

# GM 52443

GEOLOGY AND GEOCHEMISTRY OF THE BELLECHASSE GOLD DEPOSIT, BELLECHASSE PROJECT

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Québec 

**EXPLORATION SUMMARY REPORT  
BELLECHASSE PROJECT  
1993**

**GEOLOGY AND GEOCHEMISTRY  
OF  
THE BELLECHASSE GOLD DEPOSIT  
BELLECHASSE TOWNSHIP  
QUÉBEC**

February 21, 1994  
Ste-Justine, Québec

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QUEBÉC**

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**GEOLOGY AND GEOCHEMISTRY  
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BELLECHASSE TOWNSHIP  
QUÉBEC**

**INTRODUCTION**

A program of exploration work has been completed on 39 mining claims totalling 1140 hectares in Bellechasse Township, Québec.

An inventory of untested high-potential geochemical, geophysical and geological exploration targets exist within the immediate area of the deposit, and detailed geological mapping was conducted over these areas (on the northeastern half of the Bellechasse grid) as a follow-up to previous surveys conducted in the area of the Bellechasse deposit in recent years.

As part of the new work, twelve new trenches were dug over selected high-potential areas.

The results of the 1993 work program are very encouraging. New gold mineralization has been uncovered in several locations, notable on the northeastern extension of the 88 Zone. Additionally, the trenching has confirmed the existence of extensive gabbro units well to the south of the known mineralized area, presenting the possibility for substantially increasing the size of the currently defined Bellechasse deposit.

Further exploration work is strongly recommended.

**PROPERTY AND LOCATION**

The mining claims are situated in Bellechasse Township in the Eastern Townships district of southern Québec, near the village of St-Magloire, approximately 100 kilometres southeast of Québec City and 125 kilometres northeast of the mining centre of Thetford Mines (figure 1).

The 39 claims are contiguous and cover an area totalling 1140 hectares (figure 2).

LICENSE	CLAIM	TOWNSHIP	RANGE	LOT	HECTARES
416621	2	Bellechasse	CM-NE	14	20
393636	1	Bellechasse	CM-NE	15	20
393636	2	Bellechasse	CM-NE	16	20
393636	3	Bellechasse	CM-NE	17	20
393636	4	Bellechasse	CM-NE	18	20
393637	1	Bellechasse	CM-NE	19	20
393637	2	Bellechasse	CM-NE	20	20
393637	3	Bellechasse	CM-NE	21	20
393637	4	Bellechasse	CM-NE	22	20
430367	1	Bellechasse	CM-NE	23	20
430367	2	Bellechasse	CM-NE	24	20
430367	3	Bellechasse	CM-NE	25	20
430367	4	Bellechasse	CM-NE	26	20
374760	2	Bellechasse	II	3	40
393705	1	Bellechasse	II	4	40
393705	2	Bellechasse	II	5	40
393706	1	Bellechasse	II	6	40
393706	2	Bellechasse	II	7	40
336567	1	Bellechasse	II	8	40
336567	2	Bellechasse	II	9	40
336568	1	Bellechasse	II	10	40
336568	2	Bellechasse	II	11	40
403810	1	Bellechasse	II	12	40
393709	3	Bellechasse	II	13	40
430380	1	Bellechasse	III	3	40
393707	1	Bellechasse	III	4	40
393707	2	Bellechasse	III	5	40
393708	1	Bellechasse	III	6	40
393708	2	Bellechasse	III	7	40
393709	1	Bellechasse	III	8	40
172245	2	Bellechasse	III	9 N½	20
393710	1	Bellechasse	III	9 S½	20
172245	3	Bellechasse	III	10 N½	20
393710	2	Bellechasse	III	10 S½	20
G8358	1	Bellechasse	III	11 N½	20
393710	3	Bellechasse	III	11 S½	20
G8358	2	Bellechasse	III	12 N½	20
393710	4	Bellechasse	III	12 S½	20
393709	2	Bellechasse	III	13	40
<b>TOTAL</b>	<b>39</b>				<b>1140 ha</b>



