

## 2ND AGENCY.

We are familiar with water and ice as transporting agencies, the former exercised in various ways, the latter as ice sheets in the Bay of Fundy and the Gulf of St. Lawrence. In Alpine regions ice in the form of glaciers is well known as a transporting agent.

The deposits which we have been examining as a class, are known by the names diluvium, drift. Parts of these are also distinguished by the qualifying adjective, *glacial* (deposit). The striation is also called glacial or glaciation, while others retain the term drift, e. g. gravelly deposit.

The term Diluvium refers us to early geology, when the deluge of Scripture was regarded as the great cause that produced these accumulations. This view is now, however, regarded as untenable.

The term Drift refers to another early view, which is still maintained by some in reference to the gravelly deposit,—that the northern hemisphere had been scoured by broad waters and currents which had extensively transported material from north to south, and left the banks of drift as monuments of the dreadful catastrophe.

The banks and their derivations, with the striation which we have been examining, are distinguished as glacial, and bring us to existing views and ~~distinctions~~<sup>inclusions</sup>, the agency being ~~the~~ respectively, ice sheets, ice bergs, and glaciers. Heretofore in the field of our observation we have been dealing with incontrovertible facts, now we meet with in our field, controvertible opinions,—we meet with the advocates of ice sheets, and icebergs.

(*To be continued.*)

ART. II. — ON A CORRESPONDENCE BETWEEN THE FLORA OF NOVA SCOTIA, AND THAT OF COLORADO, AND THE ADJACENT TERRITORIES. BY. JOHN SOMMERS, M.D., *Prof. of Physiology in the Halifax Medical College.*

(*Read before the Institute of Natural Science, Feb. 14, 1876.*)

WHILE engaged recently in looking through a Synopsis of the Flora of Colorado and the adjacent Territories, appended to the

admirable report of the U. S. Geological and Geographical Survey of the Territories, by Dr. F. V. Hayden, I was deeply interested in finding described there many species identical with those of our Provincial flora.

I was therefore led to institute a comparison between these floras, for which purpose I prepared a list of Provincial species, making it as complete as circumstances would permit; contrasting this latter with the synopsis, I was enabled to observe the amount of correspondence between them; this, in its result served to reveal a much closer alliance than a casual study seemed to show, a circumstance which induced me to bring the subject before the Institute.

Inasmuch as the Coloradian Flora presents us with many truly boreal species and a few maritime plants indigenous to our locality, whose origin, so far as we are enabled to understand it, has been in the northern portion of our continent, we are led thereby to a consideration of their migration thither.

Considering the respective localities of the two regions, we find a difference which is in favor of Colorado; its geographical position may be roughly stated as being on the thirty eighth degree of north latitude, while that of Nova Scotia is on the forty-fifth, or a variation of seven degrees, sufficient on this side of the continent to produce that diversity of climatic conditions which exists between Nova Scotia and those Middle States that lie under the same degree of latitude as Colorado.

As these conditions influence plant life very materially, since we find the Middle States Flora deviating considerably from our own, how much more would we expect finding a wider variation in the flora of a region so far to the west of us, which from this latter circumstance had its difference of climate increased by that peculiarity of the isotherms or heat lines seeking on this continent a much higher latitude on its western side than that which they occupy to the east; the isotherm of Nova Scotia, "speaking without book" finding its western extremity some ten or fifteen degrees north of it, that of Colorado arising very far south of it on our side of the Continent. This phenomenon presenting to us a very wide departure between the mean annual temperatures of regions situated directly

opposite on either side, constitutes a very important factor when we wish to form an estimate of the relative physical peculiarities or conditions of such places.

Notwithstanding what has just been stated, and the proof which the synopsis gives of a more copious Flora to Colorado than our own, a flora too which numbers southern species exotic to us, it yet includes nearly one-third of our indigenous species, also many genera which have closely allied species.

