well as of various accessions and additions to the exhibition series. We note that the 'Warren' mastodon is said by Dr. Dwight to be twelve feet high, but when properly mounted it will be decidedly under ten. In regard to the group of the crested cassique the desirability of treating the bottom of the case as if it were the ground may be questioned. The impression will certainly be given, no matter what the label says, that the nests are close to the ground instead of high above it. It may not look well to leave the bottom of the case bare, but it is better to do this than to give a wrong impression.

SOCIETIES AND ACADEMIES.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

At the 179th meeting, April 11, 1906, Major C. E. Dutton gave an outline of his paper on 'Radioactivity and Volcanoes' in advance of its formal presentation before the National Academy of Sciences.

The Gold Field District, Nevada: Mr. F. L. Ransome.

Drainage of the Taylorsville Region, California, during the Auriferous Gravel Period: Mr. J. S. Diller.

The drainage system of the Taylorsville region, outlined by its deposits of auriferous gravels, includes the broad valley of a river heading south of Haskell Peak and flowing north through the Downieville quadrangle for nearly fifty miles across the fortieth parallel by Mount Jura into a lake or estuarine water body that covered the north end of that portion of the Sierra Nevada. This ancient watercourse is directly across the present drainage, which is west into the North Fork of Feather River.

Though the exact head of the auriferous gravel stream is in doubt, it originated in a distinct mountain range near the source of the Yuba and American Rivers. Its course is clearly marked by numerous gravel deposits well exposed by hydraulic mining. The bulk of the material is gravel with some sand and boulders which indicate, as pointed out by H. W. Turner, a steeper grade for this stream than for those flowing down the west slope of the Sierras.

The delta deposit at the mouth of the stream is nearly a dozen miles in length and breadth. Where thickest it has 400 feet of arkose sand beneath about 600 feet of gravel, and possibly represents the whole of the gravel period. Towards the top are rhyolitic tuffs and andesitic breccias such as cover the earlier gravels of the west slope of the range. Its well-preserved flora is clearly that of the auriferous gravel period.

Since the gravel period that portion of the range has been profoundly faulted and the gravels displaced at several points to the extent of 2,000 feet. The fault along the Honey Lake escarpment runs out into a fold over which the gravel is lithified into solid conglomerate and some of the pebbles are faulted and crushed in a remarkable manner.

A Source of Hydrocarbons in the Ordovician: Mr. David White.

It having been observed that the zinc deposits in southwestern Wisconsin are largely coincident geographically with the distribution of certain carbonaceous or 'oil' shales; the examination of the latter was undertaken to determine, if possible, the origin and mode of occurrence of the hydrocarbons which seemed to have influenced the ore deposition.

The shales, known as Plattville shales, of lower Ordovician (Black River?) age, lie at the base of the Galena limestone, regarded by Ulrich as Trenton. They occur in irregular patches scattered over an area of nearly 2,000 square miles. The oil shales embrace thin black shales and thicker chocolate to buff shales mingled with calcareous sediments and containing occasional marine invertebrate remains. The approximate analysis is reported to show a loss of volatile of 21 per cent. from air-dried material, with an additional loss of about 8 per cent. by incineration. The rock yields a very porous light oil, 1.98 in specific gravity, giving gas bubbles in water. The gas distilled from the oil shale gave Professor Rollin T. Chamberlain: H_2S, 6.79; hydrocarbon vapors, 11.11; CO_2, 18.12; heavy hydrocarbons, 4.00; CO, 8.40; O_2, .26; CH_4, 35.98;

H_2, 13.18; N_2, 2.21; total, 100.05. The shales burn readily with a long yellow flame and slight bituminous odor.

Thin sections of the light chocolate shales show them to contain minute, flattened, generally oval and discoid, translucent bodies of a brilliant lemon-yellow color, and highly refractive, the refringence, as determined by F. E. Wright, being 1.619. These yellow bodies, varying from 8 to 62 microns in horizontal diameter and 5 to 20 microns in vertical, usually thinly lenticular and irregularly rounded at the edges but often nearly oval, are, in vertical section, seen to lie horizontally matted with other sediments, and crystals of later formation, precisely like the matting of forest leaves beneath the winter snow. While varying greatly in size, they accommodate themselves topographically when overlapping or surmounting the coarser rock material, and seem to preserve their individuality even when apparently in contact. They are incredibly numerous, constituting over 90 per cent. of the rock mass in the richest layers.

