S.W. Sheet

Geological Survey of Canada.

GEORGE M. DAWSON, C.M.G., LL.D., F.R.S. &c., DIRECTOR.

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Eastern Townships Map.

Legend.

Devonian.

- F1 — Lower Devonian

Silurian.

- E6 — Lower Helderberg
- E1 — Medina

Cambro-Silurian.

- D5 — Hudson River (Lorraine)
- D4 — Utica

West of the St. Lawrence and Champlain Fault.

- D3 — Trenton and Black River
- D2 — Chazy
- D1b — Calciferous
- D1a — Potsdam sandstone

East of the St. Lawrence and Champlain Fault.

- D3b — Black and grey graptolitic slates of Memphremagog Lake etc.
- D3a — Farnham black slates and limestone
- D2b — Mystic and Bedford limestones and slates
- D2a — Upper part of Phillipsburg and St. Armand section.
- D1b — Lower part of Phillipsburg and St. Armand section (Levis)
- D1a — (Presumably upper portion of Sillery)

Cambrian.

- Upper Cambrian — C3 — [illegible] and conglomerates.
- Lower Cambrian — C1 — Olenellus zone, Lower Potsdam of Billings, Georgia Series of Walcott.
- Cambrian (undivided) — C

Huronian?

- Pre-Cambrian — AB

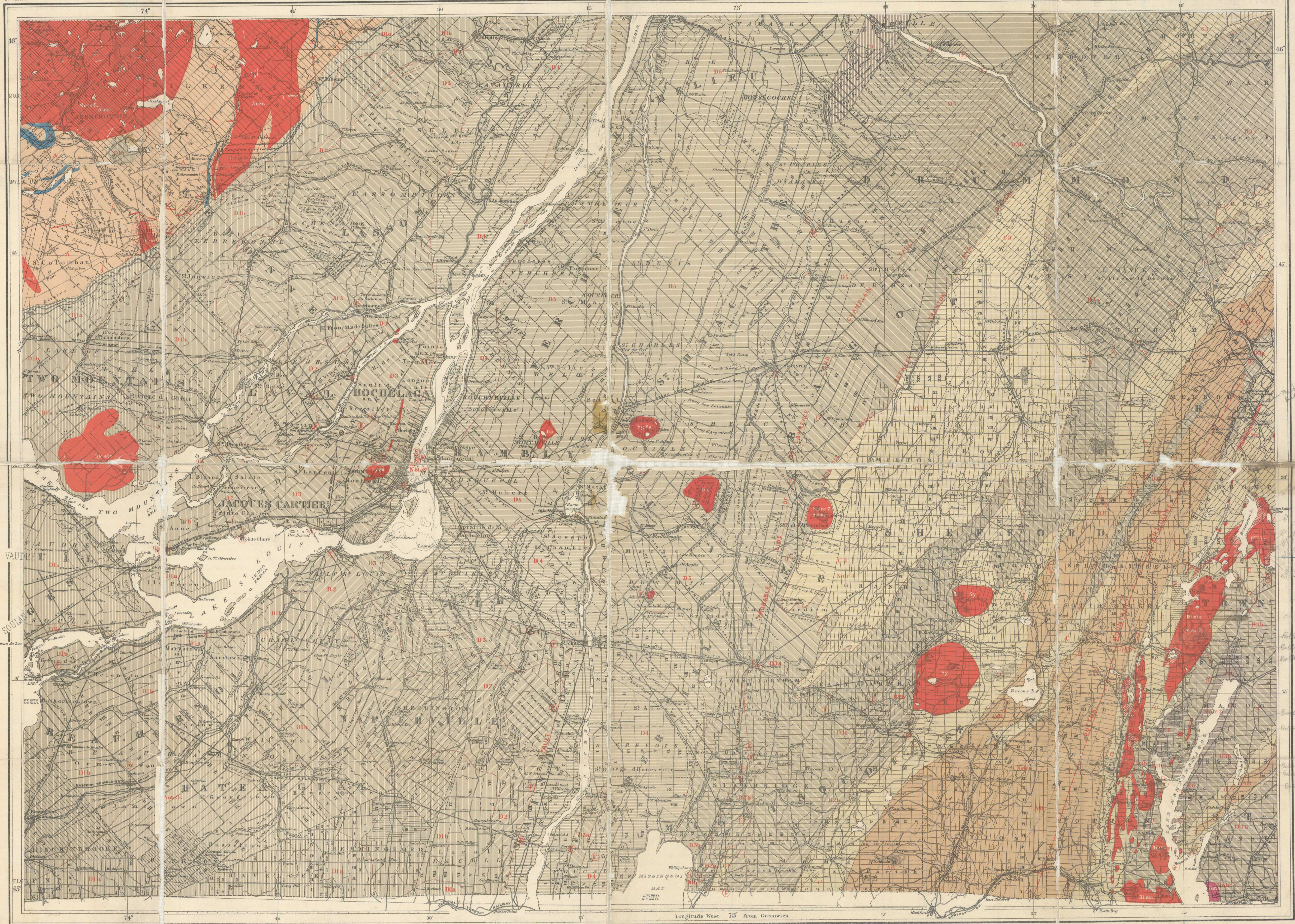
Laurentian.

