

periment—as witness the English Sparrow—and if undertaken at all should be done only under that branch of the government service which for many years has been charged by Congress with investigations of the economic status of birds and mammals. While we should gladly see feathers and parts of birds obtained by killing the birds no longer used for ornamental purposes, it is probable that legislation would accomplish nothing. On the whole, the bill appears useless, and the new functions given to the Fish Commission are extremely ill-advised. Such bills should be referred to a committee of the National Academy of Sciences for an opinion.

ELEVENTH ANNUAL MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA, DECEMBER 28TH, 29TH AND 30TH, NEW YORK.

II.

Origin of the Grahamite in Ritchie Co., W. Va.

Va. I. C. WHITE, Morgantown, W. Va.

THIS mineral, resembling coal in physical aspect, and extending, in a vertical fissure two to three feet wide, downward to an unknown depth, was shown to be a residual product derived from the evaporation of petroleum. Its location is near the 'Oil-break' anticline of Andrews, and it probably tapped off oil from the 'Saltwater Sandstone' of the drillers. This sandstone is now the source of productive wells located near the Grahamite vein.

The paper led to the discussion of asphaltic deposits in fissures and to the source of graphite and other hydro-carbons in pegmatite veins. A. P. Coleman cited the anthraxolite of the Sudbury region, an ultra-anthracitic material in fissures. J. S. Diller mentioned the pitch-coal of the Coos Bay lignite mines, Oregon, which cuts the lignite in veins. J. F. Kemp brought up the graphitic pegmatites of the Adirondacks, the presence of small amounts of carbon in

the gabbros and the tarry material in the Branchville, Conn., quartz. M. E. Wadsworth referred to carbon in meteorites.

Structure of the Iola Gas Field, Allen Co., Kansas. EDWARD ORTON, Columbus, O.

Read by I. C. White, in the absence of the author.

NATURAL gas is more widely distributed, geologically and geographically, and exists in larger quantity than any one would have claimed 20 or even 10 years ago. Its productive horizons cover the entire Paleozoic column of the country. Cities supplied, at least partially, with natural gas for fuel and light are no longer uncommon. Two distinct divisions can be made of its accumulations, viz.: That which is stored in *impervious rocks* as shales, most limestones, etc., and that which is found in *porous rocks*. These divisions may be provisionally styled *Shale gas* and *Reservoir gas*, each having characteristics of its own. *Shale gas* occurs in comparatively small wells. Its wells lack uniformity of rock pressure. It does not occupy definite horizons; it exists independently of petroleum in many cases, has *staying* properties, does not depend on the structural arrangement of the strata that contain it. *Reservoir gas* is found in great wells, approaches uniformity of rock pressure in each subdivision of territory, occupies definite horizons, is accompanied by oil, its wells generally come to a sudden end, is entirely controlled by the structure of the rocks in which it is accumulated. Two structural phases of rocks are specially important in this connection, the *anticline* and the *terrace*. The time has come for the acknowledgment of *structure* in reservoir gas fields even in advance of measurements. The Iola gas field is one of great promise. Its source is in a sandstone of the Cherokee shales, or near the bottom of the coal measures. It proves to be a *terrace* of well-marked character. For seven miles the top of the

gas rock has an elevation of 131 feet above tide, rising at no point more than 45 feet above this. At this summit the largest well of the field is located. The relations were shown by a geological cross-section. The importance of the fuel to the local zinc industry was described.

There was no important discussion.

The Conshohocken Plastic Clays. T. C. HOPKINS, State College, Pa.

THE plastic clays near Conshohocken, Pa., form an isolated deposit. The resemblances to the New Jersey and Gay Head clays in colors, texture and structural features suggest clays of the same age. The location and character of the deposits were briefly described. There was no discussion.

A Remarkable Landslip on the Rivière Blanche, Portneuf County, Quebec. GEORGE M. DAWSON, Ottawa, Ont.

IN this paper a brief account was given of the landslip that occurred on May 7th, last. It affected the thick deposit of Leda clay that floors this part of the St. Lawrence plain and serves to indicate that a clay of this character may, under certain circumstances, for a short time, behave almost as a liquid. The paper was illustrated by the lantern and threw light on disturbed glacial or post-glacial deposits elsewhere.

