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THE OTTAWA NATURALIST.

VOL. X. OTTAWA, DECEMBER, 1896. No. 9.

THE GEOLOGY OF THE OTTAWA AND PARRY SOUND RAILWAY.

By R. W. ELLS, LL.D., F.R.S.C.

The opening of the Ottawa, Arnprior and Parry Sound railway, while marking an epoch in the affairs of the Capital from the commercial standpoint, furnishes, to the student of Natural History, fresh fields for study along the several lines in which the members of the Field-Naturalists' Club are interested. It has rendered readily accessible many places which have hitherto been reached with great difficulty and at very considerable expense. To the student of Geology and Palæontology it is especially advantageous; since many interesting points can now be easily reached and large areas of fossiliferous strata can be examined, many of which will furnish a rich harvest to the collector. With the object of calling attention to some of these, and thus arousing interest in the subject on the part of our younger members, as well as renewed interest among those who have already done good work in collecting and determining the fossil contents of our Palæozoic formations, a brief sketch of some of the leading geological features observable along the line is here presented.

Starting from the Capital, a short run of about fifteen miles over a generally level country brings us to the first stopping place near the line between Nepean and March. The formations traversed in this distance are nearly all horizontal, and comprise the Trenton, Black River, Chazy, Calciferous and Potsdam. The last three can be well seen between the crossing of the Canadian Pacific railway, south of Britannia, and the station

at South March. The Black River and the Trenton formations, between this crossing and the city are well exposed, and contain well defined characteristic fossils which are obtainable from the ledges on the Experimental Farm and on the knolls to the west. An interesting feature to be noticed as we approach the March line is a cutting in which Potsdam sandstone is penetrated by dykes of quartzose granite which have altered the rocks in contact very considerably. The sandstone in the vicinity contains numerous markings of *Scolithus*, and the quarry, from which the stone was obtained of which much of the Parliament buildings is composed, is situated on the hill near by. This locality is therefore of very considerable interest in several ways and affords excellent opportunities for the study of our lowest Palæozoic formation in the Ottawa basin. As we approach South March station, however, knolls of hard dioritic and granitic rock appear on either hand, and form the eastern terminus of a somewhat extensive ridge of the old Laurentian rocks. These embrace granite, gneiss, crystalline limestone, etc. and in close proximity to the station are deposits of mica and graphite which form interesting subjects of study to the mineralogist. A number of minerals can be collected at this place and the locality is well worthy of a visit by the club at some not far distant day.

From March to Carp the road traverses a depression in these Laurentian rocks, coming out on the Palæozoic basin about two miles east of the latter station. The old rocks, however, continue along the north side of the railway below this place and present excellent opportunities for the study of the various eruptives which are associated with the Laurentian everywhere throughout this area. At Carp station, several cuttings in the gravels contain shells of marine origin, and the study of the sands and gravels allied to the glacial period can be readily made. The Black River limestone can be well seen two or three miles to the south of the station and these hold an abundance of the characteristic fossils of the formation which are easily obtainable.

From Carp to Kinburn, which is the next station, going west, the country is clay covered and rock ledges do not appear; but the Black River limestones continue to the south, and about two miles east of Kinburn, on the road north of the railway, a large quarry in this rock affords excellent opportunities for collecting the characteristic fossils of the formation. South of Kinburn station a drive of six miles over a good road brings one to Pakenham, where the Black River formation is also well exposed on the Mississippi River and where fossils can be obtained in the bed of the stream at low water in great abundance. This is an excellent locality for their study and very convenient of access. Thence towards Galetta, the road, after following the valley of the Carp River for a mile or so, enters the low ridge of the Laurentian again and furnishes a good opportunity for observing the relations of the granites, gneisses and associated limestones till Galetta is reached. These rocks can also be well seen at this latter place and the intrusive dykes are easily recognized. About a mile and a half from the station on the road to Fitzroy Harbor, and a short distance north of the channel of the Mississippi, an old opening in limestone for a lead mine is an interesting point for mineralogical study, the association of the eruptive dykes being well seen at this place.

At Fitzroy Harbor, four miles from Galetta, are the celebrated Chats Falls, probably the most beautiful in the whole course of the Ottawa River. The water falls in a series of cascades over a huge dyke of granite extending across the entire channel of the river which here has a breadth of two miles or more, thus furnishing a magnificent water power, destined at no distant day to be utilized, and equal in economic importance to that of the Chaudiere in this city. This locality is a very interesting one to the geologist since the crystalline limestones are here largely developed and there is also a great variety of intrusives associated with them.

