constant constituents of the diamond. It is a curious fact, that when these yellow diamonds are heated out of contact with the air they lose their color, and remain colorless so long as they are not exposed to the light: then they immediately regain it.

A discussion on chemical changes in their relation to micro-organisms was opened by Professor Frankland. He stated that contact action had been held to be of two kinds, — that where both of the bodies underwent a change, and that in which one of the bodies remained unchanged. The last was called catalytic action. The changes taking place in organized bodies had been referred to the last class, but organic chemistry had proved them to belong to the first. In organized bodies, both analytical and synthetical changes take place; but in general the first take place in the bodies of animals, and the last in vegetables. This enables us to determine to which of the two kingdoms a body belongs, and judged by this criterion the microcosms belong to the animal kingdom. Soluble ferments, on the contrary, act by contact without giving of themselves. The changes which these soluble ferments produce were then shown in a series of tables; and it was seen that the resulting analytical reactions were usually quite simple, but were attended by the evolution of heat. Referring to this point, it was suggested, that as allotropic and isomeric changes often convert potential into kinetic energy, it might be possible to maintain life through these changes. The reactions produced by the micro-organisms were next shown in a series of charts, together with illustrations of their forms. The reactions in these cases were far less simple; but in some instances, as with the Saccharomyces cerevisiae, it is a question how far the by-products are due to the action of the micro-organism. The power of these organisms to resist chemical substances generally and high temperatures was shown, yet spongy iron quite destroyed them. It is of the utmost importance to discover some simple agent for destroying these bodies, which is harmless to man.

In discussing this topic, Professor Roscoe pointed out the fact that one ferment produces only one reaction, and that this was probably true in those more complicated reactions which attend disease. Dr. Dallinger stated that he was able by slow stages to so change the environment of a micro-organism, that eventually it lived under conditions entirely unlike its natural ones, and that he had cultivated the most highly organized ones in solutions which contained no organic matter whatever. Dr. Dewar called attention to the wonderful preservative power of hydrogen peroxide. One one-hundredth of one per cent will preserve urea indefinitely. It does not, however, preserve milk indefinitely, on account of the physical action of the milk globules, while it has no action whatever on the soluble ferments. He believes the heat evolved by the action of the ferments to be due to the hydration of the alcohol; and he pointed out that we have in bacteria the most delicate agent we now possess for detecting oxygen, and the most accurate for measuring light.

Sir John Lawes and Dr. Gilbert presented a paper on some points in the composition of soils. This was a continuation of the paper presented to the American association two years ago; and it is sought to show that the view which has been maintained, that a soil is a laboratory and not a mine, is erroneous; for not only the facts adduced by the authors in this and other papers, but the whole history of agriculture so far as we know it, clearly show that a fertile soil is one which has accumulated within it the residue of ages of previous vegetation, and that it becomes less fertile as this residue is exhausted. The results of many analyses and experiments with the soils of Manitoba and other prairie lands were cited in evidence.

PROCEEDINGS OF THE SECTION OF GEOLOGY.

IT is impossible, in the limited space at our disposal, to do any thing like justice to the large number of interesting papers presented to this section, and to the discussions called out by them. Moreover, coming prominently before the section as there did, such questions as glacial action, causes of the ice age, formation of the basins of the great lakes, the origin of coal, metamorphism, and the many questions connected with the archean rocks, and when these questions were discussed by men like Dawson, Hall, Geikie, Newberry, Hunt, Bonney, and by many younger though no less earnest workers in geology, it is easier to imagine than to describe in detail the interest attached to such an occasion.

The number of papers presented — fifty-one — was too large to admit of satisfactory discussion; and, even hurried over as they were, it was necessary for the section to meet again upon a fifth day, instead of completing its work in four sittings as was originally anticipated. Many of the topics presented were passed over so lightly as rather to discourage the presentation of papers containing the results of long and patient labor. Even the important questions treated of by Dr. Blanford in his opening address were lost sight of except as he occasionally called them to mind.

