GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

NOTES

The Rivière Gatineau sheet includes parts of Superior, Southern and Grenville Provinces of the Canadian Shield, and parts of St. Lawrence Platform and Appalachian Orogen, an area of about 275,000 square kilometres - 107,000 square miles. The Canadian Shield forms a peneplaned upland of low, rolling, wooded hills, with moderate relief where incised by major rivers. The St. Lawrence Lowlands are low-lying, drift-covered plains, settled and cultivated, with scattered hills of basement inliers and the Monteregian Intrusions. The lowlands merge southeastward with the northeast-trending ridges and low hills of the Appalachian Mountains.

Precambrian rocks of the Canadian Shield occupy three quarters of the sheet. The oldest, of Archean age, occur in the Pontiac Belt of Superior Province. They are mainly sedimentary, with primary structures well preserved, or plutonic, and exhibit easterly, Kenoran, structural trends. Minor volcanic rocks have yielded copper and gold. The grade of metamorphism is lower amphibolite facies.

In Cobalt Embayment of Southern Province late Lower Aphebian clastics rest unconformably on inliers of Archean volcanics and iron formation. The strata are intruded by sills and dykes of Nipissing diabase and are broken by normal faults of several ages. Silver, cobalt and iron have been produced. The rocks are moderately deformed, but not metamorphosed, as a consequence of possibly both the Hudsonian and Grenvillian Orogenies.

Within Grenville Province, age assignments of the rocks are uncertain and tentative. They are based on a few isotopic ages and on broad lithological and structural characteristics. The province is bounded on the northwest by the Grenville Front marked by northeast-trending tectonite and prograde metamorphic fronts produced in the Grenvillian Orogeny or earlier. Grenvillian deformed basement extends beneath St. Lawrence Platform and the Appalachian Orogen. The region yields niobium, uranium, magnesite, nepheline syenite and iron.

Most gneisses in the Ontario Gneiss Belt are considered to be metamorphic equivalents of the Lower Aphebian, Huronian Supergroup of Southern Province. These are dominantly quartzofeldspathic, pink or grey, well layered, and mainly at amphibolite, rarely granulite grade of metamorphism. Large parts are underlain by shallow dipping gneisses with variable axial trends, commonly plunging gently southeast. Several episodes of folding may be represented but the dominant structural grain is northwest and is considered to be Hudsonian. In contrast, gneisses of the Quebec Gneiss Belt are more commonly dark grey, less well layered, and are considered Archean. Granulite grade is also more common. These rocks exhibit structural features with easterly trends that are possibly Kenoran. The Central Metasedimentary Belt includes marble, quartzite, aluminous gneiss and metavolcanics of the Helikian Grenville Group. The belt has an overall strong northeasterly Grenvillian structural grain. Metamorphic grade ranges from upper greenschist to granulite but is mainly amphibolite. In the Central Granulite Terrane are leucocratic to melanocratic para- and orthogneisses of unknown age. The structural grain is northerly or wraps around the large Morin and Adirondack anorthositic plutons which are possibly younger than the typical Late Paleohelikian Elsonian intrusions.

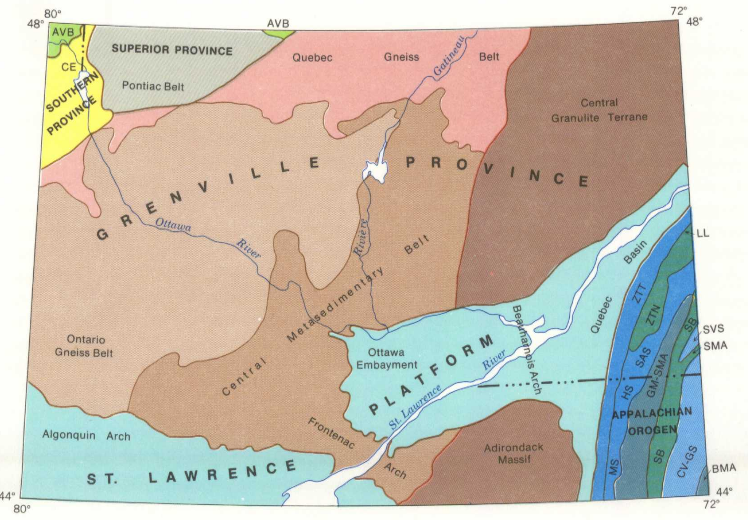
Radiometric dates vary from about 1,000 m.y. to 1,700 m.y. but these may represent metamorphic ages. Granitic plutons are scarce and commonly of small size. Nepheline syenite was emplaced before the end of Grenvillian metamorphism near the boundary between the Ontario Gneiss Belt and the Central Metasedimentary Belt. Late tectonic quartz monzonites, and alkaline intrusions, occur mainly in the latter belt.