The crystalline limestones extend to Arnprior, which is situated at the junction of the Madawaska and the Ottawa

Rivers, but at this place they are overlaid by horizontal beds of the Calciferous limestone which show at several points in the town and along the river up to Braeside to the south of which, however, the fossiliferous ledges of the Black River formation are seen and are well worthy of study, several quarries being located in its strata. A little farther west, to the south of Sand Point, excellent opportunities are also presented for collecting the characteristic fossils of the formation, the beds holding *Tetradium fibratum* being well developed about a mile south of the last named place.

The bluish-striped limestones of Arnprior, and of the section thence to Renfrew, belong to what has been called the Hastings Series; and by crossing the Ottawa River by the ferry from Braeside, their continuation into the province of Quebec can be readily seen, the association of striped crystalline limestone, hornblende rocks and dolomitic and other schists being well exhibited, so that this locality is a very interesting one from the geological standpoint. The celebrated Iron mines of Bristol are situated in the rocks of this series on the Quebec side of the Ottawa.

Between Arnprior and Glasgow, the next station, the road traverses an area, largely clay covered, but ridges of the peculiar bluish-striped crystalline limestone, which is extensively quarried at Arnprior, occur at intervals. At Glasgow, however, these are cut off by a well pronounced area of reddish granite which crosses the track and extends northward for several miles. In its westward extension this granitic belt has a breadth of several miles on the Renfrew and Burnstown road and is an important geological feature in this area. From Glasgow to Renfrew, the rocks, where exposed, are alternately granites and crystalline limestone, the latter predominating as Renfrew is approached. At this latter place extensive quarries are in operation in the limestone and large quantities are extracted, both for building and for burning to lime, for both of which purposes it is well suited.

West of Renfrew an extensive clay flat extends up the

valley of the Bonnechère River to the vicinity of Douglas. To the north of this valley the rocks are crystalline of the old series, comprising both limestones and gneisses as well as frequent masses of granite. Similar rocks occur to the south of the railway, but approaching Douglas it skirts the south side of a large outlier of the Black River formation and several quarries are here located in these rocks. In these the characteristic fossils are quite abundant and a careful study of the several strata will amply repay the collector. To the north of Douglas village also these rocks are well exposed, and will yield good results.

From Douglas to Caldwell the rocks are of the old series, being well exposed near the latter station. Occasionally pyroxenic rocks are seen with these, and traces of various minerals were observed at several points, but not in quantity to be of economic importance. But little exploration has yet been done in this area for minerals as yet, and it is possible that subsequent search may be more successful. The road passes about a mile to the south of Eganville which is on the Bonnechère River ; but before reaching Eganville station it crosses another very considerable outlier of the Black River formation, which extends northward to the river and also presents a good field to the fossil collector. At Eganville itself the Chazy also appears, and the presence of several small faults along the valley of the stream tends to complicate the structure and make the study more interesting. To the south of Eganville, at Clear Lake, a very interesting mineralogical field is presented, and several islands in this lake have afforded a rich collecting ground for mineralogists both from the United States and Canada for some years, and some very rare and valuable minerals have been obtained. A very interesting outlier of Utica Shale was found several years ago by the officers of the Geological Survey on the north slope of the mountain which rises from the south shore of the lake, at an elevation of about 800 feet above the sea.

The valley of the Bonnechère west of Renfrew, and nearly to Douglas, is occupied by heavy deposits of clay. These must

in places have a depth of nearly a hundred feet; but though undoubtedly of marine origin, they have as yet, in this particular locality yielded no marine organisms. This is however a feature observed in most of the clays of the upper Ottawa basin, the marine shells being almost entirely confined to the overlying sands and gravels. The same mode of occurrence is observed near the St. Lawrence at River Beaudette, where a ridge of gravel, in places very coarse in character, has yielded the valves of a large *Balanus* as well as other marine forms. Characteristic Chazy rocks, however appear in the stream at Douglas Village, underlying the Black River formation and extend up the valley of the Bonnechère for some distance. They are also well exposed at the Fourth Chute about midway between Douglas and Eganville, and at this place there is "remarkable subterranean channel, where a part of the water turns off at right angles to the general course, running northerly, for about ten chains, through a great cavern. This cavern is usually nearly dry, excepting during freshets, but has been turned to advantage by throwing a dam across the main body of the river near the middle of the fall. This turns through a sufficient quantity of water to convert the channel into a mill-race, and the fall at the lower end is applied to drive the wheel of the mill.*" The Black River limestones are also well exposed on the north side of the river to the west of Douglas and contain characteristic fossils of the formation.

