nature. It is probably the ordinary way in which white-flowered, hairless and spineless varieties and so many analogous novelties are produced in the field and in horticulture. The experimental instances seem quite sufficient and broad enough to establish the principle, but as yet they belong almost to the retrogressive mutations. The claim that progressive changes are also due to sudden mutations still mainly rests on our theoretical conception of the evolution of organic life in general. But, fortunately, some experimental evidence is coming in of late for this point also.

HUGO DE VRIES

LUNTEREN, HOLLAND

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION E—GEOLOGY AND GEOGRAPHY

THE sixty-ninth meeting of Section E (Geology and Geography) of the American Association for the Advancement of Science was held in the auditorium of the new U. S. Bureau of Mines Building in Pittsburgh, Pa., on December 28 and 29. Professor George H. Perkins, vice-president of Section E, presided.

The general program, of which abstracts follow, was so full that each session far overran the usual time limit. Geological workers from the general Pittsburgh region contributed much to the success of the meetings.

The address of the retiring vice-president, Professor Rollin D. Salisbury, of the University of Chicago, upon the subject, "The educational value of geology," was given on the afternoon of December 28, and was printed in SCIENCE, April 5.

On the morning of December 29, a symposium entitled "Mineral resources and chemical industry" was held jointly with Section C. This was essentially a war-time session dealing with the peculiar problems now facing this country as the result of the war, the unusual demand for certain materials and products, and the necessity of relying upon the country's own reserves and industries for various materials formerly imported in large measure from sources not now available. The papers upon mineral resources described in detail the special efforts now being made by the U. S. Geological Survey and the U. S. Bureau of Mines to solve the problem of supplying the country with the necessary fuels, potash salts and metals (such as tungsten, chromium, nickel, cobalt, vanadium, manganese, etc.) which are required for the successful prosecution of the war. The papers on chemical industries portrayed some of the efforts put forth by the chemists in response to certain urgent needs and special situations developed by war conditions.

The Symposium comprised the following papers:

1. Introduction to the discussion of our mineral reserves under war conditions: David White.
2. Coal, coke and tar distillation: S. W. Parr.
3. The bearing of the oil industry on the war: C. H. Beal.
4. Glassware, with special reference to chemical glassware: S. R. Scholes.
5. Potash production in the United States: W. B. Hicks.
6. Research in chemistry and metallurgy as applied to non-ferrous metals: C. H. Fulton.
7. Domestic resources of ferro-alloy ores: D. F. Hewett.

These papers will be published in another number of SCIENCE.

Dr. David White, of the U. S. Geological Survey, was elected vice-president of the association and chairman of Section E for the coming year; Dr. Wallace W. Atwood, of Harvard University, member of the council; Dr. George F. Kunz, of New York, member of the General Committee; Dr. George F. Kay, of the University of Iowa, member of the sectional committee to serve one year in place of Dr. David White, resigned, and Dr. L. C. Glenn, of Vanderbilt University, member of the sectional committee for five years. To represent Section E at the celebration in honor of the one hundred and seventy-fifth anniversary of the birth of Abbé René Just Haüy, to be held at the American Museum of Natural History, New York City, on February 28, 1918, there were appointed by the chairman Dr. E. C. Hovey, Dr. C. P. Berkey and Dr. J. E. Woodman.

The titles and abstracts of the papers of the general program follow:

Glass sands: CHAS. R. FETTKE (will be printed in SCIENCE).

The Saltsburg sandstone as a building stone: S. B. BROWN.

