actions: P. V. Bevan. The union of hydrogen and oxygen in contact with a hot surface: Dr. W. A. Bone and R. V. Wheeler. On the formation of salts in solution, especially in tautomeric bodies: Prof. J. W. Brühl. On the active variety of chlorine: D. L. Chapman and C. H. Burgess. Hydroaromatic compounds: Prof. A. W. Crossley. On the energy of water and steam at high temperatures: Prof. C. Dieterici. A suggested explanation of the phenomena of opalescence observed in the neighbourhood of critical states: Prof. F. G. Donnan. On double acetylides: Major A. E. Edwards and Prof. W. R. E. Hodgkinson. Sur les manganates et les permanganates: Dr. A. Étard. Mesoxalic semialdehyde: H. J. H. Fenton. Note on the influence of radium radiations on atmospheric oxidation in presence of iron: H. J. H. Fenton. A reaction for ketoses: H. J. H. Fenton. A colour reaction for methylfurfural and its derivatives: H. J. H. Fenton and J. P. Millington. Ueber Isocysteïn (Isothioserin): Prof. S. Gabriel. Sur le spectre du souffre dans la photographie de l'étincelle des minéraux: M. le Comte de Gramont. Quelques observations sur le groupement des raies du spectre du silicium d'après l'effet de la self-induction, et sur leur présence dans les spectres stellaires: M. le Comte de Gramont. On crystal structure and its relations to chemical constitution: Prof. P. Groth. Methods of investigating alloys illustrated from the copper-tin series: C. T. Heycock and F. H. Neville. On some reactions between ammonium salts and metals: Prof. W. R. E. Hodgkinson and A. H. Coote. The stereochemistry of nitrogen: Dr. H. O. Jones. The constitution of nickel carbonyl: Dr. H. O. Jones. Exhibition of photographs of sections of an Australian siderite: Prof. A. Liversidge. On dynamic isomerism: Dr. T. M. Lowry. The oxidation of carbohydrates by hydrogen peroxide in presence of ferrous sulphate: R. S. Morrell and A. E. Bellars. Studies in the dynamic isomerism of α- and β-crotonic acids: R. S. Morrell and E. K. Hanson. The constitution of phthalein salts: Prof. Richard Meyer. The decomposition and synthesis of ammonia: Dr. E. P. Perman. Changes produced by the β rays: Sir William Ramsay. The action of organic bases on olefinic ketonic compounds: Dr. S. Ruhemann. (1) The vapour density of hydrazine hydrate; (2) the combining volumes of carbon monoxide and oxygen; (3) the action of heat on oxalates; (4) some alkyl derivatives of sulphur, selenium, and tellurion: Dr. A. Scott. A hexachlor-α-picoline and its derivatives: W. J. Sell. A new theory of the periodic law: G. J. Stokes. On the presence of arsenic in the body and its secretion by the kidneys: W. Thomson. On the velocity of osmosis and on solubility; a contribution to the theory of narcosis: Prof. Isidor Traube. Exhibition of effects produced by precipitating silver chromate in gelatin: Prof. Isidor Traube. The asymmetric nitrogen atom: Prof. E. Wedekind. On the products obtained by the action of tertiary bases on some acid chlorides: Prof. E. Wedekind. Pseudomorphosis in organic persulphates: Prof. R. Wolffenstein.

As in previous years, the practice of inviting two special reports on subjects of current interest and making these the basis of a discussion, met with considerable success, the communications of this order at the Cambridge meeting being made by Dr. H. O. Jones and Dr. T. M. Lowry; forming comprehensive summaries of our knowledge of the subjects discussed, which will be found very valuable by all who are engaged in teaching chemistry. The business of the section was brought to a conclusion on Tuesday afternoon by an address from Sir James Dewar on new low temperature phenomena and their scientific applications; this attracted a very large and appreciative audience, who followed the novel experiments with the greatest interest. The committees of the previous year were re-appointed, and two new committees were formed to deal with the subjects of dynamic isomerism and transformation of diazonium compounds and allied substances.

Although the neighbourhood of Cambridge does not offer many opportunities for studying industries of chemical interest, a very successful visit was made to the woad works near Wisbech, a description of which has appeared already in the columns of NATURE. Visitors were shown the processes of cropping, milling, and balling, and examined the drying racks on which the balls are placed until the second milling process, which takes place in November.

GEOLOGY AT THE BRITISH ASSOCIATION.