Going west from Eganville we traverse considerable areas of drift, the underlying rocks being the gneisses and limestones of the Laurentian, till we reach Golden Lake station. This is situated near the lower end of Golden Lake, a beautiful sheet of water about eight miles in length, around the shores of which the crystalline rocks are well exposed, and these occupy the country to Killaloe near the upper end of the lake. Here the gneisses are in great force and well stratified. The cuttings along the road between Golden Lake station and this point are

*Geology of Canada, p. 176, 1863.

largely in drift gravel and sand, which has replaced the clays which form so prominent a feature to the eastward. These sands have a wide distribution in all directions and the distribution of the drift in this vicinity forms an interesting subject of study. Great blocks of the Black River limestone occur here and there, and a very interesting development in this connection is the number of them observed on the high ridge to the south of Clear Lake at an elevation of nearly 1400 feet above the sea, along the Brudenell road.

The country west of Golden Lake now becomes much more rugged, the surface being hilly and the valleys occupied largely with drift sand and gravel. Thence on to Barry's Bay the rocks are mostly granitic and gneissoid, the limestones having but a small development; but a small outlier of Palæozoic rocks was noted in a shallow cutting on the road about four miles west of Killaloe station, which appeared to belong to the Chazy limestone formation, but from which no fossils were obtained, and its exact horizon is therefore as yet undetermined. The granitic character extends westward from Barry's Bay for a long distance but the geology of the western portion of this road has not yet been examined.

Many interesting observations on the striæ have been made and the general course of the ice movements have been approximately outlined. These will however form the materials for another paper by Mr. Wilson on the surface geology of the area which will be of much interest and value.

In addition to the locality at Carp where marine shells can be obtained it may be of interest to note that these fossils were also observed on the summit of the Laurentian ridge north of Kinburn, and easily accessible by the road leading directly northeast from that station, at about three miles distant. Another interesting locality, for these shells, readily reached from Glasgow station by the road leading north from that point, is the summit of the ridge to the south of Sand Point, which also is a station on the Canadian Pacific railway. The shells at this place are strewn over the surface of the Black River or lower Trenton

limestone which forms a ridge rising to the height of about a hundred feet above the Ottawa River at this place. The sand or gravel in which the shells were originally embedded has nearly all been removed and the bare rock is exposed at the surface. This is also an excellent spot for collecting fossils from the underlying rocks.

For those members of our Club who are interested in fossil collecting an excellent opportunity is afforded for the study of the fauna of the Black River formation in the many scattered outliers which are found to the south of the Ottawa River, in the townships of Bromley, Stafford and Wilberforce. Those between Douglas and Cobden can be easily reached, either by the Ottawa and Parry Sound railway, from Douglas station, or from Cobden on the Canadian Pacific. Large outliers occur in Stafford near the lower end of Muskrat Lake in which the fossils are abundant and easily obtained. The celebrated locality at the Paquette's Rapids on the Ottawa, near the foot of Allumette Island, is now easily reached by the Pontiac and Pacific Junction railway, which now runs to that point, but a week's trip or even less will enable one to visit all the principal areas to the south of the river and furnish plenty of material for future study. The Black River formation at one time must have had a very extensive development, since its scattered outliers are now found over a very considerable extent of country, lying between the Ottawa and the Madawaska Rivers. Among the most extensive, and at the same time most readily accessible of these, is a series of outcrops to the south of Arnprior, lying to the north of the mountain ridge which extends from the vicinity of White Lake to Pakenham. These have as yet been but little studied, but the rocks contain an abundance of fossils at many points and some of the principal exposures can be reached in a distance of four to five miles south from either Arnprior or Galetta.

For convenience of reference a synopsis of the various geological formations to be seen at the several stations is appended. The elevations of the different points along the line

have been kindly furnished by Mr. James White, Geographer to the Geological Survey.

