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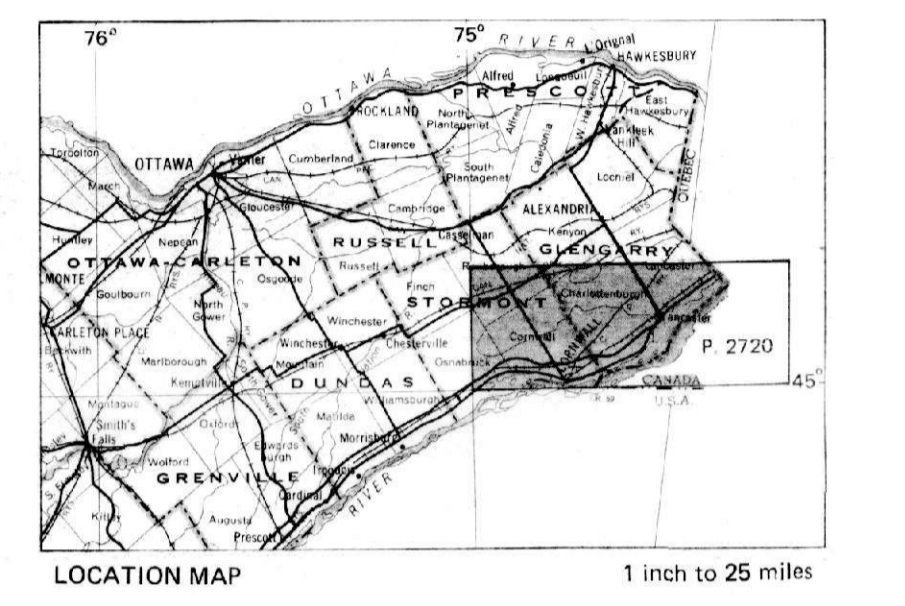
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PALEOZOIC GEOLOGY
CORNWALL - HUNTINGDON
AREA
SOUTHERN ONTARIO

Scale 1:50 000
NTS References: 31 G/1.2
ODM-GSC Aeromagnetic Maps: 1693G, 1694G
OGS Geological Correlation Map: 2418

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LEGEND

PHANEROZOIC	
UPPER ORDOVICIAN	
13	*Queens Formation: red to light greenish-grey siltstone and shale, with interbedded silty biotitic limestone in lower part.
12	*Crislian Formation: interbedded dark grey shale, fossiliferous calcareous siltstone, and silty biotitic limestone.
11	*Bilting Formation: dark brown to black shale, with laminations of calcareous siltstone.
10	*Eastview Formation: interbedded subdiagnostic to fine crystalline limestone and dark brown to dark grey shale.
MIDDLE - UPPER ORDOVICIAN	
9	Lindsay Formation: subdiagnostic to fine crystalline limestone, nodular in part, with interbeds of calcareous and shale.
MIDDLE ORDOVICIAN	
8	Verulam Formation: interbedded biotitic limestone, subdiagnostic to fine crystalline limestone, and shale.
7	Bobcaygeon Formation: interbedded calcareous and subdiagnostic to fine crystalline limestone.
6	Gull River Formation: interbedded silty dolomite lithographic to fine crystalline limestone, calcic limestone, shale, and fine-grained calcareous quartz sandstone.
5	Rockcliffe Formation: interbedded fine-grained, light greenish-grey quartz sandstone, shaly limestone, and shaly locally conglomerate at base; interbeds of calcareous (St. Martin Member, 5a) and silty dolomite in upper part.
LOWER ORDOVICIAN	
4	Oxford Formation: subdiagnostic to fine crystalline dolomite.
3	*March Formation: interbedded quartz sandstone, sandy dolomite, and dolomite.
CAMBRIAN - ORDOVICIAN	
2	*Nepean Formation: fine to coarse-grained quartz sandstone, partly calcareous in upper part.
1	*Covey Hill Formation: non-calcareous, feldspathic, fine to coarse-grained quartz sandstone and quartz-pebble conglomerate.
PRECAMBRIAN	
PC	*Undifferentiated metamorphic and igneous rocks. *Indicates units which do not occur in the map area. *Indicates units which occur in the map area beneath younger Paleozoic units.

