Québec Mines
Mining information bulletin

october 2003

Québec Mines
Mining information bulletin

october 2003

Québec Exploration 2003: A premiere!

The first edition of Québec Exploration will take place on November 24 to 27, 2003, in Québec City. As the most important event in mineral exploration to date in Québec, Québec Exploration 2003 is a key event you don't want to miss.

On the program:

- the latest mining discoveries in Québec;
- the results of new geological surveys conducted in the Far North, the Abitibi and elsewhere in Québec;
- the latest developments in oil & gas exploration in the Gulf of St. Lawrence;
- a sizeable trade show with nearly 100 exhibitors (mining companies, service providers, universities, provincial governments);
- up-to-date reviews of current ore deposit models and exploration techniques;
- an opportunity to get the full picture and learn the ins and outs about mineral exploration financing.

To register or for more information, consult the website of the event at: **www.QuebecExploration.qc.ca**.

Top

Mines

october 2003

Metallogenic overview of the La Grande Subprovince in the Lac Sakami (33F) and Lac Guyer (33G) area

Claude Dion and Jean Goutier (Géologie Québec), Michel Gauthier (UQAM)

It is generally acknowledged that the geotectonic setting is of paramount importance in controlling the distribution of the different types of metalliferous ore deposits on a global scale. In this perspective, studies conducted by Géologie Québec and its partners in the Lac Sakami and Lac Guyer area in the James Bay region have shown that the setting in this area is fairly different from settings observed further south in the Abitibi Subprovince. One of the most important of these differences is the development of volcano-sedimentary sequences unconformably overlying a tonalitic basement. The various types of mineral deposits encountered in this part of the Near North are also quite different.

The James Bay region (James Bay geology) (**PDF Format, 331 Kb**) has been the focus of an important surge in exploration since the mid-1990s. Investigations in this vast northern region successfully uncovered a large number of base and precious metal occurrences. To support these activities, Géologie Québec conducted many geological mapping surveys and synthesis studies as part of the Near North Project (see references). Thus, between 1996 and 2000, the Department has completed, in the Lac Sakami and Lac Guyer area, several detailed studies and geological surveys at 1:50,000 scale, which helped define the geological and metallogenic setting of this little-known portion of the James Bay region.

We will briefly review the main types of mineral deposits that characterize the Lac Sakami and Lac Guyer area in particular. These considerations provide valuable insights relevant to the development of exploration strategies specific to this setting

Next page

Top

octobre 2003

Metallogenic overview of the La Grande Subprovince in the Lac Sakami (33F) and Lac Guyer (33G) area

Claude Dion and Jean Goutier (Géologie Québec), Michel Gauthier (UQAM)

Geological setting of the Lac Sakami and Lac Guyer area

The Lac Sakami (NTS sheet 33F) and Lac Guyer (33G) area (Sakami-Guyer geology) (PDF Format, 209 Kb) lies in the Rivière La Grande watershed. This Archean sequence comprises a tonalitic basement, several volcano-sedimentary sequences and a series of ultramafic to felsic intrusions. Proterozoic gabbro dykes and quartz arenite basins (Sakami Formation), also Proterozoic in age, are also present.

The prime characteristic of this area is the presence of a multiphase Meso- to Neoarchean tonalitic basement (Langelier Complex, 3.36-2.78 Ga), overlain by autochthonous to parautochthonous volcano-sedimentary sequences (Guyer and Yasinski groups, Ekomiak Formation). The volcano-sedimentary sequence of the Guyer Group (33G) formed during the construction of the continental crust, and structurally overlies foliated tonalites of the Langelier Complex. Volcanic rocks of the Guyer and Yasinski groups are the products of a continental rifting episode.

In the Lac Yasinski area, the base of the pile consists of a quartz arenite and monogenic conglomerate unit that unconformably overlies the tonalitic basement. This unit, the Apple Formation, represents sediments typical of a stable platform environment. They are interbedded with and conformably overlain by volcanic rocks of the Yasinski Group. Yasinski rocks are locally overlain by wackes and polygenic conglomerates of the Ekomiak Formation. Observed sedimentary structures indicate a fluviatile or alluvial environment.

Several early to late tectonic intrusions cross-cut rocks of the Langelier Complex, the Guyer Group and the Apple - Yasinski - Ekomiak sequence. The most important are the Duncan intrusions, the Radisson Pluton and the Menarik Complex. These intrusions cross-cut folded and foliated volcanic and sedimentary rocks. After several episodes of N-S to NNW-SSE compression, La Grande rocks were overlain by an extensive sedimentary basin represented by biotite paragneisses of the Laguiche Group (Opinaca Subprovince). Although the contact is faulted in many locations, a normal contact is locally observed between these paragneisses and volcanic rocks of the Yasinski Group.

Overall, La Grande rocks are comparable to those in the Sachigo-Uchi-Wabigoon subprovinces in northwestern Ontario, where an early tonalitic basement is present, associate with an arenitic sequence and areally restricted volcanic belts. However, the setting is very different from that observed further south in the Abitibi Subprovince, which contains a much better developed volcano-sedimentary sequence and is devoid of a tonalitic

basement.

Previous page Next page

Top

Mines

october 2003

Metallogenic overview of the La Grande Subprovince in the Lac Sakami (33F) and Lac Guyer (33G) area

Claude Dion and Jean Goutier (Géologie Québec), Michel Gauthier (UQAM)

Description of occurrences

Several types of mineralized occurrences were recognized in the Lac Sakami and Lac Guyer area. They can be broadly categorized into eleven types. Occurrences most specific to the Lac Sakami and Lac Guyer area are: uraniferous conglomerates, iron formations, magmatic Cr-PGE and Cu-Ni-PGE occurrences, and Proterozoic uraniferous and polymetallic occurrences.

Type	Characteristics	Examples	Comments
Uraniferous conglomerates (U)	Stratiform arenite beds and lenses of pyritic uraniferous conglomerate;	Apple deposit (Lac Sakami area, 33 F/02): 9 Mt at 0.05% U_3O_8	
Algoma-type oxide-facies iron formations (Fe)	Thinly banded stratiform magnetite interbedded with recrystallized chert or mudstone/ siltstone;	Duncan no. 1 to 6 deposits (33 F/05 and 33 F/12): > 312 Mt at 20-23% Fe	Fm more important in the Yasinski area => more stable platform setting?

Algoma-type sulphide-facies iron formations (massive sulphides ± Cu, Zn, Ni, Pb, Ag, Au)	Stratiform layers of disseminated to massive sulphides, occasionally bedded, often associated with sulphide-rich chert horizons and oxide-facies iron formations	Minor Rusty Hill (33 F/05); Carna showing (33 F/16): 1.63% Cu and 0.27% Co	
Cu-Ni-PGE occurrences associated with komatiites		Rare	Komatiites associated with platform settings generally barren; Venus (?)
Volcanogenic occurrences: • Disseminated sulphides in fuchsite-bearing arenites	Stratiform lenses of disseminated to thinly laminated sulphides. Replacement deposits affected by metamorphic recrystallization	Showing 7 of Lac Mistacheesic (formerly Lac Discovery, 33 F/04): 2.74% Zn, 1.35% Pb and 49 g/t Ag over 10.7 m	Lack of large internal synvolcanic intrusions able to generate large-scale convection cells responsible for the formation of VMS deposits
• Massive sulphide lenses	Stratiform massive sulphide lenses, cross-cutting sulphide stringers	Sommet IV showing (33 F/09): 5.7% Cu and 1000 g/t Ag	Thin volcanic sequence
• Cu-Ag ± Au occurrences in intermediate tuffs or arkosic metasediments and their metamorphosed equivalents	Semi-massive to disseminated sulphide lenses in shear zone or disseminated sulphides in paragneiss	Chalco showing (33 G/12): 14.6% Cu and 111.0 g/t Ag	Deep-seated magmatic chambers Emplacement at shallow depth (?) => low rate of preservation
• Occurrences associated with HT alteration zones (Cu, Ag, Au)	Cross-cutting magnetite-chalcopyrite stringers, interpillow sulphides in strongly epidotized mafic volcanic rocks	Baie Mayappo showing (Tyrone 1; 33 G/12): 1.9% Cu, 11.8 g/t Ag and 0.7 g/t Au over 3 m	

• Metamorphosed LT alteration zones	Conformable or cross-cutting zones enriched in GR, TM, alumino-silicates Cordierite-anthophyllite zones (metamorphosed chlorite alteration zone)	Lac Shpogan (33 F/03), Lac Sakami (33 F/02)	
Stratabound gold occurrences associated with oxide-facies or silicate-oxide-facies iron formations (Au-Ag-As)	Disseminated sulphides (sulphidization) in iron formations associated with shear zones or breccia zones, in silicified zones or in quartz vein wall rocks Syngenetic and/ or epigenetic	Several showings: Orfée (33 G/06): up to 82.21 g/t Au	La Grande-Opinaca contact
Occurrences of magmatic origin (porphyry-type, epithermal)	Au ± Cu ± Ag ± As or Mo - Cu ± Au mineralization occurring as quartz-tourmaline-sulphide veins, veinlets or laminations, hydrothermal breccia or disseminated sulphides in altered shear zones	Relatively rare: Early mineralization in Zone 32 (33 F/10): 4.2 t at 2.1 g/t Au and 0.2% Cu Firecracker showing (33 G/16; Mo-Cu ± Ag ± Au): up to 0.14% Mo over 22.5 m in drillhole	Related to the presence of synvolcanic intrusions
Occurrences related to pegmatites	M-scale pegmatite dykes or migmatites associated with the Opinaca and Nemiscau subprovinces	Abundant: Maguy (33 C/14): 0.44% U_3O_8	Anatectic granite (Vieux Comptoir)
Magmatic Cr-PGE, Ti-V or Cu-Ni-PGE occurrences	Beds of massive to disseminated chromite; Disseminated to massive sulphides in mafic-ultramafic intrusions, sometimes in pegmatitic gabbro injections in late mafic-ultramafic intrusions	Abundant: Cr-16-18-19 showing (33 F/06): 1.38 Mt at 7.8% Cr with isolated PGE grades of 2.3 g/ t Pd and 0.8 g/t Pt Canico showing - DDH 55317 (33 F/06): 13.25% Cu over 0.15 m in drillhole	Late (post-Laguiche) intrusions

Orogenic gold occurrences related to longitudinal shear zones	Quartz-tourmaline veins and veinlets with disseminated sulphides in regional shear zones	Numerous: Zone 32 (33 F/10): 4.2 Mt at 2.1 g/t Au and 0.2% Cu; Pierre showing (33 F/06): 0.89 g/t Au over 68.25 m in drillhole	Amphibolite-grade metamorphism => atypical alteration assemblages
Proterozoic uraniferous and polymetallic occurrences	Ag - Cu - Co (± Au, PGE, Ni) or U-Th occurrences formed of locally developed breccias and lodes of calcite ± quartz ± hematite ± barite and sulphides generally associated with narrow shear zones U-Cu in reduced siltstones	Numerous: Sommet IV, Cartouche Ganiq, Maro, Lourdeau Lac Gayot, Tilly	Associated with normal faults delineating Proterozoic basins of the Sakami Formation; Remobilization of early mineralization

- Uraniferous conglomerates

These occurrences are intimately associated with the platform sequence of the Apple Formation. Placer-type uranium mineralization is hosted in rusty pyritic conglomerate beds. The Apple deposit (map sheet 33 F/02) represents the largest of this category, with a geological resource of 8.5 Mt at 0.052% U_3O_8 (Robertson et al., 1986). This deposit bears some resemblance to placer gold or uranium deposits in the Witwatersrand Basin, South Africa, and in Elliot Lake, Ontario. However, gold grades at Apple are very low.