STATIONS.	ELEVATION ABOVE SEA LEVEL.	REMARKS.
Ottawa, Central Station.	218 ft.	Trenton and Utica, well exposed.
Elgin St. Sta.	226	
South March	292	Potsdam sandstone and Laurentian gneiss and limestone with diorite and granite. Mica and graphite in the vicinity.
Carp.	315	Clays and gravels; the latter with marine shells, underlaid by Black River limestone. Laurentian gneiss and granite in ridge to the north.
Kinburn.	319	Clay flat, underlaid by the Black River formation. Laurentian granite and gneiss with crystalline limestone in ridge to the north. Marine shells on summit of ridge three miles to the north.
Galetta.	402	Mostly crystalline limestone of the old series with some gneiss, cut by dykes of granite. Marine shells near Mohr's Corner about a mile to the south-east.
Arnprior.	309	Bluish striped crystalline limestone of the Hastings series, overlaid by Calciferous limestone. Black River outcrops to the south.
Glasgow.	350	Ridge of black hornblende-rocks and reddish granite which cuts the striped limestone of the vicinity, Hastings series. Marine shells on Sand Point ridge, three miles to the north east.
Goshen.	392	Striped crystalline limestone.
Renfrew.	410	Striped crystalline limestone of the Hastings series, with ridges of hornblende schist and masses of reddish granite. Important quarries in the limestone.
Admaston.	423	Clay flat of the Bonnechère.
Douglas.	455	Large outliers of the Black River limestone with crystalline limestone and gneiss underlying.
Caldwell.	505	Mostly reddish granitic gneiss; some pyroxenic rocks in the vicinity. The 4th chute of the Bonnechère to the north.
Eganville.	528	Drift with large outliers of the Black River formation in the vicinity. Chazy and Black River rocks on the Bonnechère at the village.
Golden Lake.	543	Crystalline limestones and gneisses with granite.
Killaloe.	663	Reddish and hornblende gneiss, well stratified.
Barry's Bay.	937	Gneiss and granite. Much of the country occupied by drift sand and gravel

Geological Survey Department,
Ottawa, Canada.

FAUNA OTTAWAENSIS.

HYMENOPTERA PARASITICA—PROCTOTRYPIDÆ.

By W. HAGUE HARRINGTON, F.R.S.C., Ottawa.

The species of parasitic hymenoptera are exceedingly numerous and require much time both to collect and study. The insects very often so closely resemble others that their satisfactory determination is difficult and for these reasons, while material has been steadily accumulated, it has not hitherto been possible to publish any lists of the hundreds of species contained in our cabinets. Last winter I devoted considerable time to the study of the numerous small forms belonging to the family Proctotrypidæ, and while the examination is not yet completed, it has enabled me to present the following list. It would perhaps be more satisfactory to longer withhold it, were it not that collections run so many risks of destroyal or damage, and consequent loss of the labour bestowed upon them if records have not been published. Mr. Ashmead's exhaustive monograph of the North American species of this family, published in 1893 contained descriptions of some fifty new species from Ottawa; and the present list indicates several new species showing that our present knowledge is still limited. Many additions will undoubtedly be made, and the life-histories of many are yet unknown to us. The list indicates, usually, the localities in which specimens were captured, and the dates of appearance. The majority of the species have been captured with the sweeping net, but a considerable number have occurred in moss, collected late in the year, and a few have been bred. Where no remarks follow a species, the only examples taken were those sent to Mr. Ashmead, to whose assistance I am much indebted.

PROCTOTRYPIDÆ.

SUBFAMILY I. BETHYLINÆ.

Isobrachium myrmecophilum *Ashm.*	Male; Race-course, 22 Aug.
Mesitius bifoveolatus *Ashm.*	Female; 11 May.
Anoxus Chittendenii *Ashm.*	Male: Hull, 22 July.

Perisemus formicoides *Prov.*	Female ; Type of species.
Perisemus prolongus *Prov.*	Female ; several in May, June, and July.
Goniozus foveolatus *Ashm.*	Two males and female ; Powell's Grove and Hull, June, July and August.

SUBFAMILY III. DRYININÆ.

Gonatopus contortulus *Patton.*	One female ; Hull, 29 July.
Gonatopus flavifrons, *Ashm.*	One female ; Hull, 15 July.
Phorbas laticeps *Ashm.*	One female ; Hull, 15 July.
Chelogynus canadensis *Ashm.*	One female ; 4 June.
Aphelopus melaleucus *Dalm.*	

SUBFAMILY IV. CERAPHRONINÆ.

