*Medicago marina, Eryngium maritimum, Echinophora spinosa, Polygonum maritimum, Agropyrum, Juncus,* etc; (3) the strand cliff formation, *Crithmum, Lotus, Statice* and *Inula;* (4) the halophytic strand formation, *Atropis, Atriplex, Salicornia, Suæda, Salsola,* etc.; (5) the saltmarsh formation, *Juncus, Scirpus, Carex, Althæa* and *Tamarix;* (6) the strand meadow formation, and (7) the freshwater swamps.

The forest formations of the interior are the following: (1) the oak-ash formation *Quercus, Fraxinus, Acer, Ulmus* and *Prunus,* a very widely distributed and extensive vegetation, with several closely related oak formations; (2) the formation of the black pine (*Pinus nigra*), resembling the Mediterranean formation in few points other than the single common facies; (3) the birch formation (*Betula alba*) found here and there throughout the interior; (4) the stream bank formation (*Alnus* and *Salix*); (5) the poplar formation (*Populus alba, P. nigra*) of the broad moist valleys. The only extensive thicket formation is of a mixed character, containing *Corylus, Juniperus, Populus, Carpinus, Acer, Cratægus, Fraxinus,* etc. The herbaceous formations of a closed character are the heath, the mountain meadow, the meadow, and the swamp meadow. The open formations are those of the rockfield, the sandbanks, and the swamps, pools and streams.

The vegetation of the mountain region is treated in exhaustive fashion. The tabular statement of the positions of the various formations in the different ranges, found from pages 287 to 304, cannot be too highly commended. In itself, it is a notable contribution, showing in graphic fashion the zonation and alternation of the mountain vegetation. The forests comprise the red beech formation (*Fagus silvatica*), the pine formations (*Pinus leucodermis, P. peuce*), the fir formation (*Picea omorica*), the spruce and fir formation (*Picea vulgaris, Abies alba*), and the mixed formation, containing *Picea, Abies, Pinus, Fagus, Acer, etc.* The subalpine thickets are composed largely of *Pinus mughus, Rhododendrum, Juniperus, Alnus, Salix* and *Fagus.* The herbaceous vegetation comprises the subalpine herb, the alpine mat, and the peralpine rockfield formations.

The marine vegetation is considered briefly under the headings, litoral region and sea region; no formational limitation is attempted. The special consideration of the floristic of the vegetation is found in the third and fourth parts. The two charts, one showing the distribution of the formations over the entire country and vertically on the mountains, the other the vegetation regions, are excellent, and are of the greatest service in gaining a knowledge of the general features of the vegetation. The whole book impresses one with its modernness and thoroughness. The author moreover has been exceptionally happy in picturing formations by description, a fact which has caused the lack of numerous illustrations to be much less noticeable.

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## SOCIETIES AND ACADEMIES.

### AMERICAN MATHEMATICAL SOCIETY.

A REGULAR meeting of the American Mathematical Society was held at Columbia University on Saturday, April 26. The President of the Society, Professor Eliakim Hastings Moore, occupied the chair, yielding it during the afternoon session to Professor Thomas S. Fiske. Thirty-seven members were in attendance at the two sessions. The Council announced the election of the following persons to membership in the Society: Professor C. E. Biklé, Columbia University; Professor F. W. Duke, Hollins Institute, Va.; Dr. J. G. Hardy, Williams College; Professor H. L. Hodgkins, Columbian University; Dr. J. N. Ivey, Tulane University; Dr. J. H. McDonald, University of California; Dr. H. C. Moreno, Stanford University; Dr. T. M. Putnam, University of California; Dr. E. W. Rettger, University of California; Mr. W. H. Roever, Harvard University; Professor Irving Stringham, University of California; Dr. S. D. Townley, University of California; Mr. H. E. Webb, Stevens School, Hoboken, N. J.; Mr. A. W. Whitney, University of California. Three applications for admission to membership were received.

The Council also authorized the organization of a Pacific Section of the Society, to hold meetings in the vicinity of San Francisco. The first meeting of the new Section has already been held, on Saturday, May 3, a program of sixteen papers having been provided for this occasion.

The following papers were read at the April meeting:

Dr. H. F. Stecker: 'The curve of least contour in the non-euclidean plane.'

Mr. J. L. Coolidge: 'Quadric surfaces in hyperbolic space.'

Dr. F. H. Safford: 'Dupin's cyclides of the third degree.'

Mr. Peter Field: 'On the forms of plane unicursal quintic curves.'

Miss R. G. Wood: 'Non-euclidean displacements and symmetry transformations.'

Mr. D. R. Curtiss: 'A note on the sufficient conditions for an analytic function.'

Miss I. M. Schottenfels: 'On the definitional functional properties for the analytical functions $(\sin \pi z)/\pi$, $(\cos \pi z)/\pi$, $(\tan \pi z)/\pi$.'

Professor C. A. Scott: 'On the circuits of plane curves.'

Dr. E. V. Huntington: 'A complete set of postulates for the theory of real numbers.'

Dr. L. P. Eisenhart: 'Surfaces whose lines of curvature in one system are represented on the sphere by great circles.'

Professor E. H. Moore: 'A definition of abstract groups.'

Dr. E. V. Huntington: 'A definition of abstract groups.'

Mr. L. D. Ames: 'Evaluation of slowly convergent series.'

Dr. Edward Kasner: 'Groups of Cremona transformations and systems of forms.'

Mr. A. D. Risteen: 'The constant of space.'