The rapidity with which the Saltsburg sandstone gained favor may be seen from the number of important structures in which it has been used during the last six years. A few of these are the following: The Cabin John bridge at Washington City, some interior work in the Grand Central Railroad Station, New York City, the Russell Sage Memorial Building, the synod house of the Cathedral of St. John the Divine, the interior finishing of the Jersey City postoffice. It has been used also in the new postoffices at Morgantown, Grafton and Sistersville, and in the Presbyterian Church at Fairmont, West Virginia. It has been used in the United States Aluminum Clubhouse at New Kensington, Pennsylvania; in the W. W. Willock residence at Sewickley, the Inslie Blair residence at Tuxedo, and in the finely finished Stewart Duncan residence at Newport, Rhode Island. This last has been described as one of the masterpieces of American architecture. A still more artistic use to which it has been put is in the case of the elaborate mantels at the New Kensington Clubhouse and also the mantel in the Mulligan residence in Pittsburgh. The artistic carving and the statues on the Schwab estate, and the buffaloes and the Indian heads on the Cabin John bridge show some of the finer uses to which it lends itself. This would indicate that a new building stone of singular beauty has caught the favor of the public for refined uses, and its future popularity may be predicted with some degree of confidence. Its strength is sufficient for any purpose to which it is likely to be put, tests showing a crushing strength of 9,000 to 11,000 pounds to the square inch having been made. Its chemical composition runs thus: Silica, 96.50 per cent.; ferric iron, 1.76 per cent.; alumina, .86 per cent.; lime, .35 per cent.; magnesia, .02 per cent. It would therefore be graded as a sandstone of moderate purity with its iron cement very evenly distributed through it. Professor Stevenson probably never saw the localities of its best development, but the success of this stone forty years after reminds us of his statement, in which he calls it "a magnificent rock, in layers ten to fifteen feet thick, most of which are of excellent quality and would prove a durable building stone." Although he could hardly have foreseen the finer uses to which the Saltsburg sandstone has been put, nevertheless Professor Stevenson was a true prophet, as every geologist must be who writes only the truth.

The compilation of coals: Reinhardt Thiessen.

A complete and correct explanation of the meaning of the bright or glanz and dull coal, and an interpretation of the lamination of coal in general has never been given. In spite of many theories and attempts at explanations the matter is still in a state of confusion. Extensive studies have shown that the bright or glanz coal consists invariably of components derived from matter that at one time were larger fragments or parts of woody parts of plants, such as parts of logs, stems, branches and roots. These correspond in every respect to the parts of logs, branches and roots in peat. The dull coal represents a general débris of plant substances, and consists primarily of components derived from fragmentary parts, or chips of the woody parts of plants, and fragmentary matter derived from various other parts and organs of plants, embedded in or cemented together by an attritus, together forming the embedding medium of the larger components or bright coal. The attritus consists of what at one time was very finely macerated plant matter and corresponds in every respect to the fine "mud" in peat. The components derived from the fragmentary woody parts of plants are generally very thin and scale-like and owe their peculiar shape and form to a mode of disintegration through lesions along the annual growth rings, and along the rays, caused by a differential decay during the peat stage. This phenomenon finds an exact counterpart in recent peat.

The travertine deposits of the Arbuckle Mountains, Oklahoma, with reference to the plant agencies concerned in their formation: W. H. Emig.

At the present time there is a continuous development of travertine on the numerous falls along two parallel streams in the Arbuckle Mountains, namely Honey Creek and Falls Creek. The development of the travertine falls is due in part to the presence of felt-like masses of algæ—species of *Œdogonium* and *Vaucheria*, also *Oscillatoria* and *Lyngbya*—and in part to the presence of aggregated tufts of the water mosses, *Philonotis calcares* and *Didymodon tophaceus.* The various types of travertine, formed as a result of the continuous growth of certain plants in the calcareous water, are quite characteristic. The similarity in the microscopic structure of recent and older deposits of travertine is very striking. A comparison of the newly formed deposits with the oldest travertine of the Arbuckle Region indicates that the same plant agencies were concerned in the construction of all the travertine formations in Oklahoma.

The Kanawha black flint and other cherts of West Virginia: W. Armstrong Price.

