period by compelling the Gulf Stream waters to flow directly into the North Atlantic without passing into the Gulf of Mexico. By thus shortening its journey, the author calculated that the water would be delivered into the North Atlantic ten degrees colder than was at present the case. The author also referred to the amount of high land in the northern hemisphere as another contributing cause; and in both these suggestions he was supported by Sir William Dawson, who spoke in the discussion on the paper.

Mr. Mellard Reade gave evidence of land oscillation near Liverpool, derived from river-channels buried in drift, which itself often has an eroded surface covered by estuarine deposits, in turn overlaid by forest-beds made up of the remains of oak, Scotch fir, and birch; the latter are now just at the sea-level, or even a little below it. Three land surfaces appear to be present—one pre-glacial, the second post-glacial, and a third, still later, represented by the peat beds and submerged forests. Mr. Morton, dealing with the sea-coast of Wirral, showed that near the Leasowe embankment the sea had encroached 85 yards between 1871 and 1896, and at Dove Point the erosion was about 4 or 5 yards per annum from 1863 to the present. Mr. H. N. Ridley has not yet been able to begin excavations in the Singapore caves, but he has seen the white snake which inhabits them and is said to feed on bats; it is not blind, but has large eyes.

On the subject of Palæontology there is little to record, and in that of Petrology still less. Short interim reports were presented by the Eurypterid, Phyllopod, Moreseat, and Type Specimen Committees. Prof. Seeley described a skull of *Diademodon*, brought from Wonder Boom by Dr. Kannemeyer. The reptile possesses ten molar and premolar teeth, and its post-frontal bone differs from that of *Ornithorhynchus* in its different relation to the small brain cavity, and in contributing to form the circular orbit of the eye. Mr. Seward announced that *Glossopteris* and *Vertebraria* had been found near Johannesburg, associated with specimens of *Lepidophloios*. A similar association has lately been recorded by Prof. Zeiler in Brazilian plant-bearing beds.

Dr. Johnston-Lavis criticised the interpretation placed by Messrs. Weed and Pirsson in an igneous mass in the Highwood Mountains, Montana. Square Butte is a laccolite in Cretaceous sandstone, composed of an outer and upper layer of basic rock, called *Shonkinite* by them, and a core of syenite. Dr. Johnston-Lavis gave several reasons for supposing that the interpretation of this by differentiation on the spot was an error. Such differentiation would not result in a curved plane of separation, nor in the denser rock occurring at the top. He preferred to think the two rocks were separate intrusions, perhaps from the same magma originally, but that the upper part had been intruded first, and had acquired its basic character by absorption in passing through limestone or other basic rock walls. By the time the later intrusion of the syenitic magma took place, the rock walls had absorbed so much silica that little further change in its composition occurred. Dr. Busz recorded the discovery of corundum as a product of contact metamorphism on the southern flank of the Dartmoor granite, and amongst other minerals described the occurrence of cassiterite inside crystals of andalusite similarly produced.

A number of papers dealing with problems in physical and dynamical geology were presented. Prof. Seeley described the occurrence of false bedding in clays of Reading age, and also in similar rocks of Wealden date. Mr. Logan Lobley gave evidence to show that lava could not be derived from any great depth down in the earth's crust, and also that the shrinking of the globe since Cambrian times was a practically negligible factor in the contortion of rocks. Dr. Walther inquired, in general terms, whether evidence of fossil deserts was not likely to be obtained in the geological record. The Coral Boring Committee had to record that, in spite of two attempts, the site chosen for the operations, Funafuti in the South Pacific, had proved unsuitable; a mixture of quicksand with great coral blocks resisted all attempts made to bore through it. Time had not allowed of the transfer of apparatus and observers to another island, and consequently the project had been abandoned. Much good observational work in zoology and anthropology had, however, been carried out by the members of the expedition.