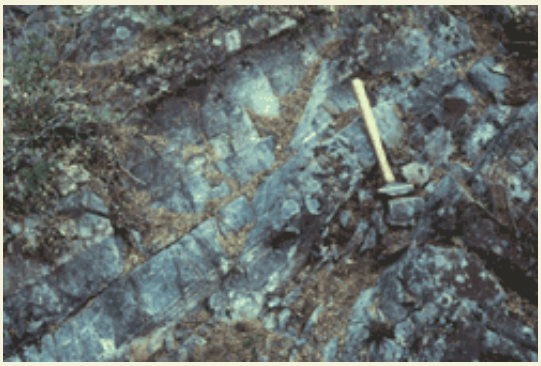
Archean arenitic platform sequences are known elsewhere, namely in the western part of the Superior Province (Sachigo and Wabigoon subprovinces), in the Slave craton, the Zimbabwe craton, etc. These sequences generally host very little mineralization (Roscoe and Donaldson, 1988). The Apple Formation is therefore one of the rare uraniferous units of this type in the world.

- Algoma type oxide facies iron formations

The Sakami area is also characterized by its abundant and particularly extensive (several kilometres) and thick (more than 400 m in certain locations) oxide-facies iron formation units. The Lac Duncan iron ore deposits (map sheets 33 F/05 and 33 F/12), for example, contain a geological resource of more than 1 Gt of ore at 20-23% Fe (Honsberger, 1976). Such a considerable volume of iron formation suggests emplacement in a relatively stable environment such as a continental platform.

In fact, iron formations in the Sakami area exhibit characteristics halfway between Algoma-type deposits (association with volcanic rocks) and Superior-type deposits (more specifically associated with platform environments). These deposits are sometimes referred to as “Carajas-type”, based on the mining district in Brazil (Gauthier, 2000).

- Magmatic Cr-PGE or Cu-Ni-PGE occurences



Some late mafic-ultramafic layered intrusions contain laterally extensive chromitite horizons (a few hundred metres), the emplacement of which was indicative of a relatively stable environment.

These beds, a few centimetres to one metre in thickness, of pure chromitite and silicate-chromitite enriched in platinum group element (PGE) are sometimes associated with low-grade copper and nickel. The Menarik Complex (Ressources Pro-Or; map sheet 33 F/06) hosts the largest deposit of this type, with a geological resource of 3.7 Mt at 8.7% Cr_2O_3 (press release by Pro-Or dated February 25, 1998) and highly anomalous PGE grades (1-3 g/t). This intrusion and its associated magmatic mineralization are comparable to major layered complexes such as the Bushveld in South Africa or Stillwater in the United States (Houlé, 2000). The Menarik Complex also hosts minor lode Cu-Ni-Co-PGE ± Au-Ag occurrences, which probably represent late remobilization of magmatic mineralizations.

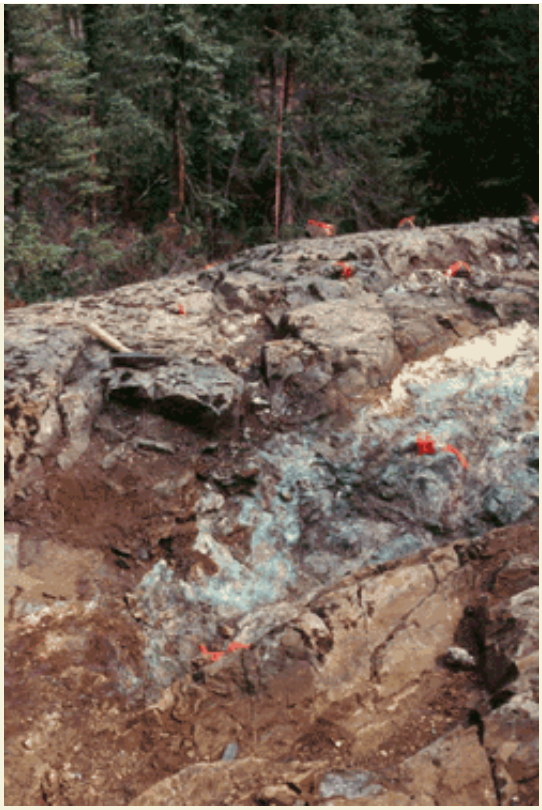
- Proterozoic uraniferous and polymetallic occurences

The area is transected by a series of normal faults that delineate Proterozoic sedimentary basins of the Sakami Formation. Several uraniferous and polymetallic occurrences associated with these structures occur in Archean granitoid or volcano-sedimentary rocks, or in sedimentary units at the base of the Sakami Formation.

Uranium occurrences in the Archean basement are hosted in chlorite schists (often deformed mafic dykes) or quartz breccias developed along shear zones. The mineralization generally exhibits strong hematization. The most important occurrences (Fouques and Schumacher, 1977) are the Ganiq showing (North zone, 150,000 t at 500 ppm U) and the Maro showing (14.72% U, 610 ppm U over 17 m).

U-Cu-V occurrences are related to sedimentary units at the base of the Sakami Formation. Uranium and other metals were reduced and precipitated as pitchblende and sulphides, disseminated in green sediments near the redox interface with red oxidized sediments. The Lac Gayot deposit (map sheet 23 M/15), located northeast of the study area, is the largest deposit of its kind in the region, with about 50 Mt at 0.1% U_3O_8 (Gehrisch, 1987). This type of setting could also be favourable for red-bed deposits. A few occurrences of this type were recognized in the Sakami area (Fouques and Schumacher, 1977), namely the Manic showing (map sheet 33 G/14; 868 ppm U over 7.5 m) and the Tilly showing (map sheet 33 G/16; 1063 ppm U).

The area also hosts several Proterozoic polymetallic showings that bear a striking resemblance to deposits in Cobalt (Ontario) and in the Great Bear Lake area (NWT). A few of these showings appear to be the result of remobilization of Archean occurrences. The best example is probably the Sommet IV showing discovered by Virginia Gold Mines (map sheet 33 F/09). The “early” component (Archean) of this system corresponds to a layer of disseminated and stringer pyrite traced over nearly 4 km along strike. This mineralized zone is deformed and parallel to the regional E-W schistosity, and associated to a black chlorite alteration zone. At Sommet IV, a massive chalcopyrite-pyrite lens is cut by discordant barite veins. Mineralized white calcite breccias occur at the intersection between the barite veins and the massive sulphides.



These breccia zones exhibit a complex mineralogy, dominated by chalcopyrite, bornite, pyrite, copper and silver sulphides, and native silver. Grades are spectacular (Roger and Boucher, 1997) at the Sommet IV showing (55.24% Ag, 3.42% Co, 0.55% Cu and 0.75% Ni) and the Cartouche showing (32.8 g/t Au, 1.08% Ag, 12.72 g/t Pt, 8.22 g/t Pd and 0.75% Cu).

This network of Proterozoic normal faults, identified by Moorhead et al. (1999) as the Wemindji-Caniapiscau structural corridor, also represents an important element for the emplacement of potentially diamontiferous kimberlites. This potential was recently confirmed with the discovery of kimberlite sills in the Wemindji area (Majescor Resources; map sheet 33 F/02).

Comparison between the La Grande and Abitibi subprovinces: “Iron formation-hosted stratabound gold deposits”, “volcanogenic massive sulphide deposits” and “orogenic gold deposits”

It may be interesting to draw a parallel between La Grande occurrences found in the Lac Sakami and Lac Guyer area and those encountered in the Abitibi Subprovince. Thus, iron-formation-hosted stratabound gold deposits appear to be much more common in the La Grande Subprovince than in the Abitibi. However, the opposite is true for volcanogenic massive sulphide deposits (VMS). Orogenic gold deposits are evenly distributed in the two subprovinces, which may suggest the existence of a single episode of emplacement for the entire Superior Province.

- Iron formation-hosted stratabound gold deposits

These gold deposits are considerably more abundant in the La Grande than the Abitibi Subprovince. This confirms the observation that gold-bearing iron formations are generally more common in high-grade metamorphic environments (amphibolite) such as the La Grande. These occurrences generally consist of disseminated sulphides in silicate-oxide-facies iron formations. Arsenopyrite is common.

Many of these occurrences are located near the contact between the La Grande and Opinaca subprovinces, namely the gold showings on Grid Km-85 held by the Cambior-Virginia Gold Mines joint venture (up to 17.6 g/t Au, map sheet 33 F/09; Simard, 1996), the Orfée showing discovered by partnersVirginia Gold Mines and GlobeStar Mining Corp. (up to 82.21 g/t Au, map sheet 33 G/06; Chenard, 1999) and Zone 25 held by Matamec Explorations (map sheet 33 F/02; 2.48 g/t Au over 54.65 m in drillhole, press release dated June 6, 2001).

- Volcanogenic massive sulphide deposits (VMS)

Although there are many indications of volcanogenic or exhalative activity in the Lac Sakami and Lac Guyer area (aluminous alteration zones, iron formations, etc.), there are very few significant mineral occurrences comparable to those found in the Abitibi. Rare occurrences of this type are typically rich in Ag ± Pb, a characteristic of VMS deposits emplaced in continental rift settings.

The only unambiguous example of a proximal VMS-type deposit in the La Grande Subprovince was recently discovered in map sheet 33 G/15 by Virginia Gold Mines (Blanchet, 2001). The Ouf showing (up to 5.80% Cu and 27 g/t Ag over 6.1 m in channel sample) consists of disseminated, stringer and semi-massive sulphides (pyrite, chalcopyrite, sphalerite, galena and pyrrhotite) hosted in brecciated rhyolites associated with iron formation horizons. The nearby presence of an impure marble horizon suggests emplacement at shallow depth, suggesting a continental rift setting.

Among the possible reasons for this relative rarety, we can mention:

- the lack of thick volcanic piles (max. 2000 m);
- the rarety of internal synvolcanic intrusions emplaced at shallow depth (similar to the Flavrian Pluton in the Rouyn-Noranda area) and which usually drive hydrothermal circulation;
- the emplacement at shallow depth, resulting in a lower rate of preservation.

- Orogenic gold deposits

The Lac Sakami and Lac Guyer area hosts a fair number of orogenic (or mesothermal) gold deposits with the same characteristics as deposits of this type found in the Abitibi. They consist of quartz ± tourmaline veins or veinlets, with minor sulphides, hosted in various lithologies and associated with major deformation zones, particularly along the boundary between the La Grande and Opinaca subprovinces. Alteration zones associated with these deposits are characterized by K, CO_2 and S enrichment, with diverse alteration assemblages based on the nature of the country rock and the regional metamorphic grade.

Among these deposits, we can mention Zone 32 (4.2 Mt at 2.1 g/t Au and 0.2% Cu, press release by Virginia Gold Mines dated March 11, 1999) and the Wedding showing (9.5 g/t Au over 4 m; Simard, 1996) discovered by joint venture partners Cambior and Virginia Gold Mines (map sheet 33 F/10) as well as the Pierre showing (Dianor Resources, map sheet

33 F/06, 0.89 g/t Au over 68.25 m; Beauregard, 2000).

The emplacement of these deposits is early to late tectonic, and coeval with the emplacement of orogenic gold deposits in the Abitibi. This mineralizing event is probably related to the final accretion and cratonization phase of the Superior Province.

Previous page **Next page**

Top

Mines

october 2003

Metallogenic overview of the La Grande Subprovince in the Lac Sakami (33F) and Lac Guyer (33G) area

Claude Dion and Jean Goutier (Géologie Québec), Michel Gauthier (UQAM)

Conclusions

The geological and geotectonic setting in the James Bay region is reflected in the various types of mineral deposits encountered in the region, which are fairly different from those observed in the Abitibi. This observation should have some impact on exploration strategies in the region.