- A — Laurentian Limestone
- A — Laurentian Gneiss and Granite

Igneous.

- Br. — Breccia
- Di. Do. Dia. Sy. — Diorite, Dolerite, Diabase, Syenite etc.
- Ser. — Serpentine
- Anor. — Anorthosite
- Zone of mixed rocks about St. Jérome Anorthosite.
- Gr. — Granite

Iron; Copper; Strike and Dip; Glacial Striæ; Fossils; Dyke; Asbestus



Compiled and drawn by Robert Barlow, Chief Draughtsman, Montreal, 1868, with additions and corrections to 1895 by the Geological Survey

PROVINCE OF QUEBEC.
Montreal Sheet.
(Eastern Townships Map)
Nat. Scale: 1/253440.

Accompanying Part J. Vol. VII (New Series)

Geologically surveyed by Sir W. E. Logan, R. W. Ells & F. D. Adams.

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NOTE 1.

The Devonian areas in south-western Quebec, recognized by characteristic fossils, are of very limited extent. They are only two in number and are found on the west side of Memphremagog Lake. The largest is on Sargent's Bay, a short distance above the wharf at Knowlton Landing, where *Taonurus cauda-galli, Psilophyton, and Bythotrephis* are found. The other area is near the Mountain House at the Owl's Head Mountain Landing, the fossils from which are chiefly corals. The horizon of the Sargent's Bay rocks is the lower portion (*Cauda-galli* grit) of the Upper Helderberg of the New York scale of formations, while the limestones of the Owl's Head Landing are probably the equivalents of the Corniferous.—(Dana's Manual of Geology, 4th Ed.)

NOTE 2.

The Lower Helderberg of Memphremagog Lake is largely a limestone formation. While not highly fossiliferous at many points, shells and corals occur at various places and clearly indicate the horizon.

The rocks classed as Medina on the map, are reddish shales and sandstones, which as yet have not yielded fossils. They overlie the Lorraine shales and were therefore assigned, by Sir W. E. Logan, to the Silurian system. The formation is difficult to outline, owing to the mantle of drift over much of the area where it occurs, and the boundaries are therefore, to a certain extent, conjectural.

The road from Phillipsburg on Missisquoi Bay to St. Armand Station on the Central Vermont Railway, crosses an almost continuous section of rocks, mostly limestones, which present certain peculiar features. They have been described in the Geology of Canada 1863, pp. 844, 680, under the heading Quebec group (Phillipsburg series). The rocks dip uniformly to the south-east till within a short distance of the railway, when a syncline appears in their upper part. The portion about Phillipsburg and the strata to the north and south, extending along this road for about three-fourths of a mile, is regarded as equivalent to the Calciferous (Levis), while the upper portion is supposed to represent the Chazy formation. These rocks, in the vicinity of Bedford, Stanbridge, Mystic, &c., contain local developments of limestone and limestone-conglomerates, from which a great number and variety of fossils have been obtained. It has, however, been found that while certain affinities exist between these and the fauna of the typical Calciferous and Chazy of the Ottawa basin, the fossils as a whole present features markedly distinct. There is also a lithological difference in the strata of the two localities. These peculiarities are supposed to be due to differences in the circumstances of deposition of the two areas, now brought into contact along the line of the St. Lawrence and Champlain fault. This fault extends from Phillipsburg to Quebec and thence eastward, separating the flat-lying formations of the St. Lawrence on the west from the highly inclined strata on the east.

The small outcrops of limestone at St. Helen's Island and Isle Ronde in Montreal Harbour are associated with volcanic breccias, but have yielded a very characteristic fauna indicating their position at the top of the Silurian system.

NOTE 3.

No definite break has yet been found in Canada between the Calciferous formation and the Potsdam sandstone, the passage between the two, both in eastern Ontario and western Quebec, being gradual. After consideration of all the evidence from the stratigraphical and palæontological standpoints, it has been decided to include them in one category as representing the basal portion of the Cambro-Silurian system. The areas of each have, however, been distinguished, where known, by a difference in the barring. Lithologically these formations are entirely distinct from the Levis and upper part of the Sillery formation, (formerly Lauzon), which are supposed to be their equivalents in age, a difference presumably due to different conditions of deposition. The Potsdam sandstone and the Calciferous are also everywhere nearly flat, while the Sillery and Levis are highly inclined, sometimes overturned, and extensively faulted.

NOTE 4.