Taking the position that every boreal species in southern situations must have passed thence, as every southern species found north must have migrated there, we may justly claim these boreal species in the Coloradian flora as our own, and endeavour to account for their emigration to that locality as well as for their maintenance or continuance outside of their proper zone.

To this end I will ask you to follow me for a short space into the region of theory, since the elucidation of these points in our discussion can be arrived at in no other way.

Taking first the question of continuance we find the species referred to confined more or less to the elevated parts of the region which they inhabit, these regions are from the peculiar physical conditions before mentioned exposed to greater vicissitudes of climate than that of our own, the climate there being excessive, having great extremes. Our extremes being less gives us a more moderate condition of climate, the probabilities are however, that between the extremes of the excessive climate of the elevated regions of Colorado we have a mean or middle condition, corresponding more or less to our own, and therefore offering favourable conditions for the growth and continuance of such boreal species as have there established themselves.

In addition to this we have the inherent property existing in many plants of living under conditions which, though apparently unfavourable, are yet not too far removed from those of their original surroundings.

The problem of plant dispersion while highly interesting, is yet surrounded by difficulties of such a nature as would at the first glance seem to render its elucidation impossible. Nevertheless, many of

these difficulties have been surmounted, and if we are yet very far from a thorough comprehension of the subject, it cannot be said that we have no data upon which we may construct hypotheses more or less reasonable. We are in this respect following the proceedings of the geologist, who supposes the dispersion of inorganic matter to have been produced by certain physical agencies acting upon it. Nor can we do better than to accept his theories as explanatory of our subject.

The glacial theory which accounts for the phenomena of the drift may afford an insight to the distribution of plant life upon this continent; it is said that the North American continent was more recently glaciated than those of the Eastern hemisphere. Without accepting this, we have evidence that the recession of this period is more recent here, since its northern extremity is yet glaciated down to the  $70^{\circ}$  of N. latitude at least. The physical condition of the continent as low as the  $36^{\circ}$  of North latitude, i. e. from ten to twelve degrees south of our present position, during the glacial period, was such as exists now on the shores of the Arctic Ocean; the then existing climate of Colorado and the adjacent zone being like that of Greenland in our epoch.

Supposing the existence of plant life in abundance in our northern region previous to the drift, a supposition which our coal measures, &c. prove, we can easily estimate the influence of the wave of congelation passing down from the north, would be to disturb the atmospheric conditions to the extent of destroying the flora in every locality invaded. But this process of ice formation was no doubt like the other processes of nature, slow in growth, not to be counted by decades or centuries, but by ages. Hence its effects upon plant life were gradual in their development; thus the hardier species would remain for a time to struggle with ever increasing adverse conditions, to be eventually destroyed or forced to emigrate with their weaker brethren, being pushed forward by every advancing wave of cold, so that in the final state of things which obtained at the point of recession of the glacial era, the boreal flora of America escaping annihilation, must have been driven

toward that portion of the continent which afforded the conditions for support.

Following the gradual withdrawal of the ice the face of the continent assuming more or less the condition which it now presents, had time to rehabilitate itself. Our northern species being pushed out by the southern forms which aided by the increasing heat began to dispute the possession of the soil forcing them to migrate northward. But not alone to this process may we attribute the reappearance of plant life in the northern portion of our continent, we must recollect that through the various stages of the glacial period, many species or individuals of species previous to their demise, had deposited germs; these from adverse circumstances, being unable to germinate, would remain imbedded in the drift, and recollecting property which many such possess of retaining their germinating power for lengthened periods, even under adverse conditions, observing as we may the immunity of the innumerable germs scattered over our soil annually, from the effects of our rigorous winters, we can easily assume that the conditions which the drift afforded for the preservation and dissemination of those germs were not more unfavorable than that of a lengthened hybernation.