Mr. Vaughan Cornish illustrated the different types of ripple-marking produced by the sea (symmetrical and knife-edged), by streams (symmetrical and rounded), and by wind (unsymmetrical). Mr. Wethered gave an account of the general character of the ocean depths at different geological epochs, alluding mainly to the chief types of lime-secreting organisms found in each great limestone mass. He described with lantern illustration many of the encrusting organisms, such as *Girvanella* and *Mitcheldeania*. Mr. Kendal pointed out the effects of solution on organisms with aragonite, and on those with calcite shells; he concluded that the readier solution of the former was the cause of the bathymetrical limit defining the extent of Pteropod ooze. In a separate communication the same author concluded that the disappearance of aragonite shells from the Upper Chalk, and the preservation of calcite organisms, argued that this rock was deposited at a depth of at least 1500 fathoms, a conclusion supported by Dr. Hume and Mr. Jukes-Browne from entirely different standpoints. Prof. Milne gave a minute report on his seismological observations during the year in the Isle of Wight. His instruments enabled him to feel the larger earthquakes at great distances, even right through the earth. From his observations on August 31, he concluded that there must have been a violent earthquake at some spot about 6000 miles distant from his observatory; a distance which probably indicates that the site of the earthquake was Japan. News of such a shock has been received, but of its intensity we at present know nothing.

It only remains to notice that the Photographs Committee recorded about 200 new geological photographs as received during the year; but that still many portions of the British Isles are woefully ill-represented in the collection which, although now lodged at Jermyn Street, still hopes to receive marked increases during the next few years.

## *GEOGRAPHY AT THE BRITISH ASSOCIATION*

THE Geographical Section was perhaps more largely attended at Liverpool than at any previous meeting of the Association, a result due in some measure to the convenient situation and beautiful construction of the large hall set apart for its meetings, and also due in part to the numerous lantern exhibitions of photographs of little-known regions. The number of papers and reports read was thirty-four, considerably more than usual, and meetings were held on five days. It was impossible, owing to the private arrangements of the gentlemen who read papers, to arrange for a proper classification of the work of the various days, and, therefore, in the following notes the strict order of the papers is not followed.

The presidential address, by Major Darwin, dealing with the scientific principles by which the development of Africa for commercial purposes should be directed, was particularly adapted for the place of meeting, on account of the very close relations between Liverpool and West Africa. Mr. G. F. Scott Elliot, in a communication on the influence of African climate and vegetation on civilisation, made an effort to generalise on the same subject from a different side. He divided Africa into four regions: (1) *The wet jungle*, which is marked roughly by the presence of the oil or coconut palm, numerous creepers —especially the Landolphia (rubber vines)—and such forms as Sesamum, *Cajanus indicus*, and Manihot as cultivated plants. This region is characterised by great heat and continuous humidity, without a season sufficiently dry to leave a mark on the vegetation. (2) *The deserts*, characterised by xerophytic adaptations, by Zilla, Mesembryanthemum, *Capparis sodada*, &c. The climate is distinguished by possessing no proper rainy season whatever. (3) *The acacia and dry grass region*, characterised by acacias, tree euphorbias, giant grasses, or frequently grassy plains in which each tuft of grass is isolated. The climate is marked from all the remaining regions by distinct dry and wet seasons; the dry season occupies from five to nine months, and leaves a distinct mark on the vegetation. This region occupies practically all Africa between 3000 feet and 5000 feet, and also extends below 3000 feet wherever the above climatic conditions prevail. (4) *The temperate grass and forest area* is distinguished by having at no season of the year such drought as leaves a permanent mark on the vegetation, by a moderate rainfall, by moderate heat, &c. The grass resembles the turf of temperate countries, and the forest shows the same sorts of adaptation as occur in temperate countries. This region is found between 4600 feet and 7000 feet. Of these regions the wet jungle is everywhere inhabited by small tribes of a weak enfeebled character, and in the lowest stage of civilisation. The desert, on the contrary, is the home of exceedingly healthy and vigorous tribes. The Acacia region is everywhere rather densely populated, but no emigrations in

large numbers have taken place from it. The temperate grass and forest regions above 5000 feet are the only places in Africa that have acted as swarming centres of population. The character of the native races inhabiting them is vigorous and turbulent, and raiding is often carried on. The differences in climate, vegetation, and abundance of wild and domestic animals, explain why it is that these races only have, except in one instance, resisted both Arab and European.

