

bacilli or vibrios, which in shape, size, motility, manner of growth in the different media, more or less resemble the cholera vibrios of Koch. Some of them also give the cholera-red reaction, sooner or later, when grown in peptone salt culture.

But there is at present known only one comma bacillus from the diseased human intestine that shows certain cultural characters, that grows at 37° C. in peptone salt cultivation with great rapidity, and gives in very short time the distinct cholera-red reaction; and this is the comma bacillus of Koch, found by him in the human intestine in Asiatic cholera. From this it follows that if in any case of choleraic disease this particular species should by microscopic examination, and by the culture test, be demonstrated as present in the bowel, the conclusion is justified that we are dealing with true cholera.

In those isolated fatal cases of choleraic disease which occurred in different localities in England during last autumn (Leicester, Derby, Westminster, Doncaster, Yarmouth, and others), apart from the symptoms and the pathological conditions of the intestine and the characteristic microscopic appearances as to the distribution of the comma bacilli, this species of vibrio was demonstrated by cultivation, and therefore we are justified in saying that these cases were of the true or Asiatic type, and we are further justified in saying that it was owing to the prompt action of the sanitary authorities that these cases were not followed by epidemic outbreaks.

But while we can state from the bacteriological examination that a particular case is true cholera, we cannot affirm with equal reliability whether this comma bacillus plays any and which rôle in the causation of the disease; nor that a case in which the bacterioscopic examination does not demonstrate the presence of Koch's vibrios in the intestinal discharges is not true cholera; and this for the important reason that in various epidemic outbreaks of true cholera there occurred in the same locality and at the same time, side by side, with undoubted cases of Asiatic cholera, and presenting the same clinical symptoms, the same pathology, and the same high death-rate, a certain proportion of cases in which Koch's comma bacilli could not be demonstrated. In what respects the bacteriology of such cases differs from cases of sporadic or English cholera, is a subject for future inquiry; at present no sufficient data are at hand.

## GEOLOGICAL SURVEY OF THE UNITED KINGDOM.<sup>1</sup>

### I.

#### ENGLAND AND WALES.

*Drift Survey.*—In the early maps published by the Survey, superficial deposits were generally left unrepresented. The importance of these deposits in questions of agriculture, drainage, water-supply, and public health having at length been recognised, it was determined that in future they should be traced and shown upon the maps. As at first they were inadequately understood by geologists, the mapping of them could not be made wholly satisfactory and complete. But as they came to be more thoroughly studied and more carefully traced, they have been represented with increasing fulness and accuracy upon the maps. It has been thought desirable to revise and complete the earlier drift surveys in the north of England, and to extend these surveys over the other parts of the country where they have not previously been made. This renewed examination of the ground is carried on upon maps of the scale of six inches to the mile, and advantage is taken of it to check, and where needful to correct, the already published mapping of the older geological formations underneath.

As the Geological Survey advanced into the eastern counties of England, the importance of the drift deposits became increasingly manifest. Over large districts indeed it was impossible satisfactorily to delineate on maps the structure and boundaries of the formations underlying the drifts which spread as a deep cover above them. For such areas drift maps only could be issued.

<sup>1</sup> Annual Report of the Geological Survey for the year ending December, 31, 1892. By Sir Archibald Geikie, F.R.S., Director General. From the Report of the Science and Art Department for 1892. (Some of those portions of the Report which describe the scientific results of the Survey operations during the last few years are reprinted here.)

It was not until the original survey of the whole of England and Wales had been completed that the systematic re-survey of the drifts was begun on the six-inch scale, over those areas not previously surveyed for this purpose. In the south-east of England, where the work is under the charge of Mr. Whitaker, it has extended from Huntingdonshire across the counties of Bedford, Hertford, Buckingham, Oxford, Berks, Wilts, Hants, and the south of Sussex.

*Tertiary.*—The re-examination of the Tertiary areas to the west of London for the Drift Survey has shown the general accuracy of the old mapping, though the boundary-lines have been occasionally improved. In Hampshire and the Isle of Wight more extensive alterations have been necessary. Thus, the Hamstead Beds, in place of occupying mere isolated patches on the high ground, as was believed when the original map was prepared, are now known to cover a large area. This was proved by Mr. Reid, chiefly by the use of portable boring-rods, such as had for some time previously been employed by the Belgian Geological Survey. These tools have also proved of great service in some recent work in the eastern counties, Certain small outliers on the Chalk of Hampshire, shown as Eocene on the old map, have now been placed among the drifts, and have been mapped as "Clay-with-flints." Probably here, as is often the case in parts of the London Basin, the so-called "Clay-with-flints" is in great part re-arranged Eocene material.

