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THE OTTAWA NATURALIST.

VOL. XI. OTTAWA, DECEMBER, 1897. NO. 9.

THE CRYPTOGAMIC FLORA OF OTTAWA.

BY PROF. JOHN MACOUN, M.A., F.L.S., F.R.S.C.

Continued from October No.

71. **B. pomiformis**, Hedw.

Crevices of damp and dripping rocks near Gilmour's Mill, Chelsea, Que.; collected on damp limestone ledges on the cliffs facing Gatineau Point, Rockcliffe Park, April 22nd, 1896. Fruiting.

XXV. PHILONOTIS, Brid.

72. **P. fontana**, Brid.

By springs at Kingsmere, and Kirk's Ferry, Que.

XXVI. LEPTOBRYUM, Schimp.

73. **L. pyriforme**, Schimp.

Rather common on burnt soil in swamps and along ditches. Casselman and Carleton Place; border of Dow's Swamp, Oct. 12th, 1884.

XXVII. WEBERA, Hedw.

74. **W. nutans**, Hedw.

On rotten logs and stumps in swamps and wet woods; common. Dow's Swamp, Kingsmere and Casselman; common in McKay's Bush; collected on old logs in Beechwood Cemetery, May 12th, 1896. Fruiting. Mer Bleue June 15th, 1892.

75. **W. albicans**, Schimp.

On wet limestone rocks under the cliffs at the end of the Electric Road, Rockcliffe Park. Nov. 9th, 1896.

XXVIII. BRYUM, Dill.

76. **B. pendulum**, Schimp.

On wet earth at Ottawa; woods north of Beechwood Cemetery, October 20th, 1884.

77. **B. bimum,** Schreb.

Common in wet woods and swamps. Borders of the Mer Bleue, June 15th, 1892.

78. **B. intermedium,** Brid.

Crevices of damp rocks and old walls. In the old quarry in Rockcliffe Park and along the cliffs by the Ottawa. May 12th, 1896.

79 **B argenteum,** Linn.

Very common on roadsides and on desiccated soil in old pastures and waste places. On earth along St. Louis Dam, October 24th, 1884.

80. **B. cæspiticium,** Linn.

On earth in pasture fields and open thickets ; open places in Rockcliffe Park, May 7th, 1896 ; in old pastures near Hintonburg, Oct. 4th, 1884.

81. **B. capillare,** Linn. Var. **heteroneuron,** C. M. & Kindb.

On roots of trees in McKay's Bush near the lake, May 24th, 1888.

82. **B. Duvalii,** Voit.

In ditches and on wet rocks. In a springy place at the end of the Electric Railway, Rockcliffe Park.

83. **B. pseudo-triquetrum,** Schwæger.

In wet woods and swamps. Swamp north of Beechwood Cemetery ; also in Dow's Swamp.

84. **B. Ontariense** Kindb.

Intermediate between *B. roseum* and *B. Beyrichii* (Hsch.), C. Mueller. Comal leaves very numerous ; lingulate, abruptly and short acuminate, revolute to ⅔ or ¾, yellow-margined above with great confluent teeth ; costa stout, excurrent. Capsule pale, with a distinct, curved collum half as long, teeth papillose and hyaline above ; archegonia numerous ; lid convex short-apiculate, not oblique.

Hitherto confounded with *B. roseum*, and quite common throughout Ontario ; generally in a barren state. On old logs and sometimes on limestone rocks in maple woods around Ottawa. Beechwood Cemetery, Rockcliffe Park, Carleton Place and Eastman's Springs ; on logs in Dow's Swamp, October 10th, 1889.

85. **B. Laweri,** Ren. and Cardt.

On rocks opposite the island in the Gatineau River, Gilmour's Park, Chelsea, Que., Sept. 9th, 1889.

XXIX. MNIUM, Linn.

86. **M. cuspidatum,** Hedw.

Quite common on earth at the roots of trees in dry woods. On earth in woods Patterson's Creek, Stewart's Bush, Carleton Place, and Beechwood Cemetery ; on earth in Rockcliffe Park, April 28th, 1896.

87. **M. rostratum,** Schwægr.