Ripple-Marks and Cross-Bedding. G. K. GILBERT, Washington, D. C.

THE general theory of ripple-marks, as developed by Darwin and others, was outlined and the relation of ripple-mark dimensions to dimensions of water oscillation was set forth. In general the distance between the crests of the ripple-marks is half the height of the wave that causes them. At the surface the particles sharing in the wave describe circles. In depths the circles flatten to ellipses and at last to forward and backward oscillations, which develop the ripple-marks. Giant ripple-marks of Me-

dina sandstones were described, with crests up to 30 feet apart. The physical conditions in which they were developed were inferred, and waves up to 60 feet high were indicated. When ordinary wind waves are complicated by currents, compound and complex cross-bedding is caused by deposition on rippled surface. The tops of the ripple-marks are cut off and deposited on the flanks of the ridges and lead to cross-bedding of variable dip and strike, which in this way differs from the cross-bedding of deltas and currents. The paper was illustrated by the lantern.

Volcanoes of Southeastern Russia. HARRY FIELDING REID, Baltimore, Md.

DURING the Russian excursion of 1897 the author visited the three very high volcanic mountains, Elbruz and Kazbek, in the Caucasus, and Ararat, farther south. This paper gives a brief description of these mountains and was illustrated by lantern views. The physiography of the region traversed, its lake basins and glaciers were all described. Special attention was given to Mt. Ararat. The supposed thawing of its snow fields by the heat developed from oxidizing pyrites was set before the Society and discussion asked, and the question of the abundance of fulgurites on one peak of Ararat and their scarcity elsewhere was proposed to the Society for explanation.

L. V. Pirsson and others dismissed the pyrites as a source of heat on account of its manifest and absurd inefficiency, despite the fact that it had been seriously advanced abroad. Experience in the Sierras led C. D. Walcott to attribute the absence of snow in certain spots to the action of wind. E. O. Hovey spoke of the occurrence of the fulgurites on Little Ararat, and A. Heilprin remarked their independence of the kind of rock and cited the unusually large ones he had met in the desert of Sahara. He also spoke of the similarity of the profile of

Ararat to that of Shasta, and others said the same of Shishaldin.

The Society then adjourned for lunch.

PETROGRAPHIC SECTION.

On reassembling for the afternoon session the Society divided into two sections, in order to finish the program. The petrographic section listened to the following papers:

Differences in Batholithic Granites According to Depth of Erosion. B. K. EMERSON, Amherst, Mass.

THE speaker reviewed the distribution of granitic rocks in Massachusetts, illustrating his remarks with a sketch map of it and of the neighboring States to the south. He commented on the tonalite near Northampton, the Cape Ann area, the Quincy area and the extension of quartz porphyries and felsites to the southwest of the last. He outlined another belt of igneous rocks that passes near Worcester. He then developed the idea regarding the tonalite that it had fused its way upward, involving in itself the overlying schists to such a degree that zones can be traced around the granite proper that mark the various stages of absorption or metamorphism of the schists. From the granite outward there is a fibrolitic zone, then a chistolitic, next an andalusitic and lastly the schists. Given one of these zones, such as the chistolitic at Lancaster, the presence of the granite may be confidently predicted in depth, although not actually visible. The demarcation of the zones is sharp enough to admit of mapping.

The next two papers followed before discussion.

Metamorphosed Basic Dikes in the Manhattan Schists, New York City. J. F. KEMP, New York City.

HORNBLende schists in narrow belts have long been known in the prevailing mica-schists of Manhattan Island. This paper

describes one special occurrence on Morningside Park, between 118th and 119th Streets, near the Columbia University Campus. A small detailed map was shown, together with analyses and petrographic details of the amphibolite and of the mica-schists. The speaker stated that the amphibolite must be referred to an igneous intrusion or to limey bands in the schists. The most reasonable interpretation seemed to him to be the igneous. The rocks were illustrated by projecting thin sections with a polarizing microscopic lantern.

The Granites on the North Shore of Long Island Sound, with some Observations on the Granites of the Atlantic Coast in General. J. F. KEMP, New York City.