FOLLOWING the president's address, which has already appeared in these pages, Dr. Marr gave an address on the geology of Cambridgeshire. He described the main physical features of the county, and showed their relations to geological structure. Opportunities were afforded during the meeting, by afternoon excursions, for visiting most of the typical sections of Jurassic and Cretaceous rocks exposed near Cambridge, including the interesting occurrence of Upper Gault at Barnwell, in which Mr. Fearnsides recently discovered an unsuspected fauna. The Boulder-clays and gravels which cover a large portion of the surface of Cambridgeshire were dealt with by Dr. Marr in his address, and were further described by Messrs. Fearnsides and Rastall, who gave an account of the boulders collected by the members of the Sedgwick Club. Mr. F. W. Harmer, in a comprehensive paper on the Great Eastern Glacier, showed that its product, the Chalky Boulder-clay, extending over a great part of the eastern counties, has a palmate form, its lobes radiating from the great depression of the Lincolnshire and Cambridgeshire fens. The fens were the centre whence the Chalky Boulder-clay was distributed, and formed the quarry out of which was excavated the enormous mass of Jurassic material which forms the matrix of this deposit.

Much of the Boulder-clay about Leicester, in his opinion, was due to the ice stream of the Trent Valley having been piled up, upon the high lands to the east of Leicester, by the pressure of ice descending from the Pennine Chain. He found no evidence to show that any considerable amount of ice entered East Anglia through the Wash gap.

Mr. W. Whitaker showed that in the valley of the Stour deep channels filled with drift have been proved by borings, one of them having a depth of no less than 477 feet. How these channels extending below sea level have been excavated is a moot point, and in this connection Mr. Lamplugh pointed out that Dr. Gilbert has found in Alaska that the excavating power of ice debouching on the sea is carried on below sea level, and until the depth of water is sufficient to float the ice.

In a note on a small anticline in the Great Oolite series at Clapham, north of Bedford, Mr. H. B. Woodward directed attention to a small fold trending N.N.W. to S.S.E. Its direction is contrary to the minor undulations affecting the Oolitic strata of the district, and while there is no evidence to connect the disturbance with glacial action, there is equally no evidence against such a supposition.

Mr. John Spiller gave an account of the recent coast erosion in Suffolk, between Dunwich and Covehithe. At Easton losses of 39 feet and 55 feet have occurred at different points during the past two years.

A report on the fossiliferous drift deposits at Kirmington was read by Mr. J. W. Stather. A boring conducted by a committee appointed by the association proved solid chalk to exist at a depth of 93 feet, and above this were two boulder-clays separated by a bed of shingle and 18½ feet of laminated warp with estuarine shells. Thin peat and sand containing fresh-water shells were found at the base of the warp. The plants in the peat, according to Mr. Clement Reid, indicate estuarine conditions, and suggest a subarctic climate. Another boring at Great Limber showed a similar laminated warp, but without shells, and it does not rest on Glacial clays.

Mr. Edward Greenly, in describing the glaciation of Holyhead Mountain, showed that the northern and eastern slopes are strongly rubbed and rounded in a general N.E. to S.W. direction, and striæ occur on the summit 721 feet above sea level, parallel with the trend of the general glaciation of Anglesey. Mica schists, occurring *in situ* at a level of 200 to 300 feet, have been raised 500 feet above their source. He ascribes the phenomena to the action of land ice, and some ill-defined moraines composed of local débris he thinks may be due to small local glaciers.

Prof. P. F. Kendall presented a report of the committee on erratic blocks, and later exhibited a model of the Cleveland area showing glacier-lakes. He incidentally referred to a boulder of Red Crag of the Waltonian type found near Sherringham on the occasion of the association excursion to Cromer. The Rev. W. L. Carter, in describing the

glaciation of the Don and Dearne Valleys, sought to extend the system of glacier lakes and overflows of the Cleveland area further south, and in another paper dealing with river capture in the Don system he explained the present condition of the Don and its tributaries as resulting from a series of river captures due to the deep cutting of its valley by the Sheaf, and its predominant power in capturing consequent streams north and south.

Other papers dealing with Glacial and post-Glacial geology were read by the Rev. Dr. A. Irving, on stratified high-level gravels and their relation to the Boulder-clay; by Mr. A. W. Gibb, on the occurrence of pebbles of white chalk in Aberdeenshire Clay: the Rev. O. Fisher, on an elephant trench at Dewlish, Dorset; Mr. H. N. Davies, on the discovery of human remains under Stalagmite in Gough's Cave, Cheddar; and reports of committees were read on Irish caves, tidal action in the River Mersey, and underground waters of north-west Yorkshire.

