mineral debris and the growth of vegetation have filled them up, and thus altered the whole face of the country, a result soon to be very marked within Wisconsin, Minnesota, and the Dakotas. Indeed, the years can almost be counted when glacial lakes within these States will be rare indeed.

The question how long a period of time has elapsed since the retreat of the glacial ice-sheet from the central portion of the North American continent cannot be here discussed. Yet, by way of suggestion, it may be said that, if the filling-up of glacial lake basins be a chronometer useful in measuring geological time, the rate at which these lake basins are now filling up and disappearing, and the fact that they have already disappeared from the southern portions of the glaciated area, are strong presumptive evidence that the ice of the glacial period lingered longest in the region between Lake Michigan and the Missouri River to the north of the 44th parallel, and that here the time since its disappearance has been comparatively brief; indeed, that the estimates of Gilbert, Wright, Winchell, Upham, and others are long enough to explain every phenomenon save, possibly, that of the redistribution of plants.

The two remaining lake types are more permanent. Rivers will continue to be silted and their currents choked so long as two streams of varying transporting power merge into one. Rock basins will continue to hold water so long as the conditions of erosion are unfavorable through the obdurate resistance of crystalline rocks, and plant growth is discouraged through the lack of soil, as is now the case around the margins of the rock-basin lakes of northeastern Minnesota.

THE ROYAL SOCIETY OF CANADA.

THE twelfth annual meeting of the Royal Society of Canada was held at Ottawa, Canada, during the week beginning May 22, and terminated its sessions on Thursday evening, the 25th.

The meeting opened under the presidency of Dr. J. G. Bourinot, C.M.G., clerk of the House of Commons, etc. The meeting was very well attended by fellows and delegates.

The society divides itself into four sections, as follows: I. French Literature and History; II., English Literature and History; III., Mathematical and Chemical Sciences; IV., Geology and Biology.

Amongst the papers which interest the readers of *Science* most were those of Sections III. and IV., besides the "Science Lecture" given to the public under the auspices of the Royal Society in the Assembly Hall of the Provincial Normal School.

The president's inaugural address dealt with "Our Intellectual Strength and Weakness," which received most favorable comment

The public science lecture was delivered by Dr. Ramsay Wright, professor of biology and histology in Toronto University. His subject was, "The Natural History of Cholera." In a masterly manner Professor Wright treated his subject, and described this minute microscopic plant through all its phases and life-history in a simple, clear, and practical manner, throwing a flood of light and giving an amount of information of great value.

In Section IV. Mr. Whiteaves gave the presidential address, in the course of which he summed up the result of researches in the Cretaceous formations of Canada. In the course of his address Mr. Whiteaves showed that in Canada no less than 600 species of fossils were known from the Cretaceous rocks of the Northwest Territories, of the Rocky Mountain region, and of the coast and islands of British Columbia. Of these some 450 were marine invertebrates, mostly shells, and characterized the two divisions into which the Cretaceous system was divided in Canada, viz., the Earlier and Later Cretaceous.

Sir William Dawson had described or identified no less than 115 species of plants from the Nanaimo, Queen Charlotte Islands, and British Columbia Cretaceous basins. Mr. Whiteaves himself had devoted his attention to the invertebrate and vertebrate faunas (*partim*), whilst Professor Cope had in his hands a number of the deinosaurian remains which characterize certain horizons of the Cretaceous in the Prairie region of the Northwest.

Then came Sir William Dawson's paper, entitled "Additional Notes on Cretaceous Plants from Port McNeill, British Columbia." The collection made by Dr. G. M. Dawson at this place was cursorily noticed in a note printed in the Transactions of this Society (1888, p. 71, Sec. IV.). As the collection is large and the specimens unusually perfect, and some of the species are new and very interesting, it has been thought desirable to prepare more detailed descriptions, more especially as these plants belong to either a station or a horizon somewhat distinct from those so familiar in the coal-fields of Nanaimo and Comox on the other side of Vancouver Island.

This paper was followed by another from Mr. Whiteaves, "Description of Some New Species of Fossils from the Trenton Limestone of Manitoba." This was a continuation of two others on the same subject which have already appeared in the Society's Transactions. It contained descriptions and illustrations of several species of Cephalopoda and of one rugose coral.

Dr. Ells then read a most interesting contribution on the geology underlying Northumberland Straits: "The Geology of the Proposed Tunnel under the Northumberland Strait between New Brunswick and Prince Edward Island." The paper discusses briefly the several geological formations which border on that portion of the Gulf of St. Lawrence adjacent to the Strait, with reference more particularly to the several members of the Carboniferous system, the rocks of which have a very considerable development in this area. The proposed tunnel, according to its present location, will traverse these between Cape Tormentine, in New Brunswick, and Carleton Point, in Prince Edward Island, and the description of the strata which will probably be encountered is given, as shown by the series of bore-holes put down during the past season along the line of the principal route.

