus lead to greater uniformity and consistency of interpretation.

In the first place a thoroughgoing analysis and classification of landforms seems necessary for a general groundwork.

Beginning with the continent as the largest unit landmass, several primary subdivisions of a comprehensive nature—*physiographic provinces*—may first be blocked out. Each of these again may be divided into smaller tracts or *physiographic regions,* each of them a distinct physiographic unit. Thus the entire Appalachian complex, from the New England ranges down to Alabama, may be spoken of as a "province"; each of its subdivisions, like the Alleghany Plateau, the Ridge-and-Valley Belt, or the Piedmont Plateau, on the other hand, as a "region."

The character of the relief of a "region" varies, as a rule, considerably from one part to another, and further subdivision into *topographic districts* suggests itself; each district having a distinct and fairly uniform *topographic character* of its own. "Topographic character" as a specific term, therefore will be used as referring properly to topographic districts. Analyzing now what determines topographic character, we find that three factors enter into it: (1) the vertical measure of the relief, (2) the types of landforms represented, (3) the disposition or manner of assemblage of the topographic units.

For the topographer's purpose it is helpful to resolve the landscape into component landmasses each of which may be considered by itself as a topographic entity or unit. Thus each mountain, spur, ridge, hill, mesa, terrace, cliff, fan, flood-plane, dune, sink, moraine, drumlin, cirque, cone, etc., constitutes a topographic unit. Obviously there are as many different kinds of topographic units as there are types of landforms. Not only, but the units of a given type frequently occur associated in different sizes, and are therefore capable of being further classed by order of magnitude. Thus an entire mountain range, a single mountain on the same, a master spur of the mountain, a small spur of the master spur, a spurlet of the small spur, etc., constitute units of successively lower orders of magnitude, yet all belonging to the same type of stream-carved landforms. The topographic character of a given district then depends largely on the kinds and sizes of topographic units represented within its compass. Contiguous districts, however, characterized by the same topographic types and the same height of relief, may yet differ conspicuously in topographic character because of differences in the disposition of the units. A third factor must therefore be taken into account, namely, the disposition, grouping or manner of assemblage of the topographic units. This concept is covered for stream-dissected districts, by the term "*topographic texture,*" and the same may perhaps with propriety be extended to others not composed of units of stream-dissection, so that it will serve to designate the manner of assemblage of topographic units of *all* types. Thus a number of different textures may be recognized, such as coarse, fine, uniform, irregular, graded, homogeneous, heterogeneous, simple, intricate, linear, trendless, radial, peripheral, etc.

Starting with this classification of landforms and this concept of topographic character as a basis, it is now in order to proceed with the formulating of criteria for the use of the topographic delineator.

From the foregoing it follows at once that a map which aims to give an expressive representation of the relief must satisfy three conditions: (1) it must correctly indicate the measure of the relief; (2) it must faithfully delineate the true character, shape and size of each topographic unit; (3) it must be reliable as to the relative position and orientation of the units, that is, it must show the texture characteristic of each district.

These rules apply to all topographic maps, whatever the scale or the nature of the cartographic device used for the representation of

the relief (whether contouring, hachuring or shading).

A number of corollaries follow, a few of which will be cited:

Elimination of units too small for delineation should proceed by order of magnitude. In a consistent map units of a certain order should not appear in one place and be omitted elsewhere.

Elimination of units of one order should not result in the enlargement of those of a higher order. The delineation of the latter, in order to be expressive, should so far as possible *suggest* the presence and character of the detail suppressed.

Consecutive reductions in scale should carry with them elimination of correspondingly higher orders of units.

In conclusion, it may be stated that the practical application of these principles by the topographer in the field proves to lead to no revolutionary changes in mapping methods, but on the contrary confirms the soundness of the practise, intuitively established though it may be, for the most part, of our ablest modern cartographers.

Ralph Arnold,
Secretary

Discussion and Correspondence

Geological Climates

To the Editor of Science: Dr. Lane, in his interesting paper published in Science for April 10, urges certain readers not to accept my "*ipse dixit*" but rather to await further promised demonstration.

With the added evidence given in the last issue of Science (pp. 784–5) it seems hardly necessary to point out that, so far as theories relating to terrestrial phenomena are concerned, it now rests solely with the scientists to demonstrate, if possible, that some vital flaw exists in my published work; so long as this can not be done, "most modern theories of geological climate" must certainly be regarded as "upset," *for these theories are based upon an adopted value for the temperature of space which is* (according to my demonstration) *too great by nearly three hundred degrees of the centigrade scale* at the earth's distance from the sun; and this result is practically independent of the errors of observation, for even if we should assume the measured focal temperature to be one thousand degrees in error, the provisional value (1°.5) for the temperature of space would be altered only a degree or so.

My result for the absolute temperature of space is not a speculative one; until it is proved incorrect it must stand as a demonstrated fact which is in no way dependent on other demonstrations to be given "later on."

It may not be out of place to remark that by attaching too much importance to the occasionally unguarded assertions of great authorities we are apt to retard, or to discourage, original work along lines still demanding rigid investigation. That a purely empirical formula like Stefan's should, by common consent, be honored to the extent of being called a "law," is misleading; that one of our great living authorities should refer to "The establishment of Stefan's law"[1] is still more misleading.

For myself, the most remarkable feature of this whole controversy is the fact that it has escaped the attention of scientists that, on purely theoretical grounds, the results deduced with the aid of Stefan's formula (or any other formula except the Newtonian) can not be in agreement with the principle of the conservation of energy.

J. M. Schaeberle

Ann Arbor, Mich.,
May 18, 1908

"Amethystine Blue."

To the Editor of Science: On page 825 of Science, May 22, 1908, Professor T. D. A. Cockerell calls attention to the development of the color of amethyst in glass exposed to strong light, and also mentions that this color is discharged by heat.

I am writing this brief note to call attention to the fact that the phenomena mentioned in Professor Cockerell's communication have long been known to chemists, and the explanation of same is very simple, viz., bottle glass is usually made of cheap raw materials,

[1] Science, March 27, p. 503.