SOURCES OF INFORMATION

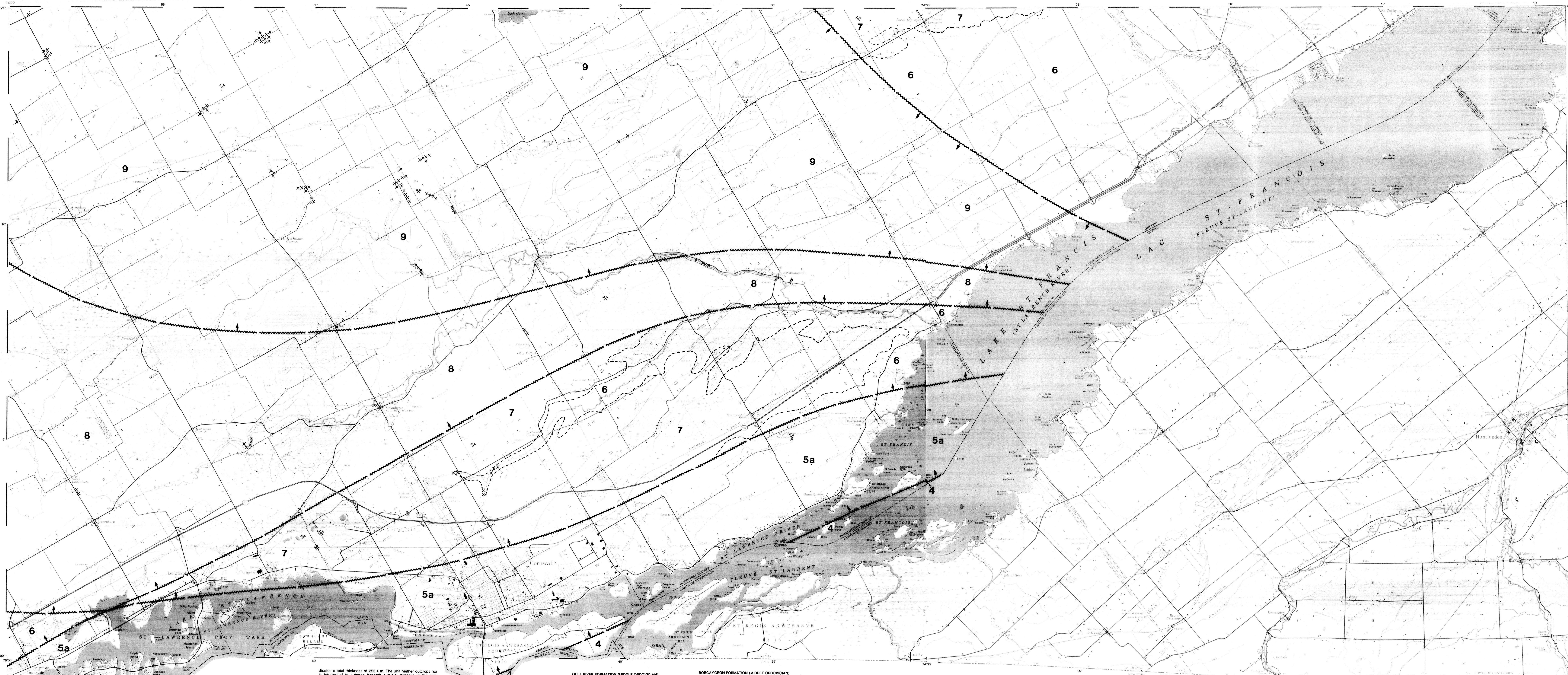
Topography from Maps 31 G/1 and 31 G/2 of the National Topographic Series.
Subsurface information mainly from Ontario Ministry of Natural Resources oil and gas well survey cards (on file with the Petroleum Resources Section, Ontario Ministry of Natural Resources, London, Ontario).
Metric Conversion Factor: 1 foot = 0.3048 m.
Contour interval: 20 feet.

