and Pleistocene strata are described, with especial reference to underground and surface waters, soils and mineral resources. Cretaceous coal, also gypsum, petroleum, fuller's earth in Tertiary strata, and other economic products are noted.

A report on the High Plains and their utilisation is contributed by Mr. W. D. Johnson. This region lies on the borders of Colorado, Kansas, New Mexico and Texas, and it corresponds approximately to what is sometimes called the Central Plains region. In the broad sense, it is a plain; in reality, it is a surface of degradation with topographic diversity. There is practically no drainage, the local precipitation being absorbed. The question of utilisation must depend on wells. The author deals fully with the origin and capabilities of the area, but his report has been left incomplete.

PART V.—*Forest Reserves.*

This volume, with accompanying atlas, deals exhaustively with timber regions.

PART VII.—*Texas.*

This contains an account of the geography and geology of the Black and Grand Prairies, Texas, with detailed descriptions of the Cretaceous formations and special reference to artesian waters, by Mr. R. T. Hill.

Pre-Cambrian schists, granites and crystalline limestones, and a series of Palæozoic and Permo-Triassic rocks form the floor of this region, and above are Cretaceous formations which are by far the most important in area and economic value. Their texture and stratigraphic arrangement conduce to the transmission or retention of underground waters in extensive and prolific artesian well-systems. They yield the most valuable soil, building material, cement, and some oil-fields. These Cretaceous strata are therefore described in considerable detail, and numerous plates of fossils are given. Various superficial deposits are likewise described.

We have received several series of *Bulletins* of the United States Geological Survey.

Series A. *Economic Geology.*—No. 180 is on the occurrence and distribution of corundum, by Mr. J. H. Pratt. The localities for corundum in the United States, with the exception of those in Montana, Colorado and California, are limited to the Appalachian region, and the mining has been confined to Georgia and North Carolina, and to the emery mines at Chester, Mass. The author includes, not only the ordinary translucent to opaque varieties of corundum, but also the sapphires and emery, which is a mechanical admixture of corundum, magnetite and hæmatite. He deals very fully with the uses and distribution of the minerals.

No. 182 is a report on the economic geology of the Silverton Quadrangle, Colorado, by Mr. F. L. Ransome. Gold, silver, copper and lead have been obtained, and it is probable that zinc ores may be worked. Fissures carrying variable amounts of ore occur in all the rocks of the area, from the Algonkian schists to the later monzonitic intrusions that cut the Tertiary volcanic series. By far the greater number are found in the volcanic rocks of the San Juan series (andesitic breccias) and of the Silverton series (massive andesite, rhyolitic and other breccias), both of Tertiary age. Detailed descriptions of the mines and of special areas are given, and the origin of the lodes is discussed.

No. 184, on the oil and gas fields of the Western Interior and Northern Texas Coal-measures, and of the Upper Cretaceous and Tertiary of the Western Gulf Coast, is by Mr. G. I. Adams. The shales of the Coal-measures are very bituminous and give evidence of the presence of organic matter in great abundance at the time of their deposition. The burying of this material and its subsequent decomposition gave rise to the oil and gas. The reservoirs are usually sandstones which vary in porosity, while the shales serve to seal in the oil and gas. The oil which occurs in the Cretaceous and Tertiary strata is associated with sulphur, gypsum and rock salt. Mendeléeff's theory, that petroleum is formed by the action of heated water on carbide of iron, is briefly discussed. Particulars are given of the production of oil and gas in different localities.

No. 193, geological relations and distribution of platinum and associated metals, by Mr. J. F. Kemp. This gives a general account of these metals, and of their mode of occurrence and distribution. It is concluded that platinum is very sparsely distributed in its mother rock. It has been mostly derived from peridotites, and the chances of finding it in quantities sufficient to mine are small.

No. 178 (not included in the economic series) deals with the El Paso tin deposits in Texas. The ores comprise abundant cassiterite and wolframite in a quartz gangue, and the veins exhibit characters similar to those of Cornwall.

Series E. *Chemistry and Physics.*—No. 186, on pyrite and marcasite, by Mr. H. N. Stokes. The author points out that much uncertainty exists in distinguishing these minerals by the usual methods. Specimens crystallising in the regular system are true pyrite, while those forming rhombic crystals are marcasite.

Series F. *Geography.*—Comprises Nos. 181, 185 and 194, which deal with the results of primary triangulation, of spirit levelling and observations on the north-west boundary of Texas. Nos. 183, 187, 190 and 192 are gazetteers of Porto Rico, Alaska, Texas and Cuba.