In St. Lawrence Platform, a northwestward thinning cover of flat-lying strata lies unconformably upon crystalline basement, an extension of the Grenville Province. Basal, northwesterly transgressive Cambro-Ordovician orthoquartzite in the Ottawa Embayment and Quebec Basin grades upward into Lower Ordovician carbonates. Disconformably overlying middle Ordovician carbonates are succeeded by southeasterly thickening black shale and siltstone and the Upper Ordovician Queenston deltaic red beds which were derived from the Taconian mountains in Appalachian Orogen to the southeast. The strata are cut by northwest-and northeast-trending normal faults of the Bonnechere graben system, probably of Cretaceous age, and associated with diatreme emplacement of the alkaline Monteregian Intrusions.

In Appalachian Orogen, thick Hadrynian volcanics and craton-derived greywacke in the Green Mountain - Sutton Mountain Anticlinorium rest unconformably upon an inlier of Grenvillian deformed crystallines. Succeeding Cambrian and Lower Ordovician carbonate and quartzite in the synclinoria to the northwest pass southeastward into the ophiolite complexes of the Serpentine Belt and the acidic and basic volcanics of Stoke Mountain Anticlinorium. Associated shale and siliceous flysch were derived mainly from the northwest and deposited upon the regionally depressed craton margin and ocean floor. All have been subjected to polyphase deformation during the Taconian Orogeny and displaced northwestward. This region contains depostis of asbestos, talc, copper and zinc. Synorogenic, southeasterly derived Middle and Upper Ordovician shale and siltstone make up the main zone of northwest-directed Taconian thrust sheets, and allochthonous mainly Cambrian strata form the synclinorial zone of nappes.

The rocks of the Serpentine Belt and Stoke Mountain Anticlinorium are overlain uncomformably by relatively less deformed Middle and Upper Ordovician greywacke-slate turbidites which form the St. Victor Synclinorium. In the Connecticut Valley - Gaspé Synclinorium, the youngest sequence of Silurian and Devonian siltstone and limestone unconformably overlie or are faulted against older rocks. During the Devonian Acadian Orogeny, the synclinorium and part of the Green Mountain - Sutton Mountain Anticlinorium were deformed by northwesterly overturned folds and intruded by Devonian plutons. Acadian regional metamorphism reached highest grades in Vermont and New Hampshire; the low pressure facies bearing andalusite passes southward into the intermediate pressure facies with kyanite.

GEOLOGICAL PROVINCES



Province boundary
Subprovince boundary

AVB .... Abitibi Volcanic Belt
CE .... Cobalt Embayment
BMA .... Boundary Mountain Anticlinorium
CV-GS .... Connecticut Valley - Gaspé Synclinorium
GM-SMA .. Green Mountain - Sutton Mountain Anticlinorium
HS .... Hinesburg Synclinorium
LL .... Logan's Line
MS .... Middlebury Synclinorium
SAS .... St. Albans Synclinorium
SB .... Serpentine Belt
SMA ...... Stoke Mountain Anticlinorium
SVS .... St. Victor Synclinorium
ZTN .... Zone of Taconian Nappes
ZTT .... Zone of Taconian Thrusts

Geological contact (mapped, assumed)
Fault (mapped, assumed)
Normal fault (hachures on hanging wall)
Thrust fault (teeth on hanging wall; mapped, assumed)
Trend line
Anticline
Syncline
Anticline and syncline (overturned)
Isograd,
biotite
garnet
kyanite
sillimanite
staurolite - kyanite
staurolite - andalusite
Carbonatite
Locality of isotopic age determination
by the G S C bK374
by other laboratories bK374h
Igneous rock, metamorphic rock
Dyke: gabbro, diabase (strike indicated by bar)
Pegmatite
Method:
Potassium-argon, rubidium-strontium ($\lambda = 1.42$), uranium-thorium-lead .... K,R,U
Material:
biotite .... b
phlogopite .... p
whole-rock isochron i
lepidolite l
amphibole .... a
zircon .... z
muscovite .... m
whole rock .... w
uraninite .... u
Age in millions of years 374
Surface sample, subsurface sample, sill .... 374, $\overline{374}$, $\underline{374}$
Other Laboratories Designation
Carleton University c
McGill University .... e
University of Toronto .... h
United States Geological Survey-Denver .... ac
United States Geological Survey-Washington .... ae
California Institute of Technology .... an
Carnegie Institution of Washington .... ao
Lamont Geological Observatory .... aq
Massachusetts Institute of Technology .... ar
Le laboratoire de Clermont-Ferrand, France .... ca