CREDITS

Geology by D.A. Williams, R.R. Wolf, and D.M. Carson, 1981-1982.
Every possible effort has been made to ensure the accuracy of the information presented on this map. However, the Ontario Ministry of Natural Resources does not assume any liability for errors that may occur. Users may wish to verify critical information. Sources include both the references listed here and information on file at the Ontario Ministry of Natural Resources' office and the Mining Recorder's office nearest the map area.
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Williams, D.A., Wolf, R.R., and Carson, D.M., 1985. Paleozoic Geology of the Cornwall - Huntingdon Area, Southern Ontario. Geological Survey of Canada, Map P.2720, Geological Series - Preliminary Map, scale 1:50 000. Geology 1981-1982.

SYMBOLS

X	Bedrock outcrop	—	Fault position
□	Quarry	—	approximate (arrow indicates downthrown side)
—	Geological boundary (position approximate)		



MARGINAL NOTES

Geological mapping of the Cornwall - Huntingdon area involved the re-examination of parts of the areas mapped by Wilson (1944, 1947) for the Geological Survey of Canada, and later included in her major publication on the geology of the Ottawa-St. Lawrence Lowland (Wilson 1949). The lowland is characterized by Paleozoic bedrock transected by a system of normal faults striking northeast to southwest.
The main physiographic feature is the St. Lawrence River, which flows eastward to northward and constitutes the southern boundary of the map area. The northwestern part of the area forms part of the Lancaster Flats Clay Plain (Chapman and Furness 1951, 1969).
The surface geology is generally thin, and Paleozoic bedrock outcrop is sparse. Scattered exposures occur in river valleys; there are some areas of pavement within which quarries have been developed.
Surface deposits have a maximum thickness in the order of 50 m. They consist of fill (which occurs as thin plains, sometimes organically developed stratified drift, and marine Champlain Sea clay, sand and gravel) and Recent alluvial sand and silt and organic top deposits (Terres 1965; Gwyn and Girard 1975; Richard 1982).

PALEOZOIC STRATIGRAPHY

The logs for Imperial Oil Lagan No. 1, GSC McCormick No. 1, and Consumers' Gas Company No. 1022 drilled in the Alexandria area to the north (Williams et al. 1982), and for the GSC Russell well drilled in Russell Township to the northwest (Williams et al. 1982a), indicate that the maximum thickness of Paleozoic rock occurring in the map area is approximately 900 m.
The formation consists of fine to coarse-grained quartz sandstone with interbeds up to a few m thick of quartz-pebble conglomera, and calcareous in the lower part, and partly calcareous in the upper part. The sandstone is well to poorly sorted, laminated, and non-to light grey, green, and brown. The quartz (1969) has documented the application of the lithostratigraphic nomenclature from the latter region to the Ottawa - St. Lawrence Lowland. The current history supports the Recommendation and use of the terms "Gull River Formation", "Bobcaygeon Formation", "Verulam Formation", and "Lindsay Formation" as therefore justified. The terms correspond to Units A, C, Unit D, and Unit F, respectively, of Williams and Wolf (1982, p.133). It is recommended that the name "Covey" be reserved to Covey site.

NEPEAN FORMATION (CAMBRO - ORDOVICIAN)

The Nepean Formation (Wilson 1946, p.10-12) does not form part of the bedrock surface in the map area, and is interpreted to occur beneath younger Paleozoic units. The entire formation was intersected in Imperial Oil Lagan No. 1 and GSC McCormick No. 1; thicknesses are 84.7 and 82.3 m, respectively.
The formation consists of fine to coarse-grained quartz sandstone with interbeds up to a few m thick of quartz-pebble conglomera, and calcareous in the lower part, and partly calcareous in the upper part. The sandstone is well to poorly sorted, laminated, and non-to light grey, green, and brown. The quartz (1969) has documented the application of the lithostratigraphic nomenclature from the latter region to the Ottawa - St. Lawrence Lowland. The current history supports the Recommendation and use of the terms "Gull River Formation", "Bobcaygeon Formation", "Verulam Formation", and "Lindsay Formation" as therefore justified. The terms correspond to Units A, C, Unit D, and Unit F, respectively, of Williams and Wolf (1982, p.133). It is recommended that the name "Covey" be reserved to Covey site.