Sir Charles Wilson gave an able and most timely discourse on the geography of the Egyptian Sudan, dwelling especially on the resources of the country, and the importance of opening out trade-routes between the Sudan and the sea; the best method of doing which appeared to him to be the construction of such a line as the Berber and Suakin railway. Lieut. Vandeleur read an interesting account of his recent journey from Uganda to the Upper Nile country, giving an excellent idea of the physical geography and resources of the region, and dwelling in particular on the difficulties to navigation caused by the floating vegetable carpet or *sudd* which frequently blocks the rivers. Amongst other slides he showed the first photographs which have been taken of the Murchison Falls on the Victoria Nile. The Rev. C. H. Robinson gave an account of his experiences amongst the Hausa in the Niger district; and Mr. H. S. Cowper gave some account of a second short journey made in March 1896, in the Tarhuna and M'salata districts of Tripoli. During his visit he examined or noted about forty additional megalithic ruins of the type called by the Arabs Senam. The route taken was by the Wadi Terr'qurt, a fine valley running parallel to the Wadi Doga, by which he entered the hills in 1895. He then proceeded to the districts of Ghirrah and Mamurah, south of Ferjana, through which runs a great wadi, the Tergilat. This reaches the sea at Kam, twelve miles south-east of the ruins of Leptis Magna, and is undoubtedly the Cinyps of Herodotus. On reaching the coast a week was spent at the ruins of Leptis and the Kam district, and the return journey was made to Tripoli by sea.

The Committee on African Climatology (President, Mr. E. G. Ravenstein; Secretary, Mr. H. N. Dickson) presented a full and satisfactory report, giving abstracts from twelve stations in tropical Africa. In recognition of the useful work done by this Committee, it was reappointed with a small grant.

Next to Africa the Arctic regions naturally commanded a large share of the attention of the Section. Preliminary accounts of three expeditions were given. Mr. J. Scott Keltie, who had just returned from taking part in the Norwegian welcome to Dr. Nansen, described his impressions of the explorer and his companions, gave an outline of the work they had done, laying special stress on Prof. Mohn's high estimate of the value of the meteorological and magnetic observations, and announced that Dr. Nansen would probably visit this country in November in order to give a full account of his great journey before the Royal Geographical Society. Mr. Montefiore Brice gave an interesting report on the progress of the Jackson-Harmsworth expedition, and showed by the lantern a number of photographs taken in Franz Josef Land, including some of the arrival of Dr. Nansen at Mr. Jackson's headquarters. He stated that next year it was probable that the expedition would be reinforced by two ships to push forward exploration in the sea north of Franz Josef Land. Sir W. Martin Conway described his experiences in crossing the interior of Spitzbergen last summer, the soft condition of the snow and the marshy character of the land having interposed obstacles which could not have been foreseen from the observations of earlier travellers. Mr. Frederick W. Howell and Dr. K. Grossman exhibited a number of striking pictures of the scenery of little-known parts of Iceland, the former dealing mainly with glacial, the latter with volcanic forms.

Other descriptive papers, in all cases admirably illustrated, were contributed by Mr. W. A. L. Fletcher, on his journey across Tibet from north to south, on which he accompanied Mr. and Mrs. St. George Littledale; by Mr. H. W. Cave, on the ruined cities of Ceylon; and by Mr. A. E. FitzGerald, on his crossing of the Southern Alps in New Zealand. Mr. FitzGerald announced that he was about to a lead a party to the Southern Andes, where he hoped to make the first ascent of Aconcagua.