THE general character of the crystalline rocks along the sound from New Haven to Narragansett Bay was outlined, and it was shown that they are chiefly granitic gneisses, with pronounced foliation, but with some augen-gneiss and considerable basic hornblende and biotitic schist. The granites at Niantic and Westerly, R. I., and at New London, Millstone Point, Stony Creek and some minor localities in Connecticut were discussed. They were shown to be biotite-granites of several varieties. Although they have nearly or quite the same mineralogy as the prevailing gneiss of the region, their intrusive character was shown by their relations to the wall-rocks and by their peculiar inclusions of the basic hornblende and biotitic schists. The supposed Carboniferous age of the Connecticut granite, as advanced by Pirsson, was mentioned as perhaps indicating a fairly late age for those in the gneissic areas. Slides of the rocks discussed were afterwards thrown on the screen with the polarizing microscope. The remarkable development of pegmatites that everywhere characterize the region was also discussed, both as regards mineralogy and geological relations. They vary from coarse

aggregates of pink microcline, natron-orthoclase, quartz, biotite and ilmenite to practically pure quartz, intermediate varieties being present. The paper concluded with a general review of the granites of the Atlantic sea-board and stated that they are with few exceptions biotite granites. Such analyses as are available were used in illustration.

In discussion of the last three papers M. E. Wadsworth remarked with regard to the amphibolites of the second paper the similar changes in peridotite dikes on Lake Superior and their clear igneous character. In reply J. F. Kemp mentioned the serpentines near New York, which have lately been shown by D. H. Newland to contain recognizable olivine, and which are probably altered basic, igneous rocks. Whitman Cross stated that the Colorado granites with which he was familiar had sharp contacts with the wall rocks and showed no such infusion as described by Professor Emerson. They resembled rather the granites of the Long Island Sound region. M. E. Wadsworth remarked that he had always been able to find evidence of the intrusive nature of massive granites wherever he had searched for it and he controverted the idea that metamorphism was responsible for them. Referring to the supposed post-Carboniferous age of the Conanicut granite J. E. Wolff stated that he and his associates at Cambridge had reached the conclusion that the granite intruded Cambrian and not Carboniferous strata. In reply to the remarks of Whitman Cross, B. K. Emerson again reviewed his interpretation of the Massachusetts phenomena.

Augite-syenite near Loon Lake, N. Y. H. P. CUSHING, Cleveland, O.

AN interesting section exposed in a railroad cut near Loon Lake shows an intrusive rock which has caught up fragments of the Grenville series. The rock is related

to the augite-syenites but the chemical analysis shows some unusual features. A large area of anorthosite mapped in Franklin county, N. Y., the past summer, was found to grade into similar rocks on all sides, and they are, therefore, regarded as variants of the gabbro magma. They present a range from rocks of the acidity of granite to basic gabbros. The analysis quoted was by E. W. Morley and was as follows:

SiO₂ 63.45, TiO₂ 0.07, Al₂O₃ 18.31, Fe₂O₃ 0.42, FeO 3.56, MnO none, CaO 2.93, BaO 0.13, MgO 0.35, K₂O 5.15, Na₂O 5.06. Loss, 0.30. Total, 99.73. The rock is composed of microperthite, quartz, hypersthene, a pyroxene near diallage and a little plagioclase. It was compared with Cape Ann and Norwegian relatives.

In discussion J. F. Kemp remarked the presence of related rocks in the Adirondack region south of Professor Cushing's area and the possibility of others having been pinched into the gneisses and disguised by metamorphism. H. S. Washington emphasized their close parallelism with the Cape Ann varieties described by him. M. E. Wadsworth discussed the passage of Minnesota gabbros into rocks of this type, and N. H. Winchell gave a most interesting review of recent results in the study of the Minnesota gabbros and their relatives. Beginning with anorthosites he showed their passage into gabbros and their occurrence both as inclusions and as segregations in diabases. The gabbros grade into the 'muscovadites' of the Minnesota geologists and the muscovadites into greenstones and perhaps into jaspilite and iron ore. R. A. Daly remarked the presence of the same rocks as those described by Cushing in Mt. Ascutney, Vt., and quoted an analysis that was very much like Cushing's. He outlined the curious change in color that the rock undergoes when quarried. He stated that it also occurs at Cuttingsville in the Killingly Peaks, Vt.