The geology of the La Grande Subprovince bears some resemblance to the geology of the Slave craton (NWT). The most striking feature that the two regions share is the presence of fragments of Mesoarchean basement, overlain by stable platform sequences. This early history is tied to the existence of deep lithospheric roots. The gold potential of the Slave craton has long been established (Yellowknife district, Lupin mine), and more recently the diamond potential (Lac de Gras). Recent work in the James Bay region, along the Wemindji-Caniapiscau corridor, has also outlined the diamond potential of the La Grande Subprovince.

Previous page **Next page**

Top

Metallogenic overview of the La Grande Subprovince in the Lac Sakami (33F) and Lac Guyer (33G) area

Claude Dion and Jean Goutier (Géologie Québec), Michel Gauthier (UQAM)

References

BEAUREGARD, A.J., 2000 – Rapport des travaux d'exploration, hiver 2000, Propriété Yasinski-Nord et PEM 1404. Ressources Dianor inc.; Assessment work report submitted to the Ministère des Ressources naturelles, Québec; GM 58304, 236 pages and 9 maps.

BLANCHET, C., 2001 – Programme été 2001, Projet LG-3.5. Mines d'or Virginia; Assessment work report submitted to the Ministère des Ressources naturelles, Québec; GM 59051, 64 pages and 5 maps.

CHENARD, D., 1999 – Rapport des travaux de terrain Été - Automne 1998, Propriété Poste Le Moyne Extension. Mines d'Or Virginia inc., Exploration Boréale inc.; Assessment work report submitted to the Ministère des Ressources naturelles, Québec; GM 57315, 303 pages and 19 maps.

FALLARA, F. – MOORHEAD, J. – ROSS, P.-S. – GOUTIER, J., 1999 – Caractéristiques de centres volcaniques et de minéralisations de type sulfures massifs volcanogènes des séquences volcaniques du lac Sakami et de la rivière Eastmain, Baie-James. Ministère des Ressources naturelles, Québec; MB 99-37, 109 pages.

FOUQUES, J.-P. – SCHUMACHER, F., 1977 – Rapport synthèse du permis S.E.S. Groupe minier S.E.S.; Assessment work report submitted to the Ministère des Ressources naturelles, Québec; GM 37017, 157 pages and 11 maps.

GAUTHIER, M., 1996a – Géologie de la région du lac Sakami (SNRC 33F). Ministère des Ressources naturelles, Québec; MB 96-13, annotated map (1:250,000).

GAUTHIER, M., 1996b – Géologie de la région du lac de la Frégate (SNRC 33G). Ministère des Ressources naturelles, Québec; MB 96-04, annotated map (1:250,000).

GAUTHIER, M. – LAROCQUE, M. – CHARTRAND, F., 1997 – Cadre géologique, style et répartition des minéralisations métalliques du bassin de La Grande Rivière, Territoire de la Baie James. Ministère des Ressources naturelles, Québec; MB 97-30, 65 pages.

GAUTHIER, M., 2000 – Styles et répartition des gîtes métallifères du territoire de la Baie-James. Chronique de la Recherche minière; volume 539, pages 17-61.

GEHRISCH, W., 1987 – Late Aphebian Syngenetic Uranium Mineralization at Gayot Lake, Northern Quebec, Canada. In Proceedings of the Uranium Symposium. Monograph Series on Mineral Deposits, Gebrüder Borntraeger, Berlin-Stuttgart; 27, pages 49-57.

GOUTIER, J. – DOUCET, P. – DION, C. – BEAUSOLEIL, C. – DAVID, J. – PARENT, M. – DION, D.-J., 1998a – Géologie de la région du lac Kowskatehkakmow (SNRC 33F/06). Ministère des Ressources naturelles, Québec; RG 98-16, 48 pages.

GOUTIER, J. – DOUCET, P. – DION, C. – BEAUSOLEIL, C. – DION, D.-J., 1998b – Géologie de la région du lac Esprit (SNRC 33F/05). Ministère des Ressources naturelles, Québec; RG 98-09, 40 pages.

GOUTIER, J. – DION, C. – DAVID, J. – DION, D.-J., 1999a – Géologie de la région de la passe Chimusuminu et du lac Vion (SNRC 33F/11, 33F/12). Ministère des Ressources naturelles, Québec; RG 98-17, 41 pages.

GOUTIER, J. – DION, C. – LAFRANCE, I. – DAVID, J. – PARENT, M. – DION, D.-J., 1999b – Géologie de la région des lacs Langelier et Threefold (SNRC 33F/03 et 33F/04). Ministère des Ressources naturelles, Québec; RG 99-18, 52 pages.

GOUTIER, J. – DION, C. – OUELLET, M.-C. – DAVID, J. – PARENT, M., 2000a – Géologie de la région des lacs Guillaumat et Sakami (SNRC 33F/02 ET 33F/07). Ministère des Ressources naturelles, Québec; RG 99-15, 41 pages.

GOUTIER, J. – DION, C. – OUELLET, M.-C. – MERCIER-LANGEVIN, P. – DAVIS, D.W., 2000b – Géologie de la région de la colline Masson, de la passe Awapakamich, de la baie Carbillet et de la passe Pikwahipanan (SNRC 33F/09, 33F/10, 33F/15 et 33F/16). Ministère des Ressources naturelles, Québec; RG 2000-10.

GOUTIER, J. – DION, C. – OUELLET, M.-C., 2001 – Géologie de la région de la colline Bezier et du lac de la montagne du pin (SNRC 33G/12 et 33G/13). Ministère des Ressources naturelles, Québec; RG 2001-13, 55 pages.

GOUTIER, J. – DION, C. – OUELLET, M.-C. – DAVIS, D.W. – DAVID, J. – PARENT, M., 2002 – Géologie de la région du lac Guyer (33G/05, 33G/06 et 33G/11). Ministère des Ressources naturelles, Québec; RG 2001-15.

HONSBERGER, J.C., 1976 – Summary report on development results and economic potential. Duncan Range Iron Mines ltd.; Assessment work report submitted to the Ministère des Ressources naturelles, Québec; GM 32503, 15 pages.

HOULÉ, M., 2000 – Pétrologie et Métallogénie du Complexe de Menarik, Baie-James, Québec, Canada. Université Laval (Sainte-Foy, Québec); Master’s thesis, 480 pages.

HOULÉ, M. – GOUTIER, J. – DION, C., 2003 – Caractérisation des intrusions ultramafiques du secteur du lac Sakami (33F). Ministère des Ressources naturelles, Québec; ET 2003-.

MERCIER-LANGEVIN, P., 2000 – Minéralisations aurifères au sein de la Tonalite de La-Grande-Sud, Baie-James, Québec. Université du Québec à Chicoutimi (Chicoutimi, Québec); unpublished Master’s thesis, 258 pages.

MOORHEAD, J. – BEAUMIER, M. – LEFEBVRE, D.L. – BERNIER, L. – MARTEL, D., 1999 – Kimberlites, linéaments et rifts crustaux au Québec. Ministère des Ressources naturelles, Québec; MB 99-35, 130 pages, 1 carte.

MOORHEAD, J. – BERNIER, L. – FALLARA, F. – GOUTIER, J. – RICHER-LAFLÈCHE, M., 2000 – Caractéristiques des zones d'altération métamorphisées du secteur du lac Shpogan (33F/02 et 33F/03). Ministère des Ressources naturelles, Québec; MB 2000-07, 132 pages.

PAQUETTE, L. – GAUTHIER, M., 1997 – Séquences archéennes du lac Sakami, Baie-James. Ministère des Ressources naturelles, Québec; MB 97-02, 34 pages.

RICHER-LAFLÈCHE, M. – MOORHEAD, J. – GOUTIER, J. – FALLARA, F., 2000 – Géochimie et pétrogénèse des roches volcaniques et des formations de fer du Groupe de Yasinski, sous-province de La Grande. Ministère des Ressources naturelles, Québec; MB 2000-13, 75 pages.

ROBERTSON, D.S. – PODOLSKY, T.P. – NUTTER, G.E., 1986 – Other conglomerate-hosted deposits. In Uranium deposits of Canada. Canadian Institute of Mining and Metallurgy; Special volume 33, pages 52-54.

ROGER, G. – BOUCHER, R., 1997 – Rapport sur les travaux d'exploration effectués en 1997, Propriété La Grande Nord, Baie-James. Mines et Exploration Noranda; Assessment work report submitted to the Ministère des Ressources naturelles, Québec; GM 55906, 197 pages and 4 maps.

ROSCOE, S.M. – DONALDSON, J.A., 1988 – Uraniferous pyritic quartz pebble conglomerate and layered ultramafic intrusions in a sequence of quartzite, carbonate, iron formation and basalt of probable Archean age at Lac Sakami; Quebec. In Current Research, Part C. Geological Survey of Canada; Paper 88-1C, pages 117-121.

SIMARD, P., 1996 – Rapport des travaux, propriété La Grande Sud. Mines d'Or Virginia Inc.; Assessment work report submitted to the Ministère des Ressources naturelles, Québec; GM 54335, 336 pages and 3 maps.

Geological setting of the Lac Sakami and Lac Guyer area
Description of occurences
Conclusions
References

Previous page

Top

Mines **october 2003**

Architectural stone potential in the Appalachians

Yves Bellemare, eng.
Géologie Québec

Since 1994, the demand for new stone varieties has steadily increased in the decorative stone and landscaping stone industry in Québec. In addition to traditional exploration for granite, prospecting for so-called soft stone or exotic stone varieties has generated considerable interest. Several areas in the Appalachians, where these types of stone were once quarried, are once again considered high-potential areas for architectural stone.

Over the past few decades, very little exploration was carried out for soft stone varieties (marble, limestone, sandstone), exotic stone (steatite, serpentine, peridotite) and slate, in order to assess their potential as sources of architectural stone. To orient future investigations efficiently, it is sometimes necessary to use geoscience data dating back to the early 20th century. Recently, the Department launched a study to assess the potential of limestones and sandstones in a few areas in the Bas-Saint-Laurent and Gaspésie regions (**Bellemare and Jacob, 2001**; Bellemare, Togola and Lapointe, 2002 (**PDF Format, 1,5 Mo**)). Prospectors and companies have also conducted some exploration on these types of stone in the Appalachians.

Marble
Sandstone
Steatite, peridotite and serpentine

Mines

october 2003

Architectural stone potential in the Appalachians

Yves Bellemare, eng.
Géologie Québec

Marble

Missisquoi Marble quarry operation in the 1930s, in the Philipsburg area
Source : advertisemet for the Missisquoi Marble and Stone Corp.

Marble or marbly limestone deposits constitute the most likely lithological units to be assessed in the short term. In the past, marble was mainly quarried in the Philipsburg areaand was used for a number of exterior and interior purposes, as the interior design of a few public buildings in Québec City indicates. This marble belongs to the upper unit of the Strites Pond Formation and the Wallace Creek Formation. These two varieties respectively consist of thick beds of very light whitish grey to medium grey calcilutites, sometimes with a green or pink tinge, and very dark grey argillaceous calcilutites.

Other similar units such as the medium grey calcilutites of the Corey Formation and recrystallized limestones of the Lac Aylmer Formation could be used as ornamental stone, but are quarried to produce high-purity limestone. In the Gaspésie region, reef limestones of the West Point Formation exhibit attractive colours and textures. In the Port-Daniel area and south of Rivière-la-Madeleine in particular, these limestones form thick reefs in certain locations.

Workshop onsite at the Missisquoi Marble quary in the 1930s
Source : advertisement for the Missisquoi Marble and Stone Corp.

