cotton under tension, which was illustrated by photographs in natural colours; the lustre of mercerised cotton is proved to be due to a corkscrew-like structure of the mercerised fibre brought about by a simultaneous swelling, shrinking and untwisting which attends the immersion in caustic soda.

Sir H. Roscoe, F.R.S., in presenting the report of the committee on duty-free alcohol, explained the conditions under which the Board of Inland Revenue are now prepared to allow the use of duty-free alcohol for the purposes of research work.

Prof. G. von Georgievics, in a paper on the theory of dyeing, argued strongly in favour of the mechanical as opposed to the chemical theory of dyeing, and claimed that the experimental work upon which the chemical theory is based is erroneous.

In opening a discussion on the general subject of combustion by a paper on the slow combustion of methane and ethane, Dr. W. A. Bone pointed out that his own experimental work showed that, in the combustion of methane, a primary oxidation to formaldehyde and steam occurs, followed by rapid oxidation of the formaldehyde to carbon monoxide, carbon dioxide and steam; in the burning of ethane both acetaldehyde and formaldehyde are formed as intermediate products.

In a preliminary note on some electric furnace reactions under high gaseous pressures, Messrs. J. E. Petavel and R. S. Hutton gave an account of work carried out in an enclosed electric furnace constructed to work with gaseous pressures up to 200 atmospheres. The reactions at present under investigation include the direct reduction of alumina by carbon, the formation of calcium carbide and of graphite, and the production of nitric acid and of cyanogen compounds.

In a paper on the atomic latent heats of fusion of the metals considered from the kinetic standpoint, Mr. H. Crompton showed that, if in the solidification of a liquid energy is lost solely in bringing moving monatomic molecules to rest, a constant can be deduced in a very simple manner from the latent heat of fusion; approximately the theoretical value is obtained for this constant with many of the metals, but not with gallium and bismuth.

Dr. E. P. Perman brought forward a number of results which he has obtained concerning the influence of small quantities of water in bringing about chemical reaction between salts; he investigated more particularly the action of potassium iodide upon salts of lead and mercury. In a paper on the constitution of disaccharides, Prof. Purdie, F.R.S., and Dr. J. C. Irvine described the methylation of cane-sugar and maltose; from experiments on the hydrolysis of the products of methylation they deduced evidence substantiating the constitutions attributed by Fischer to these two disaccharides.

Amongst other papers read in the section may be noted the following:—Stead's recent experiments on the causes and prevention of brittleness in steel, by Prof. T. Turner; the colour of iodides, by Mr. W. Ackroyd; on essential oils, by Dr. O. Silberrad; the cholesterol group, by Dr. R. H. Pickard; on acridines, by Prof. A. Senier; sur le spectre de self-induction du silicium et ses comparaisons astronomiques, by M. le Comte A. de Gramont; fluorescence as related to the constitution of organic substances, by Dr. J. T. Hewitt; freezing point curves of binary mixtures, by Dr. J. C. Philip; mutarotation in relation to the lactonic structure of glucose, by Dr. E. F. Armstrong; the synthesis of glucosides, the preparation of oximido-compounds and the action of oxides of nitrogen on oximido-compounds, by Mr. W. S. Mills; further investigations of the approximate estimation of minute quantities of arsenic in food, by Mr. W. Thomson.

GEOLOGY AT THE BRITISH ASSOCIATION.

THE programme of the geological section of the British Association is usually more or less affected by the geological character of the country around the place of meeting, and this was the case in the present year, though the geology of Southport cannot compare in interest with that of Belfast, Glasgow, or other recent meeting places.

Mr. J. Lomas (Geology of the country around Southport) explained that the solid rock, Keuper and Bunter, is for the most part below sea-level, and only reaches the surface in a few places where it projects through the thick covering of Drift. The Drift is mainly Boulder-clay with an undulating surface, on which are found a number of lake-deposits, left by lakes or meres now partially or wholly drained.

One of these, Martin Mere, was visited by most of the geologists present, and was the subject of a paper by Mr. Harold Brodrick. Upon the Boulder-clay there is a bed of grey clay, which may be of either lacustrine or estuarine origin, and on it grew a forest of oak and Scotch fir. Numbers of trunks of the trees still remain, and Mr. Brodrick remarked that they have usually fallen in a north-east direction. These tree trunks are buried in a bed of peat, which is in places as much as 19 feet thick, and many dug-out canoes have been found in this peat.