Hence we find the southern part of our continent supporting in their elevated positions species not found in the intervening plains and valleys, but having their true habitat in our northern regions, they, no doubt are boreal forms driven south in a former age, when the conditions necessary to existence were denied them in their own regions, otherwise they may have sprung from germs transported with the drift, and germinating in favorable situations. Either way the hypotheses started, may, in a measure, account for the correspondence which the list here annexed exhibits.

List of Species and allied genera,\* common alike to Nova Scotia and Colorado :

*Ranunculaceæ.*

*Clematis*, Virginiana. Linn.

*Thalictrum*, cornuti. Linn.

*Anemone*, Pennsylvanica. L.

*Ranunculus*, aquatilis. L.

*R. Flammula*. Var reptans. G.

---

\*Genera having closely related species indigenous east, though not Nova Scotian as far as is known.

- R. Cymbalaria.* Pursh.  
*R. Multifidus.* Pursh.  
*R. Repens.* L.  
*R. Pennsylvanicus.* L.  
*R. recurvatus.* Poir.  
*R. abortivus.* Linn.  
*Aquilegia vulgaris.* L.  
*A. canadensis.* L.  
*Actœa, spicata.* L. var *Rubra*  
 Bigl.
- Nymphaeaceæ.*  
*Nymphaea, odorata,* ait.  
*Nuphar,* sp——
- Rapaveraceæ.*  
*Sanguinaria, canadensis.* L.
- Fumariaceæ.*  
*Dicentra, cucullaria.* D. C.  
*Corydalis,* sp——
- Cruciferae.*  
*Nasturtium, Officinale.* R. Br.  
*Cardamine, hirsuta.* L.  
*Sisymbrium.* sp——  
*Sinapis nigra.* L.  
*Lepidium ruderales.* Linn.
- Violaceæ.*  
*Viola, cuculata.* Ait.  
*V. Canadensis.* L.  
*V. tricolor.* L.
- Caryophyllaceæ.*  
*Saponaria* sp——  
*Cerastium, viscosum.* L.  
*C. vulgatum.* L.  
*Stellaria, longipes.* Goldie.  
*Arenaria, lateriflora.* L.
- Portulacaceæ.*  
*Portulaca, oleracea.* C.  
*Claytonia, virginica.* Linn.  
*C. Caroliniana,* Michx.
- Hypericaceæ.*  
*Hypericum.* sp——
- Geraniaceæ.*  
*Geranium, maculatum.* Linn.  
*G. Carolinianum.* Linn.  
*Impatiens, fulva.* Nutt.  
*Oxalis, stricta.* L.
- Anacardiaceæ.*  
*Rhus, glabra.* Linn.  
*R. toxicodendron.* L.
- Vitaceæ.*  
*Ampelopsis quinquefolia.* Mx.
- Sapindaceæ.*  
*Acer, rubrum.* Linn.  
*A. Saccharinum.* Wang.
- Polygalaceæ.*  
*Polygala,* sp——
- Leguminosæ.*  
*Vicia,* sp——  
*Lathyrus palustris.* L.  
*Trifolium pratense.* L.  
*T. Repens.* L.  
*Apios tuberosa.* Mænch.
- Rosaceæ.*  
*Prunus, Pennsylvanica.* L.  
*P. Virginiana.* L.  
*P. serotina.* Ait.  
*Spiræa* sp——  
*Rubus triflorus.* Rich.  
*R. strigosus.* Mich.  
*R. villosus.* Ait.  
*Agrimonia, Eupatoria.* L.  
*Geum macrophyllum.* Willd.  
*G. Strictum.* Ait.  
*G. rivale.* D.  
*G. Album.* Gmel.  
*Fragaria, vesca.* L.  
*F. Virginiana.* Ehrh.  
*Potentilla, Norvegica.* L.  
*P. Canadensis.* L.  
*P. anserina.* I.  
*P. fruticosa.* L.  
*Rosa, blanda.* Ait.  
*R. lucida.* Enrh.  
*Pyrus, sambucifolia.* Cham &  
 Sche.  
*Amelanchier, Canadensis.* Torr  
 & Gr.
- Saxifragaceæ.*  
*Ribes hirtellum.* Mich.  
*R. lacustre.* Poir.  
*R. prostratum.* L. Her.  
*R. aureum.* Pursh.  
*R. floridum.* L.
- Crassulaceæ.*  
*Sedum, rhodiola.* D. C.
- Haloragææ.*  
*Hippurus, vulgaris.* L.