Dr. C. J. Keyser: 'Concerning the angles and the angular determination of planes in 4-space.'

Professor T. J. I'a. Bromwick: 'The infinitesimal generators of parameter groups,' and 'On the parabolas or paraboloids through the points common to two given conics or quadrics.'

The next meeting of the Society is the Summer Meeting, which will be held at Northwestern University, Evanston, Ill., in the first week of September.

F. N. Cole,
*Secretary.*

THE GEOLOGICAL SOCIETY OF WASHINGTON.

At the meeting of the Society on April 23, the first paper, 'Folded Faults in the Southern Appalachian,' by Mr. Arthur Keith, began with a statement of the typical Appalachian faults, which are characterized by great length and uniformity, high southeast dips, and anticlinal origin. Their planes are, for the most part, slips nearly parallel to the bedding. Next were described a group of faults whose derivation from anticlines is less obvious and whose planes are marked by great irregularity in direction and dip. Their irregularity can be ascribed to subsequent deformation, although the evidence of that is not always strong. These two classes of faults have been well known for ten or twelve years.

A third and most unusual class of faults comprises those in which great deformation by folding and faulting affected the fault planes after they were formed. This has given rise to extreme irregularity in direction and dip of the fault planes, and has thoroughly obscured their real nature. No trace of anticlinal origin appears and a section along a straight line will intersect a given fault in several places. A minimum measure of the throw is thus readily obtained and varies from fifteen to twenty miles. The evidence proving these faults consists in superposition of Archean granite on Cambrian sediments, discovery of fossils in some of the overlying masses, the establishment of a sequence of six or eight distinct formations, unconformities of distribution along the fault planes, and breccias and other direct evidences of faulting.

The position of the plane before folding can be reconstructed from the sequence of the formations against it in different places. There is thus developed a low dip of the plane toward the southeast in the nature of a shear plane gradually traversing the formations. Beginning on the northwest in the lower Silurian Tellico, it passes down through all the intervening formations into the Archean granite. From this general fact, in connection with numerous local details, it is inferred that the fault resulted from a direct thrust by the Archean granite. The deformation of the

fault plane is as great as that produced in Appalachian strata generally by the great post-Carboniferous deformation. Thus the shear plane was formed before the principal epoch of Appalachian folding. Whether or not any interval ensued between the two it is difficult to say. Carboniferous rocks are involved in the shear plane, so that it was produced at least after the Carboniferous period.

Mr. J. S. Diller then gave a paper entitled 'The Copper Region of Northern California.' Mr. Diller stated that the copper region contains an extensive series of sedimentary rocks ranging from the Miocene into the Devonian, associated with igneous masses of various ages and kinds which have intercalated or intruded the sedimentaries. A number of mountain-building epochs are recorded by breaks already recognized in the stratigraphic and faunal succession, and others will doubtless be discovered in the detailed survey. The general abundance of fossils in the Cretaceous, Jurassic, Triassic, Carboniferous and Devonian sediments is such as to render it possible to work out the structure in detail.

The ore deposits of the copper region may be conveniently considered in three groups: Auriferous quartz veins, sulphides in contact zones, and sulphides in shear zones.

The copper industry has invigorated quartz mining in the region to furnish siliceous ores for smelting.

The Black Diamond Mine near Bayha shows a number of interesting ore bodies, chiefly pyrrhotite, chalcopyrite and magnetite associated with diopside, garnet and other minerals on the contact of diabase dikes cutting the carboniferous limestones.

The deposits of the Bully Hill and Iron Mountain districts occur along shear zones mainly within rhyolitic rocks. The ores of the Iron Mountain district are almost wholly pyrite and chalcopyrite, but in the Bully Hill district chalcocite is abundant with much barite and sphalerite.

Mr. Charles Butts presented a paper entitled 'Recent Structural Work in Western Pennsylvania.' He exhibited maps of the Masontown, Uniontown, Brownsville and Connellsville quadrangles with structure contours drawn on the base of the Pittsburg coal up to the western base of Chestnut Ridge, on the top of the Pottsville formation upon the ridge, and explained the methods by which the contours were determined. A brief description of structural details was then given. In general the rocks are folded into low ellipsoidal anticlines and shallow canoe-shaped synclines, which often show remarkable minor irregularities of structure and have a decided tendency to offset laterally at short intervals. The structure seems to be intermediate between the steep regular folding of the central Appalachian ridges and the low doming and pitting of the strata farther from the mountains, such as exists in western New York, where it is impossible to detect any linear arrangement of structures whatever.

A knowledge of the possibilities of such structures can not fail to be of great assistance in stratigraphic work in such regions and should diminish its perplexities while increasing the reliability of the results.

The last paper was on the 'Stratigraphy of the Big Horn Mountains,' by N. H. Darton.

Mr. Darton gave a brief résumé of the principal stratigraphic features observed on the eastern flanks of the Big Horn Mountains during the summer of 1901. A detailed survey had been made of a portion of the district which is preliminary to more extended investigations. The geologic column comprises all the formations from Cambrian to Laramie excepting perhaps the Devonian and portions of the Silurian. Many fossils were found at various horizons, affording important means for correlation. A limited fauna was discovered in some thin limestones in the top of the Red beds but its age has not yet been definitely established. The column was compared with that of the Black Hills which had been studied in previous seasons, and a close general similarity is shown including the freshwater Jurassic but not including the Minnekahta (Purple) limestone. Conglomerates found in the Laramie formation indicate a pre-Laramie uplift of the central portion of the range.

ALFRED H. BROOKS,
*Secretary.*