The "submerged forest" at Leasowe, in Cheshire, is the remains of a similar mere which has been cut through by the sea, and the peat and tree trunks are now found on the coast below the level of high water. The question whether this points to a depression of the surface of the land was discussed, but the speakers hesitated to give any definite opinion.

Mr. Whitaker read the report of a committee appointed by the council of the Association to record observations on changes in the sea coast of the United Kingdom, and though there was no reference to Southport in the report, its reading was followed by considerable discussion. At Southport itself the land is gaining on the sea, and Mr. Lomas considers this to be due to the large amount of material brought down by the River Ribble. The sand dunes on the coast are, he believes, also due to material brought down by the river, which, drying at low water, is blown inland by the prevailing south-west wind. He remarked that sand dunes are usually found at and near the mouth of a fairly large river.

The question of coast changes was also discussed in a paper on a raised beach in County Cork by Messrs. Muff and Wright, of the Geological Survey. The beach deposits rest upon a platform of solid rock which is some 7 to 12 feet above the corresponding part of the present shore, and the beach deposits are covered by a thick bed of Boulder-clay, showing that they are of early Glacial, if not of pre-Glacial, age. This is almost an exact counterpart of the raised beach in Gower, South Wales, which was described by Mr. R. H. Tiddeman in a paper read before Section C of the British Association at Bradford in 1900.

Mr. Lamplugh (Land shells in the infra-Glacial chalk-rubble at Sewerby, near Bridlington) directed attention to the similarity of these raised beaches to that at Sewerby in Yorkshire. There we find (1) a beach deposit, a few feet above the present high-water mark, banked against an old chalk cliff; (2) a bed of land wash; (3) a bed of blown sand; and upon it (4) a bed of chalk-rubble, in which Mr. Lamplugh has found many specimens of *Pupa muscorum*, a land shell. Consequently the bed is a land wash corresponding to the "Head" of Cork and Gower. The author found this bed on the foreshore at Sewerby, showing that when it was formed the sea stood at a lower level than at the time of the beach deposits. This land wash is underneath all the Glacial Drifts of the Yorkshire coast.

In the discussion which followed the reading of these papers, it was suggested that the raised beaches may be due to an alteration in the level of the sea rather than to earth-movement. Mr. Clement Reid, however, remarked that, though the old sea beaches in Cork, Gower, and Yorkshire are about the same height above the present sea-level, there is at Penzance a well-marked notch in the rock at 65 feet above the sea, and in Sussex there is evidence of a sea-surface not only a few feet above the sea at Selsea, but also as much as 135 feet above the sea in Goodwood Park.

The relations of an estuarine deposit at Kirmington, in Lincolnshire, to the Glacial Drift was the subject of the report of a committee appointed at Belfast last year. The Kirmington Drift deposits are known to rest upon chalk, though the chalk has not yet been reached. A silty sand and chalk-rubble (1) is the lowest bed at present examined; upon it rests (2) a purple clay, no doubt a Boulder-clay, 12 feet thick; and above that (3) sand and chalky gravel 12 feet. Upon this (4) a thin fresh-water bed has now been found, and (5) a clay with estuarine shells, the whole being under (6) a second bed of Boulder-clay. The estuarine bed

with a fresh-water layer at its base is thus shown to be between two Boulder-clays, and the committee hopes to carry operations down to the Chalk before the meeting of the Association next year.

The report of the committee on Irish caves described explorations in some caves at Edenvale, near Ennis. Remains of man, associated with those of the bear, reindeer, &c., were recorded.

Implements, mainly Palæolithic, from the district between Reading and Maidenhead were dealt with in a paper by Mr. Llewellyn Treacher. He has obtained them in considerable numbers from gravels at levels of from 60 to 120 feet above the river Thames. The implements are usually of flint, but two examples of implements made from quartzite pebbles were described. The geological history of these pebbles is well known; they are from the Triassic pebble beds of the Birmingham district, and were brought into the Reading country by the River Thames in an early part of its history, when it drained an extensive tract now within the drainage area of the River Severn. Such pebbles are abundant in the old Thames Gravel, which caps much of the high ground north and north-west of Reading up to a level of about 500 feet above the sea, and no doubt the makers of the implements obtained the pebbles from the old Gravel.

The Swiss geologist, M. André Delebecque, read a short but very interesting paper on the lakes of the Upper Engadine. The lake of St. Moritz is, he said, obviously a rock basin, whilst the lakes of Sils, Silva Plana, and Campfer were, he believed, once a single lake also filling a rock basin. The torrents descending from side-valleys have now partially filled up his basin and divided it into the three lakes.

