2. *A contribution to the theory of plane curves:* DR. L. WAYLAND DOWLING, University of Wisconsin.

3. *A Canadian discoverer of the non-Euclidean Geometry:* PROFESSOR GEORGE BRUCE HALSTED, University of Texas.

4. *Note on the Folium of Descartes:* PROFESSOR ELLEN HAYES, Wellesley College.

5. *A geometrical locus connected with a system of coaxal circles:* PROFESSOR THOS. F. HOLGATE, Northwestern University.

6. *On the solution of the map-color problem:* PROFESSOR P. WERNICKE, State College of Kentucky.

7. *On the Riemann-Helmholz-Lie problem of the foundations of geometry:* PROFESSOR H. B. NEWSON, University of Kansas.

MONDAY AFTERNOON.

8. *Quaternion invariantive operators:* PROFESSOR JAMES BYRNIE SHAW, Illinois College.

9. *The geometry of some differential expressions in hexaspherical coordinates:* DR. VIRGIL SNYDER, Cornell University.

10. *On certain differential equations of the second order allied to Hermite's equation:* PROFESSOR E. B. VAN VLECK, Wesleyan University.

11. *Concerning the cubic involution and the cubic transformation of elliptic functions:* PROFESSOR OSKAR BOLZA, University of Chicago.

12. *The determination of the rational function in the reduction of the general Abelian integral to the sum of a rational function and a fundamental system of elementary integrals:* DR. J. C. FIELDS, Berlin, Germany.

13. *On the reduction of hyperelliptic functions* ($p=2$) *to elliptic functions by a transformation of the second degree:* D. J. I. HUTCHINSON, Cornell University.

TUESDAY MORNING.

14. *Further researches in the theory of quintic equations:* DR. EMORY MCCLINTOCK, New York, N. Y.

15. *A theorem concerning the coefficients of lineal substituting groups of finite order with n variables:* PROFESSOR H. MASCHKE, Chicago University.

16. *On the commutator groups:* DR. G. A. MILLER, Ann Arbor, Mich.

17. *Collineations in a plane with invariant conic or cubic curves:* PROFESSOR H. S. WHITE, Northwestern University.

TUESDAY AFTERNOON.

18. *Concerning regular triple systems:* PROFESSOR E. H. MOORE, University of Chicago.

19. *Theory of discrete manifolds:* MR. F. W. FRANKLAND, New York, N. Y.

20. *Certain transformation problems of canonical equations of dynamics:* DR. EDGAR ODELL LOVETT, University of Chicago.

21. *The true transition curve:* MR. P. H. PHILBRICK, Lake Charles, La.

22. *About sixth power numbers whose sum is a sixth power:* DR. ARTEMAS MARTIN, Washington, D. C.

23. *Preliminary report on alternate functions of complex numbers:* PROFESSOR A. S. HATHAWAY, Rose Polytechnic Institute.

General discussion of the following topics:

1. *The accurate definition of the subject-matter of modern mathematics.*

2. *The vocabulary of mathematics. The possibility of correcting and enriching it by cooperative action.*

F. N. COLE,
*Secretary.*

## *CURRENT NOTES ON PHYSIOGRAPHY.*

### ARTESIAN WELLS OF IOWA.

A COMPREHENSIVE report on the artesian wells of Iowa by W. H. Norton (Iowa Geol. Surv., VI., 1896, 113–428) brings clearly forward the favorable conditions there obtaining for this important source of water supply. The paleozoic strata have a gentle southward inclination, and also a sag over the northern part of the State from the eastern and western boundaries towards a median line. Numerous water-bearing strata, or *aquifers*, occur, from the basal sandstone that lies on the buried hills and valleys of the Algonkian floor to the sandstones of the coal measures. Cretaceous strata in the northwestern part of the State lead water away westward. Some important wells are supplied from aquifers in the glacial drift. Three artesian wells were mentioned in the State Survey Report for 1870, and no systems of water works had been then constructed. About a hundred systems are now in operation, many of them depending on artesian supply. At certain points, where many wells have been sunk, the first yield has slightly decreased, as if the limit of local supply had been reached; but great stores of subterranean water remain unexhausted beneath most of the State.

### FORESTS AND DESERTS OF ARIZONA.

THE variation of climate with altitude

and the redemption of the desert along irrigated valleys afford material for an entertaining narrative by Fernow (Nat. Geogr. Mag., VIII., 1897, 203–226). Much of the lower ground is desolate, unless exceptional rains allow a temporary growth; but the few valleys of streams large enough to feed irrigating canals contain green groves, orchards and fields. The higher plateaus and volcanoes bear forests of open growth; about Flagstaff 12,000,000 feet of lumber are cut annually. The open grouping of the trees is ascribed to variation in water storage by the soil. Although millions of pine seedlings spring up after the rains, all of them perish from frost, unless the season is exceptionally favorable. The young tree growth does not follow in annual generations, but in irregular periods of from three to ten years. Open grassy glades of fine black loam seem to mark the site of extinguished lakes. Brief account is given of an ascent of San Francisco mountain and of a visit to the Grand Canyon of the Colorado, but it seems rather negligent of the rest of the world to speak of even the unrivalled canyon as 'a thought of God on earth expressed.'