# INDEX MAP

4

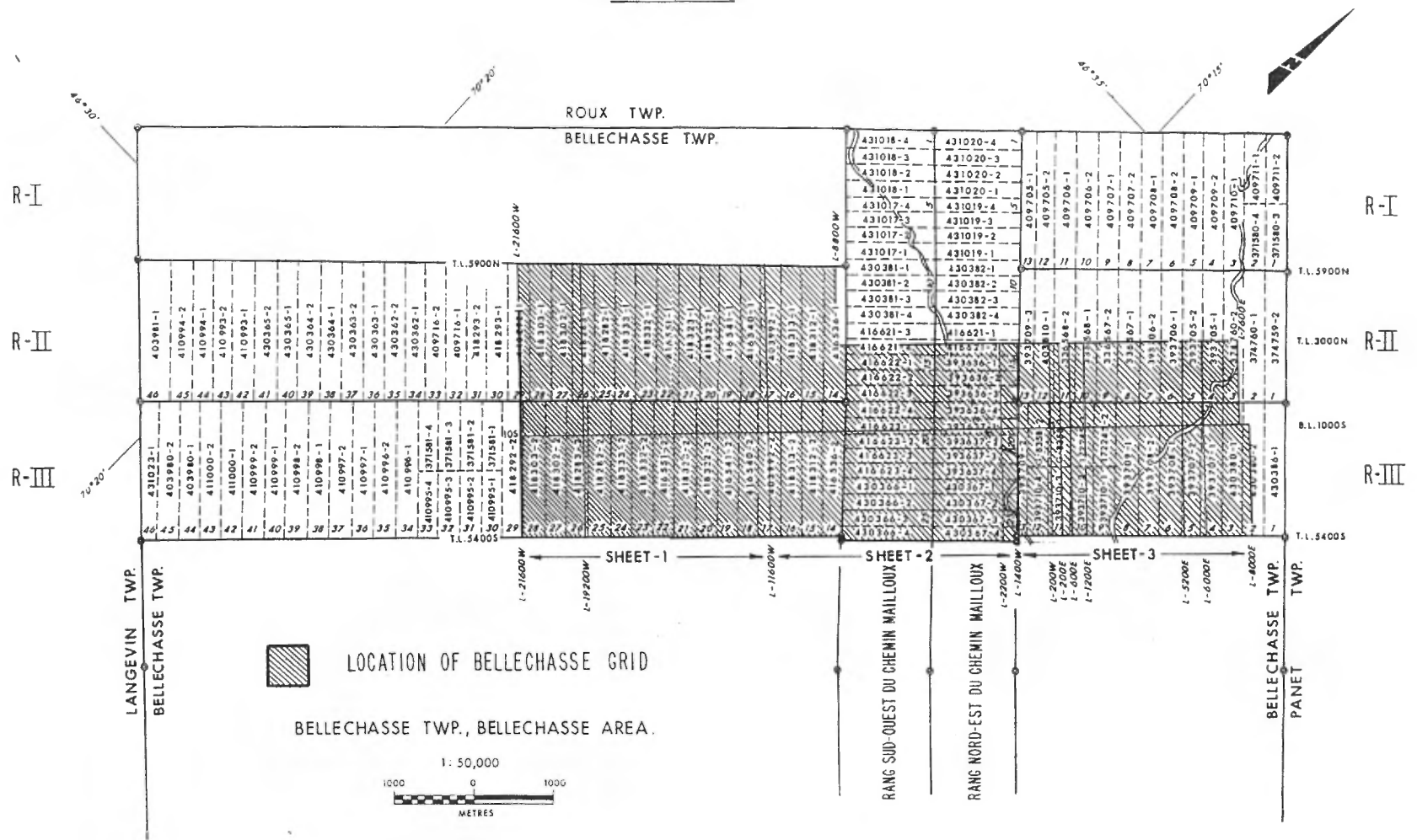


Figure 2. Location Map:  
The Bellechasse Grid, Bellechasse Township, Québec

## **SURFACE FEATURES**

The Bellechasse area supports a well developed rural and woods-industry infrastructure including an excellent network of well maintained roads.

Located in the northern foothills of the Appalachian Mountains, the topography is characterized by northeast-southwest trending ridges and valleys with a relief to 200 metres and maximum elevations of 600 metres above sea level. Agricultural land, interspersed with relatively young forest, consists mainly of forage crops. Much of the cleared land has reverted to scrub brush or has been seeded as softwood plantations. The upland forests are dominantly hardwood and are commercially sugared and cut for fuel. The valleys support a mixed bush of hardwood and softwood which is commercially harvested for pulp and lumber products in support of regional mills. Clear-cutting practices are commonly employed, greatly facilitating prospecting in freshly cut areas.