On a large boulder on "Pine Hill," Rockcliffe Park, April 16th, 1896. Barren.

88. **M. Drummondi,** Br. and Sch.

In damp or swampy woods, near High Rock, Lièvre River, above Buckingham, Que., May 19th, 1884.

89. **M. affine,** Bland.

On earth in swamps and along brooks. On roots of trees along the brook west of West End Park, October 10th, 1884.

90. **M. rugicum,** Laur.

Rather common, growing in the wettest part of Dow's Swamp. Sept. 16th, 1889.

91. **M. orthorrhynchum,** Br. and Sch.

On damp limestone rocks near McKay's Lake, Aug. 26th and Oct. 12th, 1889.

92 **M. pseudo-lycopodiodes,** C. Muell.

On the bases of trees in cedar and black ash swamps. In Dow's Swamp and at Casselman ; in the swamp north of Beechwood Cemetery, May 7th, 1896. Fruiting ; on rocks in a brook, Meeche's Lake, near Chelsea, Que., Sept. 23rd, 1893.

93. **M. inclinatum,** Lindb.

On old stumps in Dow's Swamp ; on damp limestone rocks along McKay's Lake, April 22nd, 1896 ; old fruit. Old stumps in Dow's Swamp, Sept. 16th, 1889.

94. **M. spinulosum,** Br. and Sch.

On earth at the bases of trees, chiefly hemlocks. Wet woods north of Beechwood Cemetery ; woods near Carleton Place ; on the bank of the Lièvre River at Buckingham, Que., May 14th, 1896. Fruiting.

95. **M. stellare,** Hedw.

On old stumps in cedar swamps. In Dow's Swamp, May 2nd, 1896. Old fruit.

96. **M. punctatum,** Hedw.

On earth in cedar swamps and along small brooks in woods. In Dow's Swamp ; also by a brook near Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893.

XXX. AULACOMNIUM, Schwægr.

97. **A. palustre,** Schw.

Very common in swamps. Mer Bleue and at Casselman.

XXXI. TIMMIA, Hedw.

98. **T. megapolitina,** Hedw.

On roots of trees by brooks in wet woods and on wet rocks. On roots of trees in Dow's Swamp, May 2nd, 1896, by a brook west of West End Park ; and on wet rocks south end of McKay's Lake, Oct. 16th, 1884.

XXXII. ATRICHUM, Beauv.

99. **A. undulatum,** Beauv.

On damp sandy earth in cool woods and wet sandy pastures. Common in McKay's Woods, Beechwood Cemetery, Mer Bleue and Casselman ; woods rear of Cowley's Farm, Hintonburg, April 18th, 1896. Fruit old.

XXXIII. POGONATUM, Beauv.

100. **P. brevicaule,** Beauv.

Along a ditch cut along the road leading through West Casselman• May 12th, 1891.

101. **P. alpinum,** Rœhl.

On damp sandy slopes and amongst rocks east side of Rideau River, near Hog's Back, May 7th, 1897.

XXXIV. POLYTRICHUM, Linn.

102. **P. gracile,** Menz.

Not uncommon in the Mer Bleue, near Eastman's Springs, June 15th, 1891.

103. **P. Ohioense,** Ren. and Card.

On earth in woods near Casselman, east of the Nation River. May 16th, 1891.

104. **P. juniperinum,** Willd.

In old pastures and on old pine stumps in fields and by roadsides; quite common. At the base of stumps north of Beechwood Cemetery, May 12th 1896.

105. **P. commune,** Linn. Var. **Canadense,** Kindb.

Differs principally in the low stem, about 6-8 cm. high, the pedicel not much longer, the blackish capsule much shorter than in the type which probably is very rare in Canada and only once examined by Kindberg.

In wet places at Britannia, Oct. 11th, 1892; also in hollows in the pine woods by the lake, east of Aylmer, Que., Sept. 11th, 1892; wet pastures at Casselman, June 12th, 1892.

XXXV. BUXBAUMIA, Hall.

106. **B. aphylla,** Linn.

On rocks at Chelsea, eight miles from Ottawa, Que. (Dr. Fletcher.)

XXXVI. FONTINALIS, Dill.

107. **F. antipyretica,** Linn.