Under proper microscopical manipulation, the larger of the yellow bodies appear to include a number of horizontally oval figures, characterized by an extremely narrow and usually obscure marginal ring, and a small, roundish, or slightly irregular, denser, and often darker-colored mass near the center. These figures, averaging about eight microns in length and five microns in width, are suspended in the translucent yellow bodies, in which they are similarly compressed horizontally. They are regarded as probably corresponding to the contours of collapsed and flattened unicellular plants, the outer ring representing the cell boundary, the inner, denser portion the residual contents of the cell, whose original gelosic envelope is preserved as the bright, lemon-colored, environing mass. The smallest yellow bodies appear to have contained a single oval, the larger ones, several. The yellow bodies are, therefore, interpreted as the fossil remains of microscopical, unicellular, gelosic algæ, apparently comparable to the living Protococcales. They appear to have been somewhat enriched in bitumen after the cessation of bacterial disintegration, which, in the buff shales, does not seem to have progressed sufficiently to form a noticeable fundamental jelly.

The black oil shale differs from the light chocolate and buff rock chiefly by the deeper color, probably due to greater humification and bituminization of the gelosic bodies, and, more particularly, by the suspension of the latter in a dark brown ground mass or fundamental jelly. The details of the oval figures and the included, denser, small, central masses are much more strongly defined and generally more deeply colored. The slightly smaller size of the yellow bodies in the black shale is regarded as due either to greater shrinkage under the influence of the bitumen, or to more extensive bacterial reduction. The dark brown ground mass appears to consist of a fundamental jelly, largely filled with minute mineral matter and granulose fragmental debris or wreckage due to destructive bacterial action on the gelosic bodies, many of which, like the small fragments of larger forms of associated algæ, are greatly corroded. Many of the gelosic bodies were doubtless completely decomposed. To this bacterial work on the organisms is due, in the judgment of the author, the essential character of the somewhat humified, fundamental jelly itself, to which there has probably been accession of attracted bitumen. The more extended bacterial action seen in the black shales is interpreted as antecedent and causally related to the greater bituminization of the organic matter rather than as merely incidental or accidental.

The oil shales owe their volatile hydrocarbon contents either directly or indirectly to the fossilized gelosic residues of microscopical organisms regarded as algæ, which locally compose over 90 per cent. of the sedimentary material. These pelagic or floating algæ fell in prolonged showers in quiet or protected areas where the water was presumably somewhat charged with tannic or humic solutions conducive to the arrest of anaerobic bacterial decomposition. Possibly the bacterial action was arrested by its own products. The original deposits were doubtless several times as thick as those now remaining, since it is prob-

able that the organic residue represents as little as one twelfth of the original volume.

The Ordovician, like the Carboniferous gelosic algæ, appear to have exercised an attractive or elective influence on bituminous compounds, particularly those of illuminant values, and to have consequently been permanently somewhat enriched. Portions of their hydrocarbon contents have doubtless been lost at various periods, and the great shrinkage of the shale which caused the collapse of the overlying limestone strata probably marked one, perhaps the first, of these periods of hydrocarbon reduction after their original sedimentation. Presumably accelerated loss occurred at all times of rock folding in the region. Such occasions might be favorable for the deeper zinc deposition.

The gelosic bodies found in the Ordovician oil shales of the zinc region not only explain the localization and immediate source of the hydrocarbons which have affected the deposition of the zinc ores in this part of the Mississippi Valley, but they also offer an hypothesis which it is believed will prove satisfactory, though subject to conditional modifications, in explanation of the origin of the oil and gas in rocks of Paleozoic age in other basins. There can be no doubt that similar organisms swarmed in other parts of the same sea or other seas, and that, whether or not they have been recognizably preserved as in the light chocolate shales near Plattville, they have contributed enormously to the hydrocarbon contents of their respective formations.

AT the 180th meeting on April 25, the following papers were read:

A Map and Cross-sections of the Downtown District of Leadville: Mr. S. F. EMMONS.

