

- LEGEND**
- PLEISTOCENE**
- 10 PEAT AND MUCK: 10a, muck less than three feet thick over Ordovician limestone and shale
 - 9 LOW TERRACE SANDS: recent alluvium; 9a, alluvium less than three feet thick over Ordovician limestone and shale
 - 8 HIGH TERRACE SANDS: coarse to fine sand, mostly alluvial; some beach and eolian deposits; 8a, fine gravel phase
 - 7 CHAMPLAIN SEA SEDIMENTS: marine stratified silts and clays; minor sands
 - 6 REWORKED TILL: boulder beach gravels along St. Narcisse moraine; 6a, reworked till less than three feet thick over Ordovician limestone and shale
 - 5 GENTILLY TILL: sandy; calcareous south of St. Narcisse moraine; 5a, Gently till less than three feet thick over Ordovician limestone and shale
 - 4 DESCHAILLONS VARVED SEDIMENTS: grey varved silt and clay
 - 3 EARLY OR PRE-WISCONSIN ST. PIERRE SEDIMENTS: sand and peat, probable age of peat is more than 40,000 C₁₄ years
 - 2 BECANCOUR TILL: calcareous, varied texture, some varved clay under the till
 - 1 GREENVILLE GNEISS: some till in the valleys
- PRECAMBRIAN**
- 1 GREENVILLE GNEISS: some till in the valleys

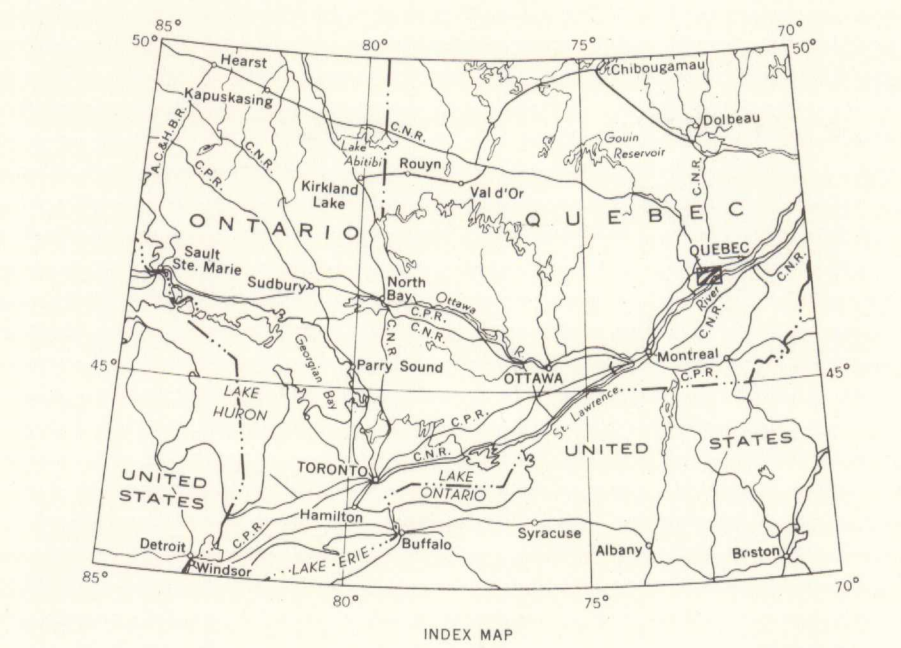
- Geological boundary (approximate)
- Glacial striae (direction of movement known, unknown)
- Sand bars
- Landslide scars (date known, unknown)
- Erosional escarpments
- Fossil locality
- Gravel or sand pit
- Geology by P. F. Karrow, 1955-1956
- Main highway
- Other roads
- Cart track
- Trail
- Railway
- Post Office
- County boundary
- Township boundary
- Intermittent stream
- Fall and rapid
- Marsh
- Foreshore flats
- Contours (interval 50 feet)

Cartography by the Geological Survey of Canada, 1959

Approximate magnetic declination, 17° 48' West

Air photographs covering this area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

In response to public demand for earlier publication, Preliminary Series maps are now being issued in this simplified form, thereby effecting a substantial saving in time. There is no loss of information, but the maps will be clearer to read if all or some of the map-units are hand-coloured.



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DESCRIPTIVE NOTES

The earliest Pleistocene event recorded in the Grondines map-area is the development of a proglacial lake in which varved clay was deposited. Glacial ice, of possible Illinoian age, then overrode the varved clay and deposited the Becancour till-sheet. Retreat of the ice from the St. Lawrence Lowlands was followed by a non-glacial interval when stream activity was dominant and thick deposits of stratified sands with some plant remains were laid down. This interval has been named the St. Pierre Interval (Gadd, 1959). It may be Sangamon in age.