On stones in the brook running through the Beaver Meadow west of Hull.

XXXVIII. DICHELYMA, Myrin.

108. **D. pallescens,** Bruch and Schimp.

On the bases of trees and twigs in water-holes near St. Patrick's Bridge; also very abundantly in the woods subject to spring floods around Leamy's Lake, Hull, Que., Nov. 9th, 1896. Fruiting.

XXXIX. NECKERA, Hedw.

109. **N. pennata,** Hedw.

Quite common on trunks in swamps or wet woods around Ottawa. On trunks north of Beechwood Cemetery, also in Dow's Swamp; on trunks "Pine Hill," Rockcliffe Park, April 16th, 1896.

110. **N. oligocarpa,** Bruch and Schimp.

On ledges of limestone rocks opposite Gatineau Point, Rockcliffe Park, May 7th, 1896.

XL. LEUCODON, Schwægr.

111. **L. sciuroides,** Schwægr.

Common on trunks in all old woods. Dow's Swamp, Carleton Place, Eastman's Springs and Casselman; in McKay's Woods, May 7th, 1896. Barren.

XLI. HOMALIA, Brid.

112. **H. Macounii,** C. M. and Kindb.

H. trichomanoides, Lesq. and James Mosses of N. America, 245. Very nearly allied to *Homalia trichomanoides*; differs in the leaves being longer, rather lingulate, the lowest basal cells yellow, the perichetial leaves more suddenly narrowed to the very short acumen, the segments of the peristome cleft between the articulations.

On the bases of trees on the south end of Cowley's Farm, west of Hintonburg; on limestone rocks east end of McKay's Lake; on the cliffs facing Gatineau Point, Rockcliffe Park, May 7th, 1896.

XLII. MYURELLA, Bruch and Schimp

113. **M. julacea,** Bruch and Schimp.

On old stumps in cedar swamps. In the swamp north of the Experimental Farm; also in Dow's Swamp.

114. **M. Careyana,** Sulliv.

On ledges of limestone rocks, east of the creek in the Beaver Meadow west of Hull, Que.; crevices of wet limestone rocks at the north end of Rockcliffe Park near the old mill, May 7th, 1896; on rocks at Meeche's Lake, Sept. 23rd, 1893.

XLIII. LESKEA, Hedw.

115. **L. polycarpa,** Ehrh.

Very abundant on the bases of trees in the inundated flats between Leamy's Lake and the mouth of the Gatineau River. Nov. 9th, 1896.

116. **L. nervosa,** Myrin.

On trunks in McKay's woods; on boulders at the east end of Rockcliffe Park, near the old saw mill, May 7th, 1896; also at Carleton Place.

XLIV. ANOMODON, Hook. and Tayl.

117. **A. rostratus,** Schimp.

Very common on the roots of trees in swamps and on the faces of perpendicular, damp rocks. Seldom fruiting. On rocks in Rockcliffe Park, April 22nd, 1896.

118. **A. attenuatus,** Heuben.

Quite common on the bases of trees in black ash swamps and wet woods. Fruiting abundantly in the autumn. On trees in Rockcliffe Park, April 16th, 1896.

119. **A. obtusifolius,** Br. and Sch.

Abundant on the bases of trees in black ash swamps and wet woods around Ottawa. Fruiting in the autumn. On trunks south end of Cowley's Farm, near Hintonburg, April 18th, 1896.

120. **A. apiculatus,** Bruch and Schimp.

On decaying logs and flat limestone rocks in McKay's Woods, opposite the entrance to Beechwood Cemetery; on limestone rocks, Rockcliffe Park, April 22nd, 1896.

121. **A. viticulosus,** Hook. and Tayl.

Very common on limestone rocks near McKay's Lake and along the Ottawa west of Hull, and on damp ledges in woods along the Beaver Meadow west of Hull, Que.; on damp rocks facing the river, Rockcliffe Park, April 22nd, 1896.

122. **A. heteroideus,** Kindb.