On the day devoted to palæontology, Prof. Sollas gave an account of his new method of examining fossils by means of serial sections and their reconstruction by means of wax models. In this way he contrasted the structure of Ophiurids of recent and fossil types.

The finding of Holoptychius scales in the Cornstones of Salisbury Crag has led Drs. Horne and Peach to regard some of the beds occurring near Edinburgh, and hitherto thought to be of Carboniferous age, as belonging to the Old Red Sandstone period. Dr. Horne described the beds, and exhibited a revised map of the district. Dr. Traquair dealt with the fish remains found in the above deposits, and then read a paper on the fauna of the Upper Old Red Sandstone of the Moray Firth area, in which he summarised the results of many years' work.

Mr. G. W. Lamplugh directed attention to the fact that many of the phosphatic casts of fossils found in the Lower Cretaceous rocks at Upware, Potton, and Brickhill, and usually regarded as derivative, really are indigenous. At Speeton and in Lincolnshire these same fossils are found at their proper horizons, and indicate the life of the period. In another paper Mr. Lamplugh showed, by means of the marine fossils from the Ironstones of Shotover Hill, that the Ironstone originated through the alteration of a band of Portland Limestone.

Mr. E. A. Newell Arber, discussing the fossil plants of the Upper Culm Measures of Devon, concludes that the flora indicates an Upper Carboniferous age, and the coal-bearing beds of the Bideford district are the equivalents of the Middle Coal-measures elsewhere in Britain—a higher horizon than has previously been assigned to these beds.

In the same measures, too, he has found mineralised plant remains in the form of rolled fragments of stems, arranged without order in a fine grained sandstone. These are not contemporaneous with the sandstone.

The committee on the life zones in the British Carboniferous rocks reported investigations made in the Culm Measures of North Devon, the Pendleside series of the Derwent Valley, Derbyshire, the North Staffordshire Coalfield, and in South Wales.

The second report of the committee on the fauna and flora of the Trias included an elaborate description of rhyncosauroid and chelonoid footprints, beautifully illustrated by photographs by Mr. H. C. Beasley, and lists of Triassic fossils in the Jermyn Street and British Museums by Mr. E. T. Newton and Dr. A. Smith Woodward.

Prof. H. G. Seeley exhibited and described fossil footprints of reptiles from the Stormberg beds of the Karroo of Cape Colony.

In petrology and mineralogy eight papers were read. One, by Prof. H. Bäckström, was of great interest as showing that the great iron ore deposits of Lappland have been brought up by volcanic agency from great depths.

Mr. A. Harker exhibited a series of Tertiary Plutonic rocks (including gneisses) from the Isle of Rum. He described the characters and distribution of the earlier ultrabasic group. Into these eucrite has been intruded, and later an acid magma. The complex was then streaked out by movement, and well banded gneisses of the Lewisian type were formed.

Mr. E. Greenly suggested that the recent lava-pyramid formed on Mont Pelée might afford a clue to the origin of the lava domes of the Eifel.

Prof. H. A. Miers, dealing with the occurrence of gold in pyrites crystals, showed that in the Urals fresh crystals contained the gold uniformly disseminated, whereas on weathering into limonite the gold formed a nugget in the middle with crystalline facets. As other examples of concentration due to the attractive forces of crystallisation, he cited gypsum in clay, marcasite, pyrites, barytes, and phosphatic nodules.

Mr. Lamplugh, in the discussion which followed, remarked that the "dead earth is alive all the time," and gave instances where the formation of nodules has crushed the surrounding shales.

The basic patches occurring in the Mount Sorrel Granite, according to Mr. R. H. Rastall, are all inclusions of foreign material, and are not the result of concretionary action.

Papers were also read on the different modifications of zircon by Mr. L. J. Spencer, and on three new minerals and curious crystals of blende from the Binnenthal by Mr. R. H. Solly.

The granite from Gready in Cornwall was described by Prof. K. Busz.

The geology of the Oban Hills, Southern Nigeria, by Mr. J. Parkinson, and the report of the committee on geological photographs, complete the list of papers read in Section C, with the exception of a paper by Prof. Kendall on evidence in the Secondary rocks of persistent movement in the Charnian Range, and the discussion on the nature and origin of earth movements, an account of which is subjoined.

Discussion on the Nature and Origin of Earth Movements.

