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THE CANADIAN

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AND REPLACING

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THE

CANADIAN RECORD

OF SCIENCE.

VOL. II. JANUARY, 1886. NO. 1.

Cretaceous Floras of the Northwest.

By Sir William Dawson.

The following is a summary of the general conclusions of a paper on this subject, now in the press in the "Transactions of the Royal Society of Canada," and in which a number of new species recently collected by Dr. G. M. Dawson, Mr. Weston, and Mr. Tyrrell, of the Geological Survey, are described and figured.

GEOLOGICAL RELATIONS OF THE FLORAS.

In a memoir by the writer in the first volume of the Transactions of the Society will be found a table of the Cretaceous formations of the western Northwest Territories of Canada, prepared by Dr. G. M. Dawson, and giving the geological position of the plants at that time described. The new facts detailed in the paper mentioned require us to intercalate in this table three distinct plant-horizons not previously recognized in the western territories of Canada.

One of these, the Kootanie series, should probably be placed at the base of the table as a representative of the Urgonian or Neocomian; or, at the very least, should be held as not newer than the Shasta group of the United States geologists, and the lower sandstones and shales of the Queen Charlotte Islands. It would seem to correspond in the character of its fossil plants with the oldest Cretaceous floras recognized in Europe and Asia, and with that of the Komé formation in Greenland, as described by Heer. No similar flora seems yet to have been distinctly recognized in the United States, except, perhaps, that of the beds in Maryland, holding cycads, and which were referred many years ago by Tyson to the Wealden.

The second of these plant-horizons, separated according to Dr. G. M. Dawson, by a considerable thickness of strata, is that which he has called the Mill Creek beds, and which corresponds very closely with that of the Dakota group, as described by Lesquereux, and that of the Atané and Patoot formations in Greenland, as described by Heer. This fills a gap, indicated only conjecturally in the table of 1883. Along with the plants from the Dunvegan group of Peace River, described in 1883, it would seem to represent the flora of the Cenomanian and Turonian divisions of the Cretaceous in Europe.

Above this we have also to intercalate a third sub-flora, that of the Belly River series at the base of the Fort Pierre group. This, though separated from the Laramie proper by the marine beds of the Pierre and Fox Hill groups, more than 1,700 feet in thickness, introduces the Laramie or Danian flora, which continues to the top of the Cretaceous, and probably into the Eocene, and includes several species still surviving on the American continent, or represented by forms so close that they may be varietal merely.

Lastly, the subdivision of the Laramie group, in the last report of Dr. G. M. Dawson, into the three members known respectively as the Lower or St. Mary River series, the Middle or Willow Creek series, and the Upper or Porcupine Hill series, in connection with the fact that the fossil plants occur chiefly in the lower and upper members, enables us now to divide the Laramie flora proper into two sub-floras,—an older, closely allied to that of the Belly River series below; and a newer, identical with that of Souris River, described as Lignite Tertiary in Dr. G. M. Dawson's Report on the 49th Parallel, 1875, and which appears to agree with that known in the United States as the Fort Union group, and in part at least with the so-called Miocene of Heer from Greenland.

From the animal fossils and the character of the plants, it would seem probable that the rich flora of the Cretaceous coal fields of Vancouver Island is nearly synchronous with that of the coal-bearing Belly River series of the western plains.

It will thus be seen that the explorations already made in Canadian territory have revealed a very complete series of Cretaceous plants, admitting, no doubt, of large additions to the number of species by future discoveries, and also of the establishment of connecting links between the different members; but giving a satisfactory basis for the knowledge of the succession of plants, and for the determination of the ages of formations by their vegetable fossils.

In connection with the subjoined table it should be understood that Tertiary floras, probably Miocene in age, are known in the interior of British Columbia, though they have not yet been recognized in the territories east of the Rocky Mountains.

Before leaving this part of the subject, I would deprecate the remark which I see occasionally made, that fossil plants are of little value in determining geological horizons in the Cretaceous and Tertiary. I admit that in these periods some allowance must be made for local differences of station, and also that there is a generic sameness in the flora of the Northern Hemisphere, from the Cenomanian to the modern; yet these local differences and general similarity are not of a nature to invalidate inferences as to age. No doubt so long as palæobotanists seemed obliged, in deference to anthority, and to the results of investigations limited to a few European localities, to group together, without distinction, all the floras of the later Cretaceous and earlier Tertiary, irrespective of stratigraphical considerations, the *subject lost its geological importance. But when a good* series has been obtained in any one region of some extent, the case becomes different. Though there is still much imperfection in our knowledge of the Cretaceous and Tertiary floras of Canada, I think the work already done is sufficient to enable any competent observer to distinguish by their fossil plants the Lower, Middle, and Upper Cretaceous, and the latter from the Tertiary; and, with the aid of the work already done by Lesquereux and Newberry in the United States, to refer approximately to its true geological position any group of plants from beds of unknown age in the west.

The successive series may be tabulated as on the opposite page, with references for details to the fuller table in my memoir of 1883.

Though the flora of the Belly River series very closely resembles that of the Lower Laramie, showing that similar plants existed throughout the Senonian and Danian periods in North America, yet it is to be anticipated that specific differences will develop themselves in the progress of discovery. In the meantime, it scarcely seems possible to distinguish by fossil plants alone the Lower Laramie beds from those of Belly River; and, if these are really separated by 1,700 feet of marine strata, as is now believed on stratigraphical grounds, the flora must have been remarkably persistent. The Dunvegan series of Peace River probably corresponds in time with the marine Niobrara and Benton groups farther south and the Mill Creek with the Dakota group.

PHYSICAL CONDITIONS AND CLIMATE INDICATED BY THE CRETACEOUS FLORAS.

In the Jurassic and earliest Cretaceous periods the prevalence, over the whole of the Northern Hemisphere and for a long time, of a monotonous assemblage of Gymnospermous and Acrogenous plants, implies a uniform and mild climate and facility for intercommunication in the

SUCCESSIVE FLORAS AND SUB-FLORAS OF THE CRETACEOUS IN CANADA.
(IN DESCENDING ORDER.)

PERIODS.	FLORAS AND SUB-FLORAS.	REFERENCES.
Transition Eocene to Cretaceous.	Upper Laramie or Porcupine Hill	Platanus beds of Souris River and Calgary. Report Geol. Survey of Canada for 1879, and Memoir of 1885.
Upper Cretaceous (Danian and Senonian.)	Middle Laramie or Willow Creek beds.	
	Lower Laramie or St. Mary River	Lemna and Pistia beds of bad lands of 49th Parallel, Red Deer River, etc., with Lignites. Report 49th Parallel and Memoir of 1885.
	Fox Hill Series	Marine.
	Fort Pierre Series	Marine.
	Belly River	Sequoia and Brasenia beds of S. Saskatchewan, Belly River, etc., with Lignites. Memoir of 1885.
	Coal Measures of Nanaimo, B.C., probably here.	Memoir of 1883. Many Dicotyledons, Palms, etc.
Middle Cretaceous (Turonian and Cenomanian.)	Dunvegan Series of Peace River	Memoir of 1883. Many Dicotyledons, Cycads, etc.
	Mill Creek beds of Rocky Mountains	Dicotyledonous leaves, similar to Dakota Group of the U.S. Memoir of 1885.
Lower Cretaceous (Neocomian, etc.)	Suskwa River beds and Queen Charlotte Island Coal Series. Intermediate beds of Rocky Mts.	Cycads, Pines, a few Dicotyledons. Report Geol. Survey. Memoir of 1885.
	Kootanie Series of Rocky Mountains	Cycads, Pines, and Ferns. Memoir of 1885.

north. Toward the end of the Jurassic and beginning of the Cretaceous, the land of the Northern Hemisphere was assuming greater dimensions, and the climate probably becoming a little less uniform. Before the close of the Lower Cretaceous period the dicotyledonous flora seems to have been introduced, under geographical conditions which permitted a warm-temperate climate to extend as far north as Greenland.

In the Cenomanian, we find the Northern Hemisphere tenanted with dicotyledonous trees closely allied to those of modern times, though still indicating a climate much warmer than that which at present prevails. In this age, extensive but gradual submergence of land is indicated by the prevalence of chalk and marine limestones over the surface of both continents; but a circumpolar belt of land seems to have been maintained, protecting the Atlantic and Pacific basins from floating ice, and permitting a temperate flora of great richness to prevail far to the north, and especially along the southern margins and extensions of the circumpolar land. These seem to have been the physical conditions which terminated the existence of the old Mesozoic flora and introduced that of the Middle Cretaceous.

As time advanced, the quantity of land gradually increased, and the extension of new plains along the older ridges of land was coincident with the deposition of the great Laramie series, and with the origination of its peculiar flora, which indicates a mild climate and considerable variety of station in mountain, plain and swamp, as well as in great sheets of shallow and weedy fresh water.

In the Eocene and Miocene periods, the continent gradually assumed its present form, and the vegetation became still more modern in aspect. In that period of the Eocene, however, in which the great nummulitic limestones were deposited, a submergence of land occurred on the Eastern Continent which must have assimilated its physical conditions to those of the Middle Cretaceous. This great change, affecting materially the flora of Europe, was not equally great in America, which also by the north and south extension of its mountain chains permitted movements of migration not possible in the Old World. From the Eocene downward, the remains of land animals and plants are found only in lake basins occupying the existing depressions of the land, though more extensive than those now remaining. It must also be borne in mind, that the great foldings and fractures of the crust of the earth which occurred at the close of the Eocene, and to which the final elevation of such ranges as the Alps and the Rocky Mountains belongs, permanently modified and moulded the forms of the continents.

These statements raise, however, questions as to the precise equivalence in time of similar floras found in different latitudes. However equable the climate, there must have been some appreciable difference in proceeding from north to south. If, therefore, as seems in every way probable, the new species of plants originated on the Arctic land and spread themselves southward, this latter process would occur most naturally in times of gradual refrigeration or of the access of a more extreme climate, that is, in times of the elevation of land in the temperate latitudes, or conversely, of local depression of land in the Arctic, leading to invasions of northern ice. Hence, the times of the prevalence of particular types of plants in the far north would precede those of their extension to the south, and a flora found fossil in Greenland might be supposed to be somewhat older than a similar flora when found farther south. It would seem, however, that the time required for the extension of a new flora to its extreme geographical limit, is so small in comparison with the duration of an entire geological period, that, practically, this difference is of little moment; or at least does not amount to antedating the Arctic flora of a particular type by a whole period, but only by a fraction of such period.

It does not appear that, during the whole of the Cretaceous and Eocene periods, there is any evidence of such refrigeration as seriously to interfere with the flora, but perhaps the times of most considerable warmth are those of the Dunvegan group in the Middle Cretaceous and those of the later Laramie and oldest Eocene.

It would appear, that no cause for the mild temperature of the Cretaceous needs to be invoked, other than those mutations of land and water which the geological deposits themselves indicate. A condition for example of the Atlantic basin in which the high land of Greenland should be reduced in elevation and at the same time the northern inlets of the Atlantic closed against the invasion of Arctic ice, would at once restore climatic conditions allowing of the growth of a temperate flora in Greenland. As Dr. Brown has shown,[1] and as I have elsewhere argued, the absence of light in the Arctic winter is no disadvantage, since, during the winter, the growth of deciduous trees is in any case suspended; while the constant continuance of light in the summer is, on the contrary, a very great stimulus and advantage.

It is a remarkable phenomenon in the history of genera of plants in the later Mesozoic and Tertiary, that the older genera appear at once in a great number of specific types, which become reduced as well as limited in range down to the modern. This is no doubt connected with the greater differentiation of local conditions in the modern; but it indicates also a law of rapid multiplication of species in the early life of genera. The distribution of the species of *Salisburia, Sequoia, Platanus, Sassafras, Liriodendron, Magnolia,* and many other genera, affords remarkable proofs of this.

Gray, Saporta, Heer, Newberry, Lesquereux, and Starkie Gardner, have all ably discussed these points; but the continual increase of our knowledge of the several floras, and the removal of error as to the dates of their appearance must greatly conduce to clearer and more definite ideas. In particular, the prevailing opinion that the Miocene was the period of the greatest extension of warmth and of a temperate flora into the Arctic, must be abandoned in favour of the later Cretaceous and Eocene; and, if I mistake not, this will be found to accord better with the evidence of general geology and of animal fossils.

While the Memoir, of which the above are the conclu-

[1] Florula Discoana.

sions, was passing through the press, the report of Mr. Whiteaves, F.G.S., Palæontologist to the Canadian Survey, on the invertebrate fossils of the Laramie and Cretaceous of the Bow and Belly River districts appeared ("Contributions to Canadian Palæontology," Vol. I. Part i, 89 pages and 11 plates). This valuable Report constitutes an independent testimony, based on animal fossils, to the age of the beds in question, and accords in the main very closely with the conclusions above derived from fossil plants. Unfortunately, however, no animal remains have yet been found in the Kootanie series, and the only fossil recorded from the Mill Creek beds is a species of *Inoceramus*, characteristic in the United States of the Niobrara and Benton groups, but which is found in beds which may be somewhat higher than those holding the plants.

The Structural Features of "Discina Acadica" (Hartt), of the St. John Group.

By G. F. Matthew.

This rather common species of the Cambrian at St. John Basin was first figured and described in the second edition of Sir J. Wm. Dawson's "Acadian Geology;" but as, owing to the imperfect material in his hands, the original describer, Prof. C. F. Hartt, did not clearly apprehend the nature of this species, a few words relative to the structural features of this, one of the earliest of the gasteropods, may be of interest.