Plants densely tufted, green, finally fuscescent or blackish. Stem creeping, subpinnate, much branching and furnished with numerous small, flagelliform branchlets, densely beset with very small, oblong, obtuse and nerveless leaves; paraphyllia broad. Stem-leaves subdistant, decurrent, appressed when dry, open-erect when moist, from a broadly ovate base suddenly narrowed to a long, subulate or sublinear acumen, entire, faintly papillose; margins revolute at the base; branch-leaves more attenuate; cells round-oval, the marginal of the base quadrate; costa vanishing below the acumen. Dioecious. Fruiting specimens not found. This species resembles *Leskea nervosa* in habit.

On flat limestone rocks and the roots of trees in McKay's Woods, opposite the entrance to Beechwood Cemetery; on limestone rocks at Meeche's Lake, near Chelsea, Que., Sept. 23rd, 1893.

XLV. PLATYGYRIUM, Bruch and Schimp.

123. **P. repens,** Bruch and Schimp.

On old logs in woods at Eastman's Springs, Casselman and Carleton Place; on old logs in woods north of Beechwood, May 7th, 1896.

Var. **orthoclados,** Kindb.

Branches elongate and not curved. All basal leave-cells orange. Segments linear, not completely free at base, smooth or denticulate at one side, not shorter than the teeth.

On old logs at the south end of Skead's Farm, west of Hintonburg, May 15th, 1885.

XLVI. PYLAISIA, Bruch and Schimp.

124. **P. polyantha,** Bruch and Schimp.

On rotten logs at Carleton Place ; on trees in McKay's Woods, Oct. 12th, 1884.

125. **P. Selwynii,** Kindb. Ott. Nat. II., 156.

Differs from *P. intricata* in the denser, darker green tufts, the leaves broader, short-acuminate, reflexed to the acumen at one border or at both, the short alar and marginal cells more numerous, the capsule short-oval, the segments adhering to two-thirds of the teeth.

Very abundant on old cedar fences along the Richmond Road, three miles west of Ottawa ; also on fences west of Hintonburg, April 18th, 1896. Mr. A. J. Grout reduces this species to *P. intricata*, and believes it to be merely a more compact form.

126. **P. intricata,** Bruch and Schimp.

Common on logs and trunks, in woods and on old cedar rails around Ottawa ; on fence rails and trunks and branches in Rockcliffe Park, April 28th, 1896.

127. **P. velutina,** Bruch and Schimp.

On old logs in Dow's Swamp, Sept. 25th, 1889.

XLVII. ENTODON, C. Mueller.

128. **E. acicularis,** C. M. and Kindb.

Tufts compact, brown-yellow or variegate with green. Stems much divided, very radiculose ; branches very short and turgid, not attenuate Leaves imbricate, with difficulty loosed from the stem, scarcely open when moist, finally golden-yellow, from the ovate-oblong base suddenly narrowed to a fine aciculiform or subulate point, denticulate nearly all around ; cells not chlorophyllose, linear-lanceolate or fusiform, the alar not well defined ; costa generally wanting. Barren.

On limestone rocks in woods near McKay's Lake, May 2nd, 1885 ; also by an old lime-kiln at Britannia, Oct. 11th, 1890,

In a late revision of the genus Mr. A. J. Grout has reduced this species also to a form of the next.

129. **E. cladorrhizans,** (Hedw.)

On old logs in Rockcliffe Park and McKay's Woods, April 16th, 1896 ; on stones and logs at Britannia ; and very abundant on old logs in woods at Carleton Place. Fruiting abundantly in autumn.

XLVIII. CLIMACIUM, Web. and Mohr.

130. **C. Americanum,** Brid.

On the ground in swamps about wet woods around Ottawa. Seldom fruiting, but frequent in woods along the Beaver Meadow, Hull

Que. ; on earth in the swamp north of Beechwood Cemetery, May, 1885.

131. **C. dendroides,** Web. and Mohr.

In a swamps on the east side of the Beaver Meadow west of Hull, near the north end, Oct. 24th, 1891. Fruiting abundantly.

XLIX. PTEROGONIUM, Swartz.

132. **P. brachypterum,** Mitten.

On a small maple trunk in a piece of woods along the west side of McKay's Lake. Fruiting. April 28th, 1896. This determination is doubtful.