Sir James Grant gave an eloquent address on the gold discoveries in Canada, and Mr. E. Odlum, of Vancouver, described the contested territories on the borderland of British Columbia and Alaska. These papers attracted the greater attention on account of the approaching visit of the British Association to Toronto. Mr. Ralph Richardson initiated a short discussion on the boundary lines in British Guiana, attributed to Sir Robert Schomburgk.

The geography of the British Islands was not lost sight of at the meeting. The Rev. W. K. R. Bedford described some old tapestry maps of parts of England, woven at Weston in the last quarter of the sixteenth century, now preserved in the Bodleian Library at Oxford, and in the Chapter-house at York. They are on the scale of about four inches to one mile, and show some features which do not appear on the maps in contemporary atlases. Dr. H. R. Mill called attention to his scheme for a geographical memoir to accompany the maps of the Ordnance Survey, on a specimen of which he is now at work. Dr. Gulliver, of Harvard, gave an interesting discussion of the coast-forms of Romney Marsh, dwelling on the origin of the cuspate foreland of Dungeness, and pointing out the importance of treating such problems according to the genetic cycle. Mr. B. V. Darbishire showed by a series of maps of the South Wales coal-field, how the physical structure of the country controlled the distribution of population, and the construction of lines of communication.

There were several papers dealing with physical geography. Mr. John Coles gave a demonstration of two methods of photographic surveying, exhibiting the cameras used for each. He expressed his conviction that photographic methods were bound to take a very important place indeed in the surveys of the immediate future. Prof. J. Milne discussed earthquakes and sea-waves, with special reference to recent occurrences in Japan; and Mr. H. N. Dickson gave a short account of the work which he has in progress on the temperature and composition of the water of the North Atlantic. Mr. A. J. Herbertson exhibited some of a series of maps of the mean monthly distribution of rainfall for the world, which he is at present engaged in compiling, in collaboration with Dr. Buchan. They present the facts of the distribution of rainfall for the first time in a form admitting of the study of seasonal variations.

Mr. Vaughan Cornish contributed one of the most valuable and original papers read to the Section, in the form of a practical study of the formation and distribution of sand-dunes. He said that in the sorting of materials by wind the coarser gravel is left on stony deserts or sea-beaches, the sand is heaped up in dune tracts, and the dust (consisting largely of friable materials which have been reduced to powder in the dune district itself) forms widely-scattered deposits beyond the limits of the dune district. Three principal factors operate in dune tracts, viz. (1) the wind, (2) the eddy in the lee of each obstacle, (3) gravity. The wind drifts the fine and the coarse sand. The upward motion of the eddy lifts the fine sand, and, co-operating with the wind, sends it flying from the crest of the dune. The backward motion of the eddy arrests the forward drift of the coarser sand, and thus co-operates with the wind to build the permanent structure of the dune. Gravity reduces to the angle of rest any slopes which have been forced to a steeper pitch either by wind or eddy; hence in a group of dunes the amplitude cannot be greater than (about) one-third of the wave length. This limit is most nearly approached, owing to an action which the author explained, when the wind blows alternately from opposite quarters. Gravity also acts upon the sand which flies from the crests, causing it to fall across the stream lines of the air. To the varying density of the sand-shower is due the varying angle of the windward slope of dunes. When there is no sand-shower the windward becomes as steep as the leeward slope. When the dune tract is all deep sand the lower part of the eddy gouges out the trough, and, when the sand-shower fails, the wind by drifting and the eddy by gouging, form isolated hills upon a hard bed. In a district of deep sand, negative dunes ("Suljes") may be formed. The encroachment of a dune tract being due not only to the march of the dunes (by drifting), but also to the formation of new dunes to leeward from material supplied by the sand-shower, it follows that there is both a "group velocity" and a "wave velocity" of dunes. Since the wave velocity decreases as the amplitude increases, a sufficiently large dune is a stationary hill, even though composed of loose sand throughout. Where material is accumulated by the action of tidal currents, forms homologous with the ground plan of dunes are shown upon the charts. The vertical contours and the movements of subaqueous sand dunes are conditioned by the different tactics of sand-shower and sand-drift.

