characters, without destroying them or forcing their removal by the introduction of strange or exotic forms."

The second volume of the Monographs (No. xviii.) describes the Gastropoda and Cephalopoda of the New Jersey Marls and accompanying beds; the Lamellibranchiata and Brachiopoda having been already the subject of a memoir (No. ix.). These deposits are generally glauconitic; the fossils are casts, often ill-preserved, so that the determination of them has been not seldom attended by great difficulties; they bear a superficial resemblance to those from the Cambridge Greensand of England, and the rock contains a certain proportion of phosphate of lime, though these casts do not appear to be, strictly speaking, phosphatised. The Marls, as is well known, are mostly Cretaceous in age, no part representing the Neocomian, but the uppermost beds are referred to the Eocene. Beneath the last are indications of a very slight break: so that systems which in our own country and the adjacent parts of Europe are separated by a wide gap, in this region are practically continuous. The beds—which may possibly be Neocomian—beneath the Marls, called the Raritan clays, are brackish or even fresh water in origin; the Marls themselves are marine, but shallow water deposits. The Cretaceous members contain the usual cephalopods, which come chiefly from the lower Marls, as indeed do most of the other fossils. Among these are seven species of Ammonites, four of Scaphites, and three of Baculites; Turrilites, Heteroceras, Ptychoceras, and Belemnitella are each represented by one species. None, however, appear to be individually common, and most are rare. The Eocene contains one Nautilus and one Aturia. The Gastropoda are fairly numerous, 136 in the Cretaceous and 52 in the Eocene. As the former volume showed, the Lamellibranchiata are more strongly represented in the Cretaceous than in the Eocene, and in the former deposit dominate over the Gastropoda; the Brachiopoda are in neither numerous. The illustrations in this volume exceed fifty plates.

The eleventh annual report is in two parts. The first, after the usual official matter, contains two lengthy memoirs; the first, almost a volume in itself, by Mr. W. J. McGee, entitled the "Pleistocene History of North-Eastern Iowa," the second, by Mr. A. J. Phinney, on the "Natural Gas Field of Indiana," with an introduction by the former author. In the "Pleistocene History" Mr. McGee gives a very full and interesting account of the drifts of a large area of Iowa, with maps illustrative of the conclusions which he considers them to justify. The region appears to have been twice invaded by ice, the earlier glaciation being "the longer and the more energetic." Glacial striæ, however, are very rarely found, in consequence, probably, of the incoherence of the rock masses to this region. As memorials of these invasions of the ice-sheet, an upper and lower till can generally be distinguished; and the latter sometimes shows crumplings, interpreted as memorials of the pressure of the second ice-sheet; between these tills a kind of "forest-bed" is frequently to be found. By each advance of the ice-sheet, rivers were dammed and great lakes formed on its margin, in the waters of which materials were deposited from the ice and from other sources, much of this being a stiff clay, locally named "gumbo." During the first invasion the land sank; perhaps sufficiently to allow of an invasion of the sea. A similar but less extensive subsidence took place in consequence of the second invasion. These depressions aided in the formation of the lakes. A summary this, necessarily very imperfect, but it may suffice to indicate the general conclusions at which the author has arrived.

The second memoir contains a vast amount of information concerning the natural gas and oil wells of Indiana, and is prefaced by a general sketch of the distribution of bituminous deposits. The commercially valuable bitumens occur (not in America only) in the Lower Silurian rocks, and continue to comparatively recent times, but the most important are found in the Silurian and Devonian systems, and in the Tertiary series. In the first the products are chiefly gas; in the second both are found, petroleum probably predominating; while in the third nearly all the known forms occur.

The second part of the report deals exclusively with irrigation. Maps and details of the arid region of the United States are given, from which it appears that this extends from their northern frontier to the 32nd parallel of latitude, and from the eastern slopes of the Sierra Nevada approximately to the 100th parallel of longitude, thus including the great Inland Basin and the Rocky Mountains. On the ranges, however, there is a considerable amount of precipitation. As stated by Major Powell, in evidence before a Committee of Congress, the rainfall on the mountains may vary from 25 to 60 inches per annum, while in the valleys below it is generally less than 15, and sometimes even as small as 3 inches.