On the Phenocrysts of Intrusive Igneous Rocks.

L. V. PIRSSON, New Haven, Conn.

THE speaker argued for the formation of phenocrysts at or near the places where they are found in rocks, and against the necessity of the generally accepted idea that they are deep-seated and older crystallizations brought up by the magma, *i. e.*, against the necessary 'intratelluric' nature of them. He distinguished the 'single' type which does not occur as a mineral of the ground mass and the 'recurrent' type which does. As incompatible with an intratelluric origin, he advanced the following well-known phenomena: (1) Absence of phenocrysts from contact zones. (2) Absence from dikes and sheets whose parent laccolite is richly provided with them. (3) The throngs of small rod-like crystals that surround phenocrysts and are not flow-phenomena, but due to crowding back, by growth of phenocrysts; further tabular phenocrysts which occur in all orientations in a rock. (4) Phenocrysts of porphyritic granites may or may not be intratelluric, according as we view porphyritic rocks as differing from granitoid in kind or in degree. (5) Micro-structure, both internal as regards inclusions and external as regards surrounding crystals, may be explained by formation near the surface. The arguments for an intratelluric origin, *viz.*: (1) Large size, and (2) flow-arrangement and resorption-phenomena, were discussed. As opposed to the views of the French petrographers, that there are two distinct periods in the crystallization of every igneous rock, and of the Germans, that there are two for the porphyritic and one for the granitoid, Pirsson argued for only one for each, and emphasized the viscosity of the magma as an important factor in conditioning the epoch of crystallization, and the rate of cooling as of great influence on the result. With a long time, *i. e.*, slow cooling, the granitoid texture results; with

a short period, the porphyritic or felsitic. The presence of water-vapor is also important. With a quick fall in temperature the earliest minerals to begin have the best chance to develop; the later ones are hurried or are cut off. Hence, single phenocrysts result. Mass action is also important. The most abundant minerals have a predominant tendency to develop. Too great regularity is not, however, to be expected in Nature. The speaker closed with a statement that he had no hopes of the Section agreeing with him, but he courted discussion. He was mildly thunder-struck to find very general agreement and approval as evinced in remarks by J. P. Iddings and Whitman Cross, although, the hour being late, the paper could not receive the attention that its importance and interest merited.

The last paper of the Section was the following:

The Mica Deposits of the United States. J. A. HOLMES, Chapel Hill, N. C.

THE speaker stated that to-day all the commercial mica produced in the United States is derived from North Carolina. It is universally obtained from pegmatite dikes, in which as a maximum not over 1 or 1½ per cent. of the dike is mica, and about 0.1 per cent. is the rule. About 5 per cent. of this mica or less is merchantable as sheets; the rest, if utilized, is ground. The chief defects are the crushing and warping due to dynamic processes, and the so-called 'ruling' or cleavage which runs across the leaves and is probably due to pressure. The speaker described in particular the mica deposits of New Mexico, where the pegmatites are associated with granites at the base of the Grand Cañon series and are older than the Algonkian. They are damaged by folding and pressure, which, however, largely fail in the Appalachian belt. The hour being late, no discussion followed, and after a vote of thanks to the authori-

ties of Columbia University the section adjourned.

GENERAL SECTION.

In the other section, before which papers bearing on glacial geology and some more general topics were read, the following program was presented. The notes of the section on which the following account is chiefly based were kept by Arthur Hollick, but by a misunderstanding they are less complete than those for the previous papers:

Pre-Cambrian Fossiliferous Formations. CHAS. D. WALCOTT, Washington, D. C.

A DESCRIPTION was given of the pre-Cambrian formations which have yielded traces of life, including the announcement of the discovery of fossils indicating highly organized life in the pre-Cambrian belt terrane of Montana. The fossils occur in a fissile black shale or slate called the Empire shales and are of eurypteroid forms. The paper was illustrated by geological sections and by photographs and specimens of the fossils. It was discussed by J. A. Holmes, H. S. Williams, Bailey Willis and H. M. Ami.

After the reading of the paper opportunity was given for the discussion of the papers presented the day before by W. D. Johnson and H. W. Turner. The discussion was participated in by I. C. Russell, H. F. Reid, G. K. Gilbert and W. D. Johnson.