OXFORD FORMATION (LOWER ORDOVICIAN)

The Oxford Formation (Wilson 1946, p.14-16) does not outcrop in the map area, but is interpreted to occur beneath surficial deposits in the northeastern part of the area. A total thickness of 48.6 m was intersected in the GSC Russell well.
The lower member of the formation corresponds to Units A and B of Williams and Wolf (1982, p.133); the 2 units are here combined because of their lithological similarity. This member consists of interbedded silty dolomite, lithographic to fine crystalline limestone, shale, and fine-grained calcareous quartz sandstone. A black calcareous-bearing shale approximately 1 m thick described by Raymond (1911, p.180) is the basal bed of the member. The upper contact is the top of the uppermost dolomitic bed.
The upper member of the formation (Unit C of Williams and Wolf 1982) consists of lithographic to fine crystalline limestone. The contact of the upper member is the top of the uppermost lithographic bed.

ROCKCLIFFE FORMATION (MIDDLE ORDOVICIAN)

The Rockcliffe Formation (Wilson 1946, p.17-19) outcrops in the southern part of the map area. A thickness of 112.9 m of the formation was intersected in the top of Imperial Oil Lagan No. 1.
The formation consists of interbedded fine-grained light greenish-grey quartz sandstone, shaly limestone, and shale; quartz sandstone and shale predominate in the lower part of the formation and shaly limestone and shale in the upper part. The upper part of the formation is also characterized by interbeds of calcareous (St. Martin Member of Clark 1972, p.62) and silty dolomite.
The Rockcliffe Formation is equivalent to the Pamela and Lovellite Formations of the Montreal area.

BOBCAYGEON FORMATION (MIDDLE ORDOVICIAN)

The Bobcaygeon Formation (Units D of Williams and Wolf 1982) outcrops in the southern and northeastern parts of the map area. A total thickness of 85.0 m was intersected in the GSC Russell well. Two members of the formation can be distinguished in the Ottawa - St. Lawrence Lowland. The lower member consists of subdiagnostic to fine crystalline limestone, calcareous shale, and calcareous. The subdiagnostic to fine crystalline limestone and calcareous are grey to brownish grey to brown, very thin to thick bedded, and weather light bluish grey to brown. Shale interbeds are up to 3 cm thick.
The subdiagnostic to fine crystalline limestone is bedded to massive, and have grey to brownish-grey fresh surfaces and bluish to brownish-grey weathered surfaces. The calcareous and beds are bedded to massive and have light to medium grey fresh surfaces and bluish to brownish-grey weathered surfaces, cross-bedding, intralaminar, and stylolites are common.
The Bobcaygeon Formation is equivalent to the Lery, Oueua, Min Ent, and Deschambault Formations of the Montreal area.

LINDSAY FORMATION (MIDDLE - UPPER ORDOVICIAN)

The Lindsay Formation (Unit F of Williams and Wolf 1982) outcrops in the northern part of the map area. A total thickness of 32.0 m was intersected in the GSC Russell well.
The formation consists of interbedded subdiagnostic to fine crystalline limestone (commonly nodular), calcareous shale, and calcareous. The subdiagnostic to fine crystalline limestone and calcareous are grey to brownish grey to brown, very thin to thick bedded, and weather light bluish grey to brown. Shale interbeds are up to 3 cm thick.
The Lindsay Formation is equivalent to the Teleseville Formation of the Montreal area.

VERULAM FORMATION (MIDDLE ORDOVICIAN)

The Verulam Formation (Unit E of Williams and Wolf 1982) outcrops in the central part of the map area. A total thickness of 32.2 m was intersected in the GSC Russell well.
The formation consists of interbedded biotitic limestone, subdiagnostic to fine crystalline limestone, and shale. The limestone are very thin to medium bedded, and have grey to brownish-grey fresh surfaces and bluish grey to brown weathered surfaces. Shale interbeds are up to 6 cm thick.
The Verulam Formation is equivalent to the Montreal Formation of the Montreal area.