Mr. R. P. Whitfield first drew attention to the calcareous nature of the test of this species, and suggested that it was a gasteropod allied to *Palæacmea* or *Metoptoma*. Mr. C. D. Walcott afterwards referred it to the former genus, after a study of the type-specimens preserved in Prof. Hartt's collection at Cornell University; but he subsequently referred it to Dr. H. Hicks' genus, *Stenotheca*. This is where the late Mr. E. Billings placed a similar shell found in the Cambrian limestone of S.E. Newfoundland, and to this genus they are undoubtedly closely allied; but an examination of a series of small shells of the St. John group, which have a closer affinity for the shell from the Menevian group of Wales, which was the type of Dr. Hicks' genus *Stenotheca*, leads the writer to infer that Hartt's species *acadica* is not so close to Hicks' *S. cornucopia* as is the group of small shells above referred to. Hence it should be distinguished as a sub-genus, characterized by its subcircular aperture and patelloid form. Probably its nearest relatives now living are not the true limpets, but are among the Fissurellidæ, and especially in the genus *Parmophorus*, which it resembles in many important particulars. The dimensions of the adult of *S. acadica* are: height about 7 mm., width and length of the aperture equal, and about 12 mm. In the young shells, however, the form is quite different, being proportionately higher and much narrower at the aperture; in both of these respects resembling the small Stenothecæ above referred to.

The internal markings of the shell leave no doubt as to its affinities being with the Gasteropods; in the young individual herewith figured they are well displayed, the course and extent of the muscular impression being clearly defined: the apex is directed backward and the muscular scar is of an elongated horse-shoe form.

Except for the absence of an involute apex this species is not unlike *Carinaropsis carinata* (Hall) of the Trenton formation; it is compressed near the apex, and expands rapidly toward the aperture in a manner similar to that species, but in the way in which the concentric ridges are added it is comparable with *Metoptoma (?) rugosa* (Hall).

It lived in shallow seas along the coast, if one may judge from the species associated with it, and probably was a bottom-crawler. The true Stenothecæ appear to have been more varied in habitat, as some are found in company with Hartt's species, and others in finer shales, where they are buried with remains of seaweeds (?), sponges, hydrozoa, etc. A fact in relation to the variation of resembling forms like these is related by Dr. Woodward in his "Manual of the Mollusca," where he speaks of several wide limpets which assume a narrow compressed form when growing on the stems of seaweeds. Similar differences of habitat may have led to the characteristic form of the aperture and other features which distinguish *S. acadica* from the more typical Stenothecæ.

The vertical range of this species is not great, for it is not known either above or below Div. 1c, but it is rather common where it does occur, and its associate species are those that have been found to abound in comparatively shallow water near the shore line. At an horizon corresponding to that in which our species is found, occurs the European *Metoptoma barrandei* (Linnarsson.)

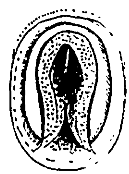

FIG.—*Stenotheca* (sub-gen.?) *acadica*, Hartt, sp., magnified 4/1, young individual exhibiting the internal characters of the shell. The horse-shoe shaped muscular impression open in front, the visceral cavity with a sharp ridge thickening and stiffening the apex. The inner area of the visceral cavity is lozenge-shaped opposite the more rigid part of the dorsal ridge.

ORIGIN OF THE AINOS AND THEIR FINAL SETTLEMENT AND DISTRIBUTION IN JAPAN.

BY D. P. PENHALLOW.

The Ainos probably displaced an earlier race of people in Japan, or at all events found remains of such a people there. Considering, then, that they are not truly autocthonous, we are led to inquire into their origin, as well as their first appearance in the country. Naturally, we first of all seek evidence from the people themselves, concerning their ancestors and their first appearance in the country ; but in so doing we are furnished with traditional lore, which, however interesting, often proves of little value in arriving at the true facts. Yet it is proper for us to give these traditions due consideration, as being the only historical records of the people.

The principal tradition of their origin is that already related,[1] according to which Jinmu Tenno, the founder of the Japanese, became displeased with his daughter and set her adrift in an open boat. After floating about for some days, she landed on the distant shores of an island now called Yezo, and there formed an attachment for a dog, the result of the union being the first of the Aino people.

Such a tradition possesses no value, and in all probability it did not originate with the Ainos themselves, but with the Japanese who sought to degrade them as much as possible. Moreover, the Japanese origin of this tradition seems the more probable, when we consider that they have endeavored to give the story a certain plausibility by tracing an immediate connection between it and the word, *Aino.* Thus, in Japanese, the word *inu* means a dog, and certain scholars maintain that the word, *Aino,* is but a corruption of this, it being originally applied in allusion to the supposed origin of the people. Yet again, other scholars endeavor to make the word a derivation of *ai-no-ko,* "an offspring of the middle," as signifying a cross between a woman and a dog.

The entire tradition loses whatever of value it may have possessed, when we bear in mind that the Japanese occupation occurred about B.C. 600, and the history of this latter people, points most unmistakably to the occupation of the country at that time by the Ainos. Moreover, if hard pressed for a reason for holding such a tradition, the Ainos usually reply with primative simplicity, "because the Japan ese tell us so." The reluctance which the Ainos exhibit in making this statement, is but a further evidence of the lingering awe with which they regard their conquerors.

That they owe their existence to a god, is also one of the leading traditions of the Ainos; but where they first appear ed, they cannot say.

Mr. Griffis speaks of the word, *Aino,* as of rather modern

[1] See CANADIAN RECORD OF SCIENCE, i. 228–236.

origin; but this there is good reason to doubt. At all events, in their own language, the word means "man" and appears to be the only equivalent of this word in use; and every attempt to trace it back to *inu* or *ai-no-ko* would but strengthen our belief in attempts to degrade the Aino as much as possible. This, moreover, is in accord with the line of policy which has been pursued by the conquering people from the first up to very recent date, for we find that with their advent the Ainos were looked upon with contempt as very inferior beings; and, as they did not give way to the new-comers quite rapidly enough, were pursued into the northern wilds by a war of extermination. From that time on, the Japanese have considered it degrading to have any relations with the Ainos, other than those which would naturally exist between a conquering and conquered people; and, in carrying this policy to an extreme, there might and doubtless would arise many stories greatly to the disadvantage of the Aino, which, repeated through several centuries, would come to be looked upon by many as true, and finally accepted to a certain extent by the Ainos themselves because of their realizing the gulf which separated them from the Japanese, as well as faith in the superior knowledge of the latter.

We must, therefore, look elsewhere for the origin of this interesting people; and we naturally turn at once to an examination of them as they are found at the present day, as well as of localities where they have been, and where they have left undoubted evidence of their presence in words of their language which still linger as first applied to natural objects. Of the Aino movement previous to their occupation of Japan, we can derive no evidence from remains of their manufactures or structures, for none of these have yet been found; and we are thus brought to base our knowledge of their progress upon remnants of their language, which, after all, is the most reliable guide we can probably have, particularly when supplemented by physical characteristics and traditions.

We are well aware that, even at the present time, the Ainos are familiar denizens of eastern Siberia, but it is desirable to determine whence they came for settlement even there.

Throughout the length and breadth of Japan, as we find it to-day, there are many Aino names, clearly recognizable as such, applied to mountains and other prominent natural objects as well as to places, towns and cities; and these are permanent monuments exactly similar to the lasting record of their former greatness, which our North American Indians have left in such names as Connecticut, Winnipesaukee, Niagara, etc., etc. Though the Aino words have undergone much modification at the hands of the Japanese, yet it is difficult so to disguise them that they cannot be recognized. Conspicuous examples of this are to be found in the present name of the town Matsumai from the Aino *Mado-mai*. Likewise in the modern capital town of Sapporo, we have a corruption of the Aino *Satsu-poro*, "a great dry place." And if we apply this test more generally, we may readily discover traces of the Ainos over a much wider area. Thus *Kurile*, applied to the northern chain of islands reaching to Kamschatka, is a distinctively Aino word. When in this manner we get back to the continent, we there discover still further undoubted traces of this people.

Upon this point Latham[1] says:—"I cannot think it is by mere accident that the root, *kor*, appears in the names, *Kor*ia, *Kur*ile and *Kor*iak; nor yet that it is by accident that, when we reach the Baltic, the same syllable appears in *Kar*dia and *Kur*land, also reappearing in the name of the government of *Kur*sa." Pritchard[2] considers the Aino to be closely related to the Samoides and Caucasian tribes, thus leading us to examine western Siberia for evidences of their early home and settlement. Yet again Brace[3], who regards the Japanese as a graft on the Ainos, speaks of the latter in such terms as might lead us to believe that they "belong to the north Turanian family, and though their language does not precisely determine the race, probably the Tungusian." Wood[4] gives great weight to matters of tradition, and is thereby strongly led to the belief in a western origin, for

[1] Descriptive Ethnology.
[2] Nat. Hist. of Man., p. 227.
[3] Races of the Old World.
[4] Trans. Eth. Soc., New Series, iv. 34, etc.

he tells us that, "the chief objection to a northern origin for the Aino is, that they persist in cherishing the tradition that their ancestors came from the west; that is from some place in the direction of the Asiatic continent."

Here and there, along the northern borders of Siberia, are also to be found remnants of a language which show the undoubted presence at some former period of the Aino people, and we may thus retrace their course until, as all the evidence now at our disposal permits, we locate them in the region of the Southern Caucasus, as the centre from which they were dispersed. This view is, as we have seen, consistent also with tradition; and, if we also add the evidence of physical characteristics, then we must grant the probable correctness of this view.

Dr. Scheube, after elaborate studies of this people, distinctly states that there is "no Mongolic type in the Aino," and he further speaks of them as most nearly comparable to the Russian peasantry. Topinard[1] expresses the same view, and speaks of them as comparable to the people of the Moscow district.

The appearance of the Aino is so distinct from that of the Japanese as to determine a wide separation of the two people, even upon the most casual inspection. What these distinctions are, will appear on another occasion; but I may observe in passing, that an unprejudiced observer at once notes the very close resemblance, even in color of skin, which the Ainos bear to Europeans, and all the best accounts of this people speak of this.

After reaching the eastern confines of Siberia, it is a comparatively easy task to trace the Ainos in their subsequent wanderings. They appear first to have spread along the coast from Kamschatka southward, probably as far as Mongolia. Finding the Island of Karafuto—Saghalien—easily reached by boats, and, at certain times when the tides were favorable, even on foot, they were naturally led in time to occupy a territory which afforded, in its streams, an abundance of food in the form of fish. Eventually, the narrow

[1] Anthropology, p. 476. See also *Nature*, xxvi. 524, etc.

strait of La Perouse was easily crossed, and the Island of Yezo was then found to hold out the same temptations to settlement which had previously been discovered in Karafuto. From this point, different considerations operated to tempt them in opposite directions. To the north-east, the long line of the Kuriles offered tempting fishing-grounds from which could be obtained, in the seal and sea otter, an abundance of food and warm clothing; while they would hardly encounter a more rigorous climate, probably less so, than that to which they were accustomed in Siberia. We have also to bear in mind that these islands, as well as the Aleutians, may have been occupied from the north. Again, from Yezo, as a starting point, they found temptations in an opposite direction, not only in an abundance of fish, but in an increasingly warm climate and an abundance of vegetable food which would become of a more enticing character as they constantly progressed southward. The material which they were accustomed to use for clothing in Siberia, they still found abundantly in Yezo and Northern Honshiu. Thus in course of time, the Ainos came to occupy the entire chain of Japanese Islands from the extreme north, probably as far south even as the Riu-Kiu Islands, and it was thus that the Japanese found them at the time of their occupation. As the Japanese came more fully into possession of the country, they preserved and adopted into their own language such names of very prominent natural features as had been bestowed by the Ainos; and these, often with great modification, remain at the present time as evidence of the former presence of this people.

At first gaining a foothold upon their new territory through peaceful overtures, the Japanese, with the consciousness of increasing strength, no longer preserved the measures of precaution dictated by prudence born of a sense of the Ainos' savage superiority; but gradually adopted more boldness, made demands where before treaty was required by good judgment, and finally became openly aggressive. Thus, gradually, they came to occupy the entire southern extremity of Honshiu and the adjacent islands. The Ainos in the meantime, at first susceptible to kindly overtures, gradually became suspicious and uneasy as the strength of the Japanese increased and their demands were more openly made and boldly enforced. Seeing their lands and choicest hunting-grounds fast taken from them, they soon felt that, by a resort to force only, could they hope to preserve their natural rights. Then followed a series of bloody wars in which the Japanese, possessing superior skill and weapons, were in the end victorious, and the poor aborigines were driven further and further towards the northern portion of the country in the direction from which they came. Early Japanese history is filled with accounts of this constant struggle.

The retreat of the Ainos seems to have been slow, however, and stubbornly made, for in A.D. 110, seven hundred years after the first landing of the Japanese, the Ainos were still in possession of the region extending southward from Tokio to the Hakone Mountains, and at this date is chronicled an important campaign of Yamato-Dake against the savages of this district. By the middle of the fourth century, the war, which had been continuously waged against the Ainos for so long a time, had driven them well to the north, so that they were confined principally to the region lying beyond lat. 38° N. The policy which led to constant warfare with the Ainos, continued in full force and was perhaps given fresh strength, when, quite at the end of the twelfth century, the Mikado appointed Yoritomo as his great general, or "barbarian-subjecting great general," the Tei-i-tai Shogun. Driven finally to the limits of Honshiu, their last hold on the main island was lost; and crossing the Straits of Tsugaru (Sangar), they found refuge in the wilds of Yezo. Not even here, however, did they find immunity from persecution, for the Japanese soon discovered the valuable fisheries and compelled the Ainos to yield an unwilling consent to their occupation of the island. Thoroughly subdued at last, with broken spirits, they calmly bowed to the inevitable and became quietly submissive, and thus it is that we find them to-day.