The Downtown district includes the streets and buildings of the city. Its surface is covered by 200 to 500 feet of glacial material, forming a gently sloping tableland which extends to the Arkansas Valley and must be passed through by mine shafts before they can reach the underlying rock in place. Very large bodies of ore, mainly in oxidized form, have been and are still being discovered in the underlying rocks, and it is to aid in their development that this map is being prepared in advance of the general map of the district.

In the early surveys of the district, made in 1880–81, Mr. Emmons distinguished two divisions in the gravelly material that covers the rock in place: the lower, which is stratified and consists mainly of fine-grained sands and marls, was called 'lake beds,' while the upper division, which consists entirely of unstratified boulders and clay, was called 'wash.' The former beds were assumed to have been deposited in a glacial lake ponded back in the upper Arkansas Valley by the glaciers which issued from the lake fork of the Sawatch Mountains near Twin Lakes during the first glacial period. In the terms of modern physiography, these deposits would be for the most part more properly classed as glacial-fluvial beds, as has been claimed for the whole by glacialists who have recently been studying the Twin Lakes region; but Mr. Emmons still inclines to the belief that a lake covered a part, at least, of the upper Arkansas Valley in which the finer materials, issuing from beneath the earlier glaciers, were deposited. The faulting of these beds, shown in the recent mine workings, proves a certain amount of uplift in the region back of Leadville since the glacial period.

In the original survey it was shown that the slopes of the Mosquito Range, back of Leadville, consist of fault blocks successively uplifted toward the east along north and south striking faults, in which the sedimentary beds lie in shallow synclines, the faults themselves following the steeper limb of the anticline. Recent underground developments have shown that, while the main fault planes were correctly located, their displacement was often distributed on several planes, so that the beds to the west of each fault zone descended not with the even slope of a syncline, but in a series of steps. Depths below the surface of the bottom of the basins, as determined on the syncline theory, were in general correctly given in the successive cross-sections of the original map. In the case of the block represented by the down-town area, however, no shafts had penetrated the covering of glacial

deposits, and, while a shallow syncline in the underlying limestones was assumed to exist in this block as in the others, no facts were available from which the western limit of the synclinal basin could be determined. The finding of ore in this area was primarily dependent upon whether the ore-bearing limestones had been eroded off before the so-called Lake Beds were deposited; in other words, whether the slope of the rock surface beneath these beds is greater than the dip of the limestones.

Mine workings opened in this area during the last ten or fifteen years have disclosed a number of more or less parallel faults by whose displacement the beds have been carried down as though by steeper dips than those observed, thus increasing the horizontal area of possible ore bodies. The vertical range of the beds has also been shown to be much greater than was originally supposed, the ore making at several different horizons, called 'contacts' by the miners. While the possible extent of ore bodies still existing in this western basin is thus shown to be much larger than was originally supposed, no sufficient data from shafts or borings are yet available to accurately determine its western limit, though it is probable that to the southwest of the city there is a considerably wider extent of still uneroded limestone than was represented on the sections of the original map of Leadville.

Mr. Emmons referred briefly to the criticisms that have been made of his original explanation of the genesis of the ores, and showed that, while these criticisms are based on misapprehension of his statements, the explanations offered as alternatives are difficult to bring into accord with the observed facts.

Observations on the Contact Deposits at Copper Mountain, Southeastern Alaska: Mr. CHAS. W. WRIGHT.

Changes in Level at Yakutat Bay, Alaska, due to 1899 Earthquake: Mr. RALPH S. TARR and Mr. LAWRENCE MARTIN. (Presented by Mr. Martin.)

This paper will appear in the current volume of the *Bulletin of the Geological Society of America.*

ARTHUR C. SPENCER,
Secretary.

THE SOCIETY OF GEOHYDROLOGISTS, WASHINGTON.

THE eighth regular meeting of the society was held on April 18, 1906. The following papers were presented:

Plans for Underground Water Investigation in the West in 1906: N. H. DARTON.

Occurrence of Underground Waters in Sanpete and Sevier Valleys, Utah: G. B. RICHARDSON.