*Cretaceous.*—On the older one-inch maps the Chalk was shown as one mass, no attempt being made to indicate its subdivisions. Indeed no such subdivisions were formerly recognised, save a general grouping into Chalk-with-flints and Chalk-without-flints. Sometimes the lowest portion was separately referred to as Chalk Marl. In later surveys, however, advantage has been taken of the opportunity of tracing on the ground the subdivisions that can now be mapped. These are as follows:—

- Upper Chalk.
- Chalk Rock.
- Middle Chalk, with Melbourn Rock (at the base).
- Lower Chalk, with Totternhoe Stone.
- Chalk Marl.

The separation of the thick mass of Chalk into so many distinct subdivisions has both an economic and a scientific interest. By revealing the actual structure of the Chalk and the outcrops of its several members the new mapping renders essential service in questions of water supply. It likewise indicates the undulations into which, in consequence of subterranean disturbances, the Chalk has been thrown. These undulations, though often too gentle to be safely inferred from surface exposures, are apparent when the outcrops of the several subdivisions of the Chalk are continuously traced.

In the Chalk-area of Hampshire, Mr. Hawkins, by mapping out these horizons, has proved the general accuracy of the interpretation of the structure of that region given by Dr. Barrois. The uprise at Winchester is well marked, Lower Chalk being there brought to the surface. The folds traversing the Chalk in the western part of the Hampshire Basin, though more strongly marked than those of the London Basin, can only be satisfactorily made out by mapping the subdivisions of the Chalk. Some of the ruptures attendant on the plication of the rocks, so marked in Dorsetshire, are prolonged even into Sussex, and have been detected by Mr. Reid as far east as Eastbourne, where on the foreshore the Cretaceous strata are repeated by faults and overthrusts.

It seems not impossible that the detailed and accurate mapping of the disturbances in the Chalk may ultimately give a clue to the depths of the underlying Palæozoic rocks, a question of the utmost practical importance in regard to the tracing of coal-bearing deposits beneath the south of England.

In 1891 phosphatic Chalk, closely resembling that which is commercially worked in the North of France and in Belgium, was noticed for the first time in this country by Mr. Strahan. The bed is exposed in a Chalk-pit at Taplow, but at present has not been detected elsewhere.

The relations of the Gault and Upper Greensand have long been a matter of uncertainty. Mr. Bristow, the late Senior Director, believed that the two were really one formation, one being locally developed at the expense of the other. Mr. Godwin-Austen regarded the Upper Greensand as a shore-deposit, in part contemporaneous with the Gault of deeper waters. Other geologists have expressed similar views. These

opinions have received support from our recent surveys. The upper part of the Gault becomes more sandy to the west, and was there mapped as Upper Greensand; the clay coloured as Gault in Wiltshire representing only about the lower third part of the Gault of Folkestone. This clay becomes so thin to the west that it cannot be separately mapped.

Mr. Jukes-Browne makes three divisions of the Gault and Upper Greensand series, which are now found to constitute really one formation:—

3. Greensands and Sandstone, and chert beds (Zone of *Pecten asper*).
2. Buff Sands, Malmstones, and silty Marls; the last representing the Upper Gault (Zone of *Ammonites rostratus*).
1. Lower Gault Clays (Zone of *Ammonites lautus* and *Amm. interruptus*).

The Chert-beds of Wiltshire and Devonshire are local developments in the Zone of *Pecten asper*. They are not found in Dorset, but they attain importance in the Isle of Wight, and were there separately mapped by Mr. Strahan.

In the neighbourhood of Devizes the subdivisions of the Upper Greensand are well marked. The lower one, or "Malmstone," contains, especially in the lower part, colloidal silica in the form of small round globules and sponge spicules, sometimes to the extent of from 40 to 50 per cent. of the stone. The upper division, about 70 feet thick, near Devizes, consists of green and grey sands. As these are irregular in thickness, thin out rapidly to the north, and extend as a band in a nearly east and west direction, they may represent an ancient sand-bank. The persistence of the Malmstone over a very wide extent of the "Upper Greensand" of England is a noteworthy fact.