The president, in introducing the subject, which proved to be one of the most attractive features of the section, observed that movements of the earth's crust manifesting themselves in the fracturing, overthrusting, and folding of strata had been in operation from the earliest to the latest geological periods, and though intermittent so far as any one region was concerned, there was reason to believe that they had been more or less continuously in action throughout the world as a whole. Their operations, in fact, were essential to the existence of land surfaces, for in their absence all rocks projecting above the sea would be worn away, and the globe would be enveloped in one continuous ocean. Notwithstanding these facts, no theory as to the cause of the movements has commanded universal acceptance.

While some hold that the shrinking of the globe by cooling and the efforts of the crust to adapt itself to the shrinking interior are the prime causes, others maintain that the scale on which folding and overthrusting in the crust have taken place is out of all proportion to the shrinking that can be attributed to such a cause.

Earth movements may be divided into two principal classes, namely, movements of expansion, which are evidenced by normal faulting, and movements of compression, such as are indicated by buckling, overthrusting, and shearing of strata, by the superinduced structures of cleavage and schistosity, and by the extrusion of granitic rocks and metamorphism.

Dr. Horne presented the evidence he had accumulated from observations in the north-west Highlands, and traced the types of movement from the unaltered areas to the areas showing the greatest disturbance of all, namely, the Moine schists. In one region the Moine schists have been pushed ten miles to the west, and are seen lying on undisturbed Cambrian Limestone. Some of the movements undoubtedly occurred in pre-Torridonian times, others succeeded almost up to the Devonian period.

The veteran geologist, the Rev. Osmond Fisher, said he used to think that the corrugations of the earth's crust were due to compression through the shrinking of the interior. To judge of the sufficiency of this cause, the first thing to be done was to seek a measure of the compression, and then compare the result of the effects of cooling with the actual amount of compression. The most satisfactory measure appeared to be the thickness of the layer which the corrugations would form if levelled down. In 1863 Lord Kelvin formulated a law of secular cooling upon the hypothesis of a solid interior. Adopting a probable value for the contraction of rocks in cooling, Mr. Fisher calculated

the thickness of the layer which would be produced by the corrugations resulting, and found it far short of that which the existing inequalities would form if levelled down. The discovery of a level of no strain within the crust by Mr. Mellard Reade and Dr. Davison further reduced the possible amount of corrugation. Even a substratum of liquid magma holding water gas in solution would not account for it, and he therefore argued that the substratum was affected by convection currents, which, ascending beneath the oceans, flowed horizontally towards and beneath the continents.

Mr. J. J. H. Teall discussed the petrological aspect of the general question, and divided the effects of movements upon rocks into two classes, easily separable, namely, local and regional. The former were confined to the immediate areas of dislocation, while the latter extended over tens or hundreds of square miles.

Local movements were characterised by fault breccias and mylonites, these being close grained, compact rocks formed by the crushing down of original rocks as in a mill. In some cases there was no crushing, the dykes being converted into foliated schists. In respect of regional effects, we have slaty cleavage due to mechanical deformation of extensive tracts of country. Foliation might be due to the original form of crystallisation or to earth movements after consolidation.

Prof. T. McKenny Hughes thought that lateral pressure, not necessarily horizontal, had produced almost every feature, and that faults were due to compression occasioned by such pressure rather than by extension.

The folding skin of an apple due to shrinkage of the interior was not wholly comparable to earth folding, for, in the case of the earth, many complex circumstances had to be taken into account. Time was one important point, as well as such forces as molecular deformation, temperature changes, volume and force of crystallisation, and transference of material from one region to another.

Prof. W. J. Sollas said that the belts of folding could usually be correlated with the margins of preexisting oceans, and those belts of folding which were comparatively superficial must be accounted for by deep-seated causes. The inequality of the present earth was the best guide to former folding. Inequality at the meeting places of oceans and continents, together with sedimentary deposits on the ocean floor, altered the isothermal lines—flattening them out—and so produced stresses and thrusts, which resulted in pushing part of the material seawards. Thus there was a redistribution of pressure, and this produced fluid magmas, with earthquakes and volcanoes resulting. He thought that all this, however, would hardly suffice for the results produced. There must be another cause. The earth was more pear-shaped in the past than it now is by reason of its relation to the moon. Constant deformation towards its present shape produced contraction of the two hemispheres, and thus the American and Australian beltings or folds were, he thought, accounted for. Deformation of this character produced the same effects as contraction, and the two causes together, he considered, might be enough to account for the existing phenomena produced by earth movements.

