logical position occupy the lowest place geographically. The general plane of the country is determined by the upper surface of the conglomerate series, which continues to rise from the west, until, in the mountains already mentioned, it attains an elevation ranging between thirty-two hundred and thirty-five hundred feet. The Raleigh plateau-region owes its existence to the presence of the conglomerate series.

The comparatively incoherent strata of the carboniferous above the conglomerate sandstones were quickly eroded away. When the upper surface of the hard conglomerates was reached, the degradation of the surface in a measure ceased, and the mechanical action of the streams was concentrated in deepening and widening their channels. This has produced the cañon-like features so characteristic of the New-River district.

The lateral wear in most cases was necessarily slight. The marshes of Coal River form, however, a singular exception to the general topographical features; as in this case the erosion, acting laterally, has resulted in a deep and rather broad valley. The conglomerate series, with its slope to the north-west, passes beneath the lower coal-measures near the embouchure of Gauley River, which, in turn, sink beneath the water-level a short distance west of Charlestown. The lower barrens, which overlie them still farther west, pass beneath the upper coal-measures.

The cañon-like features of the valleys are gradually lost as we go westward from the Kanawha Falls; and the hills become lower and lower, until, when the Ohio is reached, they do not rise more than two hundred feet above the river.

With the exception of the gradual difference in elevation due to the general rise in the country from the Ohio eastward, the surrounding knobs appear on one and the same level, and offer the most indisputable evidence of the plateau nature of the entire country; the mountains being simply the uneroded remnants of higher strata, resting on the basal plane of the conglomerate series.

It is this character of the country, in which there are few salient points well located for suitable stations for instrumental work, that retards topographical work, and renders impracticable the application of methods that are elsewhere best adapted to effect the most economic and accurate results.

The primary triangulation extending over this section connects at the north and south with the triangulation work of the U. S. coast and geodetic survey, while the lines of the secondary work establish geographical positions throughout the entire area included between the Kanawha and Chattarawha Rivers. With these numerous geodetically determined positions, it was found possible, by judicious adjustment, to utilize a large amount of existing material, sufficiently accurate in point of drainage detail, but heretofore valueless as a means of absolute location.

The completed map, as prepared for publication, will be upon a scale of 1: 250,000, or approximately four miles to one inch, in approximate contour lines having a vertical interval of two hundred feet. When draughted, and made continuous with the government surveys extending throughout the whole southern Appalachian region, it will serve as a basis for subsequent geologic investigation in the field.

The field of work included in these surveys has long since been recognized as a most important one; and nowhere more than in the coal-measures of West Virginia is there a greater need for most concise and accurate geological and geographical knowledge, for nowhere can be found circumstances so favorable for the advantageous employment of capital.

Geological survey of Canada.

New-Brunswick division. — Work in this province will be resumed in May, under the direction of Prof. L. W. Bailey, and will be carried on in portions of Carleton and Victoria counties with a view to the preparation of an additional sheet of the general geological map of the province, of which about eight sheets have been already issued. A series of observations on the superficial geology will be simultaneously but independently undertaken by Mr. R. Chalmers.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston society of natural history.

May 7. — Mr. F. W. Putnam spoke of an interesting find by Dr. C. C. Abbott, who has made such important discoveries in the Trenton gravels of the Delaware-river valley, and who was the first to prove that man existed on the eastern coast of America at the time a large part of the country was covered with ice, or during the glacial period. The recent discovery was that of a portion of the right side of a human under jaw, which was found sixteen feet below the surface, in the gravel at the railroad cut near the Trenton (New Jersey) depot. In this same deposit, and a few feet above the jaw, Dr. Abbott had previously found a human tooth, and many stone implements of a rude type. The fragment of human jaw was exhibited, and is shown to be worn and ground in the same way as the pebbles above and about it. Mr. Putnam was on the spot a few days after the jaw had been discovered (on April 18) by Dr. Abbott, and identified the gravel and sand matrix in which the jaw is enclosed, with the material in place. Near and in the gravel above this jaw was found, a few years since, the tusk of a mastodon.

Anthropological society, Washington.

May 6. — Mr. O. Dorsey gave a classification of the Siouan tribes, including the Sioux proper, Assine-

boin, Ponka, Omaha, Osages, Kansas, Kwapas, Iowas, Otos, Missouris, Winnebagos, Mandans, Minnetarees, Crows, and Tulets. The general impression seems to have been, that this stock moved from the north-west. Mr. Dorsey took an opposing view, and traced the tribes from the south-east, up the streams, and from the region of the lakes westward. —— President Gallaudet said that there were in existence in Europe several societies whose object is to discuss the subject of international relations. The speaker took the ground that the proper basis of these relations should be ethical rather than legal. The law term for *jus gentium* was objected to, and the phrase, 'international rights,' or 'international ethics,' suggested. While nations would not listen to absolute commands of law, they have ever shown some willingness to listen to ethical arguments, on the justification of their foulest acts, by appealing to the verdict of humanity as to the justice of their cause. If publicists should insist that no acts of nations should be justified that are not right between individuals, the subject of international law would be settled on a firm basis, and Mirabeau's words, 'Le droit est le souverain du monde,' would become a fact. The paper was discussed by Major Powell, who took issue with the speaker on some of his means, agreeing with him in the desirability of the end to be attained.