Dr. Ells was elected fellow of the Royal Society at its last meeting, and has, through his numerous papers and writings on the geology of Canada, contributed much new information regarding the economic minerals, as well as some of the most intricate problems of geology, chiefly in New Brunswick and Quebec.

Mr. Lawrence M. Lambe contributed his second paper on "Sponges from the Pacific Coast of Canada." The paper describes the sponges collected by Dr. G. M. Dawson in the vicinity of Vancouver Island and the Queen Charlotte Islands. There are, all told, about twenty species, seventeen of which are siliceous.

Mr. W. Hague Harrington read a paper on the "Canadian Uroceridæ," in which descriptions, synoptical tables, and lists, together with remarks on the occurrence, distribution, etc., of the species, are given, whilst the Rev. G. W. Taylor of Victoria, B.C., presented "A List of the Land and Fresh-Water Mollusca of Canada, with Notes on their Distribution."

Mr. G. F. Matthew of St. John, New Brunswick, so well known for his valuable papers on Cambrian geology and palæontology, was to the fore with three papers or contributions:—

(*a*) "Illustrations of the Fauna of the St. John Group, No. VIII.," contains descriptions of new species from Band *b* of Division 1, and Band *b*, Division 3; also forms from Division 1 *b*.

(*b*) "On Some Remarkable Organisms of the Silurian and Devonian Rocks of Southern New Brunswick, No. 2." A paper on certain species of the above formations was read before the Royal Society in 1888. The present article contains descriptions of a few others, all of which are from the well-known plant beds of Lancaster, near St. John. These were found by Mr. W. J. Wilson, now of the Geological Survey of Canada. 1. The wing of an insect of the genus Homothetus. 2. A new species of scorpion. This species is of Silurian (Upper) type; the thoracic shield, which is unusually narrow, is the only part certainly known. 3. A new land shell; it resembles *Strophites grandæva* of Sir Wm. Dawson, but is larger and proportionately more slender. 4. A millipede, a minute species, belonging to the division Chilopoda; of which the body is not complete.

(*c*) "Traces of the Ordovician System on the Atlantic Coast." This system has not heretofore been recognized by its fossils on the Atlantic Coast of America, except at St. John, where the oldest part of it (Arenig horizon) is folded in with the Cambrian rocks at St. John. We now recognize it at two other points, viz., Conception Bay, Newfoundland, and Bras d'Or Lake, Cape Breton.

In both these localities the fossiliferous beds consist of gray sandstones holding a fauna of European facies, several of the species being common to these and the Russian deposits. Overlying the Ordovician strata at Conception Bay are the sandstones of Great Bell Island, which, as they contain Brachiopods of the Trimerellid family, are probably Silurian (Upper). The fossiliferous Ordovician deposits in New Brunswick and Maine are either fine, dark shales and slates or siliceous mud-rocks, and indicate the probable existence of one or more deep-water sounds in Ordovician times partly shut off from the ocean over the area of the Acadian provinces.

Mr. G. U. Hay contributed an interesting paper, which received hearty endorsement and well-merited comments, on the "History and Present State of Botany in New Brunswick." The subjects dealt with in this paper are: 1. The History of Botany in New Brunswick, referring briefly to the explorations made by botanists in this and the neighboring provinces in the first half of the present century, noting the discoveries of plants made and the partial or fragmentary lists, chiefly of forest trees. Of these lists, probably one of the earliest and fullest is that by Sir James E. Alexander, preserved in his second volume on "L'Acadie," and comprising over one hundred species of plants, shrubs, and trees collected between Petitcodiac and Boiestown. 2. The Present State of Botany in New Brunswick, showing that a fairly complete survey of the Phenogamous flora of the province has been made, with the result that lists aggregate between nine hundred and a thousand species of flowering plants. A beginning has also been made in the cryptogamous flora by the preparation of short lists of mosses, lichens, and algæ. The economic importance of a wider and more general study of this subject is urged, especially with regard to agriculture and forestry; the collection of information on the time of flowering of plants and the ripening of fruits each year at many stations throughout the Province; more attention paid to the medicinal plants found in the Province, and more general and systematic attempts made for the extermination of weeds.

