orographic basin, resulting from the tilting of faulted beds. The question of outlet is discussed in detail, the conclusion being that the lake did not overflow.

Chapter III. discusses the physiography of the Lahontan basin, describing in detail the valleys and mountains, and its lakes, rivers, and springs, and including numerous analyses of the waters from these three sources. Attention is given to the peculiar playas or broad mud-plains of the arid region of the Far West, as well as to the temporary lakes, called 'playa-lakes,' which frequently flood them.

The physical history of the ancient lake is fully and ably discussed in Chapter IV. Under the head of 'Shore Phenomena' we find detailed descriptions and illustrations of the terraces, bars, embankments, etc., that were formed about its shores. The highest of the ancient water-lines is named the 'Lahontan Beach;' and the most conspicuous terraces below this are the 'lithoid,' 'dendritic,' and 'thinolitic.' Each of these marks the upper limit of a variety of tufa, from which it derives its name.

Numerous sections are introduced to show the structure and relations of the mechanical sediments, which consist of two deposits of lacustral marls, separated by a heavy layer of current-bedded gravels; thus recording two lake periods and an intermediate low-water stage.

Chapter V., on the chemical history of the lake, is especially important. It includes, first, a general account of the chemistry of natural waters as they occur in streams, springs, lakes, oceans, and enclosed lakes or seas, followed by descriptions of the tufas precipitated from the water of Lake Lahontan, the salts precipitated when complete evaporation took place, the efflorescences now forming on the desiccated floor of the lake, and the salt-works of the region. As already indicated, the tufas present three main divisions. The lithoid tufa is a compact, stony variety, and is the oldest of the principal calcareous deposits that sheathe the interior of the basin. Thinolitic tufa is composed of crystals, and was formed in the ancient lake when it was greatly reduced by evaporation. The dendritic tufa has a branching or dendritic structure, whence its name, and it is the newest of the tufa formations.

Chapter VI. presents the life-history of the ancient lake as determined by the abundant molluscan remains and other fossils that have been found. The shells show that the lake was fresh throughout its higher stages. During the period when thinolite was formed, it seems to have been too concentrated to admit of the existence of molluscan life, as no fossils have been found in that deposit. A chipped implement discovered in the upper lacustral beds indicates that man inhabited the Far West during the last rise of Lake Lahontan.

Chapter VII. is a brief *résumé* of the preceding chapters; while Chapter VIII. is devoted to a discussion of the quaternary climate of the Great Basin, the periods of greatest lake-expansion being correlated with the two glacial epochs of the Sierra Nevada, and believed to indicate cold and moderately humid periods.

In Chapter IX. we have a summary of the evidence bearing on the determination of the geological age of the lake. The conclusion reached is that it existed during the quaternary, but was more recent than the date usually assigned for the close of the glacial epoch.

The tenth and concluding chapter contains an account of the orographic movements that have affected the Lahontan basin since the last high-water period, including a map showing all the post-Lahontan faults, some of which are marked by exceedingly fresh escarpments, and are evidently still in process of formation.

The illustrations are profuse and admirably executed, and Mr. Russell's style is throughout clear and graphic. Details are mainly kept in the background, or presented in tabular form; and it is probable that both in general interest and educational value this monograph is excelled by none of the publications of the Geological Survey.

Elements of Geodesy. By J. H. GORE. New York, Wiley. 8°.

THE present publication is a treatise on some geodetic operations, and intended to give the beginner a clear insight into the subject. It begins with a brief historical sketch of the various attempts to determine the figure of the earth. The former half of the book is devoted to a description of the instruments and of the elementary operations and methods of plane geodesy, but the principal object of the author is to describe the methods of spheroidic and geoidic geodesy. The student who begins to study this important branch of geodesy will, or at least ought to, be conversant with the instruments applied by geodesists, with the theory of least squares, and with the calculation of triangulations, which are set forth at some length in the first part of the book. On the other hand, the beginner, who will find some valuable and practical hints in the chapters on base measurements and the field-work of triangulations, will miss a discussion of topographical methods and operations. The book would become far more useful for the beginner, who must study the simpler geodetic operations before beginning with the measurement of the figure of the earth, if a description of the methods and theories of topography were included in the plan. The development of each formula is very complete, and the results are given in the shape that the majority of writers have considered the best. Examples are given to illustrate the application of the formulæ. The student will find at the end of each chapter a list of books referring to the subject under discussion. F. B.

NOTES AND NEWS.