*Onagraceæ.*

- Epilobium, palustre.* L.  
*E. angustifolium.*  
*Cænothera, biennis.* L.  
*Ludwigia, palustris.*  
*Circæa, alpina.* L.  
*C. Lutetiana.* L.

*Cucurbitaceæ.*

- Echinocystis, lobata.* T. & G.

*Umbelliferae.*

- Cicuta, maculata.* L.  
*Sium, lineare.* Mx.  
*Osmorrhiza, brvistyliis.* D. C.  
*Sanicula, Marilandica.* L.  
*Heracleum, lanatum,* Mx.

*Araliaceæ.*

- Aralia, nudicaulus.* L.

*Cornaceæ.*

- Cornus, Canadensis.* L.  
*C. Stolonifera.*

*Caprifoliaceæ.*

- Linnæa borealis.* Grono.  
*Lonicera ciliata.* Muhl.  
*Sambucus, pubens.* Michx.  
*S. Canadensis.* L.

*Rubiaceæ.*

- Galium trifidum.* Linn.  
*G. triflorum.* Michx.

*Compositæ.*

- Eupatorium, purpureum.* L.  
*E. perfoliatum.* L.  
*Aster lævus.* L.  
*A. Cordifolius.* L.  
*Erigeron, Canadense.* L.  
*Solidago, virga-aurea.* L.  
*S. Canadensis.* L.  
*S. Gigantea.* Ait.  
*S. lanceolata.* T. & G.  
*Rudbeckia, hirta.* L.  
*Bidens, frondosa.* L.  
*Bidens, Connata.* Muhl.  
*B. Chrysanthemoides.* Mx.  
*Anthemis, arvensis.* L.  
*Achillea milefolium.* L.  
*Antennaria, biennis.* Willd.  
*Gnaphalium decurrens.* Ives.  
*Senecio, aureus.* L.  
 Var *obovatus.* T. & G.

Var *Balsamitæ.* T. & G.

- Mulgedium pulchellum.* Nutt.  
*Sonchus, asper.* Vill.

*Lobeliaceæ.*

- Lobelia inflata.* L.

*Campanulaceæ.*

- Campanula, rotundifolia.* L.

*Ericaceæ.*

- Arctostaphylos, Uva-ursi.* Sprn.  
*Chimaphilla umbellata.* Nutt.  
*Kalmia, glauca.* Ait.  
*Pyrola, rotundifolia.*  
*P. secunda.* L.  
*Monesis, uniflora.* L.

*Plantaginaceæ.*

- Plantago, major.* L.

*Primulaceæ.*

- Primula farinosa.* L.  
*Lysimachia, ciliata.* L.  
*L. stricta.* Ait.  
*Glaux, maratima.*

*Serophulariaceæ.*

- Linaria, Canadensis:* Spreng.  
*Chelone, glabra.* L.  
*Mimulus, ringens.* L.  
*Veronica, Americana.* Schwz.  
*V. serpyllifolia.* L.  
*V. scutellata.* L.  
*Rhinanthus, crista-galli.* L.  
*Pedicularis, Canadensis.* L.  
*Melampyrum, Americanum.*  
 Michx.

*Verbenaceæ.*

- Verbena, hastata.* L.

*Labiatae.*

- Mentha Canadensis.* L.  
*Lycopus, Europeus.* L.  
*Brunella, vulgaris.* L.  
*Teucrium, Canadense.* L.  
*Seutellaria, galericulata.* L.  
*S. parvula.* Michx.  
*Stachys, palustris.* L.