Geological compilation by A.J. Baer, W.H. Poole and B.V. Sanford, 1971

Geology of the Canadian Shield was compiled by A.J. Baer, the Appalachian Orogen by W.H. Poole and the St. Lawrence Platform by B.V. Sanford from published and unpublished maps of the Geological Survey of Canada, the Quebec Department of Natural Resources, and the Ontario Division of Mines, and from the state geological maps of New York, Vermont and New Hampshire. Contributions were made to the Appalachian geology by W.M. Cady, C. Hubert, P.H. Osberg, P. St-Julien and J.B. Thompson Jr., and to the Shield geology by Y.W. Isachsen, S.B. Lumbers, M. Rive and J. Rondot. Data shown in otherwise unmapped parts of the Shield are from field observations by A.J. Baer, 1968-1970

Geological cartography by J.A.R. Sauvageau and Y.F. St. Pierre Savard
Geological Survey of Canada

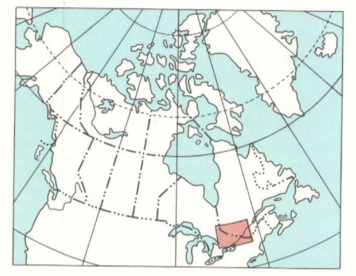
Computer-assisted and traditional cartographic techniques were used to produce the geological information portrayed on this map. Boundaries, faults, folds and isograds were digitized in the Computer Assisted Cartographic Unit of the Geological Survey

Under a co-operative arrangement, the staff of the Geological Survey of Canada used data processing and plotting facilities provided by the Automated Cartography Unit of the Surveys and Mapping Branch to generate plot files and the final reproduction material for lithography

Base-map assembled by the Geological Survey of Canada, from the IMW maps NL-17 and NL-18 published at the same scale by the Surveys and Mapping Branch in 1970 and 1964 respectively.
Roads were generalized by the Geological Survey of Canada

Copies of this map may be obtained from the Geological Survey of Canada:
601 Booth Street, Ottawa, Ontario K1A 0E8 3303-33rd Street, N.W., Calgary, Alberta T2L 2A7

Printed by the Surveys and Mapping Branch, 1977



INDEX MAP

MAP 1334A

RIVIÈRE GATINEAU

QUEBEC-ONTARIO

1:1,000,000 GEOLOGICAL ATLAS

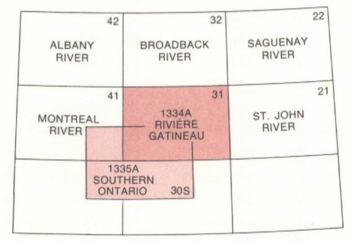
SHEET 31

GENERAL CO-ORDINATOR: R.J.W. DOUGLAS

Kilometres 25 0 25 50 75 Kilometres

Miles 20 0 20 40 Miles

Lambert Conformal Projection, standard parallels 44°40' and 47°20'



INDEX TO GEOLOGICAL ATLAS SHEETS AND REFERENCE TO NATIONAL TOPOGRAPHIC SYSTEM

LEGEND

ST. LAWRENCE PLATFORM AND APPALACHIAN OROGEN

MESOZOIC

CRETACEOUS
EARLY CRETACEOUS
MONTEREGIAN INTRUSIONS
Ky syenite
Kyu nepheline syenite
Kb alkaline gabbro

PALEOZOIC

DEVONIAN
MIDDLE DEVONIAN
mDM MOUNTAIN HOUSE WHARF: limestone

LOWER DEVONIAN
lDGM GILE MOUNTAIN: schist, quartzite
lDL LITTLETON: schist, quartzite

SILURIAN AND DEVONIAN
SDF ST. FRANCIS GROUP: limestone, quartzite, slate
SDW WAITS RIVER: limestone, phyllite

SILURIAN
SG GLENBROOKE GROUP: limestone, siltstone
SSN SHAW MTN: limestone, quartzite, NORTHFIELD: slate
SWT WABI GROUP, THORNLOE: limestone