Ice Sculpture in Western New York. G. K. GILBERT, Washington, D. C.

CAREFUL study of the Niagara escarpment in Niagara county shows that its greater features are pre-glacial, but glacial erosion has wrought important modification. The Medina shale has been so deeply sculptured as to obliterate its pre-glacial relief and substitute a broad fluting in the direction of ice movement. At Thirty Mile Point a mass of strata several hundred feet broad has been moved by the ice. The paper

was illustrated by charts and was discussed H. F. Reid and Robert Bell.

The Wind Deposits of Eastern Minnesota. C. W. HALL and F. W. SARDESON, Minneapolis, Minn.

THE paper treated of the character, origin and age of the lag gravels and dune sands so frequently seen in eastern Minnesota—more particularly in the district between the Mississippi and St. Croix Rivers. These deposits in the vicinity of Minneapolis have been more particularly studied and their relations to some fossiliferous post-glacial water deposits were considered. The paper was illustrated by photographs and was discussed by Arthur Hollick and J. B. Woodworth.

The Iroquois Beach at Toronto and its Fossils. A. P. COLEMAN, Toronto, Canada.

THE Iroquois beach north of Lake Ontario was long ago mapped in outline by Spencer, but many details in this shoreline remain to be filled in. Near Toronto two bays are found, one near Carlton on the west, the other near York on the east. Each has an area of several square miles and is cut off from the main lake by a gravel bar like the present Toronto Island. Horns of caribou are common in the Carlton bar, and teeth of the mammoth have been found in the bar near York. Fresh-water shells of four species—*Campeloma decisa* the most common—are found in beach gravels of Iroquois age near Reservoir Park, Toronto. These are the fresh-water fossils found without doubt in the Iroquois beach deposits. As the main Pleistocene beaches from Agassiz to Iroquois contain fresh-water shells, they must have been formed in lakes and not arms of the sea. The numerous marine shell-bearing deposits of the east of Canada cease before Lake Ontario is reached. The paper was illustrated by diagrams and by fossil shells.

It was discussed by G. K. Gilbert, Robert Bell and J. B. Woodworth.

Thames River Terraces. F. P. GULLIVER, Southboro', Mass.

CUTS have recently been made for a new line of railway on the east bank of the Thames river between New London and Norwich. They expose the structure of many terraces which were regarded as Champlain deposits by the late Professor J. D. Dana, and which were referred to the post-glacial, flooded rivers. The presence of eskers at lower levels has, however, always been a fact difficult of explanation on this hypothesis. The railway cuts expose many delta lobes of fine sand which point down stream and toward the sides of the old valley and rest upon its covering of till. In instances their axes point up side valleys and away from the central axis of the main valley. The fine sand is covered by coarse boulders, such as are found in front of Alaska glaciers. The speaker explained them as due to a retreating glacier which filled the center of the main valley and discharged its waters and sediment laterally as well as longitudinally. This raised the question of possible side-ponds to the glacier, at one or several altitudes and of the corresponding new interpretation of the terraces that would follow as a result of the suggestion.

The Gold-bearing Veins of Bag Bay, Western Ontario. PETER McKELLAR, Fort William, Ont.

THE object of this paper is to show the peculiarities of the gold-bearing veins in the granite area at Bag Bay, Shoal Lake, west of the Lake of the Woods, Ontario. These veins are characterized by the smallness of the quartz fissures compared with the quantity of valuable ore they yield under development. The paper was read by Robert Bell in the absence of the author. At its conclusion the following were read by title:

Stratigraphy of the Pottsville Series in Kentucky.

MARIUS R. CAMPBELL, Washington, D. C.

American Homotaxial Equivalents of the Original Permian. CHARLES R. KEYES, Des Moines, Iowa.

Geology and Physiography of the West Indies.

ROBERT T. HILL, Washington, D. C.

Surface Features of Northern Kentucky. MARIUS R. CAMPBELL, Washington, D. C.

Conditions of Formation of Dykes and Vein Fissures. N. S. SHALER, Cambridge, Mass.

Geology of the Crystalline Rocks of Manhattan Island and Vicinity. FREDERICK J. H. MERRILL, Albany, N. Y.