This paper led to a discussion on the origin of rock-basins. The author thought that, though Glacial erosion could hardly take place in very compact rocks, yet in many places even granite and gneiss become much decomposed, and glaciers may have swept away the decomposed rock and thus have produced hollows. Mr. Marr considered that every region containing rock-basins must be studied by itself, and that they are probably the result of many different causes.

Mr. Lamplugh said that, in regions of extreme Glacial erosion, we find true rock-basins near the gathering ground of ice, but as we approach the margin of the glaciated area we find lakes due to terminal moraines, kettle holes, &c.; thus in the marginal areas the lakes are not the result of direct ice-erosion, but are due to secondary causes.

Mr. Clement Reid said it was unfortunate that in north Europe the ice had so completely cleared away the soft deposits of the late pre-Glacial age that we have very little evidence as to the age of the lake or rock-basins.

In south Europe such evidence is often to be found, and he mentioned a case in Italy, near Florence, where there have been three lakes; the lowest, now silted up, is of about the age of our Cromer Forest Bed, the second, also filled up, is a Pleistocene lake, whilst the third, and highest, still exists as a lake. The speaker suggested that these lakes were due to earth-movements in a direction at right angles to the valley.

Passing to petrography, Mr. Teall contributed a most interesting paper on dedolomitisation. Taking a cherty dolomite, such as that of Durness, he showed that it has been dedolomitised by the formation of magnesian silicates, whereas in the case of the marbles formed of calcite and brucite it may be inferred that, under the conditions which prevailed during the intrusion of the plutonic rocks, the carbonic acid freed itself more readily from the magnesia than from the lime, thus in the absence of silica giving rise to the formation of periclase and converting the original dolomite into an aggregate of calcite and periclase, the periclase having been subsequently changed to brucite. The author instanced the predazzite of the Tyrol as a rock probably formed in this latter way. The history of the rock would then be as follows:—(1) formation of the limestone; (2) dolomitisation; (3) intrusion of igneous rock and dedolomitisation in consequence of the development of silicate or periclase; (4) hydration.

Mr. G. W. Lamplugh, whose name is well known in connection with the study of crush-breccias and conglomerates, read a paper on the disturbances of junction-beds from differential shrinkage and similar local causes during consolidation. He thought that in many cases rock was indurated before it became covered up by the succeeding strata, and that many of the curious structures we see in calcareous rocks may have been due to hardening before anything was laid on top of them. He instanced structures common in the Chalk and Lower Cretaceous rocks. He suggested that shrinkage during consolidation may account for the peculiar appearances which we sometimes see where a thin clay or shale is interbedded with thick sands, such as in the Hastings Sands, or at a junction such as that of the sand of the Lower Greensand with an underlying clay.

Mr. J. Lomas referred to a similar problem in a paper on Polyzoa as rock-cementing organisms.

The difficult question of the distinction between intrusive and contemporaneous igneous rocks was raised in papers by Mr. W. S. Boulton and by Messrs. T. H. Cope and J. Lomas, and was discussed at some length.

Mr. Boulton dealt with the basaltic rock associated with the Carboniferous Limestone at Spring Cove, Weston-super-Mare. The igneous rock shows a marked pillow-structure, contains tuff and agglomerate, and includes lumps and masses of the limestone.

The tuff within the sheet behaves like a lava showing flow structure, and is clearly not the result of sedimentation. The author believes the included limestone-fragments were derived from the underlying calcareous floor when it was a sea-bottom, the masses having been rolled and picked up by the lava, and thus become intercalated between its spheroidal masses. He thought the igneous rock was a submarine flow of lava. Messrs. Cope and Lomas dealt with the igneous rocks of the Berwyns. The district has a dome-like structure, shales and limestones of Llandeilo age being exposed on the top of the dome, whilst the newer Bala beds form a ring around. There are four thick sheets of rock which have hitherto been regarded as contemporaneous volcanic ashes. The authors, however, believe them to be intrusive igneous rocks.

Mr. J. G. Goodchild (Some facts bearing on the origin of eruptive rocks) contended that intrusive masses, as a rule, replace their own volume of the rocks which they invade, and do not cause displacement to any important extent. This paper gave rise to some discussion, for there were present many believers in the existence of laccolites. One speaker suggested that the presence of flow structure along the margins of intrusive igneous rocks was scarcely in harmony with the author's views. It was, however, admitted that there were difficulties when a dyke ends upwards or laterally against strata.