While the discussions were sufficiently animated, — some of them perhaps even more so than was seemly, — the animation was due, to a considerable extent, to the tenacity with which each one held to his own theories, rather than to any considerable array of facts brought forward to sustain them.

The section met in the lecture-room of the Redpath museum. A full audience heard the address of Dr. Blanford the chairman, and toward the close of its delivery Lord Lansdowne was one of the listeners.

At the close of the address, in accordance with English usages, a vote of thanks to the speaker was proposed by Sir William Dawson, who commended Dr. Blanford's presenting a subject so full of debatable matter as likely to excite the greatest interest and discussion. Seconding the motion, Dr. Selwyn, director of the Geological survey of Canada, referred to instances similar to those mentioned, which occur in Vancouver's Island and in parts of Australia not re-

ferred to in the address by the chair. The general impression made by the address seemed to be that the problems presented were not only important ones, but too much so to admit of much discussion here, and that they can be solved only by a large amount of observation and field-work.

The ten papers presented during the first day's session, with one exception, related to the geology of the dominion.

The paper of Mr. Gilpin upon gold-mining in Nova Scotia, that of Mr. Brown upon the apatite deposits of Quebec, and that of Mr. Merritt upon the localities and output of economic minerals in Canada, were more or less statistical, and, although important in themselves, did not admit of much discussion.

A short paper by Mr. Frank Adams of the Geological survey of Canada, upon the occurrence of Norwegian 'apatitbringer' in Canada, and its associated minerals, although upon a subject mineralogical rather than geological, was a valuable contribution in itself, and drew forth an interesting discussion by Dr. G. H. Williams of Johns Hopkins University. Recent studies of optical anomalies seen in many minerals seem to show that not a few substances have different crystalline forms at different temperatures. One of these, pyroxene, has a tendency to pass into hornblende when the temperature is lowered. Nature may accomplish the same thing by pressure. Such changes have been observed by Dr. Williams in certain rocks in Maryland and New York, where schistose structure and these changes appear to be co-extensive.

Mr. Honeyman's paper upon the geology of Halifax Harbor was strongly dissented from by Dr. Selwyn, supported by Professor Hitchcock, who insisted that the rocks at that locality were lower Cambrian, and not archean as stated, except perhaps in isolated masses.

The coal-fields of the dominion were treated of directly and indirectly by Mr. Bailey of the Canadian survey on the Acadian basin in American geology, Mr. Gilpin on the distinctive features of the Nova Scotian coal-field, and by Mr. Budden on the coals of Canada.

The Acadian basin borders upon and includes the Gulf of St. Lawrence, New Brunswick, Nova Scotia, Newfoundland, and Prince Edward Island, dipping on all sides toward the gulf. Within this great basin, the most important coal-fields are those of Cumberland, Pictou, and Cape Breton. The beds are more or less folded; the axes of the folds are east-west; and, except where they have been complicated with older strata, there are no serious faults. Differences between districts within this great basin are probably due to local influences in the original basin, rather than to isolation. Attention was called by Dr. Selwyn to the contrast between this broken region and the less-disturbed country adjoining it to the west and north-west, which he considered was due to the limiting of the disturbances by the great St. Lawrence and Champlain fault. This fault is supposed to follow up the St. Lawrence River from somewhere in the gulf, to Quebec, where it leaves the stream, and swings more strongly to the south, and passes down Lake Champlain to somewhere in the vicinity of the Hudson River. To the east of this great fault, the rocks are metamorphosed, folded and broken, while to the west they are but slightly disturbed, and dip at low angles. Besides the coal-fields occurring in the St. Lawrence basin, the two other localities within the dominion producing coal were referred to; one extending from the 97th parallel to the base of the Rocky Mountains, the other on Vancouver's Island. Of the three fields, the first is in the carboniferous, while the last two belong to the secondary or tertiary formations. But little is known as yet of the coal of north-west British Columbia, while that of Vancouver's Island is said to be the best on the west coast.