Sir John Evans remarked that thirty years ago he had argued that if a globe with a fluid nucleus and a solid crust were postulated, deposition or other causes would result in the solid crust moving over the nucleus, and this disturbance would produce a change in the position of the pole. There was evidence of such a change in the fossil fauna and flora of the Arctic and Antarctic regions. This might be an additional aid beyond those due to cooling.

Prof. Blake thought that, in speaking of thrusts, Dr. Horne had only given the description, and not the cause. In the north of Scotland, where did the force come from? He suggested that if mountains expanded upwards by lateral or upward pressure, a sufficient cause for such thrusts would be found. He had never, he said, seen a true isoclinal fold, and he considered it mathematically impossible for one to exist; the nearest to it in nature was a pleisioclinal fold.

Prof. Rothpletz, of Munich, referred to overthrusts he had observed in Saxony twenty-five years ago. The Scotch overthrusts were older than those of the Alps. In the Alps the plane of the overthrust got steeper and steeper as it approached Vienna. When the folding was a shortening of the earth's crust, the overthrust was a shortening too, in another direction. The matter was more difficult of observation in Scotland, as the overthrusts ended in the sea.

Prof. Boyd Dawkins referred to a case in the Derwent Valley where folding had taken place over level beds, and thought they were not necessarily formed at the root below mountains.

Prof. J. Milne submitted that the seismologist required a world like that of the physicist, one as rigid as cast iron. Earthquake waves traverse chords of the earth at 11 or 12 km. a second, *i.e.* twice as rapid as through steel. This indicates a world very rigid and uniform in the interior. He thought that if it were liquid with convection currents, as urged by Mr. Fisher, the velocity of tremors would not be uniform.

Dr. Knott advised caution in accepting the abrupt change from solid to liquid as supposed by Prof. Sollas. The changes from solid to liquid would probably be through a viscous condition.

Prof. Kendall, in winding up the discussion, pointed out that the special feature of continental margins was deposition. Deposits, acting as imperfectly conducting blankets, would cause the isotherms and the critical zone to rise, and the weakest spot would give way. Given stiff rocks above the critical zone and plastic rocks below, puckering must take place. He considered that in thrust planes the rocks were not forced over horsts, but the horst was wedged underneath them. While areas of sedimentation were weak, other and thinner rocks were stationary under deforming stresses.

Following the discussion, Prof. Kendall read a paper on the evidence in the Secondary rocks of persistent movement in the Charnian Range, in which he gave specific examples of the movements which had been discussed by previous speakers. He referred to the speculations of Godwin Austen, who stated that all recent anticlines are built on older anticlines.

The Charnwood rocks showed evidence of folding in a N.E. to S.W. direction even before Cambrian times. These movements were continued in pre-Carboniferous, Carboniferous, and Permian times, and grounds existed for the belief that they were repeated at intervals during the Jurassic and Cretaceous periods. The Charnian axis, he believes, constitutes the boundary of two important coal fields which extend under the Secondary rocks far to the south.

J. LOMAS.

RECENT STUDIES OF DISEASE ORGANISMS.

AT the recent Cambridge meeting of the British Association, the results of several investigations of organisms associated with various diseases were described before the section of zoology, and are here summarised separately from the general report of the proceedings of the section, which will appear in another issue of NATURE.

Mr. A. E. Shipley, F.R.S., on behalf of Dr. Elliot Smith, gave a brief account of Looss's observations on *Ankylostoma duodenale* (miner's worm), and directed attention to the series of preparations sent by Prof. Looss from Cairo illustrative of his recent work. The male and female of this worm are found hanging in numbers to the intestinal walls of the man affected, and produce enormous numbers of eggs, which are discharged from the body. These give rise to small active worm-like larvæ which live in mud, and enter the body of man either along with food or through the skin, which they can penetrate without causing any visible lesion of the part. They then enter the lymph- and blood-vessels, are swept into the circulation, and eventually reach the lungs, where they pass from the blood-vessels into the air cavities. From the time the larvæ perforate the skin until they reach the lungs they remain the same size, but as soon as they reach the air vesicle they begin to grow rapidly. They pass into the bronchioles, up the bronchi and trachea, and, emerging through the glottis, pass down the œsophagus to the duodenum, where they become sexually mature. The bare-footed races of the tropics and subtropics, both in the Old World and America, are widely and generally infected with this worm, which produces severe anæmia, often ending in the death of the host.