Irrigation, depending on surface streams, has been successfully practised in these fertile valleys since the country was first settled, but the supply is insufficient and attention is being turned to developing the underground resources. Sanpete and central Sevier Valleys occupy structural depressions in the plateaus of central Utah. This part of the state is underlain chiefly by strata of Mesozoic and Tertiary age, which lie flat or are only gently inclined, except along lines of upheaval where locally the beds are sharply tilted. The valleys are filled with irregular lenses of gravel, sand and clay, largely, if not entirely, of fluvial origin, which contain abundant underground water. In the lowlands flowing wells are obtained, and over large parts of the valleys pumping plants using electricity developed from the adjacent mountain streams can be operated. Water is also available from bedrock sources. A remarkable series of springs, yielding in all upwards of 95 second feet, occur along faults at the base of the mountains, and in places new flows have resulted from tunneling into the fault planes. There is also the probability of locally obtaining artesian wells from strata that dip towards the lowlands.

THE ninth regular meeting, held on May 2, was devoted to the following discussion:

Treatment of Water Problems in Folios: C. A. FISHER, G. B. RICHARDSON, M. L. FULLER and F. H. NEWELL.

Mr. Fisher presented the results of a review of the folios of the Geological Survey, point-

ing out the general improvement in the treatment of underground water problems which has taken place in the last few years, but calling attention to certain western folios in which the water problems, although of paramount importance, had not been treated, and emphasizing the need of more extended discussions. Mr. Richardson enumerated the more important problems which the investigations should cover, laying stress upon the need of accurate data relating to flow, head and quality of waters in addition to information as to their geologic occurrence. Mr. Fuller discussed the relative economy and thoroughness of the hydrologic studies as conducted by geologists or geohydrologists, advocating the employment of the former if they could give the necessary time. Mr. Newell spoke on the desirability of having the hydrologic work of geologists referred to the division of hydrology for approval in the same way that the geology of hydrologists is referred to the geologic branch.

M. L. Fuller,
Secretary.

BOSTON SOCIETY OF NATURAL HISTORY.

At the annual meeting of the society, May 2, 1906, the following officers were elected:

President—Charles Sedgwick Minot.

Vice-presidents—Charles P. Bowditch, Henry W. Haynes, Edward L. Mark.

Secretary—Glover M. Allen.

Treasurer—Edward T. Bouvé.

Councilors for three years—Charles F. Batchelder, Hubert L. Clark, William M. Davis, W. L. W. Field, N. T. Kidder, William L. Underwood, Arthur W. Weysse, Miss Mary A. Willcox.

The curator, Mr. Charles W. Johnson, in his annual report, called attention to the interest and activity shown in building up the New England collection which is henceforth to be the chief display of the museum. Two large exhibition cases have been installed during the past year and a pair of moose from Maine have been secured for one of these, while the deer and caribou are to be displayed in the other. A list of desiderata of New England birds and mammals has been printed with a view to aiding the society's efforts in making its collection of these groups as nearly complete as possible. A number of additional New England birds has been secured through the gift of Mr. Augustus Hemenway. The collection of New England invertebrates has also been largely augmented during the year, particularly through the efforts of the entomologists of the society. The Emily L. Morton collection of Microlepidoptera, containing 195 species and 755 specimens, largely from the vicinity of Newbury, N. Y., has also been received through Mr. H. H. Newcomb.

Two Walker prizes were awarded in the annual competition for the best memoirs presented on subjects previously announced. The first prize of $100 was awarded to Professor Amadeus W. Grabau, of Columbia University, for his essay on 'The Interpretation of Stratigraphic Series by the Principles of Sedimentary Overlap.' The second prize of $50 was awarded to Professor Douglas W. Johnson, of the Massachusetts Institute of Technology, for his essay on 'Drainage Modifications in the Tallulah District. A Study in River Capture.'

The subjects announced for the Walker Prize competition, 1907, are:

1. The structure and affinities of some fossil plant or group of fossil plants.

2. The development of the gametophytes in any little-known representative of the Coniferales.

3. The anatomy and development of some order or group of the angiosperms.

4. The functions and habits of animals in their relations to environment and to each other.

5. The habits and structure of any species of the Myriapoda.

6. A contribution to a knowledge of the rate of speed at which birds travel.

The paper of the evening was by Mr. George Carroll Curtis on 'Geographic Modeling from the Naturalist's Standpoint.'

Glover M. Allen,
Secretary.

DISCUSSION AND CORRESPONDENCE.

A FEW NOTES ON 'INDIAN MOUNDS' IN TEXAS.

Noting an article written by Mr. P. J. Farnsworth, 'On the Origin of the Small