A revived industry of some interest on the borders of Bedfordshire and Buckinghamshire is the extraction of fuller's earth from the Lower Greensand. This deposit is now worked by mines on the flanks of the escarpment. Mr. Cameron has frequently visited these mines, and has described them in papers read before the British Association and elsewhere.

*Jurassic.*—Some of the most important recent additions to our knowledge of the structure of the Jurassic and Cretaceous rocks of the South of England have been made by Mr. Strahan in his re-examination of Dorsetshire by the Drift Survey. The area known as the Isle of Purbeck has long had a peculiar geological interest, not only from the fact that the Portland and Purbeck rocks there reach their maximum development, but also from its structure. It is traversed by an extremely sharp and faulted monoclinical fold, a continuation of the Isle of Wight monocline, from which, however, it differs in being accompanied by inversion of the strata and much overthrust faulting. This structure may in fact be regarded as an intermediate stage between a simple monocline and a complete overthrust. The deeply indented coast affords unusual facilities for examining the effect of the movement. The old one-inch map, on account of the smallness of the scale, gave merely a diagrammatic view of the structure of the "island." In the re-survey on the six-inch scale both the faults and the subdivisions of the strata have been traced with a detail that was before impossible. In the Isle of Purbeck the principal additions to the map consist in the tracing of the subdivisions of the Cretaceous system. The Lower Greensand, which is so well developed in the Isle of Wight, was known to exist in the Isle of Purbeck also, but its limits had never been determined. It has now been separated from the Wealden group, with which it was formerly confused, and it has been traced westward until it finally thins away, while at the same time the Wealden Shales, which form the uppermost subdivision of the Wealden group in the Isle of Wight, have been traced through the Isle of Purbeck as far westward as they extend.

During the mapping of the Lower Greensand some interesting evidence as to its relation with the overlying Gault came to light. This evidence tends to confirm the conclusions formed during the re-mapping of the Isle of Wight, for the break at the base of the Gault, which was there only suspected, becomes so much more pronounced westwards as to suggest that the base of the Cretaceous system might have been more suitably drawn at the bottom of the Gault than at the bottom of the Wealden group, which is inseparably connected with the Purbeck beds. Moreover, a conglomerate which forms the base of the Gault seems to correspond to the Carstone of the Isle of Wight, which has again been correlated with the Folkestone beds. The suggestion, therefore, made long ago, that a portion of the

Folkestone beds should be included in the Upper Cretaceous group receives support. In the Weymouth Peninsula the principal alterations relate to the mapping of the subdivisions of the Chalk as far westward as they are recognisable, and in the tracing of certain subdivisions of the Corallian rocks which are locally developed near Weymouth. The numerous faults of the area have also been followed, with a minuteness of detail which was impossible on the old one-inch map. An interesting result has been obtained from this work. The faults and foldings of the strata, though nearly all agreeing in direction, were found to have been formed at two different periods, the one set affecting the Oolitic rocks but passing under the Upper Cretaceous strata without disturbing them, the other breaking through both Oolitic and Cretaceous rocks alike. The older movements took place between the deposition of the Upper and Lower Cretaceous strata, while the later set were obviously contemporaneous with the Isle of Wight and Isle of Purbeck monoclines, which are believed to be of Miocene age. In more than one case, faults of the later age cross obliquely the older lines of fracture, producing a complication which could only be worked out on the large scale map. The break at the base of the Gault mentioned above seems to have been due to the faulting and upheaving of the rocks during the first of these periods of disturbance. It becomes here a most pronounced unconformability, and the Gault with a thin conglomerate at its base passes over the edges of the Wealden, Purbeck and Kimeridgian rocks in rapid succession.

*Triassic.*—Advantage has been taken of the prosecution of the Drift Survey across the salt districts of Cheshire and Staffordshire to obtain much additional information regarding the Triassic rocks, especially with reference to their industrial aspects. Mr. C. E. de Rance has collected 208 sections of the salt deposits at Northwich, Middlewich, Winsford and Lawton. He has likewise reduced some mining plans of salt-workings and placed their details on the six-inch maps, and has further collected tables of the levels of the brines at various periods, reducing these levels to Ordnance datum, and thus showing the height of the Upper and Lower rock-salt surfaces.