Red and greenish grey stromatactis calcilutite
of the West Point Formation in Port-Daniel

Marble
Sandstone
Steatite, peridotite and serpentine
Slate
Granite

Previous page **Next page**

Top

Mines

october 2003

Architectural stone potential in the Appalachians

Yves Bellemare, *eng.*
Géologie Québec

Sandstone

Red standstone of the Robitaille Formation used to manufacture dimension stone in Saint-Mathieu

Several sandstone and siltstone units also possess the necessary attributes to attract the attention of prospectors and companies. The most remarkable sandstones belong to the Robitaille Formation, which

Source : Robert Paquette

outcrops in the Saint-Mathieu and Saint-Guy area in the Bas-Saint-Laurent region. These were used for many different purposes on a local scale.

This stone favourably compares to certain varieties produced in Canada, England or the United States. It comprises cm-scale to m-scale beds of red, pink, violet pink, brownish orange and whitish grey quartz arenites. Arenites of the Robitaille Formation offer good potential for the production of landscaping stone, building stone and locally, dimension stone. Also worth mentioning are the sandstones and siltstones of the Tourelle, Val-Brillant, Kamouraska, Saint-Léon and Battery Point formations, available in a variety of colours. These may become potential sources of landscaping stone, building stone, decorative stone and dimension stone.

Marble
Sandstone
Steatite, peridotite and serpentine
Slate
Granite

Previous page **Next page**

Top

Mines

october 2003

Architectural stone potential in the Appalachians

Yves Bellemare, eng.
Géologie Québec

Steatite, peridotite and serpentine

Examples of steatite (soapstone) products fron the 'East Broughton area:masonry heater, kitchen countertop, decorative table and carving blocks

With the exception of steatite, which is still being quarried today in the East Broughton area to produce refractory stone, carving stone, fireplace liners and decorative stone, rocks associated with ophiolitic complexes have not been the object of much exploration for architectural stone. What little descriptive data we have at our disposal to assess the architectural stone potential indicates that serpentines and peridotites are highly fractured, and range from dark green to brown.

Source : Les Pierres Stéatites inc.

The most impressive deposits are reportedly located in Melbourne and Orford Township in the Eastern Townships. In the Lac Bowker area in particular, carbonatized serpentinite of the Orford-Chagnon-Baldface ophiolitic Complex was quarried in the 1940s to produce ornamental stone. It exhibits a variable colour pattern ranging from pale to dark green, often cut by white calcite veinlets or red wavy veinlets. A similar geological environment, attributed to the Caldwell Group, is also reported in the Saint-Joseph-de-Beauce area.

Working face development in the 1940s at Lac Bowker

Marble
Sandstone
Steatite, peridotite and serpentine
Slate
Granite

Previous page **Next page**

Top

Mines

october 2003

Architectural stone potential in the Appalachians

Yves Bellemare, eng.
Géologie Québec

Slate

Slate roofing tiles on a home in the Danville area

Slate deposits were mined in the Eastern Townships, from about 1854 to 1923. Slate was mainly used to produce roofing tiles, some of which can be admired on the rooftops of a number of homes in Kingsbury and Danville. They belong to the Saint-Daniel Mélange, the Stanbridge Group and the Mawcook, Saint-Victor and White Brook formations. They are usually dark grey and sometimes purple, brownish red or greenish grey.

In the Témiscouata area, an artisanal quarry was in operation in 1910. Since 1995, steel

grey slate from the Témiscouata Formation is extracted on a large-scale to produce roofing tiles exported to France, England and the United States. This has rekindled interest for this type of stone. However, most of the geoscience data available to orient future exploration work dates back to the early 20th century. A number of areas, particularly in the Bas-Saint-Laurent and Gaspésie regions, offer good mining potential and warrant more detailed investigations.

Marble
Sandstone
Steatite, peridotite and serpentine
Slate
Granite

Previous page **Next page**

Top

Mines

october 2003

Architectural stone potential in the Appalachians

Yves Bellemare, eng.
Géologie Québec

Granite

Since the mid-19th century, granite (granite, granodiorite) operations are a mainstay in the Appalachians. The Stanstead area in particular is a century-old mining centre; the stone extracted in this area has been used in the construction of numerous buildings such as the Sunlife building in Montréal. The different intrusions are well known and the potential to develop new stone operations is low outside of current mining centres.

Sun Life building in Montréal photographed in the 1940s.

Marble
Sandstone
Steatite, peridotite and serpentine
Slate
Granite

Previous page

Top

Mines

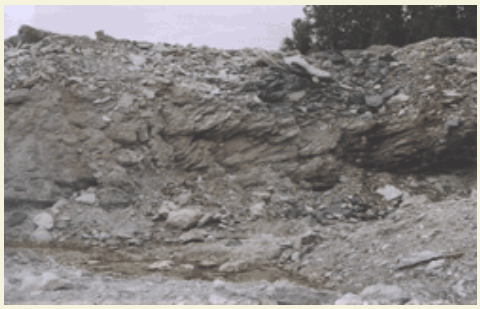
october 2003

Industrial mineral potential in the Appalachians

N'Golo Togola
Géologie Québec

The Appalachian orogenic belt in Québec offers great potential for **asbestos** (chrysotile), **talc**, **steatite** (soapstone), high-purity **limestone**, **silica**, **peat** and **salt**. It also hosts a few undeveloped deposits of **barite**, **chromite** and **gypsum**.

Several **chrysotile** orebodies associated with the ophiolite zone in the Appalachians of southwestern Québec (Estrie and Beauce regions) were once mined in the late 19th century and throughout the 20th century. This ophiolite zone lies along the Baie Verte-Brompton Line, a regional-scale intense deformation corridor. Numerous **talc** and **steatite** deposits associated with this zone have also been mined in the past. However, the only talc operation in Québec, located near Saint-Pierre-de-Broughton, shut down in 2001 due to the presence of asbestos fibres in the ore. Nevertheless, steatite is still being extracted at the Fraser mine near East-Broughton.



In the Appalachians of Québec, **limestones** are quarried in the Lake Champlain area (Missisquoi Bay) south of Saint-Jean-sur-Richelieu, and in Lime Ridge northeast of Sherbrooke. Other potential sources of pure limestone were identified in the Bas-Saint-Laurent region and in eastern Québec, in the Gaspésie region. In the Lake Champlain area, mined limestones are part of the Corey and Strites Pond formations (Philipsburg Group). In Lime Ridge, where lime production has been going on for over 150 years, quarries operated by Graymont Inc. are located in a very pure, partly recrystallized reef limestone. In the Bas-Saint-Laurent region, limestones of the Témiscouata, Sayabec, Rivière-Ouelle and Romieu formations offer good potential for industrial stone purposes. Argillites of the L'Orignal Formation in Lepage Township (Mont-Joli area) were once extracted to manufacture clay products. An obsidian deposit occurs in the easternmost part of the region, in the Mont Tuzo and Mont Squaw Cap area. In the Gaspésie region, important deposits of pure limestone

associated with the West Point and de la Vieille formations (Chaleur Group) were identified in Lefrançois Township south of Rivière-Madeleine, as well as in the Port-Daniel area south of Chaleur Bay.

In the Bas-Saint-Laurent and Gaspésie regions, **quartz-rich sandstones** of the Val-Brillant and Kamouraska formations have a silica content greater than 96%, and constitute potential sources of silica. These two sandstone units have been mined in the past as a source of siliceous flux.

The Bas-Saint-Laurent region plays a major role in Québec's peat industry. There are at least twenty peat deposits in the region, primarily located along the St. Lawrence River. Production figures for the region represent 50% of the total peat output in Québec. Most of the harvested peat is shipped to some forty different countries.

The Permo-Carboniferous basin of the Appalachians (Magdalen Basin) hosts **salt** and **gypsum** deposits and also constitutes a source of **silica sand**. Seven important salt deposits, some with interesting potassium grades, were discovered in the bedrock of the Îles-de-la-Madeleine, at depths ranging from 30 to 300 metres. The most important, the Rocher-au-Dauphin orebody, has been mined since 1982 by Mines Seleine Inc.

Dunes and tombolos on the Îles-de-la-Madeleine, along with part of the continental platform along the eastern margin of the archipelago, consist of **silica sand**, essentially derived from sandstones. This sand deposit, located in the Sandy Hook channel between Île-d'Entrée and Île-du-Havre-Aubert has been evaluated as a source of silica sand for smelting and glass. This sand contains a significant proportion of feldspar however, which must be removed.

Sedimentary basins in the Appalachian orogenic belt host a few **barite** deposits. The Upton orebody (Robex), associated with the Upton Group, and the Saint-Fabien deposit located in the Saint-Damase Formation (Trois-Pistoles Group) are currently the two largest known barite deposits in Québec. They have not been the object of mining operations however.

Ophiolitic complexes in the Appalachians (Thetford Mines, Asbestos and Orford area) host numerous podiform **chromite** deposits. The latter are hosted in dunite lenses within tectonized harzburgites, and in dunite horizons within cumulate sequences overlying the harzburgite. Several of these deposits were mined during the two world wars.

The main **gypsum** deposits occur as 5 cm to 5 m beds in a breccia with mudstone and sandstone fragments of the Maisons Formation (Windsor Group). Tiphane (1970) estimates at some 100,000 tonnes the amount of good-quality gypsum that could be easily extracted from the bedrock of the Îles-de-la-Madeleine.

Outlook and Opportunities

The ophiolitic complex in the Appalachian orogenic belt of southwestern Québec constitutes a prospective geological setting for the discovery of new chrysotile asbestos, talc and steatite deposits. Sedimentary basins in the Appalachians, on the other hand, offer good potential for industrial stone (limestone, silica) and for salt and gypsum deposits.

References

Top

Industrial mineral potential in the Appalachians

N'Golo Togola
Géologie Québec

References

BRISEBOIS, D., 1981 – Lithostratigraphie des strates permo-carbonifères de l'Archipel des Îles-de-la-Madeleine. Ministère de l'Énergie et des Ressources, Québec, DPV-796.

DE RÖMER, H.S., 1985 – Géologie des monts Stokes. Ministère de l'Énergie et des Ressources, Québec, MM-85-03.

HÉBERT, Y., 1988 – Indices et gîtes de talc des Appalaches du sud du Québec. Ministère de l'Énergie et des Ressources, Québec, ET 86-05.

HÉBERT, Y., 1985 – Géologie des gîtes et indices de talc de la région de Thetford Mines. Ministère de l'Énergie et des Ressources, Québec, MB 85-38.

JACOB, H. L. - COTNOIR, D. - DÉPATIE, J. - GOFFAUX, D. - DANIS, D. - BERGERON, M., 1991 – Les minéraux industriels du Québec - Congrès annuel de l'Association professionnelle des géologues et géophysiciens du Québec.

PETRYK, A.A., 2002 – Géologie et ressources de la région de Lime Ridge -Dudswell (Estrie sud-21E/12). Ministère des Ressources naturelles, Québec, MB 2000-18, 117 pages.

TIPHANE, M., 1970 – Le gypse des Îles-de-la-Madeleine. Ministère de l'Énergie et des Ressources, Québec. Étude spéciale 7.

Top

october 2003

Partnership at Géologie Québec: A new approach

Pierre Verpaelst
Géologie Québec

For many years now, governments have been searching for new ways to be more efficient at lower cost. Traditionally, governments have taken on the responsibility and expense for basic data acquisition in the natural resources sector, and more specifically in the geoscience field; this has been the case for over 100 years, ever since the creation of a geological service in Québec. Of course, over the years, government geologists have also exchanged information with geologists from exploration companies. Moreover, companies are required to file assessment work reports under the Mining Act. Data derived from these reports has substantially contributed to our knowledge base; since 1978, these reports are inventoried in SIGÉOM's documentary database, and a few are integrated in the Department's geological database. However, until the mid-1990s, very few partnerships existed between governments and the mining industry.