ORDOVICIAN
UPPER ORDOVICIAN
uOQR QUEENSTON: red shale; RUSSELL: limestone
uOBR BÉCANCOUR RIVER: red shale, siltstone

uOPR PONTGRAVE RIVER: argillaceous limestone

uOC CARLSBAD: grey shale
uOMD MEAFORD, DUNDAS: grey shale, limestone
uONR NICOLET RIVER: grey shale

uOCB COLLINGWOOD, BLUE MOUNTAIN: black shale, limestone
uODP DAWSON POINT: black shale
uOEB EASTVIEW, BILLINGS: black shale
uOL LACHINE: black shale
uOLE LOTBINIÈRE: black shale

uOE EAST BRANCH POND: slate, sandstone
uOS SHERBROOKE: slate, sandstone

MIDDLE ORDOVICIAN
mOBF BUCKE, FARR
mOC limestone, minor shale, TRENTON and BLACK RIVER GROUPS; ORWELL, ISLE LA MOTTE, LOWVILLE, HORTONVILLE, GLEN FALLS

mOT TRENTON GROUP: limestone

mOBR BLACK RIVER GROUP: limestone

mOBE BEAUCEVILLE: slate conglomerate, tuff
mOP PARTRIDGE: black slate

mOCZ CHAZY GROUP: limestone, sandstone, shale
mOG GUIGUES: sandstone
mOL LAVAL: limestone, sandstone, shale
mOMY MYSTIC: limestone, conglomerate
mOM MIDDLEBURY: limestone
mOR ROCKCLIFFE: sandstone, shale, limestone

mOAV AMMONOOSUC: soda-rhyolite

mOA ALBEE: phyllite, schist, quartzite
mOB BROMPTON: greenstone, rhyolite, greywacke

LOWER ORDOVICIAN
lOB BEEKMANTOWN GROUP: dolomite, limestone
lOBN BEAUHARNOIS: dolomite
lOO OXFORD: dolomite
lOC mainly carbonate formations

lOM MARCH: sandstone, dolomite

lON NEPEAN: sandstone

CAMBRIAN AND LOWER ORDOVICIAN
ЄOA ASCOT: phyllite, greenstone, rhyolite
ЄOC CALDWELL: greywacke, volcanics
ЄOS STOWE: phyllite, schist, greenstone

UPPER CAMBRIAN AND/OR LOWER ORDOVICIAN
ЄOT THERESA: sandstone, dolomite

ЄOP POTSDAM: sandstone

CAMBRIAN
MIDDLE CAMBRIAN
mЄS SWEETSBURG: slate, quartzite, (may include VAIL, SCOTTSMORE, OAK HILL, DUNHAM)
mЄO OTTAUQUECHEE: black phyllite, quartzite

LOWER CAMBRIAN
lЄC CHESHIRE: quartzite
lЄD DUNHAM: dolomite
lЄG GILMAN (Upper): quartzite
lЄPH PINNEY HOLLOW: schist, phyllite

PROTEROZOIC

HADRYNIAN AND CAMBRIAN
HЄB BONSECOURS: schist
HЄG GILMAN (Lower): slate, quartzite; WEST SUTTON: slate
HЄHN HAZENS NOTCH: phyllite, quartzite
HЄU UNDERHILL: schist, phyllite

HADRYNIAN
HH HOOSAC: biotite schist
HP PINNACLE: greywacke, schist; CALL MILL: slate; WHITE BROOK: dolomite

HTH TIBBIT HILL: greenstone

PRE-HADRYNIAN
ng MOUNT HOLLY COMPLEX: gneiss, amphibolite, schist, quartzite

MIDDLE AND/OR LATE DEVONIAN
Dg granite
Dgk potassic granite
Dqm quartz monzonite
Dgd granodiorite

ORDOVICIAN
OU UTICA GROUP: black shale

OSG ST. GERMAIN COMPLEX: shale, limestone

OS STANBRIDGE: black shale
OML MORSES LINE: slate
Ocv limestone, volcanics, slate (may be older)

OM MISSISQUOI: black phyllite, volcanics

Og granite

Ob gabbro, diorite

Oub serpentinite, peridotite, dunite

CAMBRIAN
ЄS SILLERY: sandstone, red and green slate

ЄM MELBOURNE: black slate, limestone

Єcq dolomite, quartzite, MONKTON, WINOOSKI, DANBY, POTSDAM, CLARENDON SPRINGS, TICONDEROGA, ROCK RIVER, GORGE

Єpc slate, dolomite, quartzite includes PARKER, BRIDGEMAN HILL, RUGG BROOK, SAXE BROOK, SWEETSBURG, CLARENDON SPRINGS