The palæontological papers were of considerable interest. Mr. A. C. Seward, president of the botanical section, read a paper before Section C on the fossil floras of South Africa. He considers that the plants from the Uitenhage series of Cape Colony are of Wealden age, and assigns those from the Stormberg Series to the Rhætic period. With regard to the Vereeniging plants, he describes them as belonging to a flora which flourished in South Africa, India, South America, and Australia during some portion of the Permo-Carboniferous epoch, perhaps that part nearly corresponding to the Upper Carboniferous of Europe. We have, he said, in South Africa as in South America, evidence of an overlapping or commingling of the northern and southern botanical provinces.

The Carboniferous flora of the Ardwick series of Manchester was the subject of a paper by Mr. Newell Arber, and some additional details as to the Carboniferous Mollusca were furnished in the report of the committee on life-zones in the rocks of that period.

Dr. Smith Woodward described an Acanthodian fish, Gyracanthides, from the Carboniferous of Victoria, Australia, and in illustration of another paper he exhibited some fragments of bone from Brazil. They were from a Red Sandstone formation, probably of Triassic age, and it had been suggested that they belong to an Anomodont reptile.

Mr. W. G. Fearnsides (on the Lower Ordovician rocks in the neighbourhood of Snowdon and Llanberis) gave an account of his discovery of fossils round the south-west and north-west flanks of Snowdon, from Criccieth to Llanberis. They are in beds corresponding to the well-known South Wales Llanvirn series, and are the first fossils recorded from beds on Snowdon older than the fossiliferous Bala ash of the summit.

Finally, the committee appointed last year to investigate the fauna and flora of the Trias of the British Isles made its first report. It was written by Mr. H. C. Beasley, and deals with cheirotheroid foot-prints. The attendance at the meetings of the section was good, and on several occasions the papers led to animated and interesting discussions. H. W. M.

ZOOLOGY AT THE BRITISH ASSOCIATION.

THE president's address—which was postponed until Friday, September 11, in order to avoid the hours fixed for the opening addresses in the other biological sections—dealt first with the inadequacy of the public provision made for the advancement of zoology and its applications in this country, and secondly with some considerations bearing on the problems of variation and heredity, more especially as seen in the Cœlenterata. In fact, influenced no doubt by the personal work of the president, a considerable number of the communications brought before the section this year dealt with the Cœlenterata, especially with corals and coral reefs.

Thursday, September 10.—The forenoon was given up to coral papers, and the afternoon mainly to reports of committees. Dr. J. E. Duerden (from the United States) gave two papers, "Septal Sequence in the Coral Siderastræa" and "Morphology and Development of Recent and Fossil Corals"—these being some of the results of the author's studies of living West Indian corals while he served as curator of the museum at Jamaica. He directed attention to the general occurrence of boring filamentous Algæ, and to the fact that the colours of West Indian corals are mainly due to the presence of symbiotic yellow cells (zooxanthellæ) in the endoderm. Mr. C. Crossland had a paper describing the coral formations he met with on the east coast of Africa, near Zanzibar, and Mr. Stanley Gardiner gave a general account of the coral reefs of the Indian Ocean. In connection with this, Prof. Herdman directed attention to the fact that, in the Gulf of Manaar, calcareous masses ("calcretes") of great extent are formed *in situ* on the sea-bottom by the cementing of sand and other loose material by calcareous incrusting Polyzoa. Miss Edith Pratt had a paper on the assimilation and distribution of nutriment in *Alcyonium digitatum*. The polypes exercise choice, and feed mainly on small Crustacea. Miss Pratt regards the so-called nerve-plexus as part of a system of amœboid endoderm cells conveying nutriment throughout the colony. Prof. Hickson described a case of polymorphism in a *Pennatula murrayi* from eastern seas. Dr. J. Cameron gave a lantern demonstration on the origin of the epiphysis in Amphibia as a bilateral structure.

The reports of committees were as follows:—(1) On bird migration in Great Britain and Ireland. This is the final report, and consists chiefly of Mr. Eagle Clarke's observations on the starling and the rook. (2) Naples Zoological Station. This includes a detailed account, by Mr. W. Wallace, of his investigations on the oocyte of Tomopteris. (3) "Index Animalium." The first volume, dealing with the period 1758–1800, has been issued, and the indexing of 1801–1900 is now being continued by Mr. Sherborn. (4) Zoology of the Sandwich Islands. This is the thirteenth report, and the work is still in progress. (5) Coral reefs of the Indian region. (6) Plymouth Marine Laboratory. (7) Millport Marine Laboratory. As on this occasion the physiological section did not meet separately, the physiological papers were taken in Section D. These included two reports:—(1) The microchemistry of cells. This dealt chiefly with the localisation of potassium in the living cell, and was drawn up by Prof. A. B. Macallum. (2) The state of solution of proteids.