Series G. *Miscellaneous.*—Comprises No. 188, bibliography of North American geology, &c., for 1892–1900, inclusive, and No. 189, index to the same. These will prove of great value for reference. With them we may include No. 179, a bibliography and catalogue of the fossil vertebrata of North America, and No. 177, catalogue and index of the publications of the United States Geological Survey, 1880-1901.

Monograph vol. xli. of the United States Geological Survey (1902) contains an essay on the Glacial formations and drainage features of the Erie and Ohio basins, by Mr. Frank Leverett. He describes in some detail the drift deposits which extend over a large area southwards from those lake-basins to the vicinity of the Allegheny and Ohio rivers. The soils, peat-beds and weathered zones which mark intermediate stages in the glaciation; the lakes which were formed in front of the retreating ice; and, generally, the past and present systems of drainage are discussed and explained.

A separate volume on the mineral resources of the United States for the year 1900, by Mr. David T. Day, is the seventeenth annual report on this subject issued by the United States Geological Survey. It shows a continuation of the remarkable activity in the mineral industries of the country. While coal and iron are the most important products, copper, lead, gold and manganese ores show an increase, as do petroleum, natural gas, stone, clays and other materials. The production of quicksilver, antimony and nickel, of phosphate rock, bauxite and fuller's earth has decreased.

We have, further, received the fourth volume issued by the Maryland Geological Survey, a work, as usual, sumptuously printed and illustrated. Mr. Bailey Willis contributes an essay on the history of Maryland during Palæozoic time. He gives an account of the growth and wasting of several mountain systems, the expansion of great plains and their submergence, and of the folding and dislocation of the strata. He concludes with a brief account of the influence of the older history on the later geological changes.

Other portions of this volume deal with the economic geology, the highways and tests of road-materials, and there is an important report on the clays of Maryland, by Mr. Heinrich Ries, the leading clay expert in the country. He discusses the properties of clay, chemical and physical, and shows how their bad qualities can be offset by the addition of proper ingredients. There is also a full account of the principal clay deposits of the State. A great variety of clays is found, but at present no fuller's earth. The essay may be profitably studied by all interested in clay-deposits.

ANTHROPOLOGY: ITS POSITION AND NEEDS.[1]

THE practical difficulty of drawing a dividing line between the legitimate scope of anthropology and that of other studies is so great that we are often told there is no science of anthropology. This absence of definiteness adds a charm to the subject and is fertile in the production of new ideas, for it is at the fringe of a science that originality has its greatest scope. It is only by a synthesis of the various studies which are grouped together under the term anthropology that one can hope to gain a clear conception of what man is and what he has done. After giving

[1] Abstract of an address to the Anthropological Institute by the retiring president, Dr. A. C. Haddon, F.R.S., January 26.

a brief classification of the subjects included under the general term of anthropology, Dr. Haddon said his reason for touching on the subject at all was to suggest a general survey in the hope that fellow-students may carefully consider the lines upon which future research may be undertaken with profit, as there are times and occasions when one branch of inquiry is more immediately desirable than another. A few remarks were made on certain aspects of anthropological research, and various lines for future investigation were indicated.

A claim was made that the ethnological material now being collected from all over the earth is an indispensable contribution to the science of history. It is a truism that history repeats itself, and historians were invited to consult the modern instances that are accumulating, as they will find many suggestions that will serve to throw light upon past events, which otherwise might remain obscure. It is hardly an exaggeration to say that new life has been given to classical studies by the introduction into the universities of original archæological investigations, comparative archæology, ethnology and folklore. Allusion was made to the recent signs of an interest in ethnological inquiry by various Governments of the British Empire. "Is it too much to hope," it was asked, "that at last it is being recognised that a full knowledge of local conditions and a sympathetic treatment of native prejudices would materially lighten the burden of government by preventing many misunderstandings, and by securing greater efficiency would make for economy? . . . We have not yet exhausted other methods of advancing anthropology, we have scarcely yet endeavoured to educate the masses or to interest individuals who have time or money at their disposal. Few people have any idea of the great wealth of human interest there is buried in the data in the journals of our societies, or locked up in the cases and drawers of our museums. It is this practically unexploited wealth of interest and information that we should endeavour to disseminate. The apathy of the public to our science probably is largely due to its students. . . . I have indicated some of the lines upon which our Cinderella science is advancing, but before I finally vacate the honourable position to which you have called me, I must return once again to its most pressing need.