Ten Paleozoic formations contain deposits of chert (or flint). The cherts are found in silicious and magnesian members of limestones and calcareous shales. Limestone-bearing formations apparently barren in chert are: the Silurian formations, and limestones in the upper portion of the Pennsylvanian. The Greenbrier limestone is notably poor in flint. The Kanawha Black Flint occurs in two lithologic phrases—a high-silica, low-alumina, compact phase, and a phase slightly lower in silica and higher in alumina which has a "slaty" structure. Fossils of species which possess lime shells have been leached out before the deposition of the silica. Replacement of calcium carbonate has played an unimportant rôle in the formation of the flint. Depositions of silica by descending surface waters in the pores of a carbonaceous and highly silicious rock has resulted in the formation of a dull, black, compact chert or flint. Absence of original silicious ooze is inferred but not proven. Tilting of the strata has enabled solutions to migrate along the dip, increasing silification. The black flints of the Pennsylvanian were used by the Indians in the manufacture of arrow heads and implements. They have been scattered over many counties beyond the flint outcrop. Flint from limestone formations often contains sufficient lime to form a compact surface when used in road building. Chert beds in limestone valleys form ridges upon which apples and berries grow especially well.

The determination of the stratigraphic position of coal seams by means of their spore-exines: REINHARDT THIESSEN.

There has thus far been found no index by means of which coal from different mines or from different bore holes may be correlated, or by means of which the position of a seam may be determined. The spore-exines in coal promise to furnish such an index. The coal from every seam, thus far examined, contains one or more types of exines that are characteristic or predominant or both of each bed, by means of which the coal may readily be identified and the position of its bed be determined. Spore-exines are very prominent in coal, are easily recognized and have retained all their original characters by means of which each type may easily be defined. The coal of the Pittsburgh seam contains at least one type of exine that is both predominant and characteristic of that seam. Similarly the coals from Sipsey, Alabama, Black Creek bed; Carbon Hill, Alabama, Jugger bed; Shelbyville, Ill., bed No. 2, and from Buxton, Ia. Each contains at least one type that is both the predominant and the characteristic exine. Some of these have, besides these, at least one other type that is characteristic of the seam, although not the predominant one. Bed No. 6, of Illinois, contains at least one type that is characteristic of that bed, and probably more.

The Holmesville, Ohio, glacial terrace and moraine: G. G. COLE.

The village is situated on a large terrace surrounded on all sides by low ground, with a swamp separating it from the recessional moraine half a mile south. The terrace is very steep on the north and while quite flat slopes gradually to the south. Well-washed coarse gravel is found on the northwest higher corner, the southern being fine material and sand. A peculiar arrangement occurs in the terrace: gravel of 74 per cent. local origin at the top, a belt of large boulders at a mean depth of 8 feet, mostly granitic, with fine gravel and sand beneath. This indicates a complicated origin for the terrace. The moraine is a recessional one, located five miles back from the terminal moraine at Millersburg, Ohio. It is of great size and likely to be overlooked as a glacial feature on that account. It is crescent-shaped with concave side toward the Holmesville terrace, having its two horns west and northeast of the terrace a mile apart. Numerous kettles with a kettle pond are found on its surface and border. These have been well preserved by virgin forests recently removed. Drift material 31 per cent. foreign, some Corniferous limestone from Lake Erie region being found. The terrace structure is accounted for by supposing an impounded lake between the moraine and a stage of ice recession to present site of north edge of terrace. The lower layers of terrace derived from the sediment of this lake; the boulder bed from the melting of the receding ice. The subsequent drainage of the lake around the western horn of moraine, caused the débris to collect in front of the face of ice and increased by material brought out from an interglacial tunnel at northwest corner of terrace, involving an outwash plain distributed as upper surface of the terrace. Steep sides caused by a rapid abandonment of the valley north of the terrace.

Diverse ancestry of great basin lakes: CHARLES KEYES.

Explanation of the former existence of desert lakes of great size in western America on the basis of once greater regional humidity becomes notably inadequate when it is realized that hardly any two of these vast sheets of water have had the same origin. Recent quantitative measurement of neighboring glaciation renders this agency a singularly inconsequential factor. All things considered it is inferred that the rise and decline of these great lacustral anomalies of the western arid country are not necessary consequences of changing climate, but that they, with all their attendant phenomena, are readily accounted for without recourse to meteoric agencies other than those in active operation in the region at the present time. The genesis of these desert lakes is as varied as that of lakes in the garden spots of earth.