L. THUIDIUM, Schimp.

133. **T. minutulum,** Bruch and Schimp.

On old logs in McKay's Woods ; also in woods at Ironsides ; on stumps and rocks, Rockcliffe Park, April 22nd, 1896.

134. **T. scitum,** Aust.

On beech trunks in McKay's Woods ; on beech trees on the south end of Cowley's Farm, west of Hintonburg, April 18th, 1896.

135. **T. gracile,** Bruch and Schimp.

On old logs in woods at King's Mountain, near Chelsea, Que. ; abundant on rotten logs at Leamy's Lake, near Hull, Que., Nov. 9th, 1896. Fruiting.

136. **T. recognitum,** (Hedw.) Lindb.

On old logs around the Mer Bleue ; in Dow's Swamp and in a swamp at Stittsville ; on rotten wood, "Pine Hill," Rockcliffe Park, April 16th, 1896.

137. **T. delicatulum,** Mitt.

On earth in the Mer Bleue and in the swamp north of Beechwood Cemetery ; on earth in Dow's Swamp, May 2nd, 1896.

138. **T. abietinum,** Bruch. and Schimp.

Quite common on exposed limestone rocks at Carleton Place ; also abundant around the cliffs of Rockcliffe Park. April 22nd, 1896. Always barren.

139. **T. Blandovii,** Bruch and Schimp.

In damp woods at Britannia ; in the Mer Bleue ; also on earth in Dow's Swamp.

LI. CAMPTOTHECIUM, Schimp.

140. **C. nitens,** Schimp.

Abundant in the Mer Bleue ; also in Dow's Swamp, June 4th, 1884.

LII. BRACHYTHECIUM, Schimp.

141. **B. laetum,** Brid.

A common species on stones in woods around Ottawa ; on boulders in woods at the south end of Cowley's Farm, west of Hintonburg, April 18th, 1896. Fruiting.

142. **B. digastrum,** C. M. and Kindb.

Tufts largely cohering, olive-green, not shining. Stem rigid, subpinnate or irregularly branching, radiculose below ; branches sub julaceus, obtusate. Stem-leaves when dry loosely appressed or subimbricate, crowded, patent or subsecund when moist, decurrent, not auricled, plicate, biventrose, ovate and short-acuminate with the acumen flexuous or when dry serpentino-corrugate, borders more or less recurved but not reflexed, subentire or faintly denticulate above ; lower basal cells wide and sub-rhombic, the alar rather quadrate-rectangular and not very distinct, the upper conflate, small, very chlorophyllose, the inner median sublinear, the others oblong-lanceolate ; costa thick and subflexuous, long and vanishing near the acumen. Branch leaves ovate-oblong, more distinctly revolute at the borders, denticulate at the acumen and narrower areolate. Female flowers small, inner perichetial leaves filiform-acuminate with the acumen arcuate, long-costate and denticulate. Capsule asymmetric sub-cylindric, curved ; lid long-conic ; pedicel smooth 1-2 cm. long. Peristomial teeth conic-connivent when moist, dark red-brown below, very much longer than in the middle open segments ; cilia nodulose not apendiculate, annuli none. Monœcious.. Habit of *Leucodon julaceus*.

On rocks in McKay's Woods near south end of the lake, Oct. 12th, 1889. Fruiting.

143. **B. acuminatum,** (Beauv.)

On earth in McKay's Woods between the old entrance to Beechwood Cemetery and the lake ; also on logs at Carleton Place.

144. **B. salebrosum,** Bruch and Schimp.

On stones in damp woods north of Beechwood Cemetery, Oct. 16th, 1884 ; on stones at the rear of Cowley's Farm, west of Hintonburg, April 18th, 1896.

145. **B. acutum,** (Mitt.) Sulliv.

On earth in wet woods north of Beechwood Cemetery ; also in damp woods along the Beaver Meadow west of Hull, Que., Oct. 12th, 1891.

146. **B. platycladum,** C. M. and Kindb.