It will thus readily be seen that the relations of the Aino to the Japanese were and are precisely those of the Amer-

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ican Indian to the European, and in this history is truly repeated. It is the same story of pacific intentions, bold demands, aggressive acts, and continual wars, resulting in the final subjugation and extermination of a weaker race. During the first centuries of conquest, the Ainos were called *Ebisu*, literally "savages," but later this name gave place to that by which they are now known.

If we are to examine the present geographical distribution of the Ainos, we find the southern limit in Yezo, where they are most abundant now. According to the most recent and trustworthy statistics, there are in all 16,637, of which 8,316 are men and 8, 321 women.[1] They are distributed in the eleven provinces of Yezo as follows:—

Ishikari,	1,058	Shiribushi,	857
Iburi,	3,726	Hitaka,	5,270
Tokachi,	1,498	Teshiwo,	352
Oshima,	245	Kushiro,	1,449
Nemuro,	473	Chisuma,	460
Kitami,	1,249		

Of these, however, 750 were brought from Karafuto to the province of Ishikari, when in 1876 Saghalien was ceded to Russia in exchange for the Kuriles. In addition to these, Ainos are found in Saghalien, on the opposite Siberian coast and in Kamschatka, as also to a more limited extent in Alaska.

Having progressed so far eastward, it is hard to conceive why these people should not have continued in the same direction as long as there were no great barriers. Spreading as they did from one island to another through Japan and the Kuriles, there is no reason why they should not have visited the various members of the Aleutian chain and

[1] Brauns (*Science*, ii. 134, see also i. 210 and 307,) endeavors to make it appear, from statements of missionaries and from estimates based upon the villages he passed, that there are at least 50,000 Ainos. His grounds, however, are wholly unwarrantable and his conclusions in direct conflict with the most reliable official statistics, for which he professes a profound contempt. The figures given above are essentially the same as those given by Dr. Scheube, who states the Aino population to be 17,000 in round numbers.

thus in time have reached America at a very early period. The difficulties to be met were hardly greater than those they must have encountered in passing to and from many of the islands of Japan. We are thus seriously led to ask, if some of the resemblance between the Ainos and Esquimaux are not indications of affinity rather than mere coincidences?

There thus appear possibilities of an Asiatic influence upon our earliest settlers, which may have been more than passing; but the field for speculation in this direction enlarges so rapidly, that we must await the accumulation of facts, which are now wanting, before correct judgment can be given.

New Fresh-Water Sponges from Nova Scotia and Newfoundland.

By A. H. MacKay.

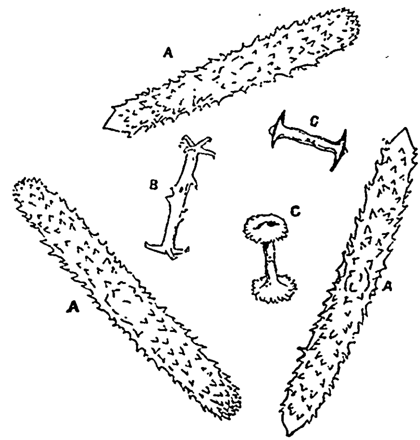
In the article on Organic Siliceous Remains found in the Lake Deposits of Nova Scotia, published in the last number of the Record of Science, Nos. 3 and 8 of the list of sponges were referred to as new. I here quote the original descriptions of the species, to which I append some observations. In the *Annals and Magazine of Natural History* of London, January, 1885, Mr. H. J. Carter, F.R.S., of England, describes a species from a lake in Pictou County, Nova Scotia, as follows:—

"*Spongilla mackayi*, n. sp.—Sessile, spreading, charged with little subglobular bodies like large statoblasts, about 1-12th inch. Skeletal spicule acerate, slightly curved and sharp-pointed, more or less thickly spined, averaging 50 by 2½-6000ths inch in its greatest diameters; [accompanied abundantly by minute birotulate flesh-spicules precisely like that of *Meyenia everetti*—that is 3 to 4-6000ths inch long, with very thin smooth shaft about four times longer than the diameter of the rotule, which is 1-6000ths inch, toothed, with the teeth recurved.] Statoblasts globular, consisting of a thick chitinous coat filled with the usual germinal matter, from which is very slightly prolonged an everted trumpet-shaped aperture; bearing slight traces externally of microcell-structure and the polygonal tissue; making one of twenty such which are arranged so as to form a subglobular body of the size mentioned; situated around a central cavity with their apertures *inward*; the whole supported by statoblast spicules of various sizes, which, intercrossing each other, form a net-like globular capsule, in which the outer parts of the statoblast are fixed and covered; apparently (for the specimen is dry) deficient at *one point*, which leads to the central cavity. Statoblast spicules acerate, sharp-pointed, like the skeletal spicules, but becoming much shorter and more coarsely spined as they approach the chitinous coats of the statoblasts, where they may be reduced to at least 27-6000ths inch in length, although often increased to 4-6000ths inch in thickness, and their spines, which are very irregular in size and situation, often as long as the spicule is broad."

The words in brackets are mine. Mr. Carter goes on, however, to notice the remarkable fact that this spongilla has flesh spicules identical with those of *M. everetti*; and suggests that possibly they may not belong to *S. mackayi*, but that their presence may be owing to the proximity of *M. everetti*, which grows in the same lake. My subsequent observations go to prove that Mr. Carter's surmise is correct, and that the flesh-spicules in the specimen are adventitious. When in St. John's, Newfoundland, this summer, I was conducted by the well-known historian and scientific observer, Rev. Moses Harvey, to Virginia Lake, a beautiful sheet of water, a few miles from the city, in which the development of *Spongilla mackayi* is very luxuriant on the stones, etc., in depths of from two to four feet of water. I have not observed these flesh-spicules in the specimens from Newfoundland or in other specimens from Nova Scotia.

The second new species was described by Mr. Edward Potts before the Philadelphia Academy of Natural Sciences, at its meeting of Feb. 24th, 1885, as follows:—

"*Heteromeyenia pictovensis,* n. sp.—Sponge light green, even when dry, massive, encrusting; texture very compact; spicules non-fasciculated, persistent; surface mostly smooth. —Gemmules very scarce, spherical crust thick.—Skeleton spicules cylindrical, short, robust, rounded, or abruptly terminated; entirely spined, spines conical at the centre of the spicule, elsewhere generally curving *forward,* or towards each extremity. Rounded terminations of spicules covered with short spines, though frequently a single large spine or acute termination is seen at one or both extremities.—



HETEROMEYENIA PICTOVENSIS.

A.—Skeleton spicule.
B.—Long statoblast spicule.
C.—Short statoblast spicule.

Dermal spicules absent or undiscovered.—Birotulates of the longer class surrounding the gemmules, rather numerous, one half longer than the others; shafts conspicuously fusiform or largest at the centre, where are frequently found one or more long spines; their rotules consist of three to six irregularly placed rays, recurved at the extremities. —Birotulates of the shorter class abundant and compactly placed around the gemmule; shafts mostly smooth, though sometimes bearing a single spine; irregularly cylindrical, but rapidly widening to support the rotules, which are large, umbonate, nearly flat, and finely lacinulate at their margins; occasionally bearing spines. — *Measurements.* Skeleton spicules 0·0075 inch long, by 0·00075 inch thick; length of long birotulates 0·0021 inch; of short birotulates 0·0012; diameter of disc of latter 0·0009 inch."

This is one of the most beautiful of our fresh-water sponges. It is so much more compact and firm than our other sponges, that it can nearly infallibly be recognized at sight or by touch when once seen and handled. Its range in Nova Scotia is quite extensive: it has been found on the Atlantic and Gulf slopes. It is also abundant in Newfoundland. *S. mackayi* is also easily recognized without microscopic examination when once seen. Its encrusting habit, with the conspicuously large compound statoblasts, is very characteristic. Its nearest congener is the variety of *Spongilla fragilis* (Leidy) described by Dr. Geo. M. Dawson as *S. ottawaensis.*

The Sun Dance of the Cree Indians.

By Campbell Lane.

When serving with my brigade in the recent Northwest Rebellion, I had an opportunity of witnessing a traditionary custom of the Indians, which may be of interest from an anthropological point of view. The ceremony was the Sun Dance. It is sometimes known as the "Great Thirst Dance," and not unfrequently as the "Torture Dance." By the former name, however, it is more generally known among the white settlers of the Northwest. The dance I attended began at 7 o'clock p. m. on Thursday, May 28th, and was continued till Saturday, 30th, at the same hour. It was Saturday afternoon when I arrived. Chief Pie-a-Pot's band, together with his visitors from other reserves, were all encamped in tents.

Having passed through the line of deserted *tepees*, forming the circumference of the camp, we approached a high central tent whence issued the beating of drums, the blowing of whistles and a monotonous drone, which told of some ceremony in progress within. Entering this tent under the guidance of two medicine men, who appeared upon our arrival, we found the chief busily engaged in the ceremony of blowing a whistle and jumping in time to the orchestra of *tom-toms* or Indian drums. After the lapse of a period of time sufficient to satisfy his sense of dignity, he came forward and welcomed us.

The tent where the dance was taking place was about forty feet in diameter. Formed like an ordinary tepee, it was decorated in the most fantastic way with colored calicoes, woollens, skins, boughs of trees and other articles. There was a large open space at the top of the tent, through which light and air were admitted. In the centre stood a stout poplar tree, shorn of its branches for some distance upwards, known as the "Medicine Pole." The tent was divided into three portions. One was reserved for spectators, consisting of small children, mothers with babes, old men and women and others who took no official part in the proceedings. The two other divisions of the circle were devoted to the braves and squaws who, after the system followed in the synagogue, were kept apart. Directly opposite the entrance was an orchestra of fifteen *tom-toms.* This musical instrument is formed by stretching a skin over a round wooden hoop, about the size of a side-drum head. Underneath are two transverse bars of wood, which the musician holds in his right hand, while he beats with his left. The time kept is what is known as double time, or the same as that of a jig. Round the interior border of the tent were two rows of stalls, an inner and outer, in which the participants in the Sun Dance were placed. In front of these stalls there was a wooden railing, or fence, breast high.

When the dance began, on an incantation from one of the medicine men—there being two who assumed direction of the ceremony—all those in the stalls jumped and blew whistles, keeping admirable time with the tom-toms. There was also a circle of warriors in full fighting attire, musket in hand, in the centre. Between each dance, which lasted from ten to fifteen minutes, came an interval of from three to five minutes.

When the tom-toms ceased to beat, the medicine man selected from the line of warriors a brave, who immediately fell out of the ring. With an air of great dignity he paraded before the orchestra, reciting his experiences as a public man. These were *twofold. He told with accuracy of detail* how many Blackfeet or hostile Indians he had killed, and how many horses he had stolen, being rated by the rest of the tribe accordingly. In the course of his narrative he frequently adopted the highly tragic vein, and gesticulated freely. He then *fell again into the ring, and in a circle* they all jumped to the music which had recommenced, muttering an indescribable, partially suppressed howl. Such are the attendant circumstances to the great event of the festival.

All those engaged in the dance were in war paint, even including the women, but no special pattern was followed, and the result was a curious blending of inharmonious colours and unsymmetrical patterns on the same face.

The object of the Torture Dance is to initiate warriors. The young "bucks" or "squaw-bucks," as they are called, in order to graduate into the class of warriors or "braves," must undergo this ordeal. Before they become initiated they are on a par with the squaw as regards the division of labour, which means that, like the squaw, they have all the menial and heavy work to do, the full-fledged brave merely going on the warpath and stealing horses.

The young "buck" is in full war paint, and, when his turn comes, is called out by the medicine man, before whom he appears perfectly nude but for a breech-clout about his loins. Stepping to the front near the entrance to the tent, he takes up too small flags or bannerettes, one in each hand, and after a few preliminary facings in the way of extending his arms, advancing towards and retiring from the medicine pole, sits down. The medicine men then close in around him, as the rest of the tribe are not allowed to see the incision, and with a sharp knife cut into his breast an inch above the nipple. As our party wore uniforms, we were invited to witness the operation. The knife used on this occasion resembled somewhat a shoemaker's knife, and though sharp, was hardly as pointed as the large blade in a pocket pen-knife. As the incision was made, a noise resembling the tearing of linen, a good deal deadened, was heard. The effect on a white man is not altogether pleasant. The knife came out of the flesh about three or four inches from the spot at which it entered. It was left there until the medicine man stooped to pick up a skewer about as thick as a common lead pencil. It was then withdrawn and the skewer inserted in its place.

During the whole of this operation the young buck never quailed, nor did his eye, which bore a perfectly stolid expression, reveal the slightest trace of suffering. Suspended from the top of the medicine pole were two ropes, to the end of each of which was fastened a leather thong. This latter was attached to each of the skewers (for the incision was made in each breast), and the buck thus firmly tied. This performed, an incantation by the medicine man followed. The music as described, recommenced, and the dance in all its ghastly earnestness began. The young buck was compelled to dance in time, swinging through the circle in which the spectators were found, and keeping the ropes tightened by a centrifugal tension. The flesh and skin of his breasts were thus drawn out in a pointed shape about half a foot from his chest. He had to continue pulling on the ropes in this way until by degrees the wooden pegs were torn out. When he had succeeded in doing this, the medicine men moistened the ends of their fingers with some herb they were chewing, and applied them to the lacerated flesh, completely staunching all effusion of blood. They then turned the exhausted man over on his face and called for the next novice.