These publications, as this imperfect sketch may indicate, are full of varied and valuable information, and are richly illustrated with maps, plates, and woodcuts. If we might venture on a general criticism, it would be that the authors not seldom exhibit a tendency to "spread themselves" too much, to be over-diffuse in style, and to enter upon general disquisitions, which, however interesting, are a little out of place in official publications. Space also seems occasionally to be wasted in giving information which would be more appropriate in a text-book of geology. As the volumes are primarily designed for the people of the United States, the authors may be presumed to know best the desires of their own public, but this redundancy is sometimes a little wearisome to outsiders. Possibly the recent reduction of the vote for the support of the Survey, which we trust will not be permanent, may be intended as an expression of this feeling. Very probably some economies might be effected, but it will be an ill-day for this branch of science if the work of the Geological Survey of the United States is seriously cramped.

T. G. BONNEY.

MEASUREMENTS OF LOW VAPOUR PRESSURES.

THE two well-known methods of measuring vapour pressures are the statical and the dynamical. In the former the pressure exerted by a vapour is measured when the substance is kept at a given temperature, while in the latter the temperature is ascertained at which the liquid boils when under a given pressure. The present volume is mainly concerned with the description of, and the results obtained by, a dynamical method of estimating very low pressures for mixed as well as for pure substances; the pressure range extending, in general, from about zero to a maximum which is below 70 mm.

Before proceeding to the description of this method, the author seeks to clear away certain discrepancies which have been recorded regarding the results of vapour pressure observations as given by the statical and dynamical methods. Dynamical observations on the fatty acids, published by himself in 1885, differed considerably at low pressures from those obtained by Landolt in 1868 from statical measurements. From the fact that the differences varied regularly with the chemical nature of the acids, it appeared possible that at very low pressures the two methods led to different results. A historical summary of work on this subject is

[1] "Studien über Dampfspannkraftsmessungen." In Gemeinschaft mit Paul Schrœter und andern Mitarbeitern von Georg W. A. Kahlbaum. Basel: Benno Schwabe, 1893.)

given, which serves to show that whereas Dalton and Magnus definitely asserted that such a difference existed, Regnault, on the other hand, although he held it to be theoretically possible, found that it could not be detected in the case of pure substances. Regnault's observations, however, were not made at very low pressures, and his observations on water seemed to indicate that in this region a difference really existed. To test this point, the author carries out dynamical observations on water and mercury at pressures below 60 mm., and ascertains that they are in perfect accord with published statical observations. He next repeats Landolt's statical observations on the fatty acids, taking elaborate precautions to introduce dry and air-free substances into the barometer tube, and obtains results agreeing with those given in 1885 by the dynamical method. Landolt's results are thus held to be inaccurate, the presence of moisture in the liquids used being regarded as the disturbing factor. This assumption is shown by Konowalow's observations to explain why the differences varied, as already indicated, with the chemical nature of the acids.

It is therefore concluded that statical and dynamical methods give the same results even at the lowest pressures. This could hardly be otherwise, however, from the fact that in the dynamical method employed a current of air bubbles is allowed to pass continually through the liquid, ample free surface being thus allowed for evaporation.

As the dynamical method is the more easily carried out, and as the results obtained by it are affected to a much less extent by traces of moisture, &c., than those given by the statical method, it is adopted for the examination of pure and mixed substances. The apparatus here employed consists of a Beckmann's boiling-point flask which is connected up with a large air reservoir fitted with a manometer. The reservoir may be exhausted either by a water pump or by an automatic mercury pump. The liquid is made to boil in the flask, which, as usual, contains glass beads, and a current of air-bubbles is allowed to pass through the liquid. The thermometer is immersed in the liquid, preliminary observations with a pure substance having shown that the same results were thus obtained as when the thermometer was suspended in the vapour. On account of the high efficiency of the mercury pump, observations could be taken when the liquid was boiling into almost a perfect vacuum.