A later glaciation (Wisconsin) again disrupted drainage and thereby formed proglacial Lake Deschailions in which grey varved clay was deposited. Lake Deschailions lasted for several hundred years before advancing ice ended its existence. The ice of the second glaciation deposited the Gently till and extended south beyond the Grondines map-area. Ice-retreat allowed marine waters to flood the depressed lowland, forming the Champlain Sea. For a time the ice-front stood in the sea, depositing fossiliferous till and stony marine clay. A minor ice-readvance overrode the marine sediments and formed the St. Narcisse moraine. Fossils indicate that the ice stood at least 100 feet of marine water at this time and the river was submerged. Final ice-retreat allowed the sea to reach its maximum extent, probably covering the land up to the present 600-foot contour level and leaving only the tops of the highest bedrock hills above water.

Slow uplift of the land resulted in the withdrawal of the sea from the area. Numerous beaches and raised deltas record various stages in the uplift. The St. Anne River deposited large sand bars on each side of its mouth in the St. Alban area. The enclosed lagoons later filled with peat. The change from marine through estuarine to fluvial conditions was gradual. Marine conditions probably ended when the water level in the St. Lawrence Valley dropped to about the 200-foot level and by the time the river level had dropped to the present 100-foot contour level, within the map-area, the St. Lawrence River had established its present course and form. The prominent hill 2 miles northeast of Ste. Anne de la Pérade was at one time an island in the river. The earlier courses of the post-glacial St. Lawrence River appear to have been farther north than that of the present river and migration to the south has occurred and is probably continuing. Higher terraces with thick accumulations of alluvial sand have been abandoned. The most recent terrace forms a low plain adjacent to the north side of the river. As stream dissection has cut into the plains of marine sediment, disastrous landslides of the earth-flow type have occurred, causing widespread property damage and some loss of life.

Precambrian rocks (1) outcrop as rounded ridges and rolling hills in the northwest half of the area. They have a weakly folded structure and are composed of scattered glacial striae, groovings, and gorges record ice-movement toward the southeast, parallel to the Precambrian structure and transverse to the St. Lawrence Valley. Pockets of till and stratified sediments lie in the hollow.

Palaeozoic rocks are not shown as a separate map-unit although they are extensively exposed in cliffs along the Ste. Anne River, east of Grondines, along the St. Lawrence River. In addition, a large area between Grondines, St. Marc, and St. Casimir is underlain by Palaeozoic limestone and shale at depths of a few feet or less. The surface of the Palaeozoic rocks is believed to slope generally to the south and southwest. At Grondines, a scarp can be traced northeastward beneath interglacial deposits. This scarp is believed to mark the course of an interglacial or preglacial St. Lawrence River. A small section of another buried valley has been re-excavated by the Ste. Anne River about a mile southwest of St. Alban. The limestone surface in the outcrop area east of St. Casimir forms several small cuestas which have been modified by glacial and fluvial erosions.

The oldest Pleistocene deposits are the Becancour till (2) and underlying varved clay. Two small exposures along the south shore of the St. Lawrence River are the only ones known in the area. The till has a clay-silt texture, a dark grey colour with a pinkish cast, and is weakly calcareous. The underlying varved clay is contorted and reddish in colour.

The St. Pierre sediments (3) are found in sections near Deschailions along the south shore of the St. Lawrence River and along the Petite Rivière du Chêne. Fluvial stratified sands constitute the bulk of the formation but, stratigraphically, the layers of peat and wood are more important. Wood from exposures of this formation outside the Grondines map-area has been dated as more than 40,000 years (W-189). The St. Pierre sediments may therefore represent the Sangamon interglacial stage.

The overlying Deschailions sediments (4), consist of grey varved clay and silt. The thickness of the formation exceeds 100 feet west of Lotbinière where there is continuous exposure along the St. Lawrence River for over 2 miles. Other notable exposures are at Deschailions, at St. Pierre les Becquets along the Petite Rivière du Chêne, and northeast of Ste. Anne de la Pérade. The clays have been exploited for many years at Deschailions in the manufacture of brick and terra cotta. The varved clay varies in carbonate content. Individual varves range from 1/4 inch to several inches thick and are graded bedding. The clays are stiff due to preconsolidation, and the upper few feet of varves are contorted; both effects are the result of overlying ice-sheet.