Sometimes, instead of breast-pins, shoulder-pins are driven through the upper arm in line with the collar bone. Another mode of torture is the fastening, by a similar process, of a cord between the shoulder blades, to which is appended a buffalo head and horns. The buck is then made to walk about the tent, dragging it on the ground behind him. There are also various other refinements of cruelty practised. They had just released a youth from the shoulder-pin test when I arrived. He stood there fainting and trembling from mingling exhaustion and pain.[1]

For those candidates who are initiated at the opening of the dance, the feeling is simply that of intense physical pain. But those who undergo the test after forty-eight hours of fasting, and after taking part in the ceremony day and night without sleep, frequently faint under the agony, and have to be cut down. This involves their going through the torture *de novo* in order to become braves.

Such is the Sun Dance. The young bucks never shrink from the crucial test of valour, but seem rather to court it. It seems strange, however, that the degree of nerve and indifference to suffering which this dance engenders, should not develop in the Indians a greater courage. Yet the youth who bears with unflinching pluck these terrible agonies, is taught never to ght, when on the warpath, unless he considers him be at an advantage.

An Abstract of the Presidents' Addresses.

By R. W. Boodle.

Whether the Presidents of the British and American Associations speak as the representatives of the lay world to the world of science (and this was their chief duty during the earlier years of the British Association), or whether their annual addresses are primarily intended as a means of popularizing the recent progress of science—they are naturally listened to with profound attention. Neither Sir Lyon Playfair's address at Aberdeen, nor Professor J. P. Lesley's at Ann Arbor,[2] however, falls within these categories. The former is of an eminently practical nature, devoted to pointing out the defects of popular education as it exists in Great Britain at the present moment. On the

[1] It sometimes takes an entire day for the pin to make its way through the flesh outwards.

[2] The two addresses bear date: Sir Lyon Playfair's, September 9; Professor Lesley's, August 26.

other hand, Professor Lesley prefers to speak to the inner circle of scientists as one of themselves, and his address might have been called "The True Temper of the Scientist." The result is that the two addresses cover very different grounds and can hardly be compared together, though each is interesting in a different way.

The address of the American President cannot fail to strike the reader as being distinctly conservative in tone. He poses as the representative of older scientists to the rising generation, dwelling on the dangers and folly of empiricism. 'Do not go too fast!' he says, 'Your own character is more important than the construction of new theories. We have too many of these: what we want is solid work and extreme caution.' Character, he insists, should not be sacrificed to science, which is "our means, and not our end. Self-culture is the only real and noble aim of life." There is danger of an over-accumulation of scientific information: "Not only the avarice of facts, but of their explanations also, may end in a wealthy poverty of intellect for which there is no cure. . . . How much we know is not the best question, but how we got at what we know; and what we can do with it; and above all what it has made of us. . . . I beg you to reflect that it is as true of science as of religion, that the mere letter of its code threatens its devotee with intellectual death; and that only by breathing its purest spirit can the man of science keep his better character alive."

The pursuit of science should be made ancillary to the public good. They are indeed closely connected. "Every advancement in science is of its own nature an improvement of the commonwealth. Every successful study of the laws of the world we inhabit inevitably brings about a more intelligent and victorious conflict with the material evils of life, encouraging thoughtfulness, discouraging superstition, exposing the folly of vice, and putting the multitudes of human society on a fairer and friendlier footing with one another. The arts of philanthropy are therefore as direct an outcome of science as is the lighting of the public streets, or the warming of our homes."

Among other questions closely connected with science is the problem of universal education; and while only a few in each community can acquire wealth of knowledge, these few must get it for themselves, and must work hard for it. It is not desirable to make the acquisition of knowledge too easy. "The harder the dinner is to chew, the stronger grows the eater. Canned science, as a steady diet, is as unwholesome for the growing mind as canned fruits and vegetables for the growing body. The wise teacher imitates the method of nature, who has but one answer for all questions: *Find it out for yourself, and you will then know it better than if I were to tell you beforehand.*" The lecturer recognized an evil tendency "in the present popular rage for over-classification, unification, and simplification of science; for ultra-symmetrical formulæ, and excessive uniformity in nomenclature." There is no logical consistency in Nature; nor can the work of the student be over-simplified without danger of its failing to produce genuine men of science.

It is characteristic of science that great discoveries can come only at long intervals, and the claim to special attention made by inexperienced stumblers on forgotten facts should be deprecated. The progress of science the President compared to a procession, in which "two facts arrest attention: first, the eager gaze of expectation which the crowd of lookers-on direct towards the quarter from which the procession comes, and their unaccountable indifference to what has already passed; and secondly, the wonderful disappearance, the more or less sudden vanishing out of the very hands of the carriers, of a large majority of the facts and theories of which they make so pompous an exposure; few of them however seeming to be aware that thereby they have lost their right to participate in the pageant, and should retire from it into the throng of spectators, at least until good fortune should take pity on them and drop some new trifle at their feet to soothe their wounded vanity."

The audacity with which young students take up difficult problems should be discouraged. "Shall such themes as the nebular hypothesis, the probable solidity or fluidity of our planet, the metamorphosis of rocks, the origin of serpentine or petroleum, the cause of foliation, the stable or unstable geographical relationships of continent to ocean, the probable rate of geological time, the conditions of climate in the ages of maximum ice, the probable centres of life-dispersion, the unity or multiplicity of the human race, the evolution of species, be babbled over by men, the amount of whose efficient work in any branch of science is measurable with a foot-rule; while those, whose entire lives have been but one exhausting struggle with the shapes which people the darkness of science, speak with bated breath and downcast eyes of these great mysteries?"

Young scientists test the value of old truths by new discoveries, but veterans reverse the rule and try new discoveries by well-established principles. The progress of science depends on the interaction of these mode of procedure. "Not by the mere increment in number of facts learned, not by the mere multiplication of discoverers, teachers and students of those facts, but by the elevation of our aims, by the enlargement of our views, by the refinement of our methods, by the ennoblement of our personalities, and by these alone can we rightly discover whether or not our Association is fulfilling its destiny by advancing science in America."

Professor Lesley concluded his address by insisting on the absolute necessity for more "Dead-work" being done by the true scientist. This department of science "comprises the collection, collation, comparison and adjustment, the elimination, correction and re-selection, the calculation and representation—in a word, the entire, first, second, and third handling of our data in any branch of human learning,—wholly perfunctory, preparatory, and mechanical, wholly tentative, experimental, and defensive,—without which it is dangerous to proceed a single stage into reasoning on the unknown, and futile to imagine that we can advance in science ourselves, or assist in its advancement in the world."

In regard to this, five propositions were laid down: "(1) That without a large amount of this dead-work there can be no discovery of what is rightly called a scientific truth. (2) That without a large amount of dead-work on the part of a teacher of science he will fail in his efforts to impart true science to his scholars. (3) That without a large amount of dead-work no professional expert can properly serve, much less inform and command, his clients or employers. (4) That nothing but an habitual performance of dead-work can keep the scientific judgment in a safe and sound condition to meet emergencies, or prevent it from falling more or less rapidly into decrepitude; and (5) That in the case of highly-organized thinkers, disposed or obliged to exercise habitually the creative powers of the imagination, or to exhaust the will-power in frequently recurring decisions of difficult and doubtful questions, dead-work, and plenty of it, is their only salvation; nay, the most delicious and refreshing recreation; a panacea for disgust, discouragement and care; an *elixir vitæ;* a fountain of perpetual youth."

In the course of illustrating these propositions, President Lesley insists on the impossibility of delegating dead-work to other men. "The man who cannot himself survey and map his field, measure and draw his sections properly, and perfectly represent with his own pencil the characteristic variations of his fossils forms, has no just right to call himself an expert geologist. These are the badges of initiation, and the only guarantees which one can offer to the world of science that one is a competent observer and a trustworthy generalizer. Nor has one become a true man of science until he has already done a vast amount of this dead-work; nor does one continue in his prime, as a man of science, after he has ceased to bring to this test of his own ability to see, to judge, and to theorize, the working and thinking of other men." Teachers in science have special need to bear this in mind, for learning is not knowledge, but, as Lessing says, our knowledge of the experience of others. "Knowledge is our own. No man really comprehends what he himself has not created. Therefore we know nothing of the universe until we take it to pieces for inspection and rebuild it for our understanding. Nor can one man do this for another: each must do it for himself; and all that one can do to help another is to show him how he himself has morsellated and recomposed his small particular share of concrete nature, and inspire him with those vague but hopeful suggestions of ideas which we call Learning, but which are not Science."

If the science of Canada should profit by the matured wisdom of Professor Lesley, our educationists have greater need to listen to Sir Lyon Playfair's address. It would be idle to maintain that education in Canada is in an ideal state of perfection. We are haunted by the phantom of a literary and classical training which is a reality in England. If the literary system of education is out of date there, it is a sham here. "In a scientific and keenly competitive age," the President says, "an exclusive education in the dead languages is a perplexing anomaly." It is a still greater anomaly where the conditions of society are altered, and education is generally allowed to be a training for business rather than the acquisition of polish.

Sir Lyon Playfair's address naturally opens with remarks suggested by last year's visit of the Association to Montreal, in the course of which he pays graceful compliments to Canada, and alludes to Sir William Dawson's selection for the Presidency at Birmingham in 1886.

"Our last meeting at Montreal," he says, "was a notable event in the life of the British Association, and even marked a distinct epoch in the history of civilization. It was by no mere accident that the constitution of the Association enabled it to embrace all parts of the British Empire. Science is truly Catholic and is bounded only by the universe. . . . The inhabitants of Canada received us with open arms, and the science of the Dominion and that of the United Kingdom were welded. . . . Our great men are their great men; our Shakespeare, Milton, and Burns belong to them as much as to ourselves; our Newton, Dalton, Faraday, and Darwin are their men of science as much as they are ours. Thus a common possession and mutual sympathy made the meeting in Canada a successful effort to stimulate the progress of science, while it established, at the same time, the principle that all people of British origin—and I would fain include our cousins in the United States—possess a common interest in the intellectual glories of their race, and ought, in science at least, to constitute part and parcel of a common empire, whose heart may beat in the small islands of the Northern seas, but whose blood circulates in all her limbs, carrying warmth to them and bringing back vigour to us. . . . No doubt science, which is only a form of truth, is one in all lands, but still its unity of purpose and fulfilment received an important practical expression by our visit to Canada. This community of science will be continued by the fact that we have invited Sir William Dawson, of Montreal, to be our next President at Birmingham."

The four next sections of the address are devoted to the relations of Science to the State, to Secondary Education, to the Universities, and to Industry. Into the details of Sir Lyon Playfair's subject I have no intention of following him: I shall merely select such remarks as have special bearing upon the educational problem of Canada,—a problem which she has hitherto attempted to solve by following in the wake of the mother country and adopting, with little alteration, a system commenced before science in the modern sense was thought of, and continued because education in Great Britain is still too much regarded as the luxury of the few rather than a necessary training for the many.

"How is it," Sir Lyon Playfair asks, "that in our great commercial centres, foreigners—German, Swiss, Dutch, and even Greeks—push aside our English youth and take the places of profit which belong to them by national inheritance? How is it that in our colonies, like those in South Africa, German enterprise is pushing aside English incapacity? How is it that we find whole branches of manufactures, when they depend on scientific knowledge, passing away from this country, in which they originated, in order to engraft themselves abroad, although their decaying roots remain at home. The answer to these questions is that our systems of education are still too narrow for the increased struggle of life."

Too much attention is paid purely to Latin and Greek, too little to the studies that are vital to the present age. "Generally, throughout the country, teaching in science is a name rather than a reality." In only three schools in Great Britain, according to the testimony of Playfair, is science adequately taught.

Turning to the Universities, Sir Lyon Playfair complains that with the wealthy exceptions of Oxford and Cambridge these are starved by the State. "The universities and colleges of Ireland have received about £30,000 annually, and the same sum has been granted to the four universities of Scotland. Compared with imperial aid to foreign universities such sums are small. A single German university like Strasburg or Leipsic receives above £40,000 annually, or £10,000 more than the whole colleges of Ireland or of Scotland. Strasburg, for instance, has had her university and library rebuilt at a cost of £711,000, and receives an annual subscription of £43,000. In rebuilding the University of Strasburg, eight laboratories have been provided, so as to equip it fully with the modern requirements for teaching and research.[1] Prussia, the most economical nation in the world, spends £391,000 yearly out of taxation on her universities. The recent action of France is still more remarkable. After the Franco-German war the Institute of France discussed the important question:—'Pourquoi la France n'a pas trouvé d'hommes supérieurs au moment du péril?' The general answer was because France had allowed university education to sink to a low ebb."

Startled by the intellectual sterility demonstrated by the war, "France has made gigantic efforts to retrieve her position, and has rebuilt the provincial colleges at a cost of £3,280,000, while her annual budget for their support now reaches half a million of pounds. In order to open these provincial colleges to the best talent of France, more than

[1] The cost of these laboratories has been as follows:—Chemical Institute, £35,000; Physical Institute, £28,000; Botanical Institute, £26,000; Observatory, £25,000; Anatomy, £42,000: Clinical Surgery, £26,000; Physiological Chemistry, £16,000; Physiological Institute, £13,900.

five hundred scholarships have been founded at an annual cost of £30,000. France now recognizes that it is not by the number of men under arms that she can compete with her great neighbour, Germany, so she has determined to equal her in intellect. You will understand why it is that Germany was obliged, even if she had not been willing, to spend such large sums in order to equip the university of her conquered province, Alsace-Lorraine. France and Germany are fully aware that science is the source of wealth and power, and that the only way of advancing it is to encourage universities to make researches and to spread existing knowledge through the community. Other European nations are advancing on the same lines. Switzerland is a remarkable illustration of how a country can compensate itself for its natural disadvantages by a scientific education of its people. Switzerland contains neither coal nor the ordinary raw materials of industry, and is separated from other countries which might supply them by mountain barriers. Yet, by a singularly good system of graded schools, and by the great technical college of Zurich, she has become a prosperous manufacturing country."