*Borraginaceæ.*

- Mertensia, sp* ———  
*Myosotis sp* ———

*Convolvulaceæ.*

- Calystegia, sepium.* R. Br.

- Solanaceæ.*  
*Solanum, nigrum.* L.
- Apocynaceæ.*  
*Apocynum, androsæmifolium.* L.  
*A. Cannabinum* L.
- Oleaceæ.*  
*Fraxinus, Americana.* L.
- Chenipodiaceæ.*  
*Chenopodium, album.* L.  
*Atriplex, patula.* L.  
*Salicornia, herbacea.* L.  
*Suæda, maritima.* Dumont.
- Polygonaceæ.*  
*Rumex, acetosella.* L.  
*Polygonum, incarnatum.* Ell.  
*P. Pennsylvanicum.* L.  
*P. aviculare.* L.  
*P. dumetorum.* L.
- Euphorbiaceæ.*  
*Euphorbia, polygonifolia.* L.
- Urticaceæ.*  
*Urtica, gracilis.* Ait.  
*U. Dioica.* L.  
*Ulmus, Americana.* L.  
*Humulus, lupus.* L.
- Cupuliferæ.*  
*Quercus, rubra.* L.  
*Corylus, rostrata.* Ait.
- Betulaceæ.*  
*Betula* sp———  
*Alnus, viridis.* Ait.  
*A. incana.* Willp.
- Salicaceæ.*  
*Salix, chlorophylla.* Andr.  
*S. sericea.* Marshall.  
*Populus, tremuloides.* Mx.  
*P. Balsamifera.* L.
- Coniferaæ.*  
*Juniperus, communis.* L.  
*J. Virginiana.* L.  
 The Genera, *Pinus*, and *Abies* represented in both Floras. The species are, however, far removed.
- Araceæ.*  
*Arisæma (Arum) triphyllum.* Torr.
- Typhaceæ.*  
*Typha, latifolia.* L.
- Sparganium, ramosum.* Huds.  
*S. Simplex.* Hudson.  
*S. angustifolium.* Englem.
- Naiadaceæ.*  
*Potamogeton, natans.* L.  
*P. perfoliatus.* L.
- Alismaceæ.*  
*Alisma, plantago.* L.  
*Triglochin, maratum.* L.  
*Sagittaria, variabilis.* Engl.
- Orchidaceæ.*  
*Habenaria, obtusata.* Lind.  
*Goodyera* sp———  
*Spiranthes, cernua.*  
*S. Romanzoffiana.* Cham.  
*Listera, cordata.* Rr. Br.  
*Coralloriza, multiflora.* Nutt.  
*Cypripedium, pubescens.* Willd.  
*C. acaule.* Ait.
- Iridaceæ.*  
*Iris, versicolor.* L.  
*Sisyrinchium, Bermudiana.* L.
- Liliaceæ.*  
*Trillium* sp———  
*Streptopus, amplexifolius.* A.C.  
*Smilacina, racemosa.* Desf.  
*S. Stellata.* Desf.  
*Lilium, Canadense.* L.  
*Erythronium, Americanum.* Smith.
- Juncaceæ.*  
*Juncus, Balticus.* Willd.  
*J. tenuis.* Willd.
- Cyperaceæ.*  
*Eleocharis, palustris.* R. Br.  
*Scirpus, validus.* Vahl.  
*Eriophorum, polystachion.* L.  
*Carex, stellulata.* L. Var. *scirpoides.* Carey.  
*C. vulgaris.* Fries.
- Gramineæ.*  
*Alopecurus, geniculatus.* L.  
*Agrostis, seabra,* Willd.  
*A. vulgaris.* With.  
*Calamagrostis, Canadensis.* Beauv.
- Festuca, ovina.* L.  
 Var. *duriuscula.* Gr.