This article paints a portrait of the current situation in terms of basic geoscience data acquisition in Québec, and introduces the notion of partnership as a new approach to apply in this field.

Next page

Top

Mines **octobre 2003**

Partnership at Géologie Québec: A new approach

Pierre Verpaelst
Géologie Québec

The situation

Nearly all of Québec's landmass has currently been the object of regional geological, geophysical or geochemical mapping. In 2006, the entire geology of Québec will have been covered at least at 1/250,000 scale. The entire landmass has been covered by geophysical surveys with a minimal resolution of 1 line per 800 metres. Finally, the geochemical coverage extends over roughly 80% of the territory.

Inventories meet our needs in terms of basic knowledge of the land. The Mines Sector of the Ministère des Ressources naturelles, de la Faune et des Parcs has adopted a systematic

approach to reach this goal. Its objective is to provide adequate coverage of the territory for industry and government decision-makers that are involved in Québec's development. In certain cases, basic data is insufficient. In order to fill these gaps, the Department has surveyed certain high-potential areas such as the Abitibi region or the Labrador Trough at higher resolution, where the 1/250,000 scale does not provide sufficient detail. Surveys are then conducted at 1/50,000 and even 1/20,000 scale. Exceptionally, even more detailed studies are carried out.

At the same time, the Department must keep its databases up-to-date, taking into account new geological and ore deposit models as well as recent work by industry. Geological data in certain regions is either incomplete or obsolete. It dates back to a time when certain models were not yet recognized. Sometimes, it was acquired with technology that is now outdated, namely in geophysics and geochemistry. Some data has even been lost, and certain samples cannot be retrieved or have been completely used up. Information in these regions must therefore be re-evaluated and updated, or in many cases, it has become necessary to collect new information. Needs change as well: the search for copper, zinc and nickel, which formed the core of our mineral economy, now extends to industrial minerals, high-technology metals, diamonds and platinum group elements. The Department must therefore acquire new data relevant to these new settings.

The government's priorities evolve and often change rapidly, according to changes in economic and social climate. Thus, the Department must find new ways to complete and update its geological inventory of Québec, to efficiently cover high-potential areas, and to find new prospective regions.

In short, we must successfully integrate new ways to meet the needs of the mining industry and of government decision-makers in terms of basic geological data acquisition in Québec.

The situation
A new approach: Partnership
The future
Conclusion

Previous page **Next page**

Top

Mines

october 2003

Partnership at Géologie Québec: A new approach

Pierre Verpaelst
Géologie Québec

A new approach: Partnership

Mining companies contribute more and more to many study projects, namely by allowing government scientists access to their databases. Agreements with universities and research institutes, which support students thanks to their research grants, are also important. Research subsidies often come from the government. This type of partnership generally leads to an exchange of services.

In the 1970s, a type of partnership was created, whereby companies paid for new analyses of stream or lake sediment samples collected by the Department in previous surveys. The results were then integrated to the government's database, and the companies benefited from a confidentiality period in return.

Here are a few recent examples of partnership involving the Department and industry:

- 1995: Agreement between SOQUEM and the MRNFP. The Department provides information on a given area in the Moyenne-Côte-Nord region in exchange for information collected by the company on anomaly sites. Data published in RG 96-02, RG 96-05, RG 97-07, RG 97-08, RG 98-01 and RG 98-02.
- 1997: Far North geochemistry survey. Five exploration companies are involved in funding the lake sediment geochemistry survey. More than 27,000 lake sediment samples were collected to launch the Far North Exploration Program. Data published in DP 98-01. (Carte du levé du Grand-Nord (**PDF Format, 1,1 Mo**))
- 2000: Creation of CONSOREM (Consortium de recherche en exploration minière - Mineral Exploration Research Consortium). This consortium was created thanks to the contributions of exploration companies involved in Québec, of two universities, of the provincial and federal governments and of a regional organization (CRD). It funds research projects specifically focussed on exploration. Example of product: Geological and geophysical atlas of base metal and gold deposits and orebodies in the Abitibi (GM 60077 to 60148).
- 2002-2003: Partnership MRNFP – Mineral and oil & gas exploration companies, to complete a regional gravity survey in the Gaspésie region, for mineral and oil & gas exploration purposes. Data scheduled for release in November 2004. (Carte du levé de la Gaspésie (**PDF Format, 231 Kb**))
- 2003: Partnership MRNFP – Exploration companies – Regional organization (MRC), to conduct a regional sediment geochemistry survey in an area north of Baie-Comeau in the Côte-Nord region. Data scheduled for release in November 2005. (Carte du levé de Manic (**PDF Format, 254 Kb**))

These new partnerships would not have been possible without the financial contribution of exploration companies. In exchange for this contribution, the companies obtain priority access to the results of funded surveys; this access is subject to a confidentiality period ranging from one to two years, depending on the size of the contribution.

Two examples of partnership stand out from the others due to the involvement of regional organizations: a regional development council (CRD) in one case and a regional county municipality (MRC) in the other. These organizations considered the projects to be sufficiently important for their regions to invest in them. This new type of partnership also allows regional organizations to take part in the decision-making process as it concerns the involvement of the MRNFP Mines Sector within their territory.

The situation
A new approach: Partnership
The future
Conclusion

Previous page **Next page**

Top

Partnership at Géologie Québec: A new approach

Pierre Verpaelst
Géologie Québec

The future

The Department believes that this type of partnership can extend to geological mapping projects. For example, in an area where mapping is only available at 1/250,000 scale, a project to map a volcanic belt at 1/50,000 scale in the Far North for example, may be set up. Ideally, this type of project would be funded 50% by one or many companies interested in the results of the project. This type of partnership already exists elsewhere in Canada, namely in British Columbia. Géologie Québec is therefore open to partnership proposals for regional data acquisition projects that fit with its mandate and its priorities as defined in its action plans.

The Department also intends to develop partnerships with other government agencies. These agencies are in fact current or potential end-users of geological data. The purpose of this type of partnership is to increase awareness of the geological data coverage in Québec and its potential uses, in addition to avoiding duplication of efforts to acquire new data.

Previous page **Next page**

Top

Partnership at Géologie Québec: A new approach

Pierre Verpaelst
Géologie Québec

Conclusion

The objectives of Géologie Québec are to improve the basic coverage to meet industry needs, to update previously acquired data considering new models and new technologies, and to fully develop the knowledge and expertise of the Mines Sector, while maintaining a long-term vision in its action plans.

Moreover, Géologie Québec has valuable expertise in terms of regional geology for the entire landmass of Québec. This expertise must be maintained and used to its full potential. Partnership is one approach that the Department intends to develop in the future to reach this objective, by promoting exchanges between partners, professionals from Géologie Québec and from industry. This approach would also allow it to continue to fulfil its mandate, which is the acquisition of geoscience data on Québec's landmass.

All exploration companies interested in forming a partnership with Géologie Québec to acquire geoscience data should contact Mr. Alain Simard, director of Géologie Québec, at the following address:

Mr. Alain Simard, Director
Ministère des Ressources naturelles, de la Faune et des Parcs
Direction de Géologie Québec
5700, 4e Avenue Ouest, bureau A-208
Charlesbourg, Qc G1H 6R1
Tel. : (418) 627-6274, poste 5021
Fax : (418) 643-2816

Previous page

A new exploration concept to develop the hydrocarbon potential in Québec

Jean-Yves Laliberté, eng. M.Sc
Direction du développement des hydrocarbures

Explorationists are increasingly optimistic

Activities related to oil & gas exploration are thriving in Québec. Oil & gas exploration licences now cover nearly 5 million hectares, a new twenty-year peak.

Map showing licensed areas (**PDF Format, 421 Kb**)

Seismic reflection geophysical surveys carried out by the MRNFP over the past three years have undoubtedly contributed in improving the geological understanding of the Bas-Saint-Laurent and Gaspésie regions and have spurred interest in these two resource-based regions. This new flurry of activity centered on the hydrocarbon potential in Québec may also be fuelled by numerous discoveries in nearby basins. These new fields are for the most part located in the carbonate complex that formed along the margin of the North American continent during the Ordovician marine transgression.

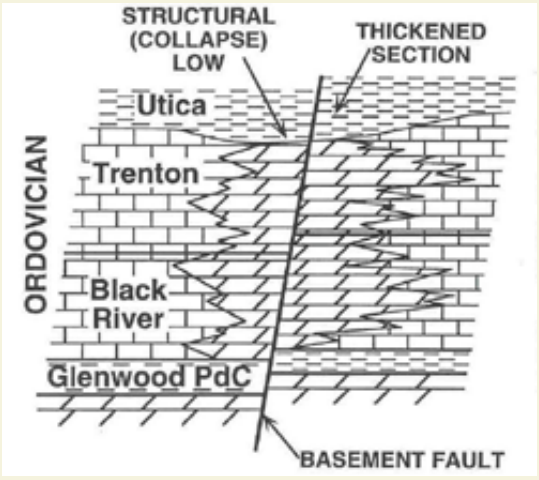
The concept of hydrothermal dolomites

The classic example of this type of carbonate-sequence reservoir is the Albion-Scipio and Stoney Point fields in the Michigan basin, where the HTD-RF (Hydrothermal Dolomite Reservoir Facies) model was developed in recent years.

This type of deposit occurs in sedimentary units equivalent to those in the St. Lawrence Lowlands, and more specifically those of the Black River and Trenton groups. Reservoir development is intimately linked to orogenic and diagenetic processes. Consequently, they always occur along extensional faults that were active during the Taconic Orogeny (Ordovician), i.e. shortly after the deposition of the Black River and Trenton groups.

These faults played a crucial role, by facilitating the migration of high-pressure high-temperature fluids. The hydrothermal fluids leached, dolomitized and fractured Black River and Trenton limestones, thereby creating breccias and secondary porosity, which allowed hydrocarbons to build up.

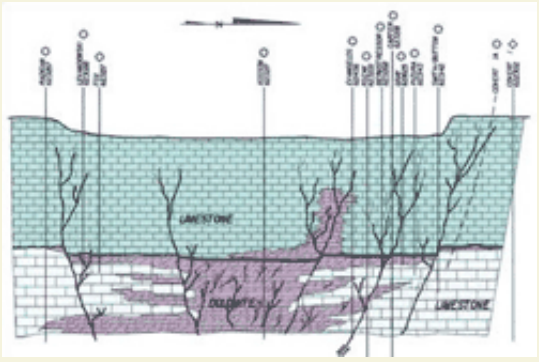
Click to enlarge



The HTD model, Tedesco 1994

This relatively new model now constitutes a prime target for companies involved in hydrocarbon exploration. The model has never been tested in Québec, while in Ontario, Michigan and New York, major discoveries are piling up. For example, Talisman Energy Inc. announced on September 2, 2003, the completion of a new natural gas well in New York State, with an output capacity of 10 million cubic feet per day.

Click to enlarge



Cross-section of the Gloades Corner reservoir in New York State
Provided by AAPG Explorer-March 2001

Basins in the St. Lawrence Lowlands and Anticosti are highly prospective for this type of deposit. Recent seismic reflection geophysical surveys, mentioned above, have proven useful in determining the location of future drilling targets.

A new approach

This new type of hydrocarbon deposit represents quite a challenge for explorationists. Rather than searching for conventional structures likely to trap hydrocarbons such as anticlines, faults or stratigraphic wedges, explorationists must now look for collapse structures associated with faults, where the seismic signature of reflectors has been fairly altered due to the action of hydrothermal fluids.