AS we go to press we have obtained a copy of the opening remarks of Prof. S. P. Langley, president of the American Association. Professor Langley spoke as follows:—

MEMBERS OF THE ASSOCIATION, — While, for the main purpose of our coming here, we are all of one mind, some must remember a peculiar pleasure in their first attendance, when they came to these meetings as solitary workers in some subject for which they had met at home only indifference, and held themselves alone in, till here, with a glad surprise, they met others, too, caring for what they cared for, and found among strangers a truer fellowship of spirit than their own familiar friends had afforded. With such communities of purpose wherever two or three among us are gathered together, it is a happy thing that we cannot remain strangers; for doubtless, of the many here who have habitually breathed "the calm and still air of delightful studies," there are few but know by experience how hard it is for one coal to keep alight alone, and how especially good it is for the solitary workers to be brought at times into the warmth of companionship. To a great many of us, then, it may be counted as the very chiefest good of such an assembly as ours to-day, that here each meets some one with a kindred glow, and finds that interest and sympathy from his co-worker without which the scientific life would be but too cold. It is most fortunate, nevertheless, that our happy constitution as a body, not only of investigators in science, but of teachers and lovers of knowledge, brings those here in greatest numbers who disseminate as well as produce it, and who are skilled to recognize the value of the newly mined product when brought into this public exchange of ideas. We must admit here, that foolish ideas as well as wise ones are brought to this open mart, and that, in dealing with the variety of papers now presented for acceptance, it becomes almost as hard a task for us to shut out folly as to entertain wisdom; for, after all, who are we that judge, and how can we say "wisdom is in us to decide," when it is chiefly because we are ignorant that we are here? Probably the only rule is that taught by experience, that since art is long and life short, experience difficult and judgment uncertain, knowledge commonly advances best by such little steps, that one foot is not lifted till the other is securely planted on the solid ground of fact. On the whole, then, while we agree that some rare visitors have come to us over the "high *priori* road," do not let us welcome without scrutiny all those who would walk over it into this association's domain. At the same time, in view of our ignorance as to the real nature and causes of things, I would plead with those of you who are judges, for a large tolerance, even of what seem to be errors of speculation, *when* these are found in company with evidence of a faithful original study of facts; for we shall then have, at any rate, done our best not to turn away Truth, even if she has come to us in an unfamiliar dress. And now I can only congratulate this assembly of her followers on a meeting which opens so auspiciously, and express the hope, that whether in the new knowledge which we may take to the section-room or find there, or in the

social pleasures the gathering brings, this may fulfil its large opening promise of being a fruitful and happy season to us and to our association.

— Dr. E. Naumann, late director of the geological survey of Japan, has published an essay on the influence of the structure of the earth upon the phenomena of terrestrial magnetism. His researches in Japan show that the magnetical lines are to some extent influenced by the *fossa magna*, a great fault which crosses the islands in a direction south-east by north-west. By studying the direction of the magnetical lines in connection with the geological structure of other countries, the author comes to the conclusion, that, in the vicinity of faults and folds, the magnetical lines show remarkable irregularities, and that a connection exists between both phenomena. Recent researches by Ciro Christoni on the intensity of terrestrial magnetism in Italy (*Atti della R. Accademia dei Lincei*, 1887, p. 200) show irregularities of the magnetical elements in the eastern part of Venetia, on the western part of the coast of Liguria, and in Val Pelice. These places coincide with centres of seismical disturbances, and suggest a connection between geological and magnetical phenomena. It seems, however, that the available material is still too incomplete for a thorough study of the question at issue, the magnetical surveys not being of a sufficiently detailed character.

— Charles E. Putnam of Davenport, Io., died July 19.

— Those interested in Spiritualism will read with special interest Prof. Carvill Lewis's account of two sittings with the noted English medium, Englinton. This medium is such a tower of faith to believers, and has deceived so many, that so glaring an exposure of his methods as Professor Lewis gives is especially valuable. The article is published in the Proceedings of the English Society for Psychical Research, May, 1887.