Three more geological papers were on the programme, but, on account of the gentlemen who were to read them being absent or engaged in the work of other sections, they were "read by title." These are as follows: "Note on the Gold-Bearing Ore of the Crawford Mine, in Peterborough County, Ont.," by Professor E. J. Chapman, LL.D. "Notes sur le forage d'un puits artésien dans le quartier du Palais, Québec," par l'Abbé J. C. K. Laflamme. Ce puits a été creusé dans un terrain dont l'horizon géologique ne semble pas encore absolument établi. L'examen des échantillons qui en ont été tirés pourrait être de nature à jeter un peu de lumière sur ce problème de stratigraphie. "Note sur la valeur de l'ouvrage de J. Cornuti sur les plantes du Canada," par l'Abbé J. C. K. Laflamme. L'auteur, dans sa monographie sur M. Sarrazin, avait déjà donné des détails capables de servir à l'histoire des sciences au Canada. En examinant l'ouvrage de Cornuti, publié longtemps avant les travaux de Sarrazin, il espère ajouter une page à peu près inconnue au plus grand nombre de nos botanistes. L'ouvrage de Cornuti a été imprimé à Paris en 1634. Par conséquent, dès le commencement de la colonie, on y a toujours prêté le plus vif intérêt au développement des sciences, et les travaux qui ont été faits sur ce point ont une valeur réelle.

Altogether the meetings were a great success. Dr. George M. Dawson, C.M.G., etc., was elected president of the Royal Society, and Dr. Bourinot honorary secretary. HENRY M. AMI.

THE PLACE OF THE LABORATORY IN TEACHING PHYSICS.

BY A. D. COLE, DENISON UNIVERSITY, GRANVILLE, OHIO.

THE use of laboratory methods in teaching physics has become almost universal in American colleges. But it may well be questioned whether the usual plan followed is the best one. Most colleges require elementary physics as a condition for admission, but this preparation is usually obtained in schools where no opportunity for systematic laboratory work is given, and the student enters college completely ignorant of laboratory manipulation, sometimes indeed without having even seen his teacher perform experiments. In his sophomore or junior year he takes a lecture course in general physics, and at the same time or the year following, a laboratory course. This latter course, however, is often elective, so that many students graduate from college without any laboratory knowledge of physics whatever.

But suppose one does take the laboratory course, is it well adapted to his needs? It often has very little connection with the lecture course, and is conducted by a different instructor. The student begins his work with no training in the accurate use of either hand or eye. Yet his first problem is often a difficult one, involving the skilful handling of complicated apparatus. He does not understand his instrument, turns to reference manuals, but finds their explanations are too general to help, or refer to a form of apparatus differing from his. The instructor cannot help him at once, as he is busy with some other bewildered student. He waits awhile, appeals to a neighbor in vain for help, finally makes a desperate start and at once succeeds in getting his instrument completely out of adjustment. When the instructor does finally get to him, it perhaps takes all the time that can be spared him to get the apparatus adjusted for a fresh start. Two hours have passed, and almost nothing accomplished. This is no fancy sketch. The writer has seen just such cases repeatedly, in several of the best-known laboratories in the country. Is it any wonder that students so misused find physics "hard" and uninteresting? The trouble is not with their work, but they have not been prepared to do it. Yet they can be prepared and with no greater expenditure of time.

Instead of giving the student ninety to a hundred and eighty experimental lectures as a preliminary to such work, give him about half that number, and in place of the other half let him demonstrate for himself the principal facts of physics in a series of about seventy-five measurements, requiring only moderate precision, in order that he may have time for a sufficient number of experiments to fairly illustrate his lecture course. Let him do this while the lectures are in progress, not after they are finished. Let the lectures be given say twice a week, on the other three days of the week give one hour to laboratory practice, and a half hour to recitation on the work of the day and the lecture of the preceding day. Keep laboratory work and lectures in close connection. The ideal method is to have all the class work simultaneously on the same subject — one connected with the lecture of the preceding day — and to conclude with the half hour of recitation.

Of course it is impracticable to duplicate apparatus to such an extent as to carry this system out perfectly, but if the class is divided into pairs for work, and each pair be provided with their own set of the instruments of frequent use, such as metric rule, hand-balances, dividers, test-tubes, etc., a considerable number of the earlier simple measurements can be carried on by all simultaneously. Thus a few glass tubes with the articles named above, will enable a whole class to study the laws of capillarity together, with an approximate verification of the law of diameters.

Where but few duplications of apparatus are possible, five or six different experiments may be going on together. To prevent confusion and loss of time, the apparatus necessary for each is placed by itself, and with it a paper describing briefly the method to be followed and giving references to books kept in the laboratory for the purpose. Each paper may be designated by a number, and each working pair is assigned one of these numbers. A class (or division) of twenty can thus get to work in one minute. For example, suppose the class is just beginning the consideration of specific gravity. Various methods of determining it have been described in the lecture of the day before. The ten working pairs are sent to the desks, where there are sets of apparatus illustrating five different methods, each duplicated once. One is arranged for finding the specific gravity of glass by the hydrostatic balance, another for that of lead by Nicholson's hydrometer, a third for that of quartz by the specific gravity flask, a fourth for alcohol by Jolly's balance, a fifth for mercury by Hare's communicating tubes. On the next laboratory day, each