Engineers' club, Philadelphia.

May 3.—Mr. S. N. Stewart exhibited a model of his river or current motor. Paddles are placed upon cranks, and maintained in a vertical position, by long, floating vanes or tails. The cranks are placed upon posts, rafts, or boats in the stream, and journalled at the water-line, thus keeping one-half of the paddle-surface in action, while the common floating-wheel, or current-wheel, only keeps one-tenth of its surface in action. In Mr. Stewart's motor, a ten-foot arm carries a paddle ten feet high. —— Mr. Thomas M. Cleemann read a paper on an economical form of bridge-truss. In outline, it resembles Whipple's arch-truss, inverted so as to bring the curved portion in tension, but differing from it in having the chord made to resist tension, and being anchored to the abutments. In this way, the only parts of the bridge in compression are the vertical posts, and the extra material required to stiffen the upper chord in an ordinary bridge is saved. To illustrate the correctness of his conclusions, Mr. Cleemann had a small model made of pink wrapping-twine, that broke with five and a half pounds, and with posts made of wooden knitting-needles. This model, by calculation, ought to have borne about eleven pounds. After loading it with a pound weight at each of the seven panel points, and letting it remain for a little time for the inspection of the members, he added, first, two more pounds at the centre, and afterwards two pounds more. With this eleven pounds, the model hesitated a moment, and then broke at each abutment, nicely illustrating the author's conclusions. He likewise gave the saving of material in such a bridge over a Pratt truss, of five hundred and sixteen feet span, and pointed out its advantages for military purposes, where facility of transportation is a prime object, and a bridge almost entirely of rope is especially valuable on this account. —— The secretary exhibited for Mr. J. H. Harden a neat topographical model of the Jones iron-ore mine in Berks county, Penn., and briefly explained the method by which such models are constructed.

Numismatic and antiquarian society, Philadelphia.

May. 1. — Mr. E. F. im Thurn of Demerara presented valuable works by himself, relative to the ethnology, geography, and fauna and flora, of British Guiana. —— A letter was read from Rev. Damaro Sota, mayor of San Sebastian, Concordia, state of Sinaloa, Mexico, in reference to his late discovery of the key to the Mexican hieratic writing, stating that he was preparing a work setting forth his views and the exact nature of his discovery. —— Dr. C. C. Abbott of Trenton read a paper on the existence of an early race in the valley of the Delaware, whose relics were found by him in the Trenton gravels, and adverted to a fragment of a human skull being found there by him on April 18, 1884, in connection with the palaecystic implements. At the conclusion of his address, he presented the society with a quantity of these hitherto debatable implements, which were plainly productions of the hand of man.

Academy of natural sciences, Philadelphia.

April 22. — Dr. Joseph Leidy directed attention to some fossils, part of a collection recently referred to him by the Smithsonian institution for examination. They consist, for the most part, of remains of large terrestrial mammals, especially related to forms which now live in the intertropical portions of the old world. Obtained in Florida, they are of additional interest as evidences of the existence, in this region, of a formation of tertiary age not previously known. An accompanying letter from Dr. J. C. Neal of Archer, Fla., states that the fossils were discovered in a bed of clay occupying a ridge in the pine-forest. They occurred over an irregular area of a hundred feet long by thirty feet wide, and were dug from variable depths of seven feet to the bed-rock, the character of which is not stated. The fossils, consisting of bones and a few teeth, are mostly in fragments, but exhibit no appearance of being water-worn, or abraded by friction among gravel. The collection embraces the remains of a young mastodon, consisting of bone fragments and detached epiphyses, with a vertebra of a teleost fish embedded in the clay adherent to the under surface of the head of a femur; the remains of several individuals of a species of rhinoceros rather smaller than, although quite as robust as, the Indian form; small fragments of the maxillae of a tapir; the remains of a llama as large as the camel; a calcaneum of a ruminant, not quite so long as that of the Irish elk, but of more robust proportions; the vertebral centrum of a small crocodile; and the remains of several other undetermined animals. The fragments were not sufficiently charac-