Origin of the Highland Gorge of the Hudson River. FREDERICK J. H. MERRILL, Albany, N. Y.

The Iowan Drift. SAMUEL CALVIN, Iowa City, Iowa.

Loess Deposits of Montana. N. S. SHALER, Cambridge, Mass.

Spacing of Rivers with Reference to the Hypothesis of Baseleveling. N. S. SHALER, Cambridge, Mass.

Glacial Phenomena of the Yukon Valley. J. B. TYRRELL, Ottawa, Canada.

The section then adjourned, after a vote of thanks to the authorities of Columbia University.

The meeting proved a very successful one, 75 Fellows of the 230 of the Society being present.

The following officers were announced as elected for the ensuing year: President, B. K. Emerson, of Amherst College; First Vice-President, G. M. Dawson, Canadian Geological Survey; Second Vice-President, C. D. Walcott, United States Geological Survey; Secretary, H. L. Fairchild, Rochester University; Treasurer, I. C. White, West Virginia Geological Survey; Editor, J. Stanley Brown, Washington, D. C.; Librarian, H. P. Cushing, Western Reserve University; Councillors, J. S. Diller, J. M. Safford, W.

B. Scott, M. E. Wadsworth, W. S. Davis, J. A. Holmes.

The following nominees were elected Fellows: A. R. Crook, Evanston, Ill.; N. F. Drake, Tientsin, China; A. H. Elftman, Grand Marais, Minn.; M. L. Fuller, Boston, Mass.; A. W. Grabau, Cambridge, Mass.; J. H. Pratt, Chapel Hill, N. C.; F. C. Smith, Deadwood, S. D.; F. B. Van Horn, Cleveland, Ohio; T. G. White, New York; S. W. Williston, Lawrence, Kansas.

J. F. KEMP.

COLUMBIA UNIVERSITY.

WINTER MEETING OF THE ANTHROPOLOGICAL SECTION OF THE AMERICAN ASSOCIATION.

THE third winter meeting of the Anthropological Section of the American Association for the Advancement of Science was held in New York on December 27th and 28th. The sessions, which were three in number, and were immediately followed by the meeting of the American Folk-lore Society, took place in the buildings of Columbia University. The attendance was materially greater than at Ithaca last winter, and in general the meeting was successful and enjoyable. The chairman, Professor Cattell, presided, and Dr. M. H. Saville was Secretary.

Eleven papers were presented, two read in abstract, and several read by title. A commendable feature of the program was its grouping of related papers. Thus the first session was devoted to physical anthropology, the second to archæology and the third was generally ethnological. It was found impracticable to follow this scheme rigidly, but it was observed sufficiently to give the discussions more distinct tendencies and greater coherence.

The first paper read—one of more than ordinary value and interest on account of its dealing with aims and methods rather than material—was by Dr. Franz Boas, and was

entitled 'Some Recent Criticisms of Physical Anthropology.' The first objection considered was the assertion that any classification of mankind by physical anthropology must be valueless because it has been found impossible to identify positively an individual, at least from his skeleton, as belonging to a group. The answer to this criticism was found in the fact that the physical anthropologist studies not individuals, but geographical or social groups. He does not concern himself with assigning individuals to groups, but with marking the differences and relationships of groups as such. That is to say, physical anthropology deals with types, not persons, and the types can be clearly distinguished and classified. Of course, the significance of the type or group depends largely on its stability, and whether there is such stability depends upon the question whether heredity or environment influences anatomical changes to a greater degree, and this question can be finally solved only by an exhaustive statistical study of several generations. Meanwhile, however, heredity would seem to be the more potent, as various evidence instanced appears to show. Hence it is concluded that the types studied by the physical anthropologist are permanent and not fortuitous or meaningless, and, therefore, allow of classification. The rest of the paper was devoted to a consideration of objections to the metrical method. The values of this method, especially in giving information obtainable in no other way, were insisted upon. But the necessity of all measurements made having some biological significance was strenuously urged. Especially useless, even harmful, were sweeping classifications by merely one arbitrarily-chosen measurement, such as those based upon the cephalic index alone.

Dr. Ales Hrdlicka followed with a paper upon the 'Negro Problem.' Dr. Hrdlicka analyzed and refuted the common belief