Habropelte fuscipennis *Ashm.*	One male.
Habropelte armatus *Say.*	One male and one female.
Lygocerus picipes *Ashm.*	One female ; Kettle Island, 23 July. Two males ; Hull, 16 and 26 Aug.
Lygocerus stigmatus *Say.*	Male and female ; several bred by Mr. Fletcher from Aphides on Rubus strigosus, July.
Megaspilus striatipes *Ashm.*	
Megaspilus Harringtoni *Ashm.*	Several ; in July and Aug. One bred from Willow Diplosis puparium emerged in April.
Megaspilus canadensis *Ashm.*	
Megaspilus Ottawaensis *Ashm.*	Apparently a common species in August. Taken at Hull, Kingsmere and Race-course. Several specimens also from moss from Dow's Swamp in Nov.
Ceraphron minutus *Ashm.*	Also found in moss from same locality.
Ceraphron auripes *Ashm.*	With the above.
Ceraphron melanocephalus *Ashm.*	One female ; Hull, 19 Aug.
Ceraphron pallidiventris *Ashm* ?	One at Beechwood on 13 Aug.
Ceraphron salicicola *Ashm.*	From Willowgalls and also from moss. Taken at Hull, 19 Aug.
Ceraphron melanocerus *Ashm.*	One specimen.
Ceraphron pedalis *Ashm.*	Both sexes ; Hull, all in Aug. except a female 13 May.
Ceraphron flaviscapus *Ashm.*	Female ; Dow's Swamp moss, Hull 13 May.
Ceraphron unicolor *Ashm.*	Female ; Hull 19 Aug.
Ceraphron sp. nov.	Female ; Hull 19 Aug. A large black species.
Ceraphron sp. nov. ?	Female ; a large pale species.
Aphanogmus bicolor *Ashm.*	Female ; from Dow's Swamp moss.
Aphanogmus marylandicus *Ashm.*?	Male ; Beechwood, 13 Aug.

SUBFAMILY V. SCELIONINÆ.

Telenomus orgyiæ *Fitch.*	Numerous specimens bred from eggs of Orgyia sp.
Telenomus gracilicornis *Ashm.*	

Telenomas podisi *Ashm.*	One female; Racecourse, 1 Aug.
Telenomus arzamae *Riley.*	Three males; Racecourse, 1 Aug.
Telenomus sp. nov.	Thirty-one specimens from two eggs of *T. polyphemus?*
Telenomus sp.	Several from eggs of undetermined moth, on Hickory leaf, July.
Trissolcus euchisti *Ashm.*	One female.
Acoloides saitidis *Howard.*	Many specimens bred from spiders eggs.
Acoloides bicolor *Ashm.*	
Acoloides subapterus *Ashm.*	Female; from Dow's Swamp moss.
Acoloides seminiger *Ashm.*	Female; with above
Ceratobæus binotatus *Ashm.*	Several females.
Bæus minutus *Ashm.*	Abundant in Dow's Swamp moss.
Bæus piceus *Ashm.*	Taken with above, but rare.
Bæus clavatus *Prov.*	Type specimen.
Bæus americanus *Howard.*	Female; under stone, Hull, 15 April.
Pentacantha canadensis *Ashm.*	Two in June.
Prosacantha melanopus *Ashm.*	From Dow's Swamp moss.
Prosacantha Linellii *Ashm.*	Female; Kettle Island, 18 Aug.
Prosacantha sp.	Female; Racecourse, 3 Aug.
Hoplogryon longipennis *Ashm.*	Female; Hull, 16 Aug.
Hoplogryon minutissimus *Ashm.*	Several; Hull and Racecourse, August.
Hoplogryon brachypterus *Ashm.*	Abundant in swamp moss in Nov. also taken in Aug.
Hoplogryon obscuripes *Ashm.*	Three females.
Hoplogryon solitarius *Ashm.*	Four males; Powell's Grove and Hull, August.
Gryon borealis *Ashm.*	Abundant; Racecourse and Hull, Aug., also in moss.
Gryon canadensis *Ashm.*	Abundant; Hull, Beechwood, Kettle Island, etc., Aug., and in moss in Nov.
Gryon flavipes *Ashm.*	Four females
Calotelia Marlattii *Ashm.*	Three males, twelve females; Hull, June and August.
Calotelia sp. nov.	Three males, nine females: Race-course, 29 August.
Calotelia sp. nov.	Three females; Hull and Race-course, August.
Macrotelia floridana *Ashm.*	Three males, one female; Hull and Kettle Island, July and Aug.
Macrotelia virginiensis *Ashm.*	One female; Hull, 5 Aug.
Opisthacantha mellipes *Ashm.*	One female.
Hoplotelia floridana *Ashm.*	One female; Hull, 26 Aug.
Scelio opacus *Prov.*	Three males; Hull and Kettle Island, August.