"Students at home spend laborious hours in reading, transcribing or collating the records of travellers, and in endeavouring to make them yield their secrets. The safety of the student usually depends upon the bulk of his material, but when one considers the sources of his information, one is sometimes appalled at the dangers he runs. The data that are available have been collected in varied circumstances by men of every degree of fitness and reliability. There are but two remedies for this state of affairs—trained observers and fresh investigations in the field. Fortunately, we are now in a position to say that means do exist for the training of field-anthropologists. Those who have had practical experience in Oceania, or who followed the literature of that region, will fully acknowledge the urgent need there is for immediate field-work. But the same pressing necessity is manifest in every quarter. Nor is it a call that we can neglect with impunity and postpone until a more convenient season. Each year sees a decrease in the lore we might have garnered, and this diminution of opportunity is taking place with accelerating speed. Oh! if we could only agree to postpone all work which can wait, and spend the whole of our energies in a comprehensive and organised campaign to save for posterity that information which we alone can collect."

ELECTRICITY AND MATTER.[1]

THE subject I have chosen is an enormous one, but it is one of exceptional interest at the present time. It is one of general interest as well as of scientific interest to students of physics. The fundamental properties of matter are now coming to be understood in a way in which they have never been understood before. What are these fundamental properties? One is cohesion, another is gravitation, and another is inertia. Concerning gravitation, we remain pretty much in the dark. It is an empirical fact that a body has weight, that two lumps of matter attract one another, with an extremely small force when we are dealing with ordinary pieces of matter, but extremely large when we are dealing with astronomical masses, such as planets or suns; but the cause of that gravitative attraction is not known, and at present appears to have little chance of becoming known. Cohesion ten years ago was in the same predicament, but cohesion now seems to be on the eve of yielding up its secret. The most striking fundamental property of matter, however, that we are beginning to understand in some degree, is that of inertia. Inertia is a popular term, but it is not always clearly understood what is meant by it. Let me explain the meaning. It may be defined as the power of overshooting the mark, or the power of moving against force. It is by inertia that a rifle bullet travels after it has left the gun. In the barrel it is urged by force; in the air the bullet goes on against an opposing force of friction because of its inertia—often in that case called the momentum. It is by reason of inertia that water runs uphill; we are sometimes told that water will not flow uphill, but that is a mistake. Heat will not flow uphill—heat will only flow from hot to cold; you cannot give it impetus and let it rush up of its own momentum, for heat has no momentum; it is not a substance, it only goes when it is pushed, and the instant you remove the force it stops. That is the case with heat, but that is not the case with any form of matter—it is not the case with anything possessing inertia. The water from a fountain rises because of the initial velocity imparted to it; for the same reason a cricket ball rises when it is thrown up; the propelling force has ceased, but the motion continues. It is the same with tides; for three hours the water is running uphill, for three hours it is running downhill. The head of the inflowing water is for three hours higher than the water behind it—the first three hours of the flow impart to the water its momentum, and the last three hours destroy that momentum gradually. The swinging pendulum is another illustration. [Having illustrated this point by a liquid in a horseshoe tube, showing the return to the position of equilibrium after a series of oscillations, the lecturer continued.] Oscillations like that are known to occur in electricity when a Leyden jar is discharged; the electricity does not go simply from the more highly charged to the less highly charged and there stop, but it goes beyond, it overshoots the mark and charges up that which was negative to positive, and then backwards and forwards, very like the oscillations in the tube. Hence it would appear as if electricity had a property resembling inertia. When I lectured here a quarter of a century ago I should have said that electricity had a property *resembling* inertia—I should have called it a mechanical analogue—an apparent inertia, simulating by inductive electromotive force the real inertia of matter. I should now go further than that, and should say that electricity has real inertia, just as real as matter: I should even go still further, and should say that in all probability there is no inertia but electric inertia; that the inertia of matter itself is to be explained electrically. In other words, what we are now arriving at gradually is *an electric theory of matter*. We are endeavouring to explain the properties of matter in terms and by means of what we know concerning electricity.

Although it may sound paradoxical to people who have not studied physics, we know more about electricity than we do about matter. Its properties have been more clearly investigated and more clearly understood than the inertia of matter, which is not understood at all. We only know its behaviour:—If a body is subject to a positive force it gradually increases its speed; if it is subject to an obstructive force it does not move in the direction of that force necessarily at once, but its motion begins to decrease, gradually stopping, and ultimately reverses its direction, if the force is continuous and if it is an active force. Many obstructive forces are only able to oppose motion like friction. In the text-books a bad example of a body obeying the first law of motion is given in the throwing of a stone upon ice, or some smooth surface. That is a bad example, because a single obstructive force acts all the time. The best example to give of the first law of motion is a case

[1] A lecture delivered at Bedford College for Women, on February 5, by Sir Oliver Lodge, F.R.S. Reported from shorthand notes.