STRUCTURAL GEOLOGY

The map area is transected by a series of steeply dipping normal faults and fault zones striking subparallel to the St. Lawrence River. The river follows a fault trace from Cornwall island to Lake St. Francis. Bedding normally close to horizontal, often dips steeply adjacent to faults and within fault zones. Fault traces are generally straight but are commonly curved in the vicinity of fault junctions, which generally consist of a single fault branching from the St. Lawrence River, 4 km west of Long Sault. 2 faults branch to the west from the junction, and 2 to the east. Convergence of fault lines are very well to medium bedded, and have grey to brownish-grey fresh surfaces and bluish grey to brown weathered surfaces. The displacement at a fault junction is approximately equal to the sum of the displacements along each set of faults which branch from the junction.
From the St. Lawrence River northward, and from the northeast part of the map area southward, progressively younger strata are exposed in fault blocks. The total fault displacements across the area are in the order of 400 m (north side down) and 100 m (south side down).
The occurrence of distinctive topographic features in different fault blocks is less apparent than it is in other areas of the Ottawa - St. Lawrence Lowland where the bedrock is generally closer to the surface. In the western part of the map area, the St. Lawrence River occurs within a fault block in which the Rockcliffe Formation underlies surficial deposits.
Stress-relief buckles were observed in the quarries of Cornwall Gravel Company and Permanent Concrete Limited (see below), and have been referred to by Russell et al. (1982). At the former locality, a quarry-floor buckle which followed a fault of minor displacement had a bend of 117°, a length of 100 m, and relief of 20 cm; other buckles with similar dimensions had trends of 160°, 182°, and 192°. At the second locality, a quarry-floor buckle had a trend of 030°, a length of 150 m, and relief of at least 25 cm; a thickness of at least 4.7 m of strata was disturbed.

ECONOMIC GEOLOGY

The Bobcaygeon and underlying Gull River Formations are quarried for use as aggregate, presently licensed operations being: the Cornwall (McCormick) quarry of Cornwall Gravel Company (Cornwall Township, concession IV, lots 3 to 5) (Hewitt 1964, p.42; Hewitt and Von 1972, p.20); the Cornwall quarry of Permanent Concrete Limited (Cornwall Township, concession IV, lots 23 to 25) (Hewitt and Von 1972, p.37); the Cornwall quarry of Warren Paving and Materials Company Limited (Dobson Construction Company Limited) (Cornwall Township, concession IV, lots 21 to 23) (Hewitt 1964, p.42; Hewitt and Von 1972, p.22); and the Pine Hill (Green Valley) quarry of Menard Construction Limited (Lancaster Township, concession VI, lots 29 to 30).
The Lindsay Formation is also quarried for use as aggregate, presently licensed operations being the Gravel Hill (Roxborough Township, concession IV, lot 9) and Moose Creek (Roxborough Township, concession IV, lot 31) (Hewitt 1964, p.41).
Rare aggregate quarries could be located within the fault blocks in which the Oxford, Rockcliffe (St. Martin Member), Gull River, Bobcaygeon, and Lindsay Formations are quarried. The Lindsay Formation is less satisfactory as a source of aggregate than the other rock units, due to a high content of interbedded shale.

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The Bobcaygeon Formation is equivalent to the Lery, Oueua, Min Ent, and Deschambault Formations of the Montreal area.

LINDSAY FORMATION (MIDDLE - UPPER ORDOVICIAN)

The Lindsay Formation (Unit F of Williams and Wolf 1982) outcrops in the northern part of the map area. A total thickness of 32.0 m was intersected in the GSC Russell well.
The formation consists of interbedded subdiagnostic to fine crystalline limestone (commonly nodular), calcareous shale, and calcareous. The subdiagnostic to fine crystalline limestone and calcareous are grey to brownish grey to brown, very thin to thick bedded, and weather light bluish grey to brown. Shale interbeds are up to 3 cm thick.
The Lindsay Formation is equivalent to the Teleseville Formation of the Montreal area.