*Carboniferous.*—It is in the re-examination of the great coal-field of South Wales that the chief recent operations of the Survey in the Carboniferous system have lain. Sufficient progress has now been made to show of how much practical value a detailed survey of this coal-field will prove to be. Mr. Strahan, who has had charge of this work, soon ascertained that while the great thickness and uniformity of character of the widespread "Pennant Grit" makes it difficult to obtain indications of the geological structure over large tracts of ground, the position of a certain coal-seam known as the "Mynyddislwyn Vein" affords an excellent horizon from which the lie of the other strata can be followed in great detail. He has accordingly devoted special attention to tracing the outcrop of this seam, and the trend of the numerous faults which have been met with in working it. He has had occasion to examine a large series of plans of old workings, and to reduce from these the necessary data upon the six-inch Ordnance maps. When these maps are completed, with all the available detailed information, they will probably afford a sufficient and accurate guide to the depth and dip of the various coal-seams over a large part of the area. The information thus worked out, combined with a precise geological mapping of the ground, will prevent the waste of large sums of money in seeking for coal, by showing exactly the limits within which the seams may be looked for, and the depths at which they may be expected.

*Devonian.*—Mr. Ussher, in the South of Devonshire, by a sedulous scrutiny of the ground, has been enabled to detect the presence of organic remains previously unnoticed, and by their aid to distinguish and trace the three great divisions of the Devonian system over the district between Newton Abbot and Plymouth. According to his observations, the following grouping may now be considered as established both by palæontological and stratigraphical evidence:—

1. *Upper Devonian.*—Slates, lying on Goniatite Limestone in the Limestone areas, and with local volcanic rocks.
2. *Middle Devonian.*—Slates, Limestones, and Volcanic rocks. The Limestones are developed in a local or sporadic manner, and in the intermediate districts they are replaced by volcanic rocks (the Ashington Series), while their basement beds are represented by occasional calcareous bands and lenticles in the slate bounding the volcanic series.
3. *Lower Devonian.*—Red and Grey Grits, Sandstones, and

Shales, apparently passing upward into the Middle Devonian Slates by the irregular intercalation of grits with slates.

During the progress of the field-work in South Devonshire a large series of specimens, sent up by Mr. Ussher, has been sliced and subjected to microscopic investigation by the petrographer to the Survey, Mr. J. J. H. Teall, F.R.S., who reports that the detailed examination of the rocks from the metamorphic area of South Devon has brought to light the fact that the previously published descriptions of the green varieties of rock were very imperfect. The specimens which have been least altered by surface-agencies consist essentially of hornblende, albite and epidote. In altered specimens hornblende is more or less replaced by chlorite; and when this is the case calcite is usually present. The hornblende is either uralitic or actinolitic in character, never compact. The feldspar is water-clear, and usually without any trace of cleavage or twinning. It has been definitely determined to be albite in one case, and from its uniform character in all the slides examined there can be no doubt that this is the dominant if not the only species present. The association of albite with hornblende, epidote, chlorite and calcite has been described by Lossen in his various papers relating to the modification of the diabases associated with Devonian rocks in the Hartz. Quartz, which had previously been supposed to form an important constituent of these rocks, appears to be comparatively scarce.

*Petrographical Department.*—The important assistance of the petrographical department has again during the past year been largely extended to the field officers, and has greatly aided their work. Mr. Teall, besides the microscopic and chemical work carried on by him in this office, and the determinations and reports made by him for the guidance of the officers in the field, has during the past year undertaken some field-work himself. As he is specially charged with the investigation of the petrography of the Lewisian gneiss—the most ancient rock in the British Isles—it was considered desirable that he should make himself practically familiar with the minutest details of the complex structure of this venerable formation, and for that end should himself map a portion of its area on the six-inch scale. The Island of Rona, lying between Skye and Ross-shire, was selected for him, and he spent nearly two months in mapping it.

With regard to the ordinary work of the department in the office and to the more important scientific results obtained by Mr. Teall during the last few years, he has at my request drawn up a memorandum, from which the following passages are taken:—The principal work of the petrographical department during the year has been the examination and description of specimens sent up by the officers in the field. Of these 492 have been prepared for microscopic examination and have been described in detail. The total number of Scottish rocks from which sections have been cut is now more than 5000. The system of cataloguing has been improved during the year. Each field officer now numbers his specimens consecutively. These specimens are entered in a book under the name of the officer who sends them up, and a record is kept of the destination of each. Those specimens of which sections are prepared are numbered consecutively in the order in which they are cut, and are entered in books kept for the purpose. When they have been described and named they are again entered in two distinct catalogues, one of which is arranged according to the sheets of the one-inch map, and the other according to petrographical types. It will thus be seen that every sliced specimen is entered four times, and that every specimen sent up for examination, whether sliced or not, can at once be found.