After thus comparing the aids given to university and to technical training on the Continent of Europe with the sums given by the State for such purposes in England—sums which appear magnificent, if compared with the subsidies received by our own Royal Institutions—the President concludes: "Either all foreign States are strangely deceived in their belief that *the competition of the world has become a competition of intellect*, or we are marvellously unobservant of the change which is passing over Europe in the higher education of the people."

In speaking of Science and Industry, Sir Lyon Playfair happens, though with a different purpose in view, to touch upon a subject more fully discussed by Professor Lesley in his address. "Though the accumulation of facts is indispensable to the growth of science, a thousand facts are of less value to human progress than is a single one when it is scientifically comprehended, for it then becomes generalized in all similar cases." Passing on, however, to the practical side of the subject, the President shows how the progress of the arts, even before science came to aid them, was traceable to three conditions: (1) The substitution of natural forces for brute animal power. (2) The economy of time. (3) Methods of utilizing waste products, or of endowing them with properties which render them of increased value to industry. "All these results are often combined when a single end is obtained—at all events, economy of time and production invariably follows when natural forces are substituted for brute animal force." And Sir Lyon Playfair points out that, during the last twenty years, the steam power of the world has risen from 11½ million to 29 million horse-power, or 152 per cent.

The concluding section of the Address is devoted to "Abstract Science, the Condition for Progress." Sir Lyon Playfair guards himself against the misconception that he is opposed to literary training. "My contention is that science should not be practically shut out from the view of a youth while his education is in progress, for the public weal requires that a large number of scientific men should belong to a community. . . . No amount of learning without science suffices in the present state of the world to put us in a position which will enable England to keep ahead or even on a level with foreign nations as regards knowledge and its applications to the utilities of life." In illustration of this fact, the advantages that the world gained from the learning of Erasmus are compared with those that accrued from the discoveries of Newton. The impetus given by the latter was not confined to the world of science. "Newton's discovery cast men's minds into an entirely new mould, and levelled many barriers to human progress. This intellectual result was vastly more important than the practical advantages of the discovery. . . . Truth was now able to discard authority, and marched forward without hindrance. Before this point was reached, Bruno had been burned, Galileo had abjured, and both Copernicus and Descartes had kept back their writings for fear of offending the Church." Turning to the great intellectual revolution of our own day, Sir Lyon Playfair adds that, "the recent acceptance of biology has had a like effect in producing a far profounder intellectual change in human thought than any mere impulse of industrial development. Already its application to sociology and education is recognized, but that is of less import to human progress than the broadening of our views of Nature."

The address concludes with the following remarks: "Abstract discovery in science is, then, the true foundation upon which the superstructure of modern civilization is built; and the man who would take part in it should study science, and, if he can, advance it for its own sake and not for its applications. Ignorance may walk in the path lighted by advancing knowledge, but she is unable to follow when science passes her, for, like the foolish virgin, she has no oil in her lamp. An established truth in science is like the constitution of an atom in matter—something so fixed in the order of things that it has become independent of further dangers in the struggle for existence. The sum of such truths forms the intellectual treasure which descends to each generation in hereditary succession."

The importance to Canada of such an address as Sir Lyon Playfair's lies, as I have said before, in the application. Canada can hardly regard her educational system as more than tentative, when she has no institutions devoted to the study of science exclusively and supported by Government aid.

NOTE ON BOULDER DRIFT AND SEA MARGINS AT LITTLE METIS, LOWER ST. LAWRENCE.

BY SIR WILLIAM DAWSON.

At Little Metis, as elsewhere on the south side of the St. Lawrence, the coast is fringed with a broad belt of boulders, wholly covered at high tide, but exposed at low tide, and occupying in many places a breadth of 30 to 50 paces, within which the boulders are packed very closely. They vary in size from 9 or 10 feet in diameter downward, and consist principally of orthoclase, gneiss, Labradorite rock and other crystalline rocks from the Laurentian of the north shore, here about 35 miles distant at the nearest point. With these are masses of the hard sandstones of the Lower Silurian rock of the south coast, and occasionally, though rarely, blocks of the Upper Silurian limestone of the inland hills to the south.

The boulders of this belt, though stationary in summer, are often moved by the coast ice in winter. This is well seen where they have been partially removed to form tracks for launching boats. In this case it is not unusual to find in the spring that such tracks have been partially refilled with boulders. On my own property, a track of this kind was completely blocked a few years ago by an angular boulder of sandstone nine feet in length, which had been lifted from a spot a few feet distant; and it is quite usual to find in a boat-track, cleared in the previous summer, a dozen boulders of two feet or more in diameter that have been dropped in it by the winter ice. Whether any of these blocks are being drifted at the present time from the north shore, is not known; but they are moved freely up and down the coast, and in dredging in depths of eight to fifteen fathoms, I have found evidence that large boulders are not uncommon on the bottom; and judging from the small specimens taken up by the dredge, they are similar to those on the shore, though apparently with a larger proportion of flat slaty fragments.

If the coast were now in process of subsidence, there can be no question that the boulders would be pushed upward and would eventually form sheets and ridges of boulders embedded in mud, much in the manner of the marine boulder-clays now found inland.

Above high water, on certain portions of the coast, there is a low terrace, only a few feet above the sea, and consisting of sand, shingle, and gravel, often with fragments of marine shells. Boulders are not numerous on this terrace and are usually merely fragments from ledges of local sandstone. Bones of large whales occasionally occur on this terrace.

Proceeding inland, we find a second terrace about thirty feet above the sea, and consisting of sand, resting on hard boulder-clay or till. This last at different places along the coast is seen to vary in quality, being sometimes hard and loaded with boulders, in other cases a clay with marine shells, and again a clay with few boulders except at its junction with the sand above. On the inner side of this terrace, where it adjoins the rocky ledges inland, there is often a raised boulder-beach like that on the present shore, but with fewer and smaller boulders, as if the transporting power had been less than at present, and possibly the time of its action more limited. But still higher, on rocky ledges rising to the height of fifty to sixty feet, there are large Laurentian boulders, on the average larger than those of the present shore, perched upon the bare rock and with a few Upper Silurian boulders from the south, which become more numerous and larger further inland. In some places these Silurian limestone boulders are sufficiently numerous to afford the material for the supply of lime-kilns providing for local requirements.

The exposed ridges of rock on the second terrace are sometimes polished with ice action, but without distinct striation, and especially on the southern and eastern sides. I had no opportunity to observe the condition of the rock surface under the boulder-clay. On the greater part of the sixty feet terrace, the rock surfaces are rough, and yet large boulders often rest directly upon them.

The till or hard boulder-clay of this coast would be claimed by some glacialists as glacier work; but there can be no doubt that these clays locally contain marine shells, and there is therefore no need of invoking land ice for their deposition. In this respect they agree with the drift deposits of the Lower St. Lawrence generally, except in the case of certain lateral valleys of the north shore which seem to have been occupied with local glaciers descending from the Laurentian highlands. [1]

[1] See Notes on Post-Pliocene of Canada, *Canadian Naturalist*, 1871-2.

Origin of the American Varieties of the Dog.[1]

By Dr. A. S. Packard.

The impression that the domestic dog of the old world has descended from wild species distinct from the wolf may be well founded, but in America the evidence tends to prove that the Eskimo, and other domestic varieties of dogs, were domesticated by the aborigines and used by them long anterior to the discovery of the continent by the Europeans, the varieties in question originating from the gray wolf or prairie wolf. First as to the Eskimo dog. From the following extract from Frobisher it appears evident that the Eskimo had the present breed of domestic dogs long anterior to the year 1577. Frobisher's account of the Eskimo themselves is, so far as we know, the first extant, and is full and characteristic. After describing the natives he goes on to say: "They frank or keepe certaine dogs not much vnlike wolues, which they yoke togither, as we do oxen and horses, to a sled or traile: and so carry their necessaries over the yce and snow from place to place: as the captive, whom we haue, made perfect signes. And when those dogs are not apt for the same vse: or when with hunger they are constrained, for lack of other vituals, they eate them: so that they are as needful for them in respect of their bignesse, as our oxen are for vs." [2]

Regarding the Eskimo dog, Richardson remarks in his "Fauna Boreali-America," p. 75: "The great resemblance which the domestic dogs of the aboriginal tribes of America bear to the wolves of the same country, was remarked by the earliest settlers from Europe (Smith's 'Virginia'), and has induced some naturalists of much observation to consider them to be nearly half-tamed wolves (Kalm). Without entering at all into the question of the origin of the domestic dog, I may state that the resemblance between the wolves and the dogs of those Indian nations, who still pre-

[1] From the *American Naturalist*, September, 1885.

[2] The Second Voyage of Master Martin Frobisher, 1577. Written by Master Dionise Settle, Hakluyt, New Ed., London, 1810, iii. 62.

serve their ancient mode of life, continues to be very remarkable, and it is nowhere more so, than at the very northern extremity of the continent, the Esquimaux dogs being not only extremely like the gray wolves of the Arctic circle, in form and color, but also nearly equaling them in size. The dog has generally a shorter tail than the wolf, and carries it more frequently curled over the hip, but the latter practice is not totally unknown to the wolf. . . . I have, however, seen a family of wolves playing together, occasionally carry their tail curled upwards."

The Hare Indian dog is also supposed to be a domesticated race of the prairie dog, as shown by the following extract from Richardson's "Fauna Boreali-Americana":—

"*Canis familiaris*, var. *B. lagopus*, Hare Indian dog. This variety of dog is cultivated at present, so far as I know, only by the Hare Indians and other tribes that frequent the border of Great Bear lake and the banks of the Mackenzie. It is used by them solely in the chase, being too small to be useful as a beast of burden or draught." It is smaller than the prairies wolf. "On comparing live specimens, I could detect no marked difference in form (except the smallness of its cranium), nor in fineness of the fur, and arrangement of its spots of color. . . . It, in fact, bears the same relation to the prairie wolf that the Esquimaux dog does to the great gray wolf."

Another variety of Indian dog is Richardson's *Canis familiaris*, var. *D. novæcaledoniæ*, Carrier Indian dog. The Attnah or Carrier Indians of New Caledonia possess a variety of dog which differs from the other northern races. "It was the size of a large turnspit dog and had somewhat of the same form of body; but it had straight legs, and its erect ears gave it a different physiognomy."

The Spitz dog, Mr. J. A. Allen informs us, is with little doubt a domesticated subarctic variety of the prairie wolf.

Sir John Richardson, in the appendix to "Back's Narrative," Paris, 1836, p. 256, remarks: "Indeed, the wolves and the domestic dogs of the fur countries are so like each other, that it is not easy to distinguish them at a small distance; the want of strength and courage of the former being the principal difference. The offspring of the wolf and Indian dog are prolific, and are prized by the voyagers as beasts of draught, being stronger than the ordinary dog."

The origin of the ordinary Indian dog of North America is obscure, but Richardson, who names it *Canis familiaris*, var. *C. canadensis*, North American dog, throws much light on its origin :—

"By the above title I wish to designate the kind of dog which is most generally cultivated by the native tribes of Canada, and the Hudson Bay countries. It is intermediate in size and form between the two preceding varieties, and, by those who consider the domestic races of dog to be derived from wild animals, this might be termed the offspring of a cross between the prairie and gray wolves. . . . The fur of the North American dog is similar to that of the Esquimaux breed, and of the wolves. The prevailing colors are black and gray, mixed with white. Some of them are entirely black. . . ." He quotes from Theodot's "Canada," written in 1630, to show that in the early period, and "perhaps even before the arrival of Europeans, they formed an esteemed article of food of the natives." Confirmatory of the theory of the Pre-Columbian origin of the Indian dog may be cited the following extract from "Hakluyt's Voyages" regarding the Indian dogs seen on Cape Breton island, p. 1593 :—

"Here divers of our men went on land upon the very cape, where, at their arivall they found the spittes of Oke of the savages which had roasted meate a little before. And as they viewed the countrey they sawe divers beastes and foules, as blacke foxes, deere, otters, great foules with red legges, pengwyns, and certain others. . . . Thereupon nine or tenne of his fellows, running right vp over the bushes with great agilitie and swiftness, came towards vs with white staues in their hands like halfe pikes, and their dogges of colour blacke not so bigge as a grayhounde followed them at the heeles; but wee retired vnto our boate without any hurt at all received." (The Voyage of the Ship called the "Marigold" of M. Hill of Redrise vnto Cape Breton and beyond to the latitude of 44 degrees and an half, 1593, written by Richard Fisher Master Hilles, man of Redriffe. Hakluyt, iii. 239.)

It is probably this variety, the bones of which have been found by Dr. J. Wyman, in the shell heaps of Casco Bay, Maine. "The presence of the bones of the *dog* might be accounted for on the score of its being a domesticated animal, but the fact that they were not only found mingled with those of the edible kinds, but, like them, were broken up, suggests the probability of their having been used as food. We have not seen it mentioned, however, by any of the earlier writers, that such was the case along the coast, though it appears to have been otherwise with regard to some of the interior tribes, as the Hurons. With them, game being scarce, 'venison was a luxury found only at feasts, and dog fleshwas in high esteem.' . . . A whole left half of the lower jaw of a *wolf* was found at Mount Desert, measuring 7.5 inches in length, making a strong contrast in size with a similar half from a dog found at Crouch's cove. This was more curved, and a length of a little less than five inches." (*Amer. Nat.*, i. 576, Jan., 1868.)