Some economic mineral deposits of east Tennessee: C. H. GORDON.

Superficial dip of marine limestone strata: KIRTLEY F. MATHER.

Petroleum geologists have long recognized the necessity of distinguishing between the inclination of beds due to purely surficial causes and that resulting from crustal deformation. The latter only is indicative of the underlying structure. Limestones may depart from horizontality as a result of groundwater action assisted by gravity. The apparent dip thus caused may extend uninterruptedly for considerable distances along hillsides and may closely simulate folded structures. Examples will be cited from the Ordovician limestones of Ontario and from the Mississippian limestones of Kentucky. The dip of limestone beds, as of all sedimentary formations, conforms originally to the slope of the floor upon which the bed is deposited. This floor may be quite irregular, as in the case of the pre-Cambrian complex upon which rest the Ordovician limestones of eastern Ontario. Quaquaversal structures in certain limestones near Kingston, Ontario, are due to deposition of those essentially clastic limestones upon the flanks of granite or gneiss hills rather than to tectonic disturbances. Submarine erosion contemporaneous with the accumulation of clastic limestones may repeatedly roughen the sea-floor and result in the development of cross bedding on a large scale. As illustrated by Mississippian limestones in Allen county, Kentucky, original dips as great as 12° have thus been caused. Their correct interpretation may be deduced only when the exposures are unusually extensive and perfect.

On the mechanics of the great overthrusts: ROLLIN T. CHAMBERLIN.

In the literature of structural geology it is commonly stated that thrust faulting under compressive stress tends to take place along planes which are inclined approximately 45° to the direction of the applied force. With qualifications, this is true of the ordinary reverse fault. But field studies in the last few years have brought to the attention of geologists impressive evidence of the wide prevalence of a distinctly different type of fault, namely the great low-angle overthrust. Its distinguishing characteristics are the very low inclination of the fault plane and the extraordinary horizontal displacement often attained. The astonishing amount of horizontal displacement is possible because of the low inclination of the plane of slippage which shows no tendency to obey the law of 45° fracture. The low angle of the fault plane seems to afford the key to the problem of the overthrust. An analysis based upon the principles of mechanics, aided by experimental studies with plaster, paraffine, clay and sand in various combinations, seems to indicate that the fault plane in the great overthrusts breaks horizontally, instead of at 45°, because of the operation of a number of factors, chief of which are: (1) The normal or direct component of the stress which acts as a frictional resistance to shearing by the tangential component of the stress. With a lowering of the angle of fracture from 45°, the intensity of this frictional resistance is diminished more rapidly than is the intensity of the tangential, or shearing stress. This makes fracturing easier at angles somewhat less than 45°, though the fault plane remains still far from horizontal. (2) Rotational strain, developed from compressive stress (*a*) in heterogeneous material by bedding, or similar structures, which present just the right differences in competency; (*b*) in homogeneous material by (1) any increase in the intensity of the tangential stress in the upper portion of the mass undergoing thrusting with respect to that in the lower portion; (2) by any factors which will lessen the resistance of the surficial portion while the deeper portion remains less affected, and (3) by any factors which will increase the resistance of the deeper portion subject to thrusting, while the upper portion remains freer to yield. Rotational strain is competent to cause fracturing at any angle between 45° and 0°, depending upon the strength of the rotational element. (3) Piling up of material in the first stages of deformation, thus increasing the gravitative or vertically acting force. Acting in conjunction with the horizontal thrusting force, this may cause a lowering of the angle of fracture. (4) Possible minor factors, as heterogeneous material, relatively great length of deformed mass (after analogy of long column), shape, etc. To these factors, operating singly or in various combinations according to the special requirements of each particular case, are attributed the peculiarities of the great overthrusts.

ROLLIN T. CHAMBERLIN,
Secretary

(*To be concluded*)