The educational aspect of geography was brought forward on

several occasions. The interim report of a Committee on Geographical education in this country appointed last year was read; the material collected by its Secretary (Mr. Herbertson) is very voluminous, but being still incomplete, its final consideration was postponed until next year. Mr. Herbertson also showed an ingenious piece of apparatus designed to explain the theory of map projections by a shadow of a skeleton hemisphere made up of wire meridians and parallels thrown on a sheet of paper by a candle, the position of which can be varied by sliding it along a bar. Mr. A. W. Andrews, of Malvern Wells, gave a thoughtful paper, from the standpoint of a practical teacher, on the importance of combining geographical and historical teaching in schools. A very similar subject was treated, with philosophic thoroughness, by Mr. G. G. Chisholm, under the title of "the relativity of geographical advantages." In his opinion geographical advantages may be considered: (1) As relative to the physical condition of the surface of a country, *e.g.* the extent of forests, marshes, &c. The former and present relative importance of Liverpool and Bristol may be explained, in part at least, by changes that have taken place under this head. Also the difference in direction by some of the great Roman roads and those of the present day, and the consequent fact that some important Roman stations in Britain are not now represented even by a hamlet. (2) As relative to the political condition of a country and of other countries. (3) As relative to the state of military science. Under these two heads the difference in the situation of the Roman wall between the Tyne and Solway and the Anglo-Scottish boundary suggests some considerations. Also the difference in the situation of some important Roman towns or stations and their modern representatives (Uriconium, Shrewsbury; Sorbiodunum, Salisbury). (4) As relative to the state of applied science—well illustrated in this country in the history of the iron and textile industries. (5) As relative to the density of population—another impotrant consideration in the industrial history of our own country. (6) As relative to the mental attitude of the people where the geographical advantages exist. Many Chinese travellers and students of China have recognised the excessive reverence for ancestors in that country as one great hindrance in the way of turning the advantages of the country to account.

Taken altogether the proceedings of Section E show that geography, viewed as a science, is in a progressive and healthy condition in Great Britain at the present time. Increased attention is being devoted to the theoretical aspects, while there is certainly no diminution in the enterprise of explorers or in their power of conveying a clear idea of the new lands and seas they visit.

## *SCIENCE IN THE MAGAZINES.*

DURING the last twenty or thirty years there has been a very large increase in the number of insane under detention in asylums. This increase, Mr. Thomas Drapes argues with much force in the *Fortnightly*, is mainly due to accumulation of chronic cases, and does not in itself necessarily indicate any increase in insanity in the sense of increased liability to mental derangement on the part of the community. In fact, the number of insane under care could double itself in the course of a comparatively short period of years without the addition of a single case to the number of those annually attacked. For these reasons, and because lunacy statistics only show a rise of 0·3 per 10,000 (from 4·5 to 4·8) of first admissions in twenty years, Mr. Drapes holds that no alarming increase has occurred in liability to insanity in England.

Twelve months ago, Dr. A. R. Wallace brought together, in the *Fortnightly*, a number of interesting facts which seemed to show that mouth-gesture was the chief factor in the origin of language. He pointed out that a considerable number of the most familiar words are so constructed as to proclaim their meaning more or less distinctly by movements of various parts of the mouth used in pronouncing them, and by peculiarities in breathing, or in vocalisation. Mr. Charles Johnston meets Dr. Wallace on his own ground by asking him, in this month's number of the *Fortnightly*, the purport of a quatrain of which two lines are:—"Jambvâmralodhrakhadira—sâlavet rasamâkulam, Padmakamalakaplaksha—kadambodumbaraortam." This is a part of a highly-coloured description which has been the admiration of centuries, and Dr. Wallace is invited to declare the meaning it expresses. But Mr. Johnston does not confine himself to setting conundrums; he shows how very difficult it is to reach any fixed principle on the lines laid down, how extremely fugitive and contradictory the expressiveness of words is. It is suggested that more sound conclusions as to the beginnings of language will be derived from the study of "The World's Baby-Talk." Just as embryology has shown that each individual climbs up his own genealogical tree, so, by watching the development of speech in a baby, we can see the first steps in articulate language. Mr. Johnston elaborates this idea, and shows that certain languages, chosen for their extreme phonetic simplicity, exhibit a striking analogy with baby-talk.