Mr. Panton's contribution upon the Silurian strata of Red River Valley, Manitoba, was of local interest, and referred to a structure that is not indicated upon the new geological map of the dominion, for want of sufficient information. The same material is already in the hands of the Canadian survey, and will appear in due time.

The principal discussion of the first day's meeting was called forth by Professor Claypole's paper upon the crumpling of the earth's crust as shown by a section across Huntingdon, Juniata, and Perry counties in Pennsylvania, a distance of sixty-five miles. The speaker showed that the folding of the strata along this line, and especially of those in Cumberland valley, has caused a shortening from an original length of about one hundred miles to the present sixty-five miles. Although Professor Claypole's method of obtaining the original length of this line was a mathematical one, and though the folding of the Cumberland-valley strata is a series of overturns, such an extensive contraction of the earth's crust was more than the section was prepared to accept without question. Doubt was expressed in regard to the trustworthiness of the data; while another member, in endeavoring to solve this very problem, basing his estimates upon Professor Lesley's maps, had computed a contraction of eighteen miles over a part of the section where Professor Claypole had made out thirty-two. It was also suggested that the thinning of the beds by crushing in the folded parts had been left out of account.

It was replied to these objections, that the data were as trustworthy as it was possible to obtain; that absolute accuracy was not claimed for the figures, for in such a case it was impossible; and that, at the least estimate, the eighteen miles remained to be accounted for over one part of the section line. The possible thinning of the beds had been left out of account, because, if such a thing had taken place in this instance, it was more than counterbalanced by the tangential pressure that caused the folding.

The 29th was devoted to the discussion of phenomena relating to, and supposed to be the results of, glacial action. Professor Lewis spoke upon the marginal kames of Pennsylvania as distinguished from the moraine; and Dr. Newberry followed with a short lecture upon the last phases in the evolution of the

North American continent. He pointed out the evidences of a genial climate at the close of the miocene and pliocene, which were soon followed by the age of ice; traced the southern limit of the ice-sheet across the continent as far as it has been observed, and expressed his belief in two glacial periods.

These papers were discussed together. Professor James Geikie was unable to draw any sharp line separating moraines and kames, for they merge into each other in such a manner that one cannot say where one leaves off and the other begins. Kames he regarded as partly morainic, and partly of subglacial origin; and he was in accord with Dr. Newberry in regard to the break in the glacial period. Sir William Dawson was inclined to think that water was largely instrumental in producing the work attributed to ice, and referred to the evidences in eastern North America, of the warm interval during the ice age. Dr. Selwyn briefly proposed a possible explanation of the supposed power of ice to excavate, in solid rocks, basins like those of the great lakes. He referred to the profound decomposition of rocks observed in Australia and in the gneiss of Brazil. In Australia this decomposition was sometimes two hundred and fifty feet deep; and he thought it possible that ice, entering such a region, would be able to make such basins as those of the great lakes. Professor Spencer, of the university of Missouri, contributed some of the results of his own work upon the subject of the origin of the basin of Lake Ontario, which led him to believe that this lake basin, at least, was not of glacial origin. Professor Hall of New York called attention to the fact that the axes of the lakes are along the lines of outcrop of the rocks, and that the basins are excavated in the softer material.

Four other contributions, relating in one way or another to the glacial period, were read without much discussion; and the theories concerning the causes of the ice age were taken up. The Rev. Mr. Hill classed the theories as cosmical, terrestrial, and astronomical. The first class was not regarded as worthy of consideration, while terrestrial theories were as readily disposed of as being more or less unsatisfactory. Attention was directed especially to the theory of Dr. Croll, a combination of the precession and eccentricity theories. It was held that the part of Croll's explanations regarding fogs, deflection of currents, and the like, would support any or all theories alike. His conclusion was, that the alteration of currents and winds seemed to be the most powerful causes thus far suggested.