It is possible that the Newfoundland dog was indigenous on that island, and also an offshoot of the gray wolf allied to the Eskimo. In their "Newfoundland," Messrs. Hatton and Harvey say that there are few specimens of the world-renowned Newfoundland dog to be met with now in the island from which it derived its name. "The origin of this fine breed is lost in obscurity. It is doubtful whether the aborigines possessed the dog at all; and it is highly improbable that the Newfoundland dog is indigenous. Some happy crossing of breeds may have produced it here. The old settlers say that the ancient genuine breed consisted of a dog about twenty-six inches high, with black ticked body, gray muzzle, and gray or white stockinged legs, with deer claws behind." Judicious treatment has greatly improved the breed. "Their color is white with black patches, curly coats, noble heads and powerful frames. The favorite Newfoundland dog at present is entirely black, of large size, from twenty-six to thirty inches in height, remarkable for his majestic appearance. It is now generally admitted that there are two distinct types of the Newfoundland dog, one considerably larger than the other, and reckoned as the true breed; the other being named the Labrador, or St. John's, or Lesser Newfoundland. The latter is chiefly found in Labrador, and specimens are also to be met with in Newfoundland," pp. 194-195.

Regarding the dogs of the Mexican Indians, Nadaillac says in his "Prehistoric America": "The European dog, our faithful companion, also appears to have been a stranger to them.[1] His place was very inadequately filled by the coyote,[2] or prairie wolf, which they kept in captivity and had succeeded in taming to a certain extent."

In a recent visit to Mexico, not only along the railroads, but in the course of a stage ride of about five hundred miles through provincial Mexico, from Saltillo to San Miguel, we were struck by the resemblance of the dogs to the coyote; there can be little doubt but that they are the descendants of a race which sprang from the partly tamed coyote of the ancient Mexican Indians. At one village, Montezuma, we saw a hairless or Carib dog as we supposed it to be; similar dogs are sometimes seen in the United States.

Finally that the domestic dog and gray, as well as the prairie wolf, will hybridize has been well established.

Dr. Coues has observed hybrids between the coyote and domestic dog on the Upper Missouri (see the *American Naturalist*, 1873, p. 385.) To this we may add our own observations made at Fort Claggett on the Upper Missouri in June, 1877. We then were much struck by the wolf-like appearance of the dogs about an encampment of Crow Indians, as well as the fort; they were of the size and color

[1] Certain kinds of dogs were, however, domesticated in America. They were called *Xulos* in Nicaragua, *Tzomes* in Yucatan, and *Techichis* in Mexico. These were considered to afford very delicate food after having been castrated and fattened.

[2] *Canis latrans*, Baird. In a description of Virginia, published in 1649, we read: "The wolf of Carolina is the dog of the woods. The Indians had no other curs before the Christians came amongst them. They are made domestic. They go in great droves in the night to hunt deer, which they do as well as the best pack of hounds."

of the coyote, but less hairy and with a less bushy tail. They were much like those lately observed in Mexico, and I have never seen such dogs elsewhere. Their color was a whitish tawny, like that of the Eskimo dog.

Confirmatory of these observations is the following note by J. L. Wortman in the report of the Geological Survey of Indiana for 1884: "During extended travel in Western U. S. my experience has been the same as that recorded by Dr. Coues. It is by no means uncommon to find mongrel dogs among many of the Western Indian tribes, notably among Umatillas, Bannocks, Shoshones, Arrapahoes, Crows, Sioux, which to one familiar with the color, physiognomy and habits of the coyote, have every appearance of blood relationship, if not, in many cases, this animal itself in a state of semi-domestication. The free inter-breeding of these animals, with a perfectly fertile product, has been so often repeated to me by thoroughly reliable authorities and whose opportunities for observation were ample, that I feel perfectly willing to accept Dr. Coues' statement."

To these statements may be added that of Mr. Milton P. Pierce, published in *Forest and Stream* for June 25, 1885, as follows: "Hybrid wolves have always been very common along our Western frontiers. I have seen several of them, sired both by dogs and wolves, and all I have seen have resembled wolves rather than dogs." It is to be hoped that our mammalogists may collect and examine this subject, particularly the skulls and skins of numerous specimens both of dogs and wolves and of the hybrids between them. Farther observations are also needed as to the fertility of the hybrids

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Notes on Pleistocene Fossils from Anticosti.

By Lieut.-Col. C. E. Grant and Sir W. Dawson.

The late Mr. Richardson of the Geological Survey, to whom we owe most of our knowledge of the geology of Anticosti, notices in his Report for 1857, the occurrence of travelled boulders and of beds of clay, holding rounded fragments of limestone and forming cliffs sixty to seventy feet high, but makes no mention of any pleistocene fossils. The specimens collected by Col. Grant, and referred to in this note, are the first that have come under my notice, and have been kindly presented by their discoverer to the Peter Redpath Museum of McGill University.

The following are extracts from a letter of Col. Grant, referring to their localities, and the mode of their occurrence:—

"The Post-Tertiary shells were first noticed in patches of blue clay in the south-west of Anticosti, in the bed of Becscia River, close to its mouth. When first seen, I thought it probable they had been washed in by a high tide from the Gulf, but on proceeding a short distance up stream, I found the clay and shells *in situ*, capped by a considerable thickness of drift, boulders, etc., in the river bank. The shells appeared to be unusually large. I collected a considerable number. Many got subsequently broken in rough weather.

"The Pleistocene clay, (Leda Clay) occurs also in the bank and bed of Chaloupe River, and it is exposed along the cliff within a few miles west of the South-west Point lighthouse, and at several other points on the south shore. On proceeding up Salmon River, north of Anticosti, at about seven miles from the mouth, the high cliff on the right bank is capped by a deposit of drift.

"Eight miles from the village of English Bay (east), a small stream from the top of the cliff lays bare several feet of blue clay, containing great numbers of very large shells of Mya. The high tide reaches the base of the clay and washes out numbers of specimens, as does the brook adjacent. I was unable to examine the coast-line except for a short distance. The cliffs, for some miles beyond, from forty to seventy feet high, are crowned by drift deposits. Where they slope, the boulders or rounded pebbles from the top get mixed up with the clay below. Fragments of shells are here numerous; complete specimens are few.

"The cliff to the west of Ellis or Gamache Bay, called, I think, 'Junction Cliff,' by Richardson, is also crowned by a drift deposit. I succeeded in reaching part of the slope where some of the Leda Clay from above had lodged. I found it contained many specimens of *Saxicava rugosa*, and a few of *Mya truncata*, the latter much smaller than those at Becscia River and eight miles east of English Bay. Glaciated or polished flags (chiefly Hudson River limestone) are not unusual in the drift of this part of the island. Laurentian boulders were frequently remarked in the river beds, some of considerable size also on the land. There is one imbedded in the soil on a partly cleared farm near English Bay.

"The Island of Anticosti seems to be rising (the old residents on various parts of the coast think the sea is gradually retiring). I was assured by an inhabitant of English Bay. that the tops only of two large Laurentian boulders, lying on the reef in front of the village were visible at low water some twenty years ago; the base and many yards of the reef beyond are now exposed to view. A high ridge of shingle and sand in rear of the village represents the old beach. The bones of a whale were found on this beach. At Macdonald's cave, Mr. Macdonald, one of the oldest residents, informed me: 'This bay is filling up so fast that it will soon be dry land. I remember, when I first came here, there were about two or three feet of water where you now stand.' At Ellis Bay, about twelve miles from English Bay village, evidence also was obtained of the gradual elevation of the Island."

The collection contains the following species, all of them previously known in the Pleistocene of other parts of Canada, and occurring as recent species in the colder waters of the Gulf and River St. Lawrence:—

Buccinum undatum, L., var. *labradoricum*. A small and somewhat short specimen, probably not fully grown.

B. glaciale, L. A decorticated shell, probably this species.

Trophon clathratum, L. (*T. scalariforme*, Gould.) A well developed specimen.

Natica affinis. One young shell.

Mya arenaria, L. Shells of moderate size, some of them distorted.

Mya truncata, L., var. *uddevalensis*. The short Arctic variety, and one of them of unusually large size.
Macoma calcarea, Chem. Large specimens.
Macoma grœnlandica, L. One small valve.
Saxicava rugosa, L. Well developed specimens and apparently common.
Astarte banksii, Leach. One valve.
Balanus crenatus, L.
Rhynchonella psittacea, L.

Col. Grant has also noted as occurring in the beds the following species, of which there are no specimens in the collection:—

Pecten islandicus.
Mytilus edulis.
Natica grœnlandica.
Balanus hameri.

In sand and clay filling the interior of a Mya, which seems to have been entombed *in situ*, are many microscopic tests of Foraminifera and valves of Cythere and Cytheridea. Among the former were the following species:—

Polystomella crispa.
Nonionina scapha, (and var. *labradorica.*)
Polymorphina lactea.
Truncatulina lobata.
Lagena sulcata.
Entosolenia globosa.
E. squamosa.
Globigerina bulloides.

As usual in the Canadian Pleistocene, *Polystomella crispa* is much more abundant than the other species. *Nonionina scapha* comes next in this respect, and all the others are rare. The material also contains numerous spicules of siliceous sponges.

The above fossils may be regarded as characteristic of the Upper Leda Clay and Saxicava sand, both of which members of the Pleistocene formation appear to be represented in Anticosti.

It would also appear that, as elsewhere in Canada, the Leda Clay is overlaid by a second or newer boulder deposit cor nected with the Saxicava sand. To this it is probable that many of the travelled boulders of Laurentian rocks belong, as they are found in this connection not only along *the whole south shore of the St. Lawrence, but even in* Prince Edward Island, and in Nova Scotia. It would be important to distinguish in Anticosti this upper drift more particularly from the lower boulder clay when this may occur, and to observe any instances of glacial striation.

With reference to the levels above the sea, it is to be observed that along the shore of the St. Lawrence there is usually a raised beach only a few feet above the level of the sea, and on which shells and bones of whales frequently occur, and a well-marked terrace, with beach deposits and boulders, at a level of sixty or seventy feet above the sea level, and this would appear to be the case also in Anticosti.

Some Prehistoric and Ancient Linear Measures.[1]

By R. P. Greg.

11. *Pelasgic.*—Dr. Schliemann, in his "Troja," p. 56, speaking of the Acropolis of the second city at Hissarlik, says: "These towers stood approximately at equal distances of a little more than fifty metres (= 164 English feet); in which measure we must certainly recognize the number of *100 ancient Trojan cubits, though the precise length of the* Trojan cubit is unknown to us [*i.e.*, to Dr. Dörpfeld and himself.] From the analogy of the oriental and Egyptian cubit, it may, however, be fixed at a little more than 0·50 metres. I call particular attention to the fact that on this computation the gate *RC* and *FM* is exactly ten cubits broad; and the vestibulum of the edifice *A* precisely twenty cubits both in length and breadth."

Dörpfeld gives one of the old Assyrian cubits as 0·50 metres = 19·7 inches, and Petrie an Eastern Mediterranean one as 19·96, so that either of these is here probably more

[1] *Academy*, Sept. 12, 1885. (Continued from the Canadian Record of Science, i. 228.)

applicable than the nearest Egyptian cubits, given by Petrie as 18·92 and 20·63.

I have collected about twenty-five of the best ancient Trojan measures I can obtain from Dr. Schliemann's works on Troy, and, having reduced them to English feet and inches, I have obtained a remarkably well-marked cubit of 19·85 inches: intermediate as between Dörpfeld's and Petrie's. It is interesting, however, that from thirteen measures of archaic tombs at Spata in Attica, as given by Dr. Schliemann in his "Troja," p. 111, I also get, very satisfactorily, a cubit of precisely the same length as this old Trojan one; and from eight measures from Tiryns (see "Mycenæ Tiryns," Chap. i.), also an exactly similar cubit. These buildings must date back from B.C. 800 to 1200, and are all more or less cyclopean in character; and may be all included in the term Pelasgic. Still more interesting would appear to be the fact that from an examination of nearly seventy of the best measures given by Dr. Schliemann, taken during his excavations at the ancient acropolis of Mycenæ, precisely the same cubit of 19·85 again is clearly obtainable.

From an examination of the measures, some seventy in number, of Etruscan tombs, as given by Dennis in his "Cities and Cemeteries of Etruria," it is very evident that this same cubit of 19·85 must also have been employed. It is, I believe, usual to include under Pelasgic a good deal of the archaic Etruscan architecture; and this remarkable persistency of the same unit of measure goes far to show an intimate connection with ancient Greece and Asia Minor.

I have, as yet, not been able to obtain measures of Lycian and Lydian tombs to carry on the further examination of this part of the subject. This cubit of 19·85 must have had some connection originally with the Assyrian. In my first letter I showed that the Hittite foot was probably $= 12\frac{3}{4}$ English inches, probably derived from an old Babylonian cubit of ·533 metre $=$ 21 inches, and also, very probably, connected with the Olympic foot of a similar derivation. This Pelasgic cubit was probably more nearly connected with the old Assyrian cubit of 19·7, first described by Dörpfeld.