Tufts densely cohering, bright green, shining. Stem irregularly branching; branches short, obtuse, complanate. Leaves loosely imbricate or patent, nearly flat, long-decurrent, distinctly auriculate, faintly striate, broad, ovate, suddenly and generally short-acuminate; borders not recurved, faintly sinuolate or sub-entire below the middle, more distinctly denticulate above; cells pale, the upper narrow, the lower near the base dilated, the alar large and well defined; costa short, reaching little above the middle. Capsule sub-oval, faintly curved; teeth dark-yellow, entire at the borders; cilia not appendiculate; lid unknown; pediel rough, about 2 cm. long, or shorter. Perichetial leaves long, fiiliform-acuminate, the point arcuate. Dicœcious.

Differs from *B. rutabulum* principally in the long-decurrent auricled leaves and the dicœcious inflorescense; from *B. rivulare* in the peristome, etc.

On stones in the bed and along the sides of a brook, north of the Parry Sound Railway, west of West End Park, May 21st. 1885.

Mr. F. A. Grout, of Columbia College, New York, who has just completed a monograph of *Brachythecium*, refers the above species to *B. rutabulum* (L.) var, *flavescens*, Brid.

147. **B. Donnellii,** Aust.

On limestone rocks in McKay's Woods, near the Lake, Sept. 25th, 1889.

148. **B. velutinum,** Bruch and Schimp.

On earth in Gilmour's Park, Chelsea, Que., Sept. 9th, 1889; on the bases of trees in Dow's Swamp, May 2nd, 1896.

149. **B. intricatum,** Hedw. (New to America.)

On rocks by a brook near Meeche's Lake, north of Chelsea, Que. Sept. 23rd, 1893.

150. **B. Starkii,** Bruch and Schimp.

On stones in the brook north of the Parry Sound Railway and west of West End Park; on the bases of trees along the Beaver Meadow west of Hull, Que., Oct. 16th. 1884.

151. **B. œdipodium,** (Mitt.)

On old log's in woods Gilmour's Park, Chelsea, Que. Sept. 9th, 1889; on rocks in woods west of Hull, Que., Oct. 20th, 1891; on earth in Beechwood Cemetery, Oct. 12th, 1889.

152. **B. curtum,** Lindb.

On stones in damp places McKay's Woods, Oct. 12th, 18 8

153. **B. reflexum,** Bruch and Schimp.

On boulders along a brook near Meeche's Lake, north of Chelsea, Que., Sept. 23rd, 1893.

154. **B. rivulare,** Bruch and Schimp.

On stones and roots in springs north of Beechwood Cemetery, Oct. 12th, 1889.

155. **B. populeum,** Bruch and Schimp.

On rock's in Gilmour's Park, Chelsea, Que. Sept. 9th, 1889; on rocks in McKay's Woods, Oct. 12th, 1889; and on boulders "Pine Hill" Rockliffe Park, April 16th, 1896; on rocks at Meeche's Lake, north of Chelsea, Que. Sept. 23rd, 1893.

156. **B. plumosum,** Bruch and Schimp.

On boulders in McKay's Woods, May 28th, 1884; on rocks in woods, Meeche's Lake, north of Chelsea, Que. Sept. 23rd, 1893.

LIII. EURHYNCHIUM, Schimp.

157. **E. strigosum,** (Hoffm.) Bruch and Schimp.

On earth and stones in woods; common. In McKay's Woods; on earth in Dow's Swamp, May 2nd, 1896; on old logs in Beechwood Cemetery, Oct. 12th, 1889; on earth in woods at Meeche's Lake, Sept. 23rd, 1863.

158. **E. Novae-Angliæ,** (Lesq. and James.)

On old logs in woods at Meeche's Lake, Que. Sept. 23rd, 1893.

159. **E. Sullivantii,** (Spruce.) Lesq. and James.

On limestone rocks along the east side of the creek in the Beaver Meadow west of Hull, Que. May 16th, 1885.

160. **E. hians,** (Hedw.) Lesq. and James.

On earth in woods near McKay's Lake, Oct. 12th, 1889. This specimen is still doubtful.

LIV. RAPHIDOSTEGIUM, Lesq. and James.

161. **R. recurvans,** (Schwægr.) Lesq. and James.

Very common on the bases of leaning trees in woods. Beechwood Cemetery and McKay's Woods, April 28th, 1896; old woods at Carleton Place.