That part of Croll's theory regarding the greater eccentricity of the earth's orbit was attacked by Mr. W. F. Stanley in another paper. He could not conceive of the earth's initial temperature having been lower, or of the sun's heating power being less, and that therefore glaciation could not have depended upon such conditions. He regarded it as a local phenomenon, due to aërial and oceanic currents.

There was no session on the 30th, the day being given over to excursions. To the English geologists the occasion was a welcome one; and under the guidance of members of the geological survey of Canada, and of the local committee, they visited Ottawa, Ausable Chasm, Lake Memphremagog, Quebec, and various localities in the immediate vicinity of Montreal.

The prominent questions coming before the section on the 1st were those regarding archaean rocks. Professor Bonney opened the question with a lengthy paper upon these rocks in England, and made some comparisons with those of Canada. Dr. T. Sterry Hunt followed, treating of the eozoic rocks of North America. The paper was a *résumé* of some of Dr. Hunt's old work. As might have been expected, the very use of the word 'eozoic' was followed by some shaking of the head among the members; and, at the close of Dr. Hunt's reading, the use of the word was criticised as taking for granted a question which is still in dispute. The writer held, however, that his use of the word did not depend solely upon whether the supposed Eozoon canadense were the remains of a living organism, but upon the evidences of organic life having come into existence at or about the geological age referred to.

Professor Hall discussed the question at some length, and expressed the conviction that the solution of the problem lay in the study, not of large masses of rock, but in the study of junctures.

Every one was interested to hear what Sir William Dawson would say upon this question. He appeared to speak with some hesitation, due doubtless to the opposition to his well-known theories. He had but little to say; urging as a reason, that he was but poorly qualified to discuss the question from the standpoint from which it was being viewed, — namely, that of a chemical geologist. He said that he had spent his time in trying to find fossils in these rocks, and had got but little thanks for his labor. He would not enter the question in regard to Eozoon here. A co-laborer has the whole matter in hand now, and will soon publish all that is known. Major Powell was called upon, but limited himself to saying that we were not much disturbed by the question in the States, but were limiting ourselves to mapping the regions covered by these archean rocks.

The paper by Prof. J. D. Dana upon the southward ending of a great synclinal in the Taconic range was read by Professor Brewer, and elicited some very heated and severe protests on the part of Dr. Hunt. He insisted that the structure referred to was known twenty years ago, that the metamorphosis of sedimentary beds assumed by Professor Dana was untenable, and that there was no vestige of a proof of such a thing. Professor Brewer replied in behalf of Professor Dana, that recent and thorough work had been done in the region referred to, and that nothing was stated upon assumption. Major Powell was astounded that Dr. Hunt should speak as he did, if the structure was as represented; and he called upon him to either give his reasons for such statements, or to retract them, for the only way to attack such a question was to attack the structure. Professor Hall opposed Dr. Hunt's position, and vouched for the structure as represented; and Dr. Selwyn spoke of the existence in British Columbia of crystalline rocks in the carbon-

iferous. Mr. Topley of the English survey then spoke of the general acceptance, by the various European surveys, of the theory of the change of sedimentary to crystalline rocks; and here the discussion of the archean rocks ended.

Members of the English survey exhibited maps colored so as to represent the solid geology; and others, of the same places showing the geology as it is actually seen upon the surface, that is, including the drift. This latter was regarded as valuable in connection with questions of water supply. Doubt was expressed, however, about the value of such surface maps save for local and temporary purposes, and it was suggested that some method be devised by which it would be possible to represent both solid and surface geology upon the same sheet.

The plan of Mr. Gilbert, of the U. S. geological survey, for a subject bibliography of North American geology, elicited some discussion. The section evidently felt a deeper interest in this paper than it was ready to express on so short a notice.