As Mr. Petrie, however, in his "Inductive Metrology," gives the Pelasgic and cyclopean unit of measure, especially as applied to Mycenæ, Tiryns, and Etruscan tombs, to be a foot of about [illegible] (see pp. 85, 89, and 93)= 11·60, "as most free from Roman influence, and the same as the ancient Greek foot of sixteen Egyptian digits," I here append in a short table some thirty-seven selected measures from the buildings of Troy, Spata, Tiryns, Mycenæ, and Etruria, showing, I think, that the cubit unit of 19·85 inches is preferable to a foot unit of 11·60. These reductions are made by the slide-rule, with sufficient accuracy for all practical purposes. Some little allowance must generally be made in the exactitude of most given measures of ruined buildings; but generally an error of two or three per cent. on either side will be sufficient:—

No. of times repeated.	No. of English feet and inches.	Cubits of 19·85 inches.	No. of times repeated.	No. of English feet and inches.	Cubits of 19.85 inches.
	3·4	2·00		23·0	14·00
2	5·0	3·00		25·0	15·00
	6·6	3·90	2	30·0	18·00
4	8–8⅓	5·00	5	33–34	20·00
3	10–10¼	6·25		40·0	24·25
	11·6	7·00	3	50·0	30·00
4	15·0	9.00		65·6	40·00
	16·6	10·00		74·0	45·00
	17·0	11·15		97·0	59·00
2	20 0	12·00		164·0	100·00
	Inches.				
3	19·7	1·0	} Trojan buildings.		
2	9·8	0·5			
	19·5	1.0 ?	Gold diadem, Mycenae.		

According to Mr. Petrie's Pelasgic unit of 11·6 inches:—

3·40= 3·50 feet.	23·0= 24·0 feet.
5·00= 5·20 "	25·0= 26·0 "
6·60= 6·70 "	30·0=·31·0 "
8·16= 8·50 "	33·6= 32·5 "
10·25=10.65 "	40·0= 41·5 "
11·60=11·10 "	50·0= 52·0 "
15·00=15 50 "	97·0=100·0 "
16·60=17·10 "	164·0=170·0 "
20·00=21·00 "	

12. *Phrygia.*—From about a dozen measures only, given

in the *Journal of Hellenic Studies*, I obtain a cubit of 19·6 inches—evidently the old Assyrian one of Dörpfeld—showing that the ancient Phrygians obtained their unit direct from Assyria, and probably not through either Pelasgic, Phœnician, or Hittite sources. But more measures would be here desirable if I could obtain them. From the tomb of Cnidus five measures give a probable cubit of 19·0 to 19·2, and, therefore, possibly = the Hittite unit.

13. *Phœnicia.*—From Perrot's and Chippiez's recent work on Phœnician art, etc., I have obtained a very probable cubit of 20·0 from only very archaic tombs and buildings in Phœnicia proper; but more measurements might be desirable. This is evidently Petrie's Eastern Mediterranean one, and probably, also, the Pelasgic one, showing how far-spread was Phœnician trading influence prior to B.C. 800, after which time Petrie's old Hellenic foot of 11·60 may have come into vogue. The curious result might seem very probable that the Phœnician cubit was one purposely averaged for convenience of a commercial and trading community like the Phœnicians from the old Assyrian cubit of 19·7 and the Egyptian royal ell of 20·5 inches, giving one almost precisely of 20 inches. Prof. Sayce suggested to me that the Pelasgic cubit might possibly be of Phœnician origin.

14. *Oceania.*—Capt. Cook describes a *morai*, or stone terraces on the island of (?) Oberea, as a series of prodigious piles of stones, 267×87 by 44 high, that would be = 300×100×50 of my prehistoric feet of 11 inches.

15. *China.*—A French writer, Remusat, also gives a Chinese foot = 12 English inches, a further confirmation of what I stated in my first letter.

Prehistoric.—I have alluded to this unit of 11·0 inches in my two previous letters. I might further add that Mr. Lukis gives 36½ feet English as the diameter of the smallest of the Cornish stone circles: this would make precisely forty prehistoric feet. The cap-stone of the rocking-stone at Pierre Martine, near Livernon, is given by Ferguson as 11×22 feet English.

In Sinai in Arabia Mr. Holland mentions series of stone, probably in connection with tombs, some of the larger of which are 45 and 90 English feet in diameter. This proportion 11 : 12, would here give 50 and 100.

It is not unlikely that the prehistoric foot-unit of 11·0 inches has simply been derived, not from any cubit, but from the length of the human foot, which would also be about one third of the military pace of 33 inches.

In my next communication I hope to say something more definite with regard to Central American and Peruvian units of measure, and which appear to present certain peculiarities and difficulties.

An Electrical Furnace for Reducing Refractory Ores.[1]

By T. Sterry Hunt.

The application of electricity in the extraction of metals has hitherto been chiefly confined to the electrolysis of dissolved or fused compounds of these by various methods. The power of electric currents to generate intense heat in their passage through a resisting medium has, however, long been known, and the late W. Siemens thereby succeeded in fusing considerable quantities of steel. But it was reserved to Messrs. Eugene H. and Alfred H. Cowles, of Cleveland, Ohio, to take a new step in the metallurgic art by making the heat thus produced a means of reducing, in the presence of carbon, the oxides not only of the alkaline metals, but of calcium, magnesium, manganese, aluminium, silicon, and boron, with an ease that permits the production of these elements and their alloys with copper and other metals on a commercial scale.

In the apparatus devised and now employed by the Messrs. Cowles, a column of fragments of well-calcined charcaal, so prepared and arranged as to present the requisite electrical resistance, is imbedded horizontally in finely pulverized charcoal, and covered by a layer of the

[1] Read Sept. 17, 1885, before the Halifax, N. S., Meeting of the American Institute of Mining Engineers, and reprinted from the Transactions.

same material coarsely broken, the whole being arranged in a box of fire-brick, covered with perforated tiles and opened at the ends to admit two carbon electrodes an inch and a half in diameter. Through these, the current from a dynamo-electric machine of 30 horse-power is now made to traverse the central core of carbon fragments, whereby such a temperature is at once produced therein that platin-iridium may be instantly melted, and the most refractory oxides already named are not only fused and volatilized, but reduced to their elemental state, with formation of carbonic oxide gas.

If alumina in the form of granulated corundum is mingled with the carbon in the electric path, aluminium is rapidly liberated, being in part carried off with the escaping gas, and in part condensed in the upper layer of charcoal. In this way are obtained considerable masses of nearly pure aluminium, and others of a crystalline compound of the metal with carbon. When, however, a portion of granulated copper is placed with the corundum, an alloy of the two metals is obtained, which is probably formed in the overlying stratum, but, at the close of the operation, is found in fused masses below. In this way, there is got, after the current has passed for an hour and a half through the furnace, from four to five pounds of an alloy containing from fifteen to twenty per cent. of aluminium, and free from iron. On substituting this alloy for copper, in a second operation, a compound with over thirty per cent. of aluminium is obtained. Already, the small experimental plant, with a 30 horse-power dynamo, is producing daily over five pounds of aluminium in the form of a rich and brittle alloy, which, by suitable additions of copper, is converted into different grades of aluminium bronze. The valuable qualities of these are so well known that it is only their great cost hitherto that has prevented their more general use in the arts. They are now offered for sale at Cleveland on a basis of five dollars a pound for the contained aluminium.

The reduction of silicon is even more easy than that of aluminium. When siliceous sand, mixed with carbon, is placed in the path of the electric current, a part of it is fused into a clear glass, and a part reduced, with the production *of considerable masses of crystallized silicon*, a portion of this being volatilized and reconverted into silica. By the addition of granulated copper, there is readily formed a hard, brittle alloy, holding six or eight per cent. of silicon, from which silicon bronzes can be cheaply made. The direct reduction of clay gives an alloy of silicon and aluminium, and with copper, a silico-aluminium bronze that appears to possess properties not less valuable than those of the compound already mentioned. Even boric oxide is rapidly reduced, with evolution of copious brown fumes, and the formation in presence of copper of a boron bronze, that promises to be of value; while, under certain conditions, crystals of what appears to be the so-called adamantoid boron are formed. In some cases, also, crystalline graphite has been produced, apparently through the solvent action of aluminium upon carbon.

Remarkable results are got by alloying small quantities of aluminium with an admixture of copper and nickel. One of these compounds, designated as Hercules metal, broke with a strain of 111,000 pounds to the square inch, with an elongation of 35 hundredths, while a ten per cent. aluminium bronze broke with 109,000 pounds. An addition of from two to three per cent. of aluminium to brass greatly increases its tensile strength, and renders it less susceptible to oxidation. While fifteen or twenty per cent. of aluminium with copper yields a brittle compound, an addition of ten per cent. of copper gives to pure aluminium a great increase of hardness and tenacity, forming an alloy that may have a wide application. It may be added that the difficulties in the way of getting together the reduced aluminium without the aid of the copper promise to be overcome at an early day, so that we may expect the cheap production of such alloys, and of pure aluminium.

The Messrs. Cowles, in their later work, have been aided by the chemical skill of Prof. C. F. Mabery, now of Cleveland, who is associated with them in one of their patents. These now cover not only the reduction of aluminium, silicon, and boron, as described, but the extraction of manganese, magnesium, and the alkaline metals by the electric furnace. I had the pleasure of hearing Professor Mabery give the first scientific notice of this discovery before the American Association for the Advancement of Science, at Ann Arbor, August 28th, and then spoke of the early results of Deville and those of Debray on aluminium and its alloys, having myself witnessed many of the experiments of both of these chemists thereon. I also insisted that the importance of this new instrument that the Messrs. Cowles have placed in the hands of chemists, for producing and controlling degrees of temperature never before obtained, can scarcely yet be estimated, either in its economic or its scientific aspect. This heat of the furnace realizes the dream of the alkahest, or universal solvent of the alchemists, and he who can rightly use it will be worthy of the ancient title of *Magister Magnus in igni.*

I may add that, through the courtesy of these gentlemen, I have since been enabled to spend two entire days in their experimental works at Cleveland, with the brothers Cowles and Professor Mabery, when they explained to me several points not yet made public, and allowed me to direct experiments with one of their furnaces. The fusion of quartz and the reduction of silicon without the presence of copper was repeated; also the reduction of boron and the formation of boron bronze, with many other interesting experiments. I then suggested trials for the reduction of titanium, both from rutile and from titanic iron ore, which will probably soon be made.

The present plant at Cleveland is but a first experimental one, and has only been in operation a few months. The Cowles Electric Smelting Company has secured a large water-power at Lockport, New York, and a dynamo-electric machine of 125 horse-power is now building for them at the Brush Works in Cleveland, which will soon be in operation at Lockport, and will permit the establishment of the electric furnace on a larger scale. A series of experiments of the products got by this remarkable discovery is, by the courtesy of these gentlemen, placed before the members of the Institute.

THE LATE DR. WILLIAM B. CARPENTER.

Science has experienced a severe loss in the recent lamented decease of Dr. Carpenter, for though he had attained an age when most men seek repose, he was still actively employed in scientific and philanthropic work, and might have done much more had his life been prolonged. Dr. Carpenter, with the acumen and thoroughness of a scientific specialist, combined a rare breadth of view and comprehension, and a wonderful facility for the clear expression of facts and principles as a teacher and popular writer. He was withal a man of large sympathies, and ready at any time to bear his part in any work of social, sanitary, or educational amelioration. As a physiologist and microscopist he had no superior; and no English man of science has done more in making his subjects of study popular and generally useful. His visit to Canada in the summer of 1882, the part which he took at that time in the meeting of the American Association in Montreal, and the admirable popular lecture which he delivered on the physical features of the Ocean, have made him personally known to many in this country, where he had long been esteemed as a writer. He entered heartily into the study of *Eozoon canadense*, when that fossil was discovered by Sir W. E. Logan; and the preparatory work, which had been done in its microscopic study by Sir Wm. Dawson in this country, was, by his request, submitted before publication to Dr. Carpenter as the most eminent specialist in the structures of Foraminifera. Dr. Carpenter, when in Canada, visited one of the most instructive localities of Eozoon, and had in course of preparation an exhaustive memoir on the subject, for which he had accumulated a large number of specimens illustrating the various forms and structures of this much disputed organism.

Dr. Carpenter was born at Exeter in 1813, and was the son of Dr. Lant Carpenter, an eminent Unitarian minister of Bristol, ' vhich city he removed in Dr. Carpenter's infancy. He was the brother of Miss Mary Carpenter, so well-known as a philanthropist, and of Dr. Philip P. Carpenter, long a resident in Montreal and equally esteemed and beloved for his scientific eminence, public services, and Christian character.

The following notice of Dr. Carpenter's life and scientific work is extracted from the London *Athenæum:*—

"Dr. Carpenter had a life of hard work. He was for years actively engaged in the drudgery of teaching; he was always preparing and compiling valuable manuals; and he was an energetic writer for, and editor of, periodical publications. The activity of many of his best years (1856-1878) was devoted to the interests of the University of London, and much of the high position which that examining body bears is due to Dr. Carpenter's character, feelings and pursuits. He was constantly engaged in elaborate researches into the general or minute structures of animals, and he took more than his fair share in the duties which scientific men owe to the scientific bodies with which they become connected.

"But, in addition to all these engagements and studies, Dr. Carpenter was essentially a good citizen. He took the highest interest in social questions, on which he threw the light of scientific knowledge; he persistently endeavoured to expose such superstitions or follies as were based on ignorance or neglect of a knowledge of natural laws; and he entered actively into the pursuit of objects which appeared likely to improve the sciences he had at heart. It is sufficient to refer to his lectures on temperance, his letters on vaccination, his exposure of phrenology, his treatment of the spiritualists and their doctrines, and the share which he took in the early days of deep-sea dredging and in advancing the general cause of marine zoology, to prove abundantly the statements just made; if any other proofs are needed, a file of the *Times* has only to be consulted.