## **DISTRICT GEOLOGY**

The stratigraphy and structure of a large area surrounding and including the Bellechasse grid has been mapped by Cousineau (1990). Other definitive work in the region includes that of Beland (1957), Gorman (1954), St-Julien (1987), Gauthier *et al.* (1989), and Robert E. Schaaf & Associates (see section four references).

Typical of the northern Appalachian fold belt, the district geology is characterized by northeast trending sedimentary, volcanic and intrusive sequences of lower Paleozoic age, tightly folded during the Taconic Orogeny and thrust faulted during the Acadian Orogeny. In relatively recent times, Williams (1979), St-Julien and Hubert (1975), St-Julien and Beland (1982), Beland (1982) and others have rationalized the tectono-stratigraphic framework (Figures 3 and 4).

The structure and metallogeny of the district are defined by the St-Victor Synclinorium, a major sedimentary-tectonic trough of Middle Ordovician rocks comprising the Magog Group. The Synclinorium is approximately 10 kilometres wide in the district and is bounded on its northwestern margin by:

- a) The Serpentinite Belt, a highly disturbed terrane of oceanic Upper Cambrian to Lower Ordovician mélangé and sedimentary rocks (Saint Daniel Formation) and ophiolites;
- b) an older Precambrian-Cambrian sequence of continental felsic to mafic extrusives and sedimentary rocks (Caldwell Formation);
- c) and granitic blocks of uncertain affinity.

The Serpentinite Belt represents vestiges of the proto-Atlantic oceanic crust which were obducted onto Cambrian continental rocks (Caldwell Formation) to the northwest. The thrust fault (obduction zone) which marks this contact represents one of the major structural features of the Canadian Appalachians: the Baie Verte-Brompton Line. This southerly dipping thrust fault separates the Humber Zone, rocks of the early Paleozoic continental platform (locally Caldwell Formation) from the Dunnage Zone, rocks of the once mobile oceanic domain (locally the Magog group and Serpentinite Belt).

To the southeast, the St-Victor Synclinorium is bounded by the Guadeloupe Fault, which marks the contact with Silurian-Devonian sedimentary sequences of the Connecticut Valley-Gaspé Synclinorium extending into Maine. Volcanic rocks, possibly part of the Ascot Formation and time correlatives of the Magog Group, occur sporadically along the boundary zone. The Ascot volcanics may be tectonic relics of an early Paleozoic (Taconic) island-arc edifice, the likely provenance for Middle Ordovician Magog sedimentation.

The lower Magog Group is comprised of a syn- to post-orogenic fining upward flysch sequence derived from the southeast and deposited in a forearc basin. It is subdivided, in stratigraphically descending order, into the St. Victor, Beauceville, Etchemin, and Frontiere Formations. At least two generations of intrusive rocks, the Mafic Igneous Complex, occur as sills within the Etchemin and Beauceville Formation. The St-Victor Formation does not outcrop in the immediate district; it is present mainly in the region to the southwest beginning in the Beauceville Region. It is comprised of a coarser grained flysch sequence derived from the continental margin to the northwest.

As indicated, the Magog Group may be lateral time equivalents of the Ascot volcanics, the prolific massive sulphide producer belt of the Sherbrooke area. The base of the Beauceville Formation contains considerable graphite and syngenetic iron sulphides defined by a broad zone of multiple electromagnetic conductors, typical of a massive sulphide environment. One gold-bearing polymetallic massive sulphide occurrence, the Champagne deposit, has been defined locally in the Beauceville Formation.