LV. RHYNCHOSTEGIUM, Schimp.

162. **R. deplanatum,** Schimp.

On flat limestone rocks in McKay's Woods, May 2nd, 1885; also on flat rocks and earth Carleton Place Sept. 26th, 1889; on earth in Beechwood Cemetery, Oct. 12th, 1884.

RECENT CONCLUSIONS IN QUEBEC GEOLOGY.

R. W. ELLS, LL. D., F. R. S. C., Geological Survey, Ottawa.

(Read before Section C., British Association Meeting, Toronto, Canada, 1897.)

The paper gives a brief outline of the progress of geological exploration in this portion of the Dominion, with a statement of the most recent conclusions arrived at as the result of the detailed study of the rocks in the field. It is largely a summary of the conclusions stated in the published report of the Geological Survey of Canada,* on this district.

The principal problems west of the St. Lawrence were the relations of the great Anorthosite masses, lying to the north of Montreal, to the Laurentian Fundamental Gneiss and the Grenville Series; and secondly, the relations of the Grenville Series itself to the underlying Gneiss on the one hand and to the Hastings Series of Ontario on the other.

These may now be regarded as fairly well settled, at least to the satisfaction of those who have most recently worked in this field. In regard to the age of the Anorthosites the old contention that these were an altered series of the sedimentary rocks, resting unconformably on the gneiss and limestone of the Grenville series, has been abandoned. It has been found that the Anorthosites and Gabbros which are associated with these, are igneous in character, and that they are newer, in point of time, than the Grenville rocks; that they have invaded these at many points and altered them along the lines of contact.

The change of view in regard to their origin dates back to about 1879-80, and their igneous intrusive character was first pointed out by Vennor nearly twenty years ago. This view was expounded by Dr. Selwyn in the report for the years mentioned, but the whole question has more recently been investigated, principally by Dr. F. D. Adams, whose observations in the field and in the laboratory have finally conclusively settled the problem and shewn that the anorthosite areas are masses of igneous rocks newer than the Grenville limestone and associated gneisses.

The second grand problem as to the relations of the Grenville limestone and associated rusty and hornblende gneisses to the Fundamental Gneiss of the Laurentian proper, has also been conclusively settled. It is now held by all the recent observers in this field that the rocks of this division are a newer

* Annual Report, Vol. VII, N. Series, 1894, Part J.

series, resting upon the Fundamental Gneiss. In this no trace of sedimentation is now apparent; while in the Grenville series the originally clastic character is clearly recognized in several of its members. The rocks of the Grenville series have been worked out along their westward development and have been found in this direction to include the series named by Vennor, the Hastings, which is apparently the same as the Grenville, under different conditions as regards alteration and local development; the limestones of the Hastings series being frequently less altered, and associated with micaceous and other schists, along with beds of slate and true conglomerates.

East of the St. Lawrence.

The great problems as to the structure of the Quebec Series or Group which have been prominent for nearly fifty years have also been settled, at least to the satisfaction of those most familiar with all the aspects of the question. The crystalline series of the Sutton Mountain, at one time regarded as the newest member of the Group has been separated and placed in the pre-Cambrian division, and are presumably of Huronian age, since it has been found that these rocks underlie the lowest fossiliferous Cambrian sediments. Above these crystalline rocks there is a very considerable thickness of strata which represent the Cambrian and which have been locally assigned to the lower Sillery formation, for the sake of description; and these rocks contain, at many points, organic remains such as trilobites, graptolites, etc., which have a marked Cambrian aspect. The fossiliferous beds of the upper Sillery and Levis have been carefully searched and studied, stratigraphically, and it has been conclusively shewn that the Levis is the upper member and overlies the upper Sillery; and, that in fact the Sillery is the downward prolongation of the Levis without manifest break, except that the fossil contents become less abundant in the upper Sillery, as in the case of the passage of the Calciferous of the Ottawa Basin downward into the Potsdam sandstone, where there is also no marked line of separation, except in the change of character in the composition of the strata. There is however a marked break between the slates and sandstones of the upper Sillery and the limestones and slates of the lower Sillery; since in connection with heavy faults between the two series there are thick beds of limestone conglomerate at the base of the upper Sillery, abounding in pebbles of limestone which contain numerous specimens of *Olenellus Thompsoni*, and

other lower Cambrian fossils. In point of time the Levis beds may be regarded as the equivalents of the Calciferous of the Ottawa Basin, while the lower portion or upper Sillery may be taken as the equivalent of the Potsdam sandstone.