Poa, pratensis. L.	<i>Musci.</i>
Triticum, repens. L.	Sphagnum, acutifolium. Ehrh.
Hordeum, jubatum. Ait.	Dicranum, varium. Hedw.
Hierochloa, borealis. R. & S.	Ceratodon, purpureus. Brid.
Setaria, viridis. Beauv.	Funaria, hygrometrica. Hedw.
<i>Equisetaceæ.</i>	Bryum, cæspiticium. Linn.
Equisetum, arvense. L.	Mnium, cuspidatum. Hedw.
E. pratense. Ehrh.	M. punctatum. Linn.
<i>Filices.</i>	Polytrichum, juniperinum. Hedw.
Polypodium, vulgare. L.	Fontinalis, antipyretica. L.
Pteris, aquilina. L.	Hypnum, lætum. Brid.
Adiantum, pedatum. L.	H. cupressiforme, Hedw.
Asplenium, Trichomanes. L.	H. molluscum. Hedw.
A. Felix-fœmina. Bernh.	<i>Lichenes.</i>
Phegopteris, Dryopteris. Fee.	Cetraria, Icelandica. Ach.
Aspidium, Filix-mas. Swartz.	Sterocaulon, paschale. Linn.
Cystopteris, fragilis. Bernh.	Cladonia, pyxidata. Fr.
Botrychium, Virginicum. Swartz.	<i>Fungi.</i>
<i>Lycopodiaceæ.</i>	No N. S. collection.
Lycopodium, annotinum. L.	

An analysis of the Nova Scotian Flora derived from species under observation, yield the result given below in tabular form. It is but just however, to explain, that owing to deficient representation of cyperaceæ gramineæ, and of all the cryptogamous orders outside of Filices and Lycopodiaceæ. "There being no list of fungi," the result is vitiated to a considerable extent.

TABLE I.—FLORA OF NOVA SCOTIA.

	<i>Nat. Orders.</i>	<i>Genera.</i>	<i>Species and var.</i>
Exogens	71	244	518
Endogens	14	59	116
Acrogens	5	50	114
Thallogens	1	14	26
Total	91	367	774

A similar tabulation of the foregoing list of species gives the following results, viz.:

Exogens	48	127	178
Endogens	10	34	44
Acrogens	4	19	24
Thallogens	1	3	3
Total	63	183	249

Thus of the seven hundred and seventy-four species constituting the Nova Scotian flora, two hundred and forty-nine, or nearly one-third of the whole are common to it and the Coloradian flora. These are collected into one hundred and eighty-three genera, or one-half that of Nova Scotia.

Comparing these species by their divisions, we find the closest alliance between the flor-exists in the Exogens and Endogens, of which considerably over one-third of each division is found. Of the Acrogenous less than one-fourth are present; of the Thallogenous a little less than one-eighth; this, however, may be owing to deficiency in our collection of Thallogens.

---

ART. III.—NATURAL HISTORY AND THE FISHERIES. BY A. P. REID, M. D., &c.

(Read before the Institute Jan. 10, 1876.)

IN this Province we have as a people been always so engaged in efforts that tend directly to increase pecuniary gain, that any study or pursuit that did not very clearly point in this direction got quietly shelved, unless by the few, who had an ardent desire to become acquainted with the operations of *nature* which surround us; and this is the more to be deplored since all our industries are so closely connected with what is revealed by the study of Natural Science.

The products of the sea are our main source of wealth, and yet how very very few, have the slightest scientific knowledge of *Marine Fauna*. The practical man says what use is it, will it teach how to catch cure or sell the fish any better than we now do by following the old *rule of thumb*, whose maxims are the result of lengthened experience? As to the sale it is of course regulated by the demand, the method of curing a matter of taste, convenience and demand, but as to the *catch* it is quite a different thing.

In this a knowledge of the life history of the different species of fish, would not only lend more certainty to the present pursuit, but also continue in coming years an undiminished abundance of this our prime necessity.