A third article in the *Fortnightly* is by Mr. H. G. Wells, and the title is "Human Evolution, an Artificial Process." Starting from well-known biological facts, suggestive conclusions in ethics and educational science are reached. "Assuming the truth of Natural Selection," says Mr Wells, "and having regard to Prof. Weismann's destructive criticisms of the evidence for the inheritance of acquired, there are satisfactory grounds for believing that man (allowing for racial blendings) is still mentally, morally, and physically, what he was during the later Palæolithic period, that we are, and that the race is likely to remain, for (humanly speaking) a vast period of time, at the level of the Stone Age. The only considerable evolution that has occurred since then, so far as man is concerned, has been, it is here asserted, a different sort of evolution altogether, an evolution of suggestions and ideas." Taking the average rate at which rabbits breed, something like two hundred generations would descend from a single doe in a century, and would be subjected to the process of Natural Selection, whereas only four or five human generations would be amenable to the same process in the same time. "Taking all these points together, and assuming four generations of men to the century—a generous allowance—and ten thousand years as the period of time that has elapsed since man entered upon the age of Polished Stone, it can scarcely be an exaggeration to say that he has had time only to undergo as much specific modification as the rabbit could get through in a century." The difference between civilised man and the Stone Age savage arises from the development of speech and writing, so that, to follow the argument, civilised man represents (1) an inherited factor, the natural man, who is the product of natural selection, and (2) an acquired factor, the artificial man, the highly plastic creature of tradition, suggestion, and reasoned thought. Obviously, then, education should aim at the careful and systematic manufacture of the latter factor.

An article by Mr. W. K. Hill, in the *Contemporary*, may be taken as an expression of the general opinion that the development of the "artificial factor," referred to by Mr. Wells, is not carried out on intelligent lines. "In the secondary school the great Scholarship Steeplechase is the chief occupation. In the university the spirit of examination, like a huge cuttle-fish, is gradually winding its multiple tentacles around every effort at original thought and ideal culture." Geometry is studied, says Mr. Hill, as an abstract concatenation of puzzles, instead of as a means to educate the faculty of reasoning. "We teach always, but seldom educate, and yet 'Instruction,' as Locke truly observes, is but the least part of education. We do not try to develop mind—we only try to stuff brain." But while men of science have regretfully to confess that the indictment has much evidence to support it, they may point, at the same time, to the growth of a better system of instruction in many of our schools and colleges—a system which makes the pupil investigate for himself natural phenomena and laws, and develops his faculties of observation and reasoning.

From mediæval history Mr. Boris Sidis has drawn a number of instances of mental epidemics which spread from one end of Europe to the other, and left thousands of people struggling in convulsions of hysterical insanity, and performing acts as if their voluntary movement had been lost, or greatly limited. To this class of mental epidemics belong the pilgrimage mania, Crusade mania, and dancing manias. These epidemics, and others, are described in the *Century*. In experiments in suggestion made by Mr. Sidis in the Psychological Laboratory at Harvard College, he found that when the attention, in perfectly normal people, was concentrated on one point for some time, say twenty seconds, commands suddenly given at the end of that time were very often immediately carried out by the subjects. Concentration of attention upon one point appears, therefore, to be highly favourable to suggestibility, and Mr. Sidis is of the opinion that—"The mediæval man was in a similar state of light hypnosis. This was induced in him by the great limitation of his voluntary movements, by the inhibi-