SUBFAMILY VI. PLATYGASTERINÆ.

Metaclisis erythropus *Ashm.*	
Leptacis flavicornis *Ashm.*	Three males; Race-course, Aug.
Leptacis striatifrons *Ashm.?*	One male; Hull, Aug.
Polymecus canadensis *Ashm.*	One male, one female; Powell's Grove, June.
Polymecus pallipes *Ashm.*	Three males, two females; Hull, June.
Polymecus picipes *Ashm.*	Two females; May 13.
Synopeas rufiscapus *Ashm.*	Eight males, eleven females; Race-course and Hull, July and Aug.
Synopeas sp.	Five females; Hull, Aug. = preceding?
Eritrissomerus sp. nov.	Thirteen males and females; Hull, Aug.
Polygnotus alnicola *Ashm.?*	Twenty-seven specimens; bred by Mr. Fletcher from dipterous galls on Muhlenbergia.
Polygnotus sp.	One male; Race-course, 1 Aug.
Polygnotus sp.	Four specimens; from willow-galls.
Platygaster Herrickii *Pack.*	
Platygaster obscuripennis *Ashm.*	Two females; from willow-galls.
Platygaster sp.	Several; from willow-galls.
Platygaster sp.	Several; from willow-galls.
Isocybus pallipes *Say.*	One female.
Isocybus canadensis *Prov.*	Both sexes abundant; May. Several specimens seem to indicate a variety, if not a distinct species.

SUBFAMILY VII. HELORINÆ.

Helorus paradoxus *Prov.*	Two females; Kettle Island, Aug.

SUBFAMILY VIII. PROCTOTRYPINÆ.

Disogmus sp. nov.	One female.
Proctotrypes rufigaster *Prov.*	Four males, one female; Hull, etc. Aug.
Proctotrypes californicus *Holmg.*	
Proctotrypes flavipes *Prov.*	Three females; Hull, Aug.
Proctotrypes abruptus *Say.*	Abundant; Race-course, Kettle Island, Hull, Aug.
Proctotrypes obsoletus *Say.*	One male.
Proctotrypes longiceps *Ashm.*	
Proctotrypes canadensis *Ashm.*	Five males, one female; Race-course, 22 Aug.
Proctotrypes medius *Ashm.*	
Proctotrypes quadriceps *Ashm.*	Three females; Race-course and Kettle Island, Aug.
Proctotrypes sp. nov.?	One male; Hull, 16 Aug., a large black species.
Proctotrypes clypeatus *Ashm.*	

(To be Continued.)

Ottawa, Canada, Dec., 1896.

THE EVOLUTION AND DEVELOPMENT OF ANIMAL INTELLIGENCE.

By WESLEY MILLS, M.A., M.D.,

Professor of Physiology in McGill University, Montreal.

As the term evolution means literally an unfolding, it is convenient and comprehensive for the purpose in view, whether it be employed in its more literal signification or in the sense that has become attached to it by the modern doctrine of evolution as set forth by Darwin and other writers of recent times.

Darwin himself believed as thoroughly in mental evolution as in organic evolution; that is to say, he held that the no corporeal or psychic (this term being employed to cover all qualities not physical whether purely intellectual or relating to will, feeling, etc.) qualities of animals were as much related by genetic descent as their corporeal features. The characteristics of the human mind for example, are to be explained, according to this great investigator, by man's descent from forms of life lower in the scale, in the same way as his corporeal nature. To illustrate, Darwin believed that we are in a position to understand the dog much better if we recognize his origin from wild forms such as the jackal, wolf, etc.

As regards man's psychic nature, however all evolutionists do not hold to Darwin's view.

Alf. R. Wallace, who enunciated the doctrine of organic evolution at the same time as Darwin, held that all the qualities of man's mind could not be accounted for in this way, though he thought such an explanation adequate for the corporeal structure of man.