Existing data must be re-examined in a new light!

Québec Exploration 2003

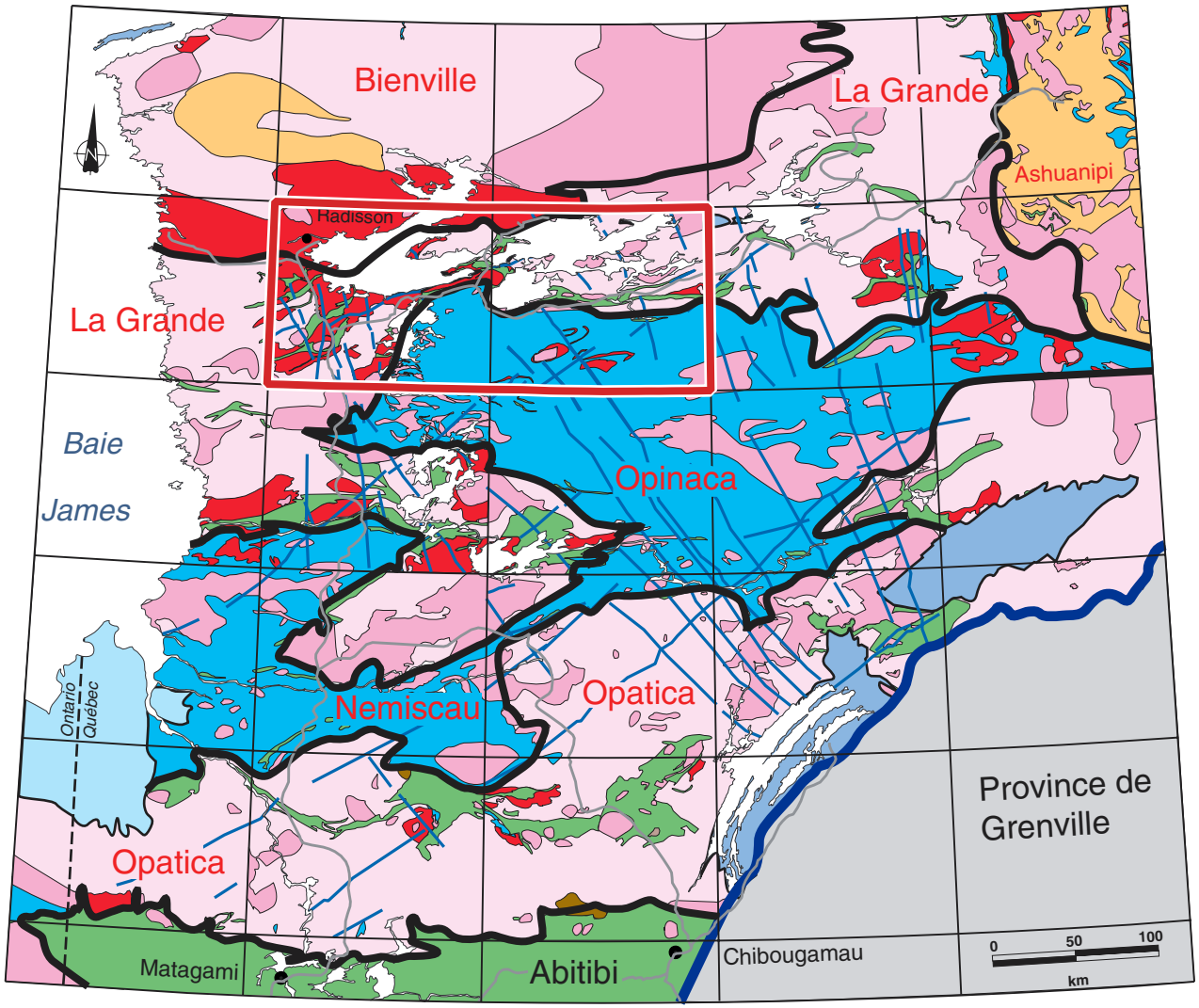
Under the theme “**New Frontiers**”, *Québec Exploration 2003* will offer a series of oral presentations namely dealing with new geological data, new regions to explore as well as new technologies and new exploration models.

A speaker session entitled **Oil & Gas** will focus on the latest developments related to hydrocarbon exploration in Québec and the search for HTD-type deposits. Mr. Graham R. Davies, internationally renowned geologist in this specific field, will be our keynote speaker for the occasion.

Top

Ressources naturelles, Faune et Parcs
Québec

Géologie Baie-James



Paléozoïque

- Roches sédimentaires

Protérozoïque

- Roches sédimentaires clastiques et dolomitiques
- Dykes de gabbro

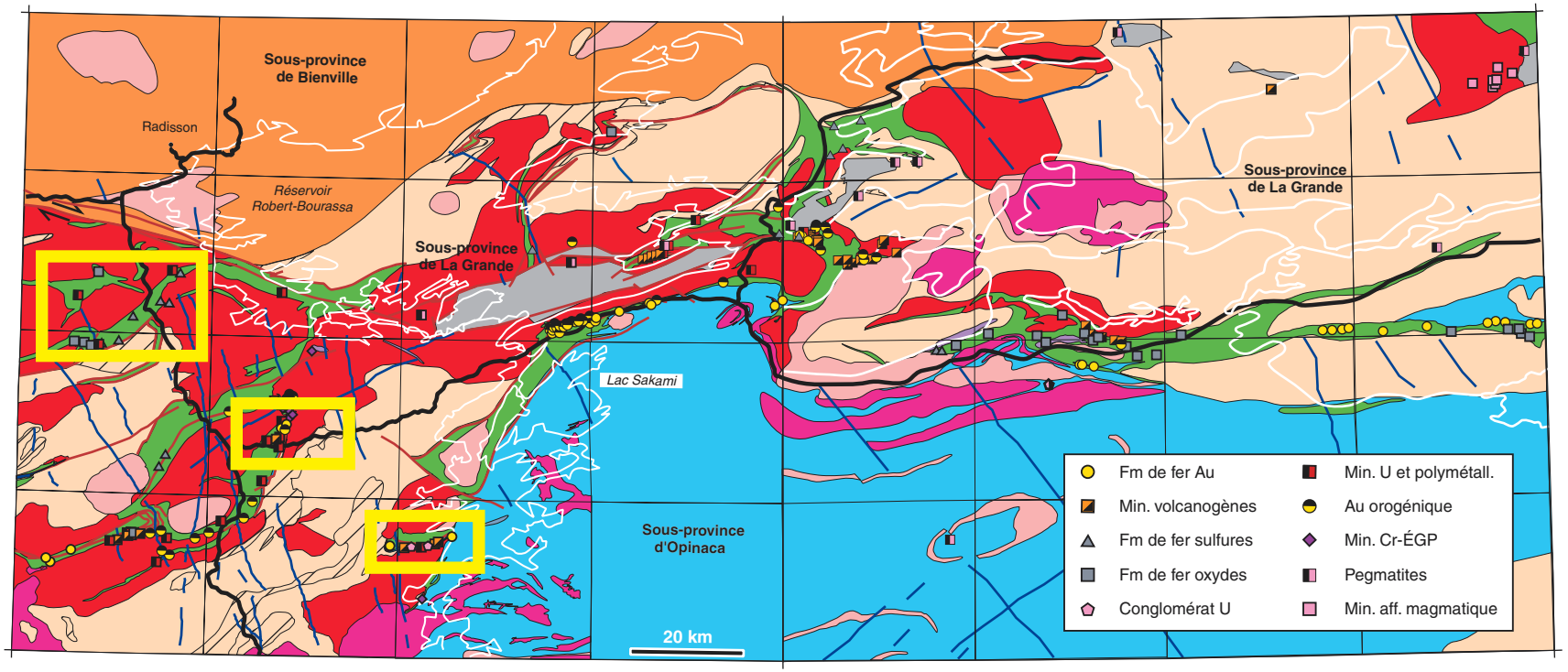
Archéen

- Granite et granodiorite
- Paragneiss
- Tonalite, monzodiorite et monzonite
- Gabbro et diorite
- Séquence volcano-sédimentaire
- Granulite
- Socle tonalitique (gneiss et tonalite)

Québec

Ressources naturelles, Faune et Parcs
Québec

Géologie Sakami-Guyer



Protérozoïque

Dykes de gabbro (2,07 Ga, 2,22 et 2,47 Ga)

Formation de Sakami (> 2,22 Ga)
Grès rouges, conglomérat, arénite quartzitique et mudrocks

Archéen

Granite du Vieux-Comptoir (2618 Ma)
Granite à biotite et pegmatite à tourmaline

Granite du Lac Taylor (2699 Ma), Pluton de Tipitipisu, Pluton de Bezier (2674 Ma) et intrusions tardives
Granite, tonalite porphyrique, granodiorite, monzonite et monzodiorite quartzifère

Sous-province d'Opinaca

Groupe de Laguiche (<2698 Ma)
Paragneiss à biotite, wacke feldspathique, arénite arkosique et conglomérat polygénique

Sous-province de Bienville

Pluton de Radisson (2712 Ma)
Monzonite et monzonite quartzifère, porphyriques

Sous-province de La Grande

Complexe de Menarik et Pyroxénite de Baie Chapus
Péridotite, pyroxénite. chromitite et lamprophyre

Intrusions de Duncan, Pluton d'Amisach Wat et Syénite du Lac Bruce (~2709 à 2716 Ma)
Tonalite à hornblende et biotite, diorite, monzodiorite, monzonite et syénite

Groupes de Guyer (2749 Ma) et de Yasinski (2732 Ma), Formations de Shabudowan et d'Ekomiak
Basalte tholéiitique, andésite, dacite, pyroclastites, formation de fer, wacke, arénite feldspathique, et conglomérats polygéniques

Formation d'Apple
Arénite quartzitique et conglomérat monogénique à PY et U

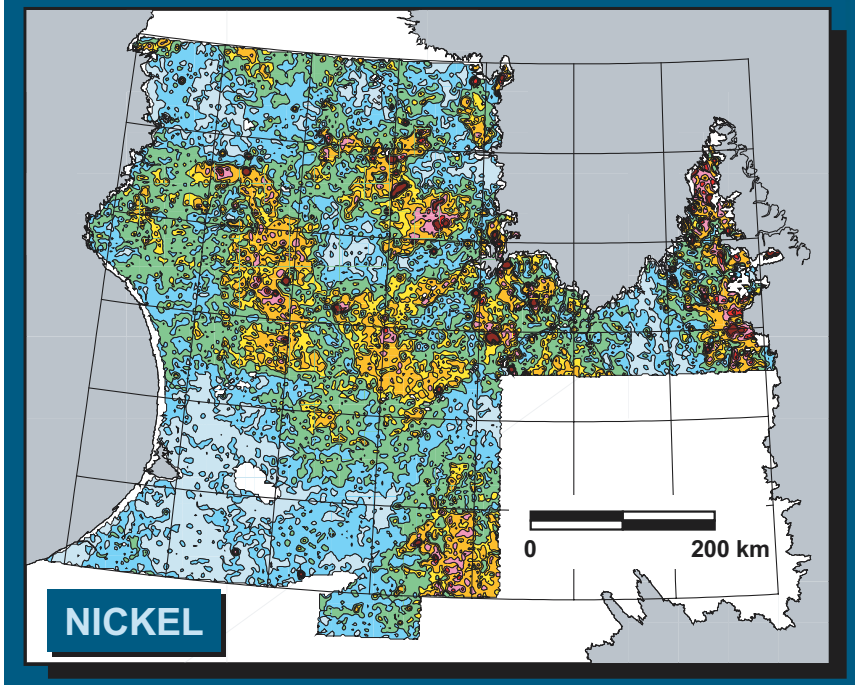
Complexe de Langelier et Pluton du poste Le Moyne
Tonalite à biotite et hornblende (2788, 2794 Ma et 2881 Ma)
Gneiss tonalitique et granitique (2811 Ma et 3360 Ma)