VERULAM FORMATION (MIDDLE ORDOVICIAN)

The Verulam Formation (Unit E of Williams and Wolf 1982) outcrops in the central part of the map area. A total thickness of 32.2 m was intersected in the GSC Russell well.
The formation consists of interbedded biotitic limestone, subdiagnostic to fine crystalline limestone, and shale. The limestone are very thin to medium bedded, and have grey to brownish-grey fresh surfaces and bluish grey to brown weathered surfaces. Shale interbeds are up to 6 cm thick.
The Verulam Formation is equivalent to the Montreal Formation of the Montreal area.

STRUCTURAL GEOLOGY

The map area is transected by a series of steeply dipping normal faults and fault zones striking subparallel to the St. Lawrence River. The river follows a fault trace from Cornwall island to Lake St. Francis. Bedding normally close to horizontal, often dips steeply adjacent to faults and within fault zones. Fault traces are generally straight but are commonly curved in the vicinity of fault junctions, which generally consist of a single fault branching from the St. Lawrence River, 4 km west of Long Sault. 2 faults branch to the west from the junction, and 2 to the east. Convergence of fault lines are very well to medium bedded, and have grey to brownish-grey fresh surfaces and bluish grey to brown weathered surfaces. The displacement at a fault junction is approximately equal to the sum of the displacements along each set of faults which branch from the junction.
From the St. Lawrence River northward, and from the northeast part of the map area southward, progressively younger strata are exposed in fault blocks. The total fault displacements across the area are in the order of 400 m (north side down) and 100 m (south side down).
The occurrence of distinctive topographic features in different fault blocks is less apparent than it is in other areas of the Ottawa - St. Lawrence Lowland where the bedrock is generally closer to the surface. In the western part of the map area, the St. Lawrence River occurs within a fault block in which the Rockcliffe Formation underlies surficial deposits.
Stress-relief buckles were observed in the quarries of Cornwall Gravel Company and Permanent Concrete Limited (see below), and have been referred to by Russell et al. (1982). At the former locality, a quarry-floor buckle which followed a fault of minor displacement had a bend of 117°, a length of 100 m, and relief of 20 cm; other buckles with similar dimensions had trends of 160°, 182°, and 192°. At the second locality, a quarry-floor buckle had a trend of 030°, a length of 150 m, and relief of at least 25 cm; a thickness of at least 4.7 m of strata was disturbed.

ECONOMIC GEOLOGY

The Bobcaygeon and underlying Gull River Formations are quarried for use as aggregate, presently licensed operations being: the Cornwall (McCormick) quarry of Cornwall Gravel Company (Cornwall Township, concession IV, lots 3 to 5) (Hewitt 1964, p.42; Hewitt and Von 1972, p.20); the Cornwall quarry of Permanent Concrete Limited (Cornwall Township, concession IV, lots 23 to 25) (Hewitt and Von 1972, p.37); the Cornwall quarry of Warren Paving and Materials Company Limited (Dobson Construction Company Limited) (Cornwall Township, concession IV, lots 21 to 23) (Hewitt 1964, p.42; Hewitt and Von 1972, p.22); and the Pine Hill (Green Valley) quarry of Menard Construction Limited (Lancaster Township, concession VI, lots 29 to 30).
The Lindsay Formation is also quarried for use as aggregate, presently licensed operations being the Gravel Hill (Roxborough Township, concession IV, lot 9) and Moose Creek (Roxborough Township, concession IV, lot 31) (Hewitt 1964, p.41).
Rare aggregate quarries could be located within the fault blocks in which the Oxford, Rockcliffe (St. Martin Member), Gull River, Bobcaygeon, and Lindsay Formations are quarried. The Lindsay Formation is less satisfactory as a source of aggregate than the other rock units, due to a high content of interbedded shale.

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