The Sillery of the North-east map-sheet of the "Eastern Township" series, is divisible into two portions, an upper and a lower, the former of which consists largely of reddish and green shales and greenish sandstones with limestone-conglomerates, the upper part of which is apparently the downward extension of the Levis formation. On the present map the rocks are well seen between Abbottsford and Granby and thence northward for many miles. The lower part of the Sillery is undoubtedly Cambrian and in the St. Lawrence River section contains characteristic fossils, *Agnostus*, etc., at certain points. The highest beds of the Sillery (Lauzon) do not appear in this area and the red and green slates, sandstones and grits of this area are therefore all probably Cambrian. The horizon of the Cambrian rocks on both sides of the Pre-Cambrian of the Sutton Mountain anticline, has not yet been definitely decided owing to an apparent absence of organic remains in the strata. The slates and quartzites at the base, are probably the equivalents of the Georgia series of Vermont (Olenellus zone) while the strata from Frelighsburg to Sweetsburg, etc., probably represent the Upper Cambrian. [illegible] for many years, and are of great economic importance.

NOTE 5.

The strata which compose the Sutton Mountain anticline, are believed to be of Huronian age. They undoubtedly underlie the lowest Cambrian. They do not resemble the typical Laurentian gneiss of the Grenville series north of the St. Lawrence river, but are not unlike the rocks which have been described as the "Hastings series" in Ontario, both in the character of the schists and the crystalline dolomites. They contain deposits of copper ore at several points, and the most productive copper mines of the "Eastern Townships" belong to this division. Gold has been reported from the gravels of some of the streams on the west side of the axis in Sutton, but nothing definite as to the value of the deposit has been ascertained. Gold has also lately been found in quartz veins cutting the strata of this series near Dudswell, north-east of Sherbrooke. Iron ore also occurs at several places. Among the rocks comprised in the area, are extensive masses of diorite, some of which is schistose. The crystalline limestones are sometimes quarried, as at Stukely, and make an excellent building stone, while they are also well suited for lime burning.

NOTE 6.

The Laurentian of the country north and west of the St. Lawrence is part of the great Archæan nucleus of the North American continent and represents the oldest system of rocks in Canada. It consists in part of foliated quartzose gneiss of more or less uniform character, which probably constitutes the basal portion of the system, and in part of more distinctly banded gneisses varying considerably in character, often containing much garnet and sillimanite, and associated in many places with bands of quartzite and crystalline limestone. This latter series consists in part at least of altered sedimentary strata and belongs to the "Grenville series" of Sir W. E. Logan. It is believed to repose upon the foliated gneiss before mentioned, and to form an upper series in the system. Its delimitation against the lower gneiss is not attempted in this area.

All these rocks are broken through by intrusive masses of anorthosite, etc., which are more recent than the Grenville series, since they cut it. They, however, are not more recent than the latest dynamic movements in the area, as they frequently show a foliation induced by pressure, especially about the borders of the masses. The old classification in which these anorthosites were regarded as constituting an Upper Laurentian series, resting on the Grenville series, is now abandoned.

NOTE 7.

The breccias found on the Island of Montreal, and at a few points in the vicinity, are presumably connected with the eruptive mass or Mount Royal. They are well seen at St. Helen's Island and Ile Ronde in the harbour of Montreal, at the White-horse Rapids on the Back River, on the west side of Ile Bizard, and on the east flank of Mont Calvaire. They are cut by dykes of diorite, which must, therefore, be of later date, and from their intimate association with the fossiliferous Lower Helderberg limestones of St. Helen's Island they are probably not far different from these in point of age.

The eruptive masses seen in the Montreal Mountain, Belœil, Yamaska, etc., as well as in the chain of hills west of Memphremagog Lake, and to the north-east towards the Chaudière River, and beyond, (see North-east sheet) [illegible] a marked resemblance to each other, and are presumably of very similar age. Specimens from a number of these were examined some years ago by Dr. F. D. Adams, (Report of Progress, Geol. Surv. Can., 1880-81-82) who found the rocks of the eastern belt to be largely an altered diabase. These masses penetrate strata of widely different age, being found associated with all the formations from the lowest Cambrian to the top of the Silurian. Portions of these diorites have been altered to a serpentine, which, however, varies in physical character and mineral contents at different points. In some of these mountain masses, the upper part is frequently fine-grained, while the lower part, and often the bulk of the mountain, is comparatively coarse-grained and syenitic. The most prominent hills of the eastern area are Mount Orford, Hog's Back, Elephantis, Owl's Head, &c., while to the north-east are the Ham Mountains, Adstock, Cranbourne, &c. (See North-east sheet.)

In the serpentine masses are found asbestus (chrysotile) chromic-iron and magnetite. The eruptive masses of Memphremagog Lake are certainly, in part, newer than Lower Helderberg.

The granite masses are found to the east of this lake. They cut slates and limestones of Cambro-Silurian age, probably Lower Trenton, and by their action have developed crystals of staurolite, chiastolite, mica, &c., in the adjacent strata. The period of the intrusion is probably about the same with that of the dioritic masses just described.

In the area west of Memphremagog Lake, serpentine outcrops are quite frequent. They are associated with diorites and are often of very limited extent, so that their delineation on the map is not always possible. The larger and more important areas have, however, been indicated by barring.