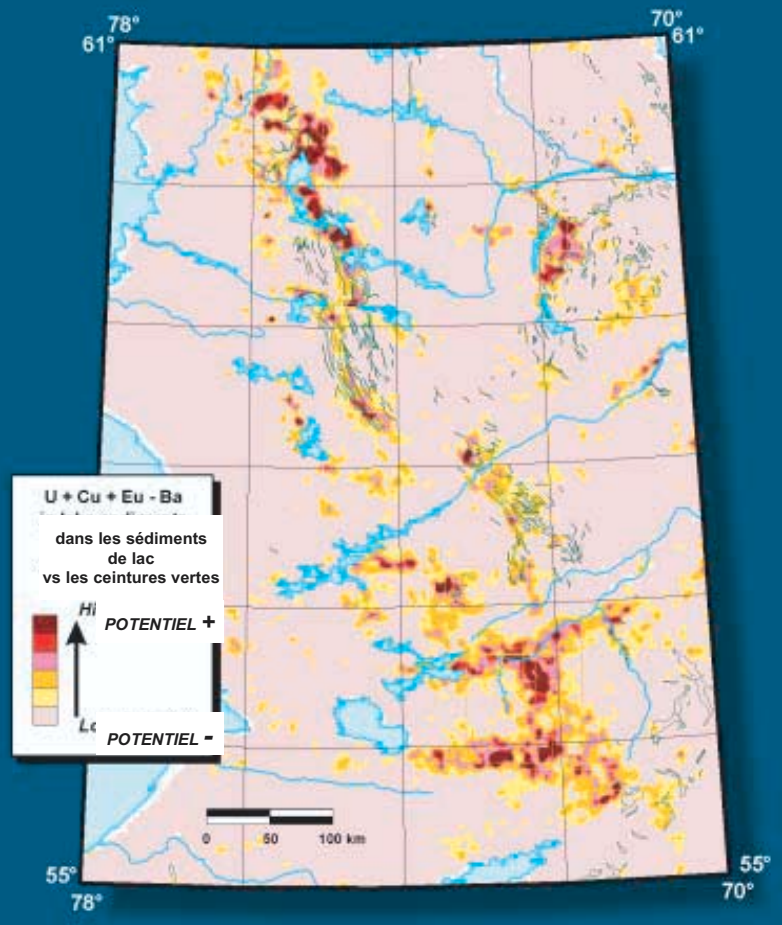
Québec

Carte du levé du Grand-Nord

Levé géochimique de sédiments de lac

Date : Été 1997
Couverture : 350 000 km²
Échantillons: 26 200 (1 per 12 km²)
Partenaires: *CAMBIOR, FALCONBRIDGE, NORANDA, SOQUEM, VIRGINIA*



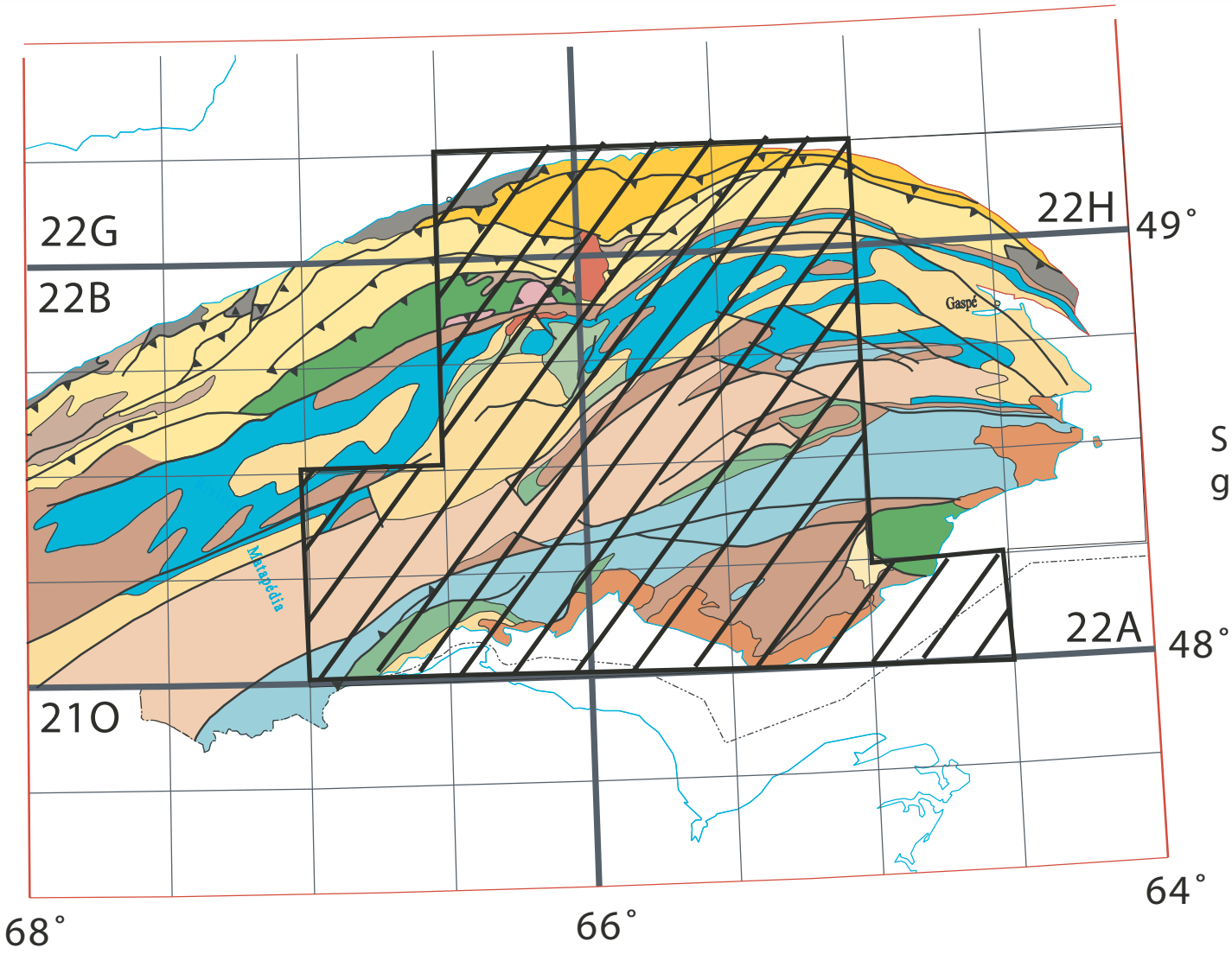


Outil pour l 'exploration et la cartographie
Système de production de cartes de potentiel minéral (' *SPCPM* ')