The majority of evolutionists are of opinion, however, that the doctrine of descent of higher from lower forms does explain both the physical and psychic nature of animals, with all their

similarities and differences, better than any other; and no one has worked out this view better than Darwin himself in his various works; and so far as the psychic is concerned, especially in his "Descent of Man"; though in this connection Romanes' "Mental Evolution in Animals" and "Mental Evolution in Man" also deserve mention as very admirable and highly scientific works.

There is, however, another sense in which the term evolution may be properly employed, viz: The unfolding or development of the individual animal from the beginning of its existence to full maturity; we may speak of the evolution of the chick from the egg; and in like manner we may follow the evolution of the mind from its first, dim manifestations to its complete development.

While the mind of the adult human being had been studied for ages it is only very recently that investigators thought of commencing at the beginning, or in other words, making researches into the nature of the infant mind; though when one reflects it seems strange that such should have been the case.

The anatomy of man and the higher animals has been rendered easier of acquirement and its true significance made vastly clearer by comparative anatomy, or the study of one form of animal life as compared with another. The structure of the cat and tiger, related animals, is each better understood if compared. But it is embryology or the study of the development of animals from their germs that has shed such a flood of light on the structure and relations of the whole animal kingdom.

The writer being convinced that the same principles apply to the study of the mental life of animals has for some years been engaged on investigation of the psychic development of animals by a method corresponding to the embryological as applied to physical developement.

Some writers, Professor Preyer especially, have published fairly complete studies on the psychic manifestations of infants. The latter's "Mind of the Child" is a monument of patience, industry and ability, and is simply invaluable to those desirous of understanding the human mind. A record has been kept by this author of his own child's mental development from the very first day of its existence to the fortieth month.

The writer of the present article is attempting to do similar work for several groups of our domestic animals or pets, and a considerable number of these investigations are now completed. It is hoped that by such researches a truer light will be thrown on the psychic nature, not alone of the animals investigated, but on that of man also; for whether we admit evolution in the Darwinian sense in psychology or not, there can be no doubt, after comparing these studies one with another, that there is much that is common in mental development as there is in physical development.

The dog and the rabbit, much as they differ in anatomy, have also much in common; and in like manner they greatly resemble each other in certain features psychically, as such studies prove beyond all doubt.

To many minds this will be evidence for the truth of evolution, and to be explained only on some such theory.

It is well known that in a very early stage of embryonic development, animals that afterwards differ widely in form and structure, can scarcely be distinguished, if at all, even by the the most expert.

In like manner the psychic behaviour of whole groups of animals has much in common during the first days of life, a remark that especially applies to those that are born blind. They all manifest certain reflexes and instincts. By a "reflex," physiologists mean a physical result, usually a movement, independent of the will. It follows because of some sort of stimulus;

and many of them would take place if the brain of the animal were removed.

The movements of the snake, after its head has been pounded into a mass beyond recognition by the school boy, are reflex, movements which when first seen cause such feelings of the "uncanny" to arise. The mechanism of these movements resides in the spinal cord, the nerves and their endings etc., and is wholly involuntary in such a case. The touch that causes it is the stimulus and the result is a reflex.

The movements of those newly born animals that are blind for some days are largely if not entirely of this reflex character, and, as has been already observed, they are of the same nature in all mammals thus born blind. This is not because they are blind, or rather because their eyes are closed, but because their blindness is an expression of the fact that their organization, both physical and psychic, is in a comparatively undeveloped condition. It will be observed, however, that these animals have developed at this period such reflexes and instincts as enable them to adapt to their new surroundings after birth. They can get nourishment by sucking—a reflex or an instinct, probably both. They can move sufficiently to huddle together and crawl close to their mother—their source of heat; for of all the enemies of young animals cold is the greatest. Warmth is a need even more urgent than food itself.

When they have learned to adapt themselves to their new environment somewhat, and so to be prepared for advances, some new developments take place rather rapidly; their eyes and ears open; they learn to see and to hear, though it must not be inferred that seeing and the opening of the eyes are contemporaneous; for as a matter of fact I have demonstrated in the clearest way that young animals born blind, as dogs, cats, rabbits, etc., do not really see objects for some days after their

*Part of a paper read before the Natural History Society of Montreal.

eyes open, though it is likely they do distinguish between light and darkness.

It appears that all animals born blind are also born deaf; at all events, I have as yet found no exception to this rule.