Friday, September 11.—After the presidential address came a paper by Dr. Gamble and Mr. Keeble on the bionomics of *Convoluta roscoffensis*, with special reference to its green cells. This was followed by three short notes by Prof. R. J. Anderson—the skull of *Ursus ornatus*, the skull of *Grampus griseus*, and the peritoneum in *Meles taxus*. The section did not meet on Saturday.

Monday, September 14.—The morning was devoted to a joint discussion with botanists on fertilisation, in which the president, Prof. Hartog, Prof. Bretland Farmer, Mr. W. Bateson, Mr. M. D. Hill, and Mr. Jenkinson took part. The following papers were then read:—M. D. Hill, on nuclear changes in the egg of Alcyonium; Prof. Hartog, on the function of chromatin in cell division, and on the tentacles of Suctoria; Prof. Hickson, on conjugation in Dendrocometes (demonstrated with slides); J. W. Jenkinson, on some experiments on the development of the frog; Dr. Leighton, on British reptiles; N. Annandale, on the coloration of Malayan reptiles; H. C. Robinson, on the walking fish of the Malay Peninsula, and also an exhibition of convergent series of Malayan butterflies.

Tuesday, September 15.—Prof. Herdman gave a short account of a remarkable phosphorescence phenomenon observed in the Indian Ocean, which led to descriptions of other similar occurrences by the president, Mr. Stanley Gardiner, Mr. Bateson, and others. Prof. Herdman then read a joint note by Mr. James Hornell and himself on pearl-formation in the Ceylon pearl oyster, giving a biological classification of pearls into (1) ampullary, (2) muscle pearls, and (3) cyst pearls. The remaining papers were mainly physiological in their bearing, viz. Captain Barrett-Hamilton, on a physiological theory of the winter whitening of animals; Prof. B. Moore, on a new form of osmometer for direct determinations of osmotic pressure of colloids, and also experiments on the permeability of lipoid membranes; Prof. Sherrington and Dr. Grünbaum, on the cerebrum of apes; Mr. J. Barcroft, on the origin of water in saliva; Dr. Greaves, demonstration of visual combination of complementary colours; Mr. C. V. Hughes, note on two rare birds; Dr. Rennie, on epithelial islets in the pancreas of Teleosteans; Mr. D. C. McIntosh, on variation in *Ophiocoma nigra*; and Prof. W. C. M'Intosh, on the eggs of the shanny. Dr. Rennie suggests that his epithelial islets are blood-glands which have entered into a secondary relation to the pancreas, and that they maintain their primitive function of producing an internal secretion.

The section did not meet on Wednesday, but on Thursday, September 17, there was a dredging expedition, in which the president and a number of the members of Section D took part. The expedition was in the Lancashire Sea-Fisheries steamer, *John Fell*, kindly lent for the purpose by the committee, and was under the leadership of Mr. Dawson (Superintendent of Fisheries), Mr. Isaac Thompson (of the Liverpool Marine Biology Committee), and Prof. Herdman. The first hauls of the fish and shrimp trawls were taken in the shallow waters off Southport and the estuary of the Mersey, in order to show the fauna of the characteristic Lancashire small-fish "nurseries"; a visit was paid to the local shrimping fleet, a fishing boat was overhauled and boarded and its nets examined, and the other routine operations of the fisheries steamer in policing and inspecting the district were fully explained to the party. The processes of taking the physical observations, and of examining, counting, and recording a haul of the trawl were also gone through. Later in the day dredging and tow-netting took place further out to sea on harder ground with a more varied fauna. Although not strictly part of the work of the section, this dredging expedition made an interesting and appropriate finish to a very successful zoological meeting.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. SYDNEY YOUNG, F.R.S., professor of chemistry in University College, Bristol, has been appointed to the chair of chemistry in Trinity College, Dublin, vacant by the resignation of Prof. Emerson Reynolds.

ONE of the two open entrance scholarships which were recently founded at the Victoria University of Manchester, each of the value of 100*l*., has been awarded to Mr. W. C. Denniston.

DR. JOHN WHITE, of the University of Nebraska, has been appointed head of the department of chemistry at the Rose Polytechnic Institute, succeeding Prof. W. A. Noyes, who was recently appointed chief chemist of the American National Bureau of Standards.

THE course of Saturday morning lectures on the teaching of mathematics, which the London Technical Education