teristic to permit of their being placed specifically. The formation represented belongs to the pliocene or later miocene, although its exact position is somewhat uncertain. The tapir had been found in several states; and the mastodon was, of course, widely distributed; but neither the rhinoceros nor the camel-like remains represented in the collection had before been found east of the Mississippi. Professor Heilprin regarded the discovery of importance as lending decided support to Professor Hilgard's views regarding the former distribution of land in the region of the Gulf of Mexico, and the probable connection of Florida with Mexico. Similar fossils had, he believed, been found in the Mexican plains. The bed-rock near Archer, Fla., belongs to the oligocene formation. —— Mr. Joseph Willcox announced that he had again found in Florida, specimens of Nummulites Willcoxi Heil., which had been regarded as of so much interest when collected by him a year ago. The examples now submitted for inspection had been obtained about fifteen miles north-east of the original locality on Cheeshowiska River, and about a hundred and fifty feet above the sea. Professor Heilprin commented on the importance of the discovery of the more elevated region just reported as indicating where the nummulitic formation could actually be seen. The other specimens were collected not more than two feet above tide-water, and were not, therefore, absolutely indicative of the position of the parent rock. From association with the Orbitolites, we can state that the beds belong to the upper oligocene age. The genera Nummulina, Orbitoides, Heterostegina, Quinqueloculina, Triloculina, and perhaps Biloculina, together with Spirorbulina, were represented in the masses of rock received from Mr. Willcox. The remains of fresh-water mollusks were associated with them, specimens of microscopic Paludina having been determined. This association of fresh-water with marine organisms might indicate the former emptying of a river into the sea, or the presence of fresh-water swamps in ancient Florida. The elevation of the locality whence the fossils were obtained need not be regarded as complicating the problem; for it must be remembered that this in no way represents the original height of the formations.

Philosophical society, Washington.

March 29. — Dr. J. S. Billings spoke of the uncertainty of measurements of cranial capacity. The best results, without the division of the skull, are obtained by means of shot, which is poured in, and afterwards measured; but even these are poor. The same observer does not obtain closely approximate results from successive measurements of the same skull, and different observers obtain widely different results. He then exhibited a series of composite photographs of skulls, each photograph being derived from a series of adult male skulls of one race. In the formation of each negative, the plate was exposed successively to from seven to eighteen skulls. —— Prof. G. Brown Goode spoke on fisheries exhibitions, describing especially the international exhibitions at Berlin (1880) and London (1883). —— Mr. M. H. Doolittle began a communication, which was completed at the following meeting.

April 12. — Mr. M. H. Doolittle completed his communication on music and the chemical elements. The mathematical theory of music requires the satisfaction of the equation $2^x = \frac{3}{2}^y$ nearly, in which, for equal temperament, $x =$ the number of equal intervals in the octave, and $y =$ the number of these intervals that correspond to a nearly perfect fifth; and, for untempered music, $x =$ the number of approximately equal intervals in the octave, and $y =$ the number corresponding to a perfect fifth. This equation gives $\frac{x}{y} = \frac{\log \frac{3}{2}}{\log 2}$ nearly, $= \frac{176031}{301030}$ nearly; and, by the method of continued fractions, we obtain the succession of approximations, $\frac{3}{5}$, $\frac{7}{12}$, $\frac{24}{41}$, $\frac{31}{53}$, etc. For scales appropriate to major thirds, but disregarding fifths, we may substitute $\frac{5}{4}$ for $\frac{3}{2}$ in the above equations, and obtain the approximations, $\frac{1}{3}$, $\frac{9}{28}$, $\frac{10}{31}$, etc. For the chord having the vibration ratio 7:4 we may obtain in like manner the approximations, $\frac{4}{5}$, $\frac{31}{26}$, etc. The fraction $\frac{7}{12}$, belonging to the first series, is the base of the chromatic scale, and, less directly, of the diatonic. The fractions $\frac{3}{5}$ and $\frac{4}{7}$, of the first and third series, probably represent all the five-toned scales of primitive music. Pentatonic, chromatic, and diatonic scales have thus a mathematical basis, and are in a proper sense natural. There is reason to believe that simple mathematical principles underlie the phenomena of chemistry, and that the quantitative relations of the elements are expressible in the derivatives of small prime numbers. There is, therefore, no *a priori* absurdity in looking for a correspondence of musical and chemical ratios. If the keys of a piano be arranged with seven consecutive keys in a line, the next seven in the next line, and so on, the columns give successions of musical fifths. It has been shown, that when the chemical elements are arranged in the order of their atomic weights, in lines of seven, the columns contain elements remarkably similar to each other. If the piano-keys be arranged in lines of twelve, the columns give octaves; but nothing is developed from a similar arrangement of the chemical elements. The general conclusion was reached, that there is no deep significance in the coincidence of the number seven in the diatonic scale and in the chemical groups. —— Mr. Henry Farquhar then reviewed the theoretical discussion in Professor Tait's article on mechanics, in the Encyclopaedia Britannica, dissenting from several of his positions.

NOTES AND NEWS.

THE 'circulars' of Johns Hopkins university now appear so frequently, and with such varied and valuable contents, that they may already be looked upon as among the most important contributions to learning in our country. This is the more remarkable as no less than five important serial publications are issued under the auspices of the university, and in large measure are devoted to contributions from its