On the general question of metamorphism much important detail has been accumulated. The fact that the central and southern Highlands of Scotland are largely composed of highly crystalline rocks of sedimentary origin has long been known. Petrographical work has tended to render the correctness of this view more and more certain. Thus fine-grained quartz-feldspathic rocks, which show no decided indications of elastic origin, have been found to be traversed by narrow dark bands in which minute crystals of zircon, rutile, and ilmenite abound. Similar bands occur in loose sandy deposits of much later geological age, so that the doubtful rock may be recognised as really a sandstone consolidated by the secondary enlargement of the quartz, and possibly also of the feldspar grains. The detailed microscopic work of the department has also thrown much light on the nature of the processes by which the present mineralogical and structural characters of the Highland rocks have been produced.

(To be continued.)

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## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE results of an inquiry into the position taken by Universities in different parts of the world as regards the admission of women, are given in the *Revue Scientifique*. It appears that the French Faculties opened their doors to women for the first time in 1863. None of the German Universities yet admit women either to lectures or examinations. There will be a difficulty, however, in resisting for long the force of opinion in favour of the admission of women to courses of study, and especially to medical classes. A petition for the removal of the present restrictions was presented to the Reichstag not long ago, containing more than 50,000 signatures of women. In Austria-Hungary and Spain the laws are against the access of women to higher education. Women possess a special school of medicine in Russia, in spite of their exclusion from the Universities. In Belgium, women are admitted to the courses in all the Faculties, and are eligible for all diplomas. They may also follow the medical profession, or become dispensing chemists. Holland has a large number of women students in its Universities, but Switzerland heads the list in this respect. During the summer semester of 1892, no less than 541 women students were studying in Swiss Universities. In Italy women are admitted to all the Faculties, and are at liberty to exercise all professions except the legal. Among the professors in Bologna University, a lady occupies the chair of histology in the Faculty of Medicine. The Universities of Jasi and Bucharest, in Roumania, are open to women, as are also those of Denmark, Sweden, Norway, and Iceland. Higher education is available for women in most parts of the United States. The result of this is that America has about 3500 women following various branches of the medical profession, 70 have been appointed physicians in hospitals, and nearly 100 are professors in schools of medicine.

THE Council of the Association of Technical Institutions have sent a letter to Mr. Gladstone with reference to the Royal Commission on Secondary Education, the appointment of which was recently announced. The signatories point out that, as the education given in the institutions represented by them is a necessary and important part of the general secondary education of the country, it is of great importance that the Royal Commission should be fully informed as to the nature of the work that is being done, as to the best means of improving and extending this work, and so enabling the institutions most efficiently to take their share in the work of national education. They therefore urge that the Royal Commission should be expressly empowered to deal with technical education, and in order that it might be able to do so effectually, that there should be among the Royal Commissioners an adequate number of gentlemen of experience as administrators and teachers of technical institutions.

THE Italian Government has decided to suppress six small universities—those of Messina, Catania, Modena, Parma, Sassari, and Siena—the academic population of which is from 100 to 400.

## SCIENTIFIC SERIALS.

*Bulletin of the New York Mathematical Society*, vol. iii. No. 5.—Prof. Klein's recent visit to Chicago was taken advantage of by American mathematicians. One of the most interesting results was the publication of twelve lectures on mathematics, with the title of "The Evanston Colloquium." An abstract of the contents of this work, by H. S. White, occupies pp. 119–122 of the present number. L. E. Dickson contributes a note on the number of inscriptible regular polygons (pp. 123–125). E. M. Blake (pp. 125–127) writes upon the "Bibliography of Mathematical Dissertations." His remarks are based upon two recently issued works, viz. "Catalogues des Thèses de Sciences soutenues en France de 1810 à 1890 inclusivement, par A. Marie (1892)," and "Verzeichniss der Seit 1850 an den Deutschen Universitäten erschienenen Doctor-Dissertationen und Habilitationsschriften aus der reinen und Angewandten Mathematik" (München, 1892). The Paris dissertations are 701 in number, and the departments furnish 172 more. The German work gives references to 939 dissertations. Both books supply a want which has long been felt, for most of these dissertations appear unannounced at irregular intervals, and are with difficulty