A brief account of his work upon the Jurassic mammals of America was given by Professor Marsh. Six years ago no Jurassic mammal was known; but five years ago they were found in Wyoming, and from one pocket alone from three to four hundred individuals have been taken, representing eight genera and twenty species.

Sir William Dawson spoke at some length upon the ancient land flora of the old and new world, calling attention to the striking correspondence found in countries widely separated.

Two paleontological papers by Mr. G. F. Mathews were spoken of in high terms, especially by the Canadian geologists; and the hope was expressed, that if, as had been suggested, one of the Canadian papers should be published in full by the association, the one upon the primitive Conocoryphean should be selected.

A paper by Prof. J. Milne, upon the earthquake phenomena in Japan, referred to the mechanical difficulties to be dealt with in his observations, and described a new earthquake house he has built upon large balls resting upon iron plates. Three hundred and eighty-seven earthquakes had been observed by him, eighty-seven per cent of which came from the sea.

Sir William Dawson then went over the leading facts worked out by Dr. Hall in his forthcoming geology of Palestine.

The last paper presented was by Mr. P. Hallett, and consisted of notes on Niagara Falls. For American geologists they contained nothing new.

It will be seen that nothing striking or new was presented to the section; indeed, some of the productions have been served up already a number of times and in various forms. But any thing different was hardly to be expected. The meeting was remarkable for bringing together workers in geology from every quarter of the globe. From Japan was Lyman, and a paper was read from Milne; from India were Blanford and Ball; from Australia were Blanford and Selwyn; from Africa was T. Rupert Jones; from Palestine was Professor Bauerman, and a paper was read from Hull; from Brazil was Branner; from England, Scotland, and Ireland, were the various members from those countries; from the States were Hall, Newberry, Marsh, Powell, and many others; while the Canadian workers were represented by Dawson, Selwyn, Whiteaves, and Adams.

PROCEEDINGS OF THE SECTION OF BIOLOGY.

IN opening the biological section Thursday, Aug. 28, the president of that section, Prof. H. N. Moseley, delivered an address upon the physiology of deep-sea life. Well fitted as Professor Moseley is to discuss the subject of deep-sea life, on account of his long participation in its investigation during the voyage of the Challenger, his address was not only a critical and discriminating review of some of the later results arrived at by other observers and experimenters, but was supplemented by many valuable statements and suggestions of his own.

Mr. C. Spence Bate, of Plymouth, Eng., read a paper on the geographical distribution of the macrurous Crustacea, which embodied many important notes on form, color, habits, and habitats of different genera of these animals. In allusion to points mentioned by Mr. Bate, Professor Moseley said that deep-sea forms either had very large eyes or had no eyes, and that there must be a source of light in the deep sea; that source was phosphorescence, but its light must be very dim. The question was still unanswered, whether the larvae of deep-sea crustacea were found at the surface, as are the larvae of other crustaceans, and had to descend two or three miles through the ocean to reach their feeding grounds as adults.

Prof. W. J. Sollas, of Dublin, read a long paper on the origin of fresh-water faunas. The main difficulties in the way of most marine animals becoming inhabitants of fresh water were considered under three different heads: first, the time requisite for the animals to adapt themselves to the new medium; second, the greater severity of climate experienced by animals in fresh water than in salt water; and, third, the inability of marine animals with free-swimming larval stages to enter the mouths of fresh-water streams, or to breed in flowing streams if they gained access to them. In regard to climate, it is a fact that many marine forms become fresh-water ones as we approach the tropics. But severity of the climate of fresh water is not alone sufficient to account for the absence from it of many families well represented in marine faunas. Professor Sollas had prepared an extensive table, comparing by orders and by families the animals of fresh with those of salt water, and finds as a rule, with some exceptions, which he accounts for by peculiarities of life-history, that fresh-water animals carry their ova in or about them during the earlier stages of development, or they develop by buds or statoblasts. Some marine forms have passed from the ocean into marshes, and