The greatest difference sometimes exists as to the psychic condition at birth of different groups of animals belonging to the same larger group. This is well illustrated by the cavy (Guinea pig) and the rabbit. The latter is born blind, deaf and comparatively helpless, while the newly born cavy can in a few hours run about, see, hear and even eat, yet both belong to the great group of rodents or gnawers. This is to be explained by the relatively short period of gestation of the rabbit, as compared with the cavy, so that the young of the rabbit are born in a comparatively immature condition. Even in the dog tribe there are differences in rate of development for the different breeds; thus, small dogs, as terriers, are precocious as compared with St. Bernards and other large breeds and they attain physical and psychical maturity earlier. A terrier is generally quite mature at one year, while a St. Bernard may grow and develop for at least two years.

The writer is not aware that a record of physical changes as complete as the psychic has been kept in studies made on infants.

This omission he has in some measure endeavored to to supply in his researches on the lower animals, because it is in this way alone, probably, that the relations of the physical and the psychic can be established. So far as investigations have been made they seem to show that psychic growth and development run parallel with the development of the nervous centres, especially the brain.

The writer has completed a research bearing directly directly on this subject, and the evidence is clear that the degree of psychic development at birth and for some days after, in

animals born blind, corresponds with a similar (undeveloped) condition of those parts of the brain that have unquestionably to do with voluntary movements and the higher functions generally.

The limits assigned to this paper will prevent my going further into details, but I hope sufficient has been brought forward to show that in animals lower in the scale as well as in man there is a development to the mind as to the body ; that this development follows, as does that of the physical organism, certain laws ; that there is a close relationship between mind and body, and that we must, if man is to be understood, study him in connection with animals lower in the scale. Man is not apart from but a part of nature, and the sooner the world ceases to isolate man and proceeds to investigate him as a part of a grand whole, the better it will be for man and all other animals.

NOTES, REVIEWS AND COMMENTS.

COLEMAN, A. P. PROF.—"The Anorthosites of the Rainy Lake Region."—Journal of Geology, Vol. IV., No. 8, pp. 907—911 Chicago, Nov.—Dec., 1896.

The quartzose granites of the Rainy Lake district, which hold the important gold-bearing veins, have been carefully studied by Lawson and Coleman in various reports to the Dominion and Ontario geological surveys. The barren anorthosites associated with these had hitherto been neglected. Prof. Coleman describes the anorthosite rock of Bad Vermilion Lake and Seine Bay region. It is of post-Keewatin age and differs from the typical anorthosites of Quebec described by Adams. "More than nine-tenths of the rock is seen to consist of plagioclase, usually sprinkled with zoisite particles, or more or less completely changed to a saussuritic mass." "An analysis of the freshest rock studied (from Seine River mouth) shows" a low percentage of silica and soda and high percentage of lime compared with Quebec anorthosites."

Prof. Coleman disagrees with Dr. Lawson regarding these anorthosite rocks in not "representing the truncated base of a Keewatin volcano" but as "having solidified under a considerable thickness of superincumbent rock" and been exposed by denudation so as to be eroded and fragments rolled into bowlders which appear as part of a conglomerate before the eruption of the granite.—H. M. A.

TYRRELL, J. BURR.—"*The Genesis of Lake Agassiz.*" Journal of Geology, Vol. V., No. 7, pp. 811—815, Chicago, Dec 1896.

In this paper, Mr. Tyrrell first describes the two centres of glaciation or gathering grounds for the snow and ice on each side of Hudson Bay during the "Great Ice Age." He then more closely defines the terms, "Keewatin glacier" and "Laurentide glacier" which have been applied to these centres by himself* and Dr. Dawson Regarding the origin of Lake Agassiz itself, Mr. Tyrrell states:—"The Keewatin glacier seems to have retired northward well into Manitoba, and possibly even beyond the northern limit of that province, before it was joined by the eastern glacier. When they united the water was ponded between the fronts of the two glaciers to the north and east, and the highland to the south and west. Thus Lake Agassiz had its beginning." The later history of the lake is to some extent still undetermined, but is given in the light of the evidence obtained during several explorations in those regions. A passing note is also made of the "Cordilleran glacier"[‡] in the mountains of British Columbia and of a fourth great glacier—the Greenland glacier[2], that which "covers Greenland at the present time."—H. M. A.

*Geographical Journal, London, pp. 439, November, 1895.
‡ G. M. Dawson in Bull. Geol. Soc. Am., Vol. 7, pp. 31-66, 1895.

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