"In the department of zoology we must make especial reference to his reports on the microscopic structure of shells, presented to the British Association in 1844 and onwards; his work on the Foraminifera (and the consequent discussions on the organic nature of *Eozoon canadense*) published in the Transactions of the Royal Society and in a volume of the Ray Society's publications; and his monograph on the structure of the feather-star. He was a diligent student and a powerful writer on every point connected with the use and improvement of the microscope, and he devoted much thought and attention to the difficult problems of ocean currents.

"But a little knowledge or reflection will make it obvious that Dr. Carpenter made numerous personal investigations in every branch of animal biology; this is, indeed, sufficiently evident from the fact that, although his great and widely known works on human physiology and on the microscope were first published long before the biological sciences had attained their present magnitude, they were based on knowledge so wide and were so thoughtfully elaborated, that editions of both are still called for, and are still necessary to every advanced student.

"In addition to such honours as the fellowship of the Royal Society, the presidency of various societies, and an honorary doctorate of laws from his old university of Edinburgh, Dr. Carpenter was a corresponding member of the Institute of France and of the American Philosophical Society, and a C.B. He leaves a widow and several children, some of whom are well known as men of science, to lament his loss. Dying in his seventy-third year, respected and regretted by all who knew him, he was an example of arduous devotion to duty and of single-minded love of science such as the world will not easily forget."

We may conclude with the following vivid sketch of Dr. Carpenter, contributed by Dr. Ray Lankester to the *Academy*: — "Dr. Carpenter embraced early in life the profession of a student and teacher of biological science, and he never ceased to work with marvellous industry and extreme ability at the tasks which had thus become to him a duty. His interest in the problems which he had helped by his researches to solve, or by his speculations to simplify, was so keen that they were ever the chief occupation of his thoughts and conversation. Where another might have indulged in some trivial dialogue, Dr. Carpenter would, with a vivacity and sincerity that were the outcome of a contented and unwearied mind, captivate his interlocutor with a serious discussion of the grounds urged against his view of the animal nature of Eozoon, or as to the nervous system of Comatula; or, again, as to the theory of ocean currents, or the reform of the University of London. What he said on such occasions was admirable, and his willingness to meet fairly an antagonist was no less indicative of the true, single-hearted man of science than the almost boyish eagerness with which he would rush into the fray. The younger generations of biologists regarded him as a man of iron frame, destined to grow younger, more laborious, more fruitful of good works, as they themselves grew on in years and sunk into rest and obscurity."

Review.

Text-Book of Botany.[1]

Incident to the very rapid advances which botanical science has made within the last few years, it has become permanently split up into several important departments. It is, therefore, a difficult matter so to condense the subject into the compass of one volume, that it may adequately meet the requirements of an ordinary college course. The series of Gray's Botanical Text-Books, however, meets the difficulty in one way, by giving a comprehensive treatment of the entire subject, devoting one volume to each of four leading departments, viz., Structural Botany, Histology and Physiology, Cryptogamic Botany, and Special Morphology and Economic Botany. This is a method of dealing with the subject which has much to commend it to the consideration, not only of teachers, but of those who desire to pursue an independent course of study as well.

The present volume, which is the second of the series, is especially welcome, from the fact that it is the first work

[1] Gray's Botanical Text-Book. Physiological Botany, Parts i and ii. By G. L. Goodale, A.M., M.D. 1885. 8vo., pp. 499 + 36. Ivison, Blakeman, Taylor & Co.

on Botany published on this side of the Atlantic, which deals wholly with Histology and Physiology. Until the present time, we have been obliged to depend almost wholly upon reprints from the German for text-books of this subject; but it is to be hoped that the issue of this volume is an indication of a future change in this direction.

In its general appearance the book is very creditable, and a decided improvement upon the usual make up of text-books. The paper and letter-press are excellent, while the figures, of which the publishers have given the author a fairly liberal allowance, are fresh—an evident effort having been made to avoid stereotyped illustrations—and in most cases admirably well executed. The references to the literature on the various subjects treated, are fairly full, and will be found a most valuable aid to the student, as also will the large amount of matter embodied in the footnotes, explanatory of the text. The student is also provided, at the end of the volume, with a large number of suggestions as to the apparatus and material required in histological studies, and also an outline of work which may be taken up. Valuable as such suggestions are, the student must outline his own course to a very large extent, using the work here given as a basis, since he will otherwise find it a physical impossibility to accomplish all that would seem desirable.

The author has endeavored, with success, to leave no element of structure or physiological fact without discussion, while his entire treatment of the subject will commend itself to teachers generally, as clear and logical; although in more than one instance there appears to be a lack in fulness of treatment which would be highly desirable, but which would hardly be practicable in a book designed for an ordinary course of instruction. In some instances, however, this becomes a fault, since the compression is carried to such an extent as to give the student a very inadequate impression of the subject discussed. Thus, at page 64, collenchyma is dismissed with great brevity, without the reader's being given a proper conception of the structure of that tissue, nor is he assisted at all by the figure (44), which is by no means a typical example. Such, however, are minor faults which are readily corrected by any competent teacher, and the author is certainly to be congratulated upon having reduced errors of all kinds to a minimum. Our knowledge of histology and physiology is now advancing at such a rapid rate, that many errors of omission, and possibly in some cases of facts also, are almost inseparable from a work of this kind. The time which elapses between the reception of the manuscript by the publisher and of the book by the public, is sufficient to make many statements old, and often to upset previous views. Bearing this in mind, the book is fully up to the times, and we can commend it as destined to meet, in a most acceptable manner, a long-felt want.

D. P. P.

Miscellaneous Notes.

Microscopical Society of Montreal.—At the Annual Meeting held November 23, the following officers were elected: Rev. Dean Carmichael, *President;* J. H. Burland, *Secretary;* H. A. Holden, *Treasurer.* Dr. G. P. Girdwood exhibited sections of Diseased Potatoes, which appeared to have been connected with a recent development of fowl-cholera. Nothing could be determined in the specimens beyond the ordinary changes and putrefactive organisms which usually accompany decomposition. Prof. Penhallow called the attention of the Society to a simple device for lifting and placing Cover Glasses. An ordinary penholder having an unsplit ferrule is employed, the latter is cut off to such a length as to leave a tube about ¼-inch long, beyond the end of the wooden handle The tube is filled with wax until the latter, on cooling, forms a well-rounded end projecting beyond the metal. The end of the wax is cut down to a flat surface of about ⅛ in. diameter. The handle is now complete and ready for use. To employ it, press the wax gently against the centre of the cover, when the latter may be lifted without trouble and placed over the mount in any direction of contact desired. The use of a needle, or slight lateral pressure on the handle, at once detaches it from the cover, leaving only a minute trace of wax behind, but this may be easily removed after the ring has hardened and the final cleaning is given.

Erosion of Glass.—Before a meeting of the Royal Microscopical Society, Dr. W. M. Ord described certain experiments to determine the cause of erosion, when surfaces of glass are exposed to the joint action of calcium, carbonate and colloids. The investigation was suggested by a note contributed by Dr. Bidie, of Madras, to *Nature*, xxvi. 549. (1882), describing an etching of glass vessels where white ant mud had been deposited. The particular direction of the experiments was largely suggested by the previous investigations of Mr. Rainey, who found that, when two separate solutions of gum—the one containing calcium carbonate, the other containing potassium carbonate—were allowed to mix slowly, and a glass slide was then introduced, a deposit of carbonate of lime was soon formed upon the surface of the slide, the incrustation being composed of minute spherules which adhered with considerable firmness. After removal of these spheres by the action of dilute hydrochloric acid, the surface of the glass was found to be somewhat opaque. From collodion casts, Mr. Rainey further proved that the opacity was due to minute depressions in the glass corresponding to the position of the carbonate of lime spherules. The formation of these bodies was shown to originate in minute granules, each with its own centre of attraction, but as they became more aggregated, the centre of attraction for each granule became replaced by one centre of attraction common to all within a certain radius, thus giving one spherule by agglomeration of numerous granules. Extending this hypothesis to the etching of the glass, Mr. Rainey argues that when such a spherule was found on a glass surface with the surrounding colloid gum sticking to the glass, and actually entering also into the composition of the sphere, the same attractive power which had determined the incorporation into one sphere of a number of spherules in contact with one another, would determine also the incorporation of adjoining molecules of glass into the incumbent sphere. Thus a pit would be found opposite each sphere.

Following up those conclusions, Dr. Ord coated a series of slides with paraffin, albumen, and glycerine, one each. These bore certain inscriptions cut through the coating so as to expose the surface of the glass. Slides of mother of pearl and of ivory were similarly treated, and all were then brought in contact with calcium chloride and potassium carbonate in such a way that evaporation was arrested and the two salts would gradually mingle over the coated surface of the slide. The results obtained at the end of twelve months showed the formation of spherules of calcium carbonate, in some cases densely aggregated, and a corresponding etching of the surfaces exposed to their contact.

The inferences drawn from these experiments are: (1) that without the use of acids or alkalies, which are known to be capable of dissolving glass, a glass surface may be eroded almost to opacity when placed in contact with carbonate of lime and a colloid; (2)

that the erosion so effected may be explained on the basis of Mr. Rainey's observations on molecular coalescence; (3) that in contact with glycerine and carbonate of potash, ivory and mother of pearl may be eroded, although as far as can be seen, no spherules of carbonate of lime are formed.

The first two conclusions are believed to be applicable to the erosion by ant mud, as observed by Dr. Bidie, while the third is held to have a much wider application, explaining by "Molecular disintegration," the formation of the Haversian spaces in bone; the excavation of shell surfaces to which Polyzoa are attached; the boring of Molluscous shells by sponges and other similar erosions. —*Journal of the Royal Mining Society*, Ser. 2nd, V. 761.

Proceedings of the Natural History Society.

The *First Monthly Meeting* of the Session of 1885-86 was held on Monday evening, October 26th, 1885, the President, Sir William Dawson, being in the chair.

The minutes of the last Council Meeting were read, and the following names proposed for membership, viz., Messrs. James M. Jack, W. C. Van Horne, P. A. Peterson, R. W. Boodle, Robert Mackay, Samuel Finlay, James McShane, M.P.P., Edward Radford and A. H. Sims.

Prof. Penhallow reported that there had been several important additions to the list of Exchanges since the regular issue had been resumed of the Society's quarterly magazine, the Canadian Record of Science. Mr. A. H. Mason, Honorary Curator, reported that, during the recess, the following additions to the Museum had been made, through the kindness of Mr. J. H. R. Molson, viz., the Teeth of Carcharoden, the Teeth of Oxyrhina, and the Vertebrae of Fishes (Eocene), found in the Phosphate beds near Charlestown, South Carolina; also the Egg of an Alligator from Jacksonville, Florida. Sir William Dawson offered some remarks upon the specimens presented, pointing out many peculiar features connected with them.

Mr. Mason called attention to the fact, that the President, Sir William Dawson, had been appointed to preside at the next meeting of the British Association, to take place at Birmingham in 1886, and considered it to be a most distinguished honor, in which we should all take much pride, as it was a position to which only the most notable men of Science were elected.

Prof. Penhallow then read a paper on "The Origin of the Ainos and their final Settlement and Distribution in Japan." After a vote of thanks to the lecturer, it was resolved that the paper should appear in the next number of the RECORD OF SCIENCE.

The *Second Monthly Meeting* of the Session was held on Monday evening, November 30th, 1885, Sir William Dawson in the Chair.

A circular was submitted from the Secretary of the Elizabeth Thompson Science Fund, "for the advancement and prosecution of Scientific research in its broadest sense," and it was resolved that Mr. Edward Murphy, Dr. Harrington, and Prof. Penhallow, be appointed a Committee to take action in reference to the claims of this Society, to obtain the assistance so beneficially bestowed by this fund, which had been founded by one of the most liberal and humane women of the present time.

It was moved by Mr. J. H. Joseph, seconded by Mr. Edward Murphy, and carried unanimously, "That the Bylaws be suspended, and that Dr. Asa Gray, of Harvard, be elected an Honorary Member of this Society, in recognition of his long and valuable services to Science."

It was resolved, "That this Society has learned with deep regret, the unexpected decease of Dr. William B. Carpenter, C.B., F.R.S., etc., and while recognizing his worldwide reputation and great services to Science and to social and educational progress, desires to convey to Mrs. Carpenter and the other members of his family, its sincere condolence and sympathy; and that the notice of Dr. Carpenter's life and services presented to this meeting, be inserted in the next number of the CANADIAN RECORD OF SCIENCE."

Two pamphlets were presented by Mr. Edward Murphy, on "Testing for Colour-blindness in the Mercantile Marine," and "Arsenical Poisoning by Wall-papers and other manufactured articles," both written by Jabez Hogg, M.R.C.S., F.R.S.

The candidates for membership proposed at the last meeting, were duly elected, and the following names submitted for election, viz., Messrs. Wm. Drysdale, C. N. Bell, of Winnipeg, Man., Dr. T. Wesley Mills, and Mr. John Lawrence.

Sir William Dawson then read his paper on "Boulder Drift and Sea Margins at Little Metis, Lower St. Lawrence," succeeded by that of Lieut.-Col. Grant, of Hamilton, on "Pleistocene Fossils." collected on the Island of Anticosti.

Prof. Penhallow then read Mr. C. N. Bell's notes on the "Exploration of some Mounds in the Northwest," while Mr. A. H. MacKay's paper of notes on "New Fresh-water Sponges" was received as read.

A cordial vote of thanks was tendered to the authors of each paper with a request that they be published in the RECORD OF SCIENCE.