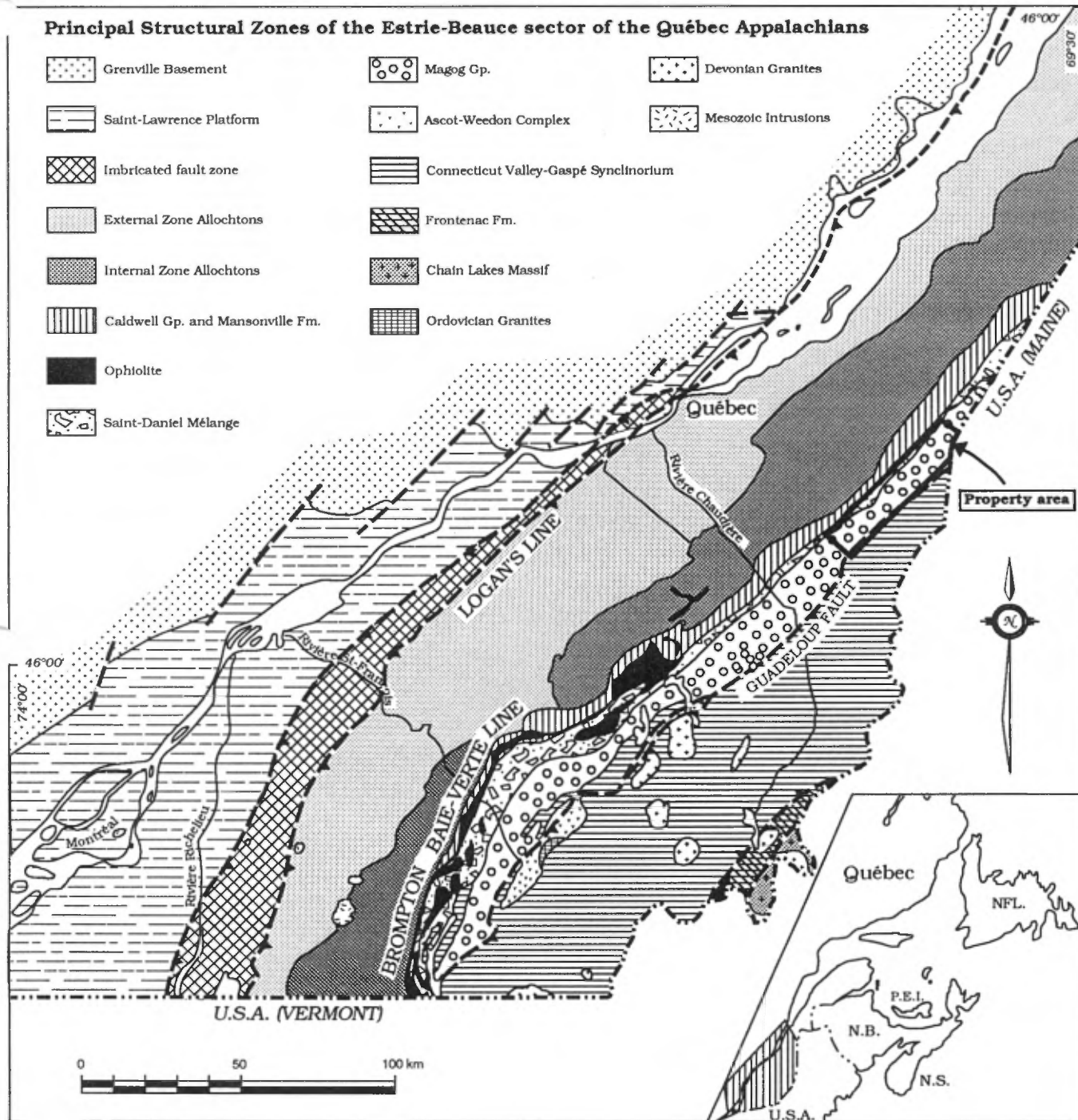


Figure 3. Tectonostratigraphic Map of the Northern Appalachians.