The rocks of Quebec City and the Citadel Hill are somewhat higher in the scale than those of the Levis shore opposite. They were at first regarded as of Levis age and lower in position than the Sillery. Subsequently they were held to represent the Hudson River and Utica divisions, but a careful study of the fossil contents, as well as of the stratigraphical relations as shewn in other portions of the field, where the similar rocks appear, shews this peculiar development of strata to belong largely to the lower division of the Trenton and not far from what is designated the Black River division. The equivalence of the areas in the vicinity of Quebec to those seen in the Phillipsburg section has also been very clearly established, and the rocks of the latter are found to range upward from the base of the Calciferous to the top of the Chazy formation. Thence eastward the ascending sequence can be traced upward into the black slates and limestones of Farnham which are apparently the equivalents of those of Quebec city, but which were at one time described as a part of the Potsdam formation.

The great areas of upper Silurian, once depicted on the map of the province of Quebec, have in large part been removed. These were supposed to occupy the greater portion of the province, east of the Sutton mountain range; and their Silurian horizon was maintained from the presence of a number of areas of these fossiliferous rocks found at various places in this district. The detailed study of this field shewed conclusively that these Silurian areas were detached outliers, sometimes of very limited extent, in places infolded with the underlying Cambro-Silurian sediments. The age of the latter was established by the finding of characteristic fossils, such as graptolites and trilobites at a number of points. It can therefore be safely asserted that by far the greater part of the area east of the Sutton Mountain anticlinal is occupied by strata of Cambro Silurian and Cambrian age and that the upper Silurian and Devonian portions are very limited in extent.

The question of the age of the mountain masses of diabase and syenite so conspicuously displayed in the area east of the St. Lawrence, has also been a somewhat difficult one to decide. In places the associated rocks have been so altered as to present the

aspect of Pre-Cambrian schists and for a time these mountains were supposed to be as old as the lowest Cambrian. Their intimate association with Silurian and Devonian sediments at a number of points, together with the fact that numerous spurs were given off from the main masses of igneous rocks which penetrated these newer sediments in the form of dykes, the fossiliferous Silurian and Devonian in contact being frequently converted into schists and otherwise altered, shews conclusively that the age of most of these mountain masses must be more recent than the sediments which they penetrate so that they are at least post-Silurian.

There are however large areas of igneous rocks in association with the pre-Cambrian strata of the Sutton Mountain axis which are of Pre-Cambrian age, since they are overlaid by the slates of the lowest Cambrian. These have also been altered and are now often seen in the form of chloritic and other schists.

The age of the Granite masses which are conspicuous features in the eastern portion of Quebec, is probably not very different from that of the diabase hills just referred to. These cut rocks of all ages from the pre-Cambrian to the Silurian. The strata in their vicinity are all greatly altered, the slates being changed into chiastolite and staurolite schists, while the Cambro-Silurian limestones have been rendered schistose and are filled with small scales of mica, often with a large development of quartz veins.

The serpentine areas in which the asbestus of the Eastern Townships is frequently found apparently belong to the diabase and olivine group. They are often found in association with the Cambrian slates but they also occur in connection with the Cambro-Silurian and Silurian strata. They are apparently altered portions of the diabase and olivine masses.

The same remarks apply to most of the igneous rocks of the Gaspé peninsula. These is here a central zone of pre-Cambrian rocks, overlaid on the north by Cambrian slates and limestones, and on the south by Silurian and Devonian strata of the great Siluro-Devonian basin. Through these newer rocks great mountain masses of diabase and kindred rocks protrude; similar to those found in the areas east of the St. Lawrence, and these are evidently newer than the fossiliferous sediments which they penetrate, since, at several points, pieces of the fossiliferous limestones are caught and held in the igneous mass.

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