The substances operated upon are the first ten normal fatty acids, the first three iso-acids and monochloracetic acid, together with mixtures of the acids themselves, and of formic acid and acetic acid, with varying amounts of water. Excellent drawings of the apparatus used, including the various pumps employed, mercury joints, &c., and curves representing the results obtained, in which 1 c.m. corresponds with 1 mm. and 1° are supplied separately along with the volume. The graphical representation of the results, and indeed the whole contents of the book, indicate that the research has been carried out with the greatest care.

As the numbers obtained are to be discussed and compared with those of other observers in a second volume, which has not yet appeared, it is perhaps out of place to say much by way of criticism at this stage. It is to be hoped, however, that in vol. ii. Ramsay and Young's work will be more fully considered, for in the present volume, especially when dealing with the identity of the values given by statical and dynamical methods, it receives anything but its fair share of recognition.

J. W. RODGER.

NOTES.

AT the coming meeting of the British Association, which will be held at Oxford, under the Presidency of Lord Salisbury, Prof. A. W. Rücker will preside in Section A (Mathematics and Physics); Prof. H. B. Dixon in Section B (Chemistry); Mr. L. Fletcher in Section C (Geology); Prof. Bayley Balfour in Section D (Biology); Captain Wharton in Section E (Geography); Prof. Bastable in Section F (Economic Science and Statistics); Prof. Kennedy in Section G (Mechanical Science); Sir W. H. Flower in Section H (Anthropology); and Prof. Schäfer in the new Section I (Physiology). The evening discourses will be delivered by Prof. J. Shield Nicholson and Mr. W. H. White. Sir Douglas Galton will be proposed as President for the meeting in 1895, at Ipswich.

PROF. BURDON SANDERSON, F.R.S., and Mr. T. Pridgin Teale, F.R.S., have been selected by the University Board o the Faculty of Medicine to represent the University of Oxford at the International Medical Congress to be opened at Rome on March 29.

THE annual Congress of the British Institute of Public Health will be held in London, from July 26 to 31, 1894, under the presidency of Dr. W. R. Smith. It will be arranged in five sections: Preventive Medicine, Chemistry and Climatology, Engineering and Building Construction, Municipal and Parliamentary, and Naval and Military Hygiene.

AN imperial *iradé* has been issued, a Turkish paper says, ordering the establishment in the chief town of each province of an antirabific laboratory similar to the one which has been working for some time in the capital. These Pasteur institutes will be established first of all in the chief towns of the most distant provinces of the empire, such as Yemen, Bagdad, Damascus, Erzeroum, and Monastir.

MR. KARL PEARSON has resigned his appointment as Gresham Lecturer on Geometry.

SEVERE earthquake shocks were felt in Odessa and other parts of Southern Russia on Friday and Sunday last.

DR. ELBS, Professor of Physical Chemistry in Freiburg University, has been appointed Professor in Giessen University.

MR. PETER JAMIESON has resigned his position on the scientific staff of the Fishery Board for Scotland.

THE death is announced of Emeritus Professor Swan, who held the Chair of Natural Philosophy in St. Andrews' University for twenty years.

M. EUGÈNE CATALAN, whose death we announced last week, was inadvertently stated to be connected with the Paris instead of the Brussels Academy of Sciences. Though born in Bruges eighty years ago, he was educated in Paris, and accepted French naturalisation. He entered the Polytechnic School in 1834, and was afterwards admitted into the civil engineering service, but gave up his post in order to devote himself to the teaching of mathematics, in which vocation he was very successful. He obtained a Professor's Chair at Charlemagne, and, at a later period, one at St. Louis College, and was also a *répétiteur* in the Polytechnic School. When the revolution of 1848 broke out, he ranked with the Republican party. After the *coup d'état*, however, he refused to take the oath of office, and returned to his native country, resuming his Belgian citizenship, and accepting a professorship in the School of Mines at Liège. He was the author of a large number of books on mathematics, and published many interesting theorems, principally relating to geometry and the theory of numbers.

THE Allahabad *Pioneer* says that the prize given by Sir Charles Elliott for scientific research in India has been awarded to Babu Chandra Kanta Basu, Madripur. His essay deals with the phenomenon known as the Barisal Guns.