Québec

Ressources naturelles, Faune et Parcs
Québec

Carte du levé de la Gaspésie



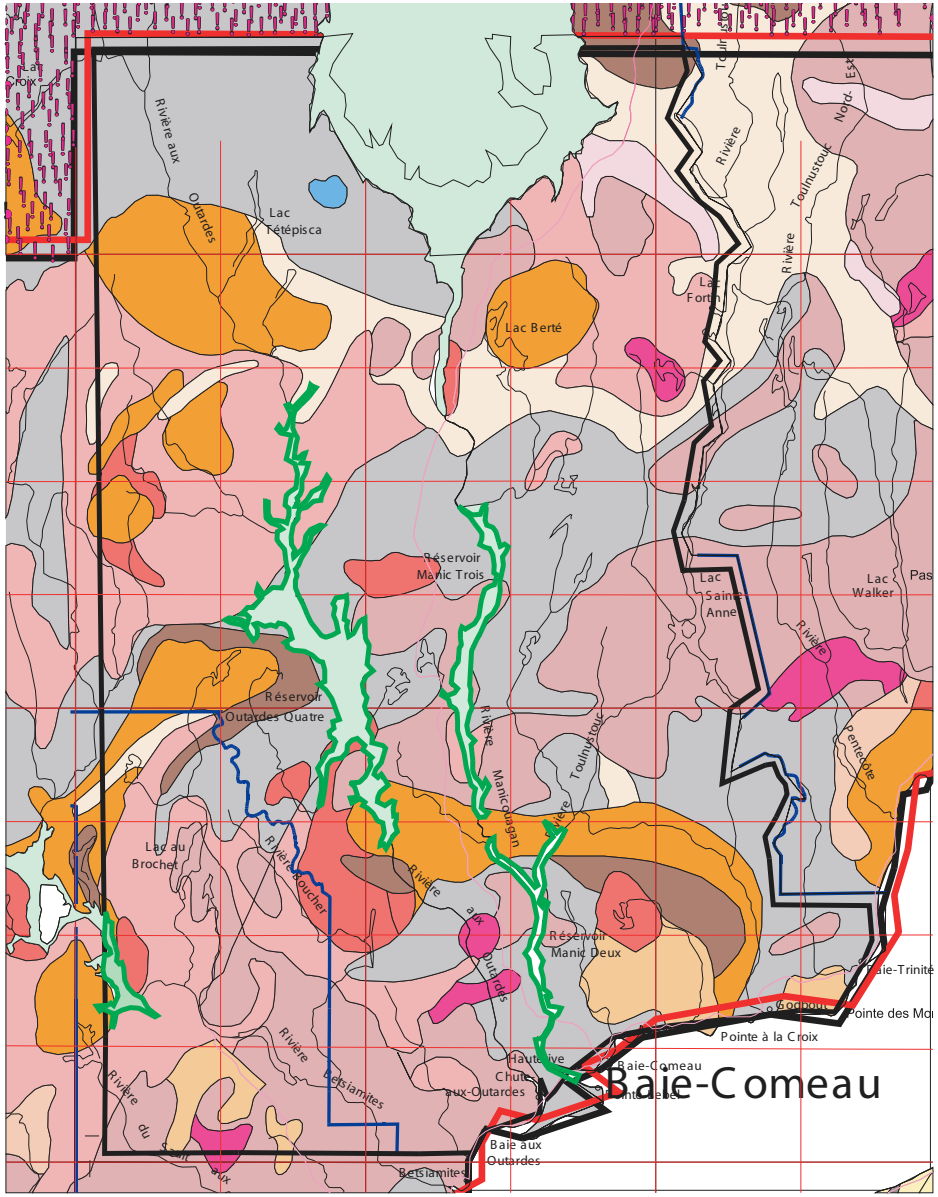
Surface du levé gravimétrique

Québec

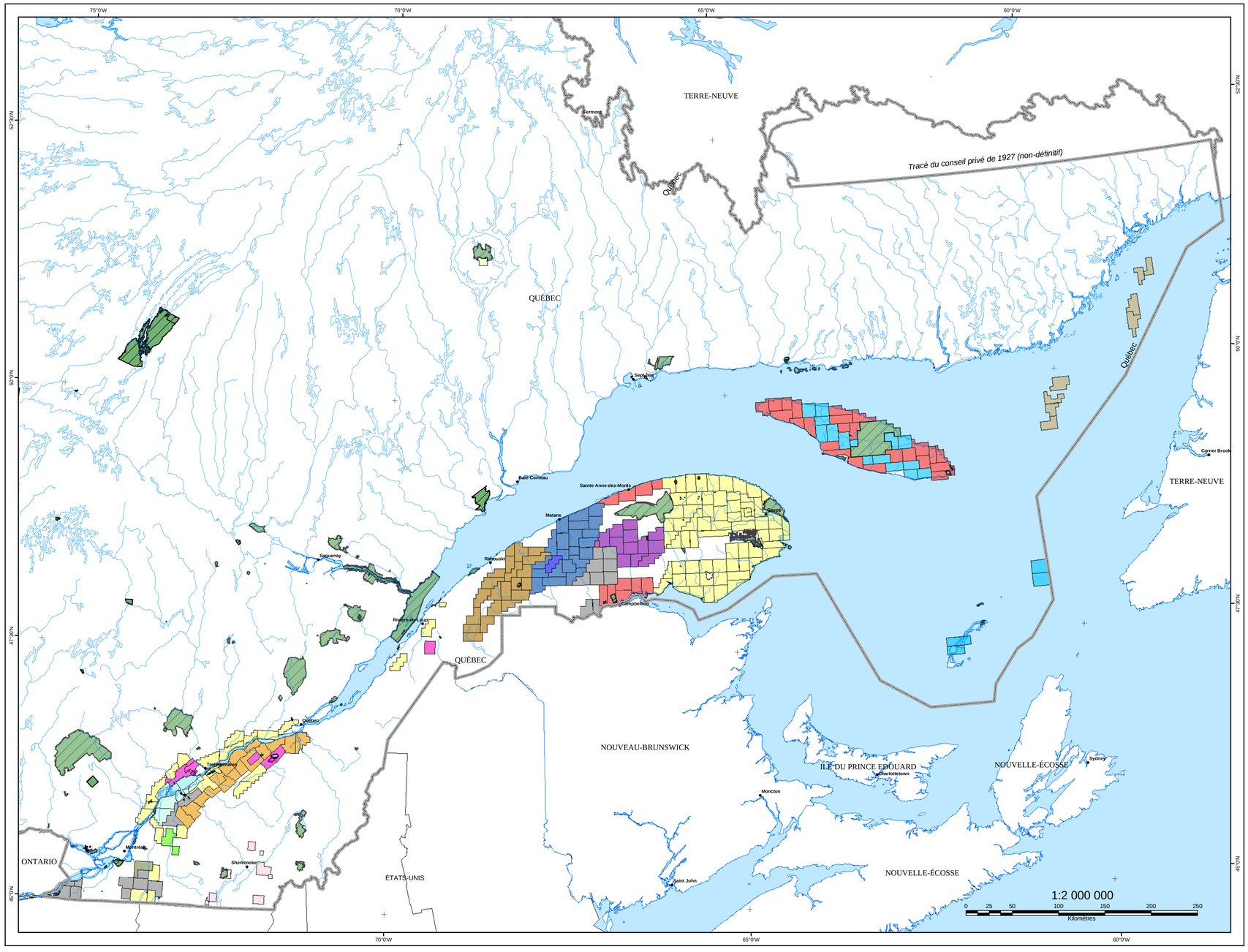
Ressources naturelles, Faune et Parcs

Québec

Carte du levé de Manic



Québec



LÉGENDE

Liste des détenteurs

- Altai Resources inc.
- Corridor Resources inc.
- Fonds d'exploration minière du Bas-St-Laurent
- Gastem inc.
- Hydro-Québec
- Intragaz Exploration, Sec
- Anna McCullough
- Junex inc.
- Lumincos Corporation
- Prospection 2000 inc.
- Pétrolia inc
- Questerre Energy Corporation
- Ressource & Énergie Squatex inc.
- Ressources Manicouagan inc.
- Saeed Ahmad
- Spiegel Sohmer s.e.n.c.r.l.
- Trenton Energy inc.
- En cours de délivrance

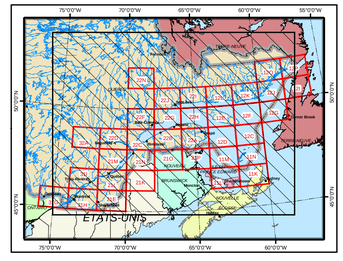
Point d'atache des permis

Signes conventionnels

- Ville
- Cours d'eau principal
- Frontière
- Route principale
- Lac
- Île
- Aire protégée

Permis et baux en vigueur

2002PG965	Permis de recherche de pétrole et de gaz naturel
1995RS095	Permis de recherche de réservoir souterrain
1998SA003	Permis de recherche de saumure
2/28/2003	Date d'émission du permis
2002BR035	Bail d'exploitation de réservoir souterrain
1995BP035	Bail d'exploitation de pétrole et de gaz naturel
1995BU004	Bail d'utilisation de gaz naturel
2/28/2003	Date d'émission du bail



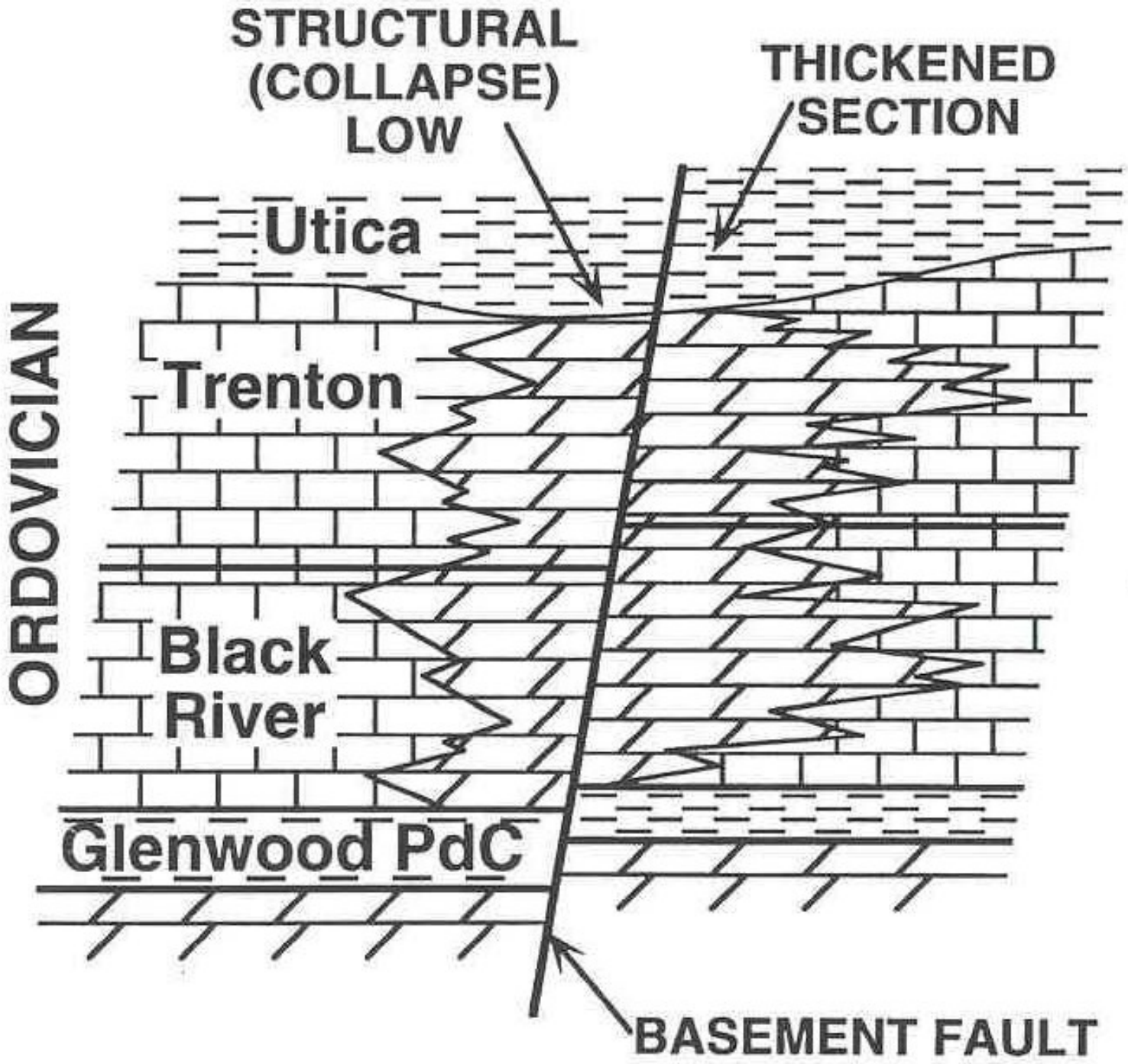
LOCALISATION DES PERMIS ET BAUX

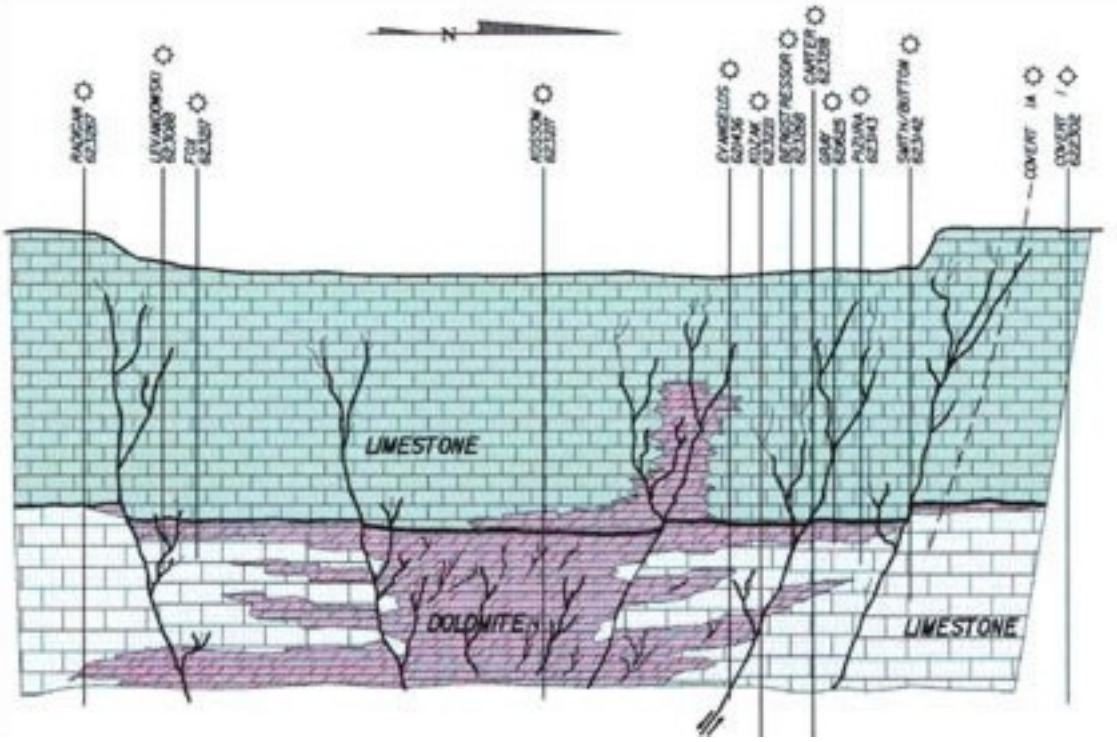
MINISTÈRE DES RESSOURCES NATURELLES ET DE LA FAUNE
SECTEUR DE L'ÉNERGIE ET DES CHANGEMENTS CLIMATIQUES
DIRECTION DU DÉVELOPPEMENT DES HYDROCARBURES

Ressources naturelles et Faune
Québec

Projection Lambert du Québec
Ellipsoïde de référence: GRS80
Système de référence géodésique: NAD83
Conception: Stéphane Beauséjour
Mise à jour: 13/10/2005

N


STRUCTURAL
(COLLAPSE)
LOW
THICKENED
SECTION
Utica
ORDOVICIAN
Trenton
Black
River
Glenwood PdC
BASEMENT FAULT


N
LIMESTONE
DOLOMITE
LIMESTONE