The Gently till (5) is extensively exposed west of St. Casimir, west of Grondines, and near Deschailions and Parisville. The long ridge extending from St. Narcisse to beyond St. Thuribe is a core of Gently till deposited in the ice-front following a brief readvance. In areas underlain by Precambrian rocks, the Gently till consists of crushed and broken Precambrian crystalline rocks and is non-calcareous; in areas underlain by Palaeozoic rocks the till contains both these crystalline rocks and Ordovician limestone and shale in moderate to large amounts. The texture is everywhere sandy but the proportion of silt and clay generally increases to the southeast. Unweathered Gently till is commonly grey in colour and is as much as 60 feet thick. The till surface is generally buried, but where exposed, is hummocky and irregular. Modified southeast-trending drumlins and ridges occur west of St. Casimir and in the southwest corner of the area.

Much of the exposed area of Gently till has been reworked by post-glacial marine and fluvial waters. The St. Narcisse moraine has coarse gravel beaches along the northwest side of the crest, formed from the till by marine erosion. Numerous gravel pits have been opened in these deposits and a large supply of poorly sorted, subrounded gravel is available. Other areas of reworked till (6) are to be found south of St. Casimir and east of Parisville. In these latter areas boulder-strewn sands and substratified silty sands overlie fresh till or limestone bedrock at depths of a few feet.

Marine sediments (7) deposited in the Champlain Sea form extensive plains in the western and northeastern parts of the area and underlie most of the area west of the Charest River between the St. Narcisse moraine and the St. Lawrence River. The deposits are grey silts and clays interstratified, at intervals of 1 inch to 6 inches, with sand. The coarser size marine sediments tend to be thin-bedded. They occur in the vicinity of former river mouths, such as near St. Alban, and near the St. Narcisse moraine. Mineralogically the clays are composed of fine rock flour including chlorite, illite, quartz, feldspar, and amphibole. The deposits are generally fossiliferous and a large fauna has been identified from them. Among the most common species is the bivalve *Hiatella arctica* (Gray), *Hiatella arctica* (Linne), *Macoma balthica* (Linne), and *Mytilus edulis* Linne. Contorted fossiliferous marine sediments underlie the till in part of the St. Narcisse moraine and indicate that the ice readvanced into the Champlain Sea. Marine sediments probably exceed 100 feet in thickness in some places. When disturbed, the fine-grained sediments lose much of their strength and large earth flows result. Such flows have occurred in prehistoric and historic times in the Ste. Genevieve, St. Prosper, and St. Thuribe areas. Sites particularly subject to these landslides are along steep stream-banks that are actively being eroded. Several square miles have been wasted in this way leaving a hummocky terrain in which the depressions develop level floors through the passage of time.

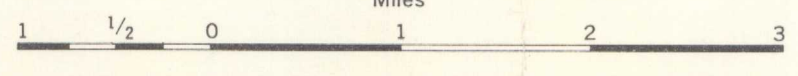
High Terrace sands (8) include marine and freshwater beach deposits, eolian deposits, and alluvium. Beach deposits are best developed along the south-east side of the St. Narcisse moraine and in delta-like accumulations near Barrage St. Narcisse and St. Alban. Eolian deposits are restricted to small areas of reworked alluvial sand northwest of Deux Rivières and in the Charest valley north of St. Prosper. Some fine gravel occurs on older terraces along the Batiscan River north of Deux Rivières. The deposits are nowhere more than 8 feet thick. Several small pits have been opened in the gravels. Most of the deposits of this map-unit are alluvial sands deposited on abandoned and raised terraces of the St. Lawrence River and its tributaries. They vary from coarse to fine in texture and are usually well sorted. A few small sand-pits have been opened and the supply of sand is very large.

Low Terrace sands (9) are alluvial deposits of more recent age found on low terraces of the major streams. Lithologically they resemble the High Terrace sands but contain more silt and organic matter.

Peat and muck (10) occur as old channel fillings and lagoon bogs. Deposits up to 13 feet thick fill lagoonal depressions between old marine offshore bars near St. Alban. A complex network of shallow channels cut in bedrock north of Grondines is filled with peat to depths of 7 feet. Shallow muck over limestone bedrock extends between the channels and provides rich agricultural soil. The peat is being exploited in one of the lagoon bogs southeast of St. Alban. A large reserve is available in the many bogs of the area.

MAP 41-1959
SURFICIAL GEOLOGY
GRONDINES
CHAMPLAIN, PORTNEUF, LOTBINIERE
AND NICOLET COUNTIES
QUEBEC

Scale: One Inch to One Mile = 1/63,360 Miles



5.1.9 Grondines, Que. Map 41-1959
A1.Ged.