### TRANSVERSE VALLEYS IN THE JURA.

A NEW contribution to the above much-discussed question is made by Dr. Fr. Jenny, (Das Birsthal: ein Beitrag zur Kenntniss der Thalbildung in Faltengebirge, Basel, 1897), with the conclusion that the several transverse valleys or *cluses* of the Birse are the result of backward erosion along lines of local distortion in the anticlinal ridges, whereby the river course has become more or less adjusted to the structure of the region. It is argued that in the early stages of folding, the drainage was consequent, and that several temporary lakes were then formed. Local deformation in the growing arches defined the river course. "The Birse has gained its present course by a change from its original path through adjustment to the structure of the mountains that it traverses."

It is not clear whether the author advocates the diversion of early consequent streams to transverse courses by the headwater growth of diverting streams or not; no explicit statement being made on this point. The antecedent origin of the rivers, advocated by Foerste and Rollier, is discarded. Yet a qualified antecedent origin is implied, for the present river course is given an early date, before the folding was nearly completed; as if consequent on the early folding and antecedent to the rest. The value of adjustment to internal structures in locating the river seems exaggerated. Even if essentially antecedent, the slight adjustments now found within the cluses might have taken place as the valleys were deepened. Moreover, it is highly probable that slight irregularities of structure, such as those to which Jenny ascribes the location of the existing cluses, would have been found wherever the cluses had been cut down across the anticlines. The frequent occurrence of cluses near the end of pitching anticlines is quite as suggestive of a course consequent upon initial folding and antecedent to later and greater folding as of dependence on slight local deformations.

### SUB-OCEANIC CHANGES.

MILNE draws attention to sub-oceanic changes (London Geogr. Journ., X., 1897, 129–146) caused by slides of detritus down the marginal slopes of continental plateaus. Cables are there broken in consequence of their burial beneath such slides. The cause of the movement is ascribed to the accumulation of land-worn detritus. In Japan a large number of earthquakes come from the deep sea off the mouth of the Tonegawa, the largest of Japanese rivers, which crosses an alluvial plain in its lower course. Many other shocks on those islands have similar

origin. Where long continental slopes descend beneath the ocean at a steeper gradient than 1 in 35, slips and earthquakes of this kind may be expected. The western boundary of the Tuscarora deep, in the North Pacific, is a source of many earthquakes, among them the destructive disturbance of June 15, 1896. There Milne infers 'sudden sub-oceanic changes along the basal frontier of a continent, the magnitude of which it is difficult to estimate.' Certain 'unfelt earthquakes' recognized by the horizontal pendulum are recorded at widely separated stations, 'and it is fair to assume that in these instances the whole world has been shaken.' Their source cannot have been on any land, for then they must have been observed in the ordinary manner; they are therefore ascribed to submarine movements.

If the occurrence of sub-oceanic slides be verified, they afford a new argument for the permanence of continents and oceans; for nowhere do the sedimentary strata of the continents exhibit so confused a structure as must be thus produced along the slope and basal frontier of a continental mass.

W. M. DAVIS.

HARVARD UNIVERSITY.

---

## *CURRENT NOTES ON ANTHROPOLOGY.*

### STONE IMPLEMENTS FROM THE POTOMAC DISTRICT.

PROFESSOR WILLIAM H. HOLMES contributes to the Fifteenth Annual Report of the Bureau of Ethnology one of his excellent and beautiful papers, this one on the 'Stone Implements of the Potomac Chesapeake Tidewater Province,' 152 pages, with 104 full-page plates, and 36 figures in the text. The geographical and geological relations of the area are carefully explained, and the artefacts themselves are examined under the classification of flaked, battered or abraded, and incised or cut stone implements and utensils. The typical forms and characters are illustrated, the processes of manufacture are set forth, and the extensive quarries where the material was obtained are described.

The conclusion of the author, after years of patient research with reference to the antiquity of man's work in this region, may be given in his own words (p. 146): "The art remains preserved to our time indicate the prevalence of extremely simple conditions of life throughout the past, and exhibit no features at variance with those characterizing the historic occupancy." So that we shall have to go elsewhere to find 'paleolithic man.'

### ETHNOGRAPHY OF THE CALCHAQUIS.

IN SCIENCE, May 7th, I referred to some interesting art remains discovered by Ambrosetti in the territory of the ancient Calchaquis. Ethnographers have been unable to identify these with any modern tribe (see 'The American Race,' p. 319). The latest effort is by Dr. Ten Kate. He availed himself of a series of skeletons in the Museo de La Plata, exhumed from old graves in Calchaqui territory. Some were deformed, and of the normal there were a number of types; but the characteristic features were extreme brachycephaly and a short stature. In both respects these ancient differed from the modern natives of the place. Looking around for similarities, Dr. Ten Kate found them among the Huarpes of the province of La Rioja, where skeletons with the same traits occur. He does not, however, identify them with the Huarpes (or Allentiacs), who are probably related to the Chaco tribes, but rather with the Araucanian stock, so far as one can judge from the synopsis of his conclusions in the *Centralblatt für Anthropologie*.

These analogies are not borne out by the linguistic evidence of the proper names in