GRENVILLE AND SUPERIOR PROVINCES

PROTEROZOIC

HADRYNIAN OR YOUNGER
diabase dyke

HELIKIAN
Hsl slate
Hnc marble
Hq quartzite
Hcg conglomerate
Hvd andesite
Hvr rhyolite
Hm amphibolite
Hn-h̄ hornblende gneiss
Hn paragneiss
Hn-bg biotite-garnet gneiss
Hn-bh̄ hornblende-biotite gneiss
Hnp porphyritic biotite gneiss
Hn-ġ graphite-garnet-biotite gneiss
Hn-s sillimanite-garnet-biotite gneiss
Hnqf biotite quartzofeldspathic gneiss
Hng migmatite, granitic gneiss
Hng-b biotitic migmatite
Hn-xh̄ amphibole-pyroxene gneiss
Hn-x garnet-amphibole-pyroxene gneiss

APHEBIAN
Ad Nipissing diabase
CAL COBALT GROUP LORRAIN: quartzite
CAG COBALT GROUP GOWGANDA: conglomerate
An paragneiss
An-b biotite gneiss
An-bh̄ hornblende-biotite gneiss
An-bg garnet-biotite gneiss
An-gh̄ hornblende-garnet-biotite gneiss
An-m muscovite gneiss
An-k kyanite-biotite gneiss
An-ġ graphite-garnet-biotite gneiss
An-s sillimanite-garnet-biotite gneiss
An-h̄ hornblende gneiss
Anqf biotitic quartzofeldspathic gneiss
Ang migmatite, granitic gneiss
Ang-b biotitic migmatite
An-hh̄ amphibole-hypersthene gneiss
An-xh̄ amphibole-pyroxene gneiss
An-x garnet-amphibole-pyroxene gneiss
1Anqf biotite quartzofeldspathic gneiss (relatively older than Anqf)

HADRYNIAN
Hy syenite

HELIKIAN
Hy syenite
Hy-h̄ hornblende syenite
Hy-h hypersthene syenite
Hyu nepheline syenite
Hy-x pyroxene syenite
Hyq quartz syenite

Hg granite
Hgk potassic granite
Hg-b biotitic potassic granite
Hg-h̄ hornblende potassic granite
Hglk alaskite
Hgo olivine granite

Ha anorthosite, gabbro

Hb gabbro
Hdi diorite

APHEBIAN OR HELIKIAN
Pg granite
Pgd granodiorite

Pn-s sillimanite-garnet-biotite gneiss

Png migmatite
Png-b biotitic migmatite
Pnqf biotite quartzofeldspathic gneiss

Pnh quartzofeldspathic gneiss leucogranulite

ARCHEAN
Asl slate
As-b biotite schist
Avr rhyolite
Avd andesite
Av volcanics
An-h̄ hornblende gneiss
An-b biotite gneiss
An-bh̄ hornblende-biotite gneiss
Anp porphyritic biotite gneiss
An-bg garnet-biotite gneiss
An-gh̄ hornblende-garnet-biotite gneiss
An-s sillimanite-garnet-biotite gneiss
Anqf quartzofeldspathic gneiss
An-xg garnet-pyroxene gneiss
An-xh̄ amphibole-pyroxene gneiss
An-x garnet-amphibole-pyroxene gneiss
An-hg garnet-hypersthene gneiss
An-hh̄ amphibole-hypersthene gneiss

ARCHEAN
Ay syenite
Ay-h̄ hornblende syenite
Ag granite
Agk potassic granite
Ag-b biotite potassic granite
Agd granodiorite
Agd-b biotite granodiorite
Aqd quartz-diorite
Adi diorite

ARCHEAN OR PROTEROZOIC
y syenite
yq quartz syenite
g granite
gk potassic granite
g-b biotitic potassic granite
gd granodiorite
gd-b biotitic granodiorite

b gabbro
di diorite

ub ultrabasics

n paragneiss
n-b biotite gneiss
n-m muscovite gneiss
n-bg garnet-biotite gneiss
n-gh̄ amphibole-garnet-biotite gneiss
n-s sillimanite-garnet-biotite gneiss
n-bh̄ hornblende-biotite gneiss

n-h̄ hornblende gneiss
n-g garnet gneiss

nqf biotitic quartzofeldspathic gneiss
ng migmatite, granitic gneiss

nh quartzofeldspathic gneiss, leucogranulite

n-hh̄ amphibole-hypersthene gneiss

ng-x pyroxene migmatite
n-xh̄ amphibole-pyroxene gneiss
n-x garnet-amphibole-pyroxene gneiss

1334A (E) (Sheet 1 of 2)

SHEET 31
RIVIÈRE GATINEAU
MAP 1334A