— The readers of *Science* know from our notes on the exploration of Africa how rapidly one discovery follows another, and that it is difficult to keep a map up to date. This fact has induced J. Perthes to publish a second edition of his large map of Africa in ten sheets (1 : 4,000,000). The student of the geography of Africa will find this map, which contains an enormous amount of detail, and which is in every respect up to the date of publication, a valuable help in his researches. The routes of explorers, the tribes with whom they came into contact, and the character of the land they traversed, are shown in the map; deserts, steppes, and regions with tropical vegetation, including savannas and woods, being distinguished by different colors. An important feature of the map, and one necessary for the critical study of geography, is the distinction between countries which are really explored and those which are known by report only; the former being written with heavy letters, the latter with light ones. The new edition, of which two sheets — Kongo and Abyssinia — have been published, contains so much new material, that the section 'Kongo' is practically a new map. The results of the journeys of Kapello and Ivens, Reichard, von François, Kund and Tappenbeck, Wolf, Büttner, Grenfell, Junker, and the observations of Captain Rouvier, have been used in constructing this sheet. The important results of these journeys were published in our map of Central Africa some time ago. The observations of Chavanne and other visitors of the Lower Kongo induced the author, H. Habenicht, to include that region in the zone of steppes occupying south-west Africa. In Section 6, 'Abyssinia,' the routes of Cecchi and Chiarini have been made use of, and — what will be welcome to most readers — Emin Pacha's province, his stations, and those of the Kongo Free State, have been marked by separate colors. The political boundaries have been corrected according to recent treaties and annexations.

LETTERS TO THE EDITOR.

*** The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

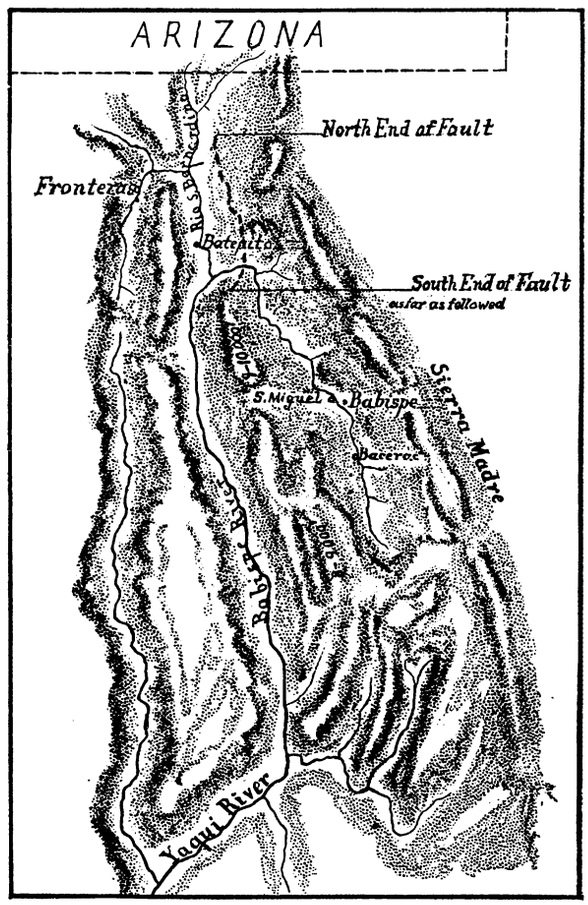
The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The Sonora Earthquake.

THE past month has been spent by me in Sonora, U.S. Mexico, in examining the scene of the greatest disturbances during the recent earthquake of May 3. This trip has required mountain-travel of about seven hundred miles, horseback and on foot; fully one-half, the latter. While it is impossible now to give the complete results of my explorations, a brief summary may prove interesting.

There is not now, nor has there been, lava eruption or crater volcano. I visited every locality in the Sierra Madres where such phenomena had been reported — fruitlessly. There is a grand fault extending along the eastern side of the San Bernardino and Yaqui River valleys for nearly one hundred miles. This fault has a general northerly and southerly strike, with a dip of from 45° to vertical; and the difference in level of the two sides is for fifty miles an average of eight feet. It lies close to the foot of the mountain-ranges, where the *mesa* drift joins the steeper part of the chain, until it crosses the Yaqui, where it goes directly into the mountains. There are numerous minor faults and fissures; and



HEIGHT IN FEET.

Fronteras, 3,350. Babispe, 3,025.
Batepito, 2,290. Bacerac, 3,150.

the entire valley of the San Bernardino is apparently sunk from two to four feet. The relative level is changed that much. This condition exists also on the Babispe River above and for some distance below Babispe, and on the Yaqui at and below its junction with the San Bernardino. Almost every water-course in the disturbed area has changed in the same way.

The town of Babispe was totally destroyed, forty-two lives lost out of a population of seven hundred. No other town in Sonora suffered much. Extensive evidence exists of irruption of water, sand, and fiery gases. As stated in my first letter, mountain-fires succeeded the first shock. These were caused by the ignited gases and falling bowlders. Time data in Mexico, away from the railways, are unprocurable, none existing. The general fact that the first shock took place May 3, about 3 P.M., and that it came from a westerly direction, is all that can be obtained.

It is much to be lamented that the ground was not thoroughly explored before the beginning of the rainy season, which set in on the 14th of June with a violence unknown since 1881. This will