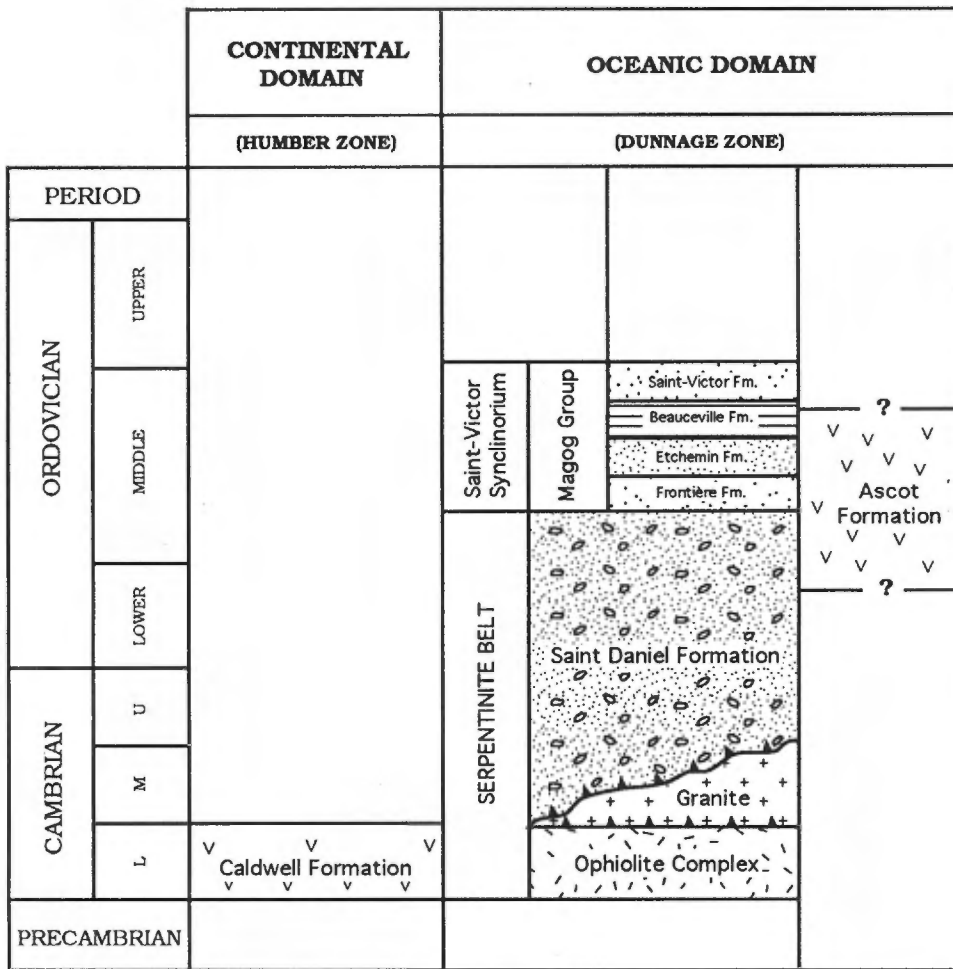


Figure 4. Bellechasse Mineral Belt, Stratigraphic Relationships.

The St-Victor Synclinorium reflects continuing continental convergence following the collision of the Taconic island-arc (Ascot Complex) with the passive continental margin. The Synclinorium plunges shallowly to the southwest and is characterized by tight to isoclinal folds exhibiting axial plane cleavage developed during the Acadian Orogeny (Cousineau, 1990). The dominant cleavage is steeply dipping and trends northeast-southwest. A weak  $S_3$  crenulation cleavage may be related to local linear trends of intense shearing which developed sub-parallel to the regional tectonic fabric during progressive deformation. Regional metamorphism is of lower greenschist facies. Most of the rocks of the region are weakly to moderately foliated; phyllite, tending locally to slate, characterizes most fine to medium grained sedimentary rocks.

Landsat imagery analysis of the area has revealed a pattern of east-west and north-south trending lineaments coextensive with possible late brittle faults reflected by offsets of airborne and ground magnetic anomalies and mapped stratigraphic offsets. All evidenced displacements are relatively small.

## DISTRICT EXPLORATION HISTORY

The Bellechasse mineral belt is defined by an alignment of mineral occurrences including gold-quartz lode deposits, gold-bearing polymetallic massive sulphide deposits, and related sub-types of mineralization in the St-Victor Synclinorium extending across Ware, Langevin, Bellechasse, and Panet Townships.

The first recorded discovery of gold in the Bellechasse belt was in Ware Township at the site of the Wilfrid Beaudoin occurrence in the early 1920's. A series of rock pits were put down but no further work is recorded; one short hole is known to have been drilled near the showing, but the exact location and results of the drilling were not recorded (Wilfrid Beaudoin Jr., personal communication).

Recorded exploration of consequence began in the fall of 1951 (Bergmann, 1953) with the discovery of a copper-nickel deposit (the Eastern Metals deposit) associated with serpentinite near St-Fabien-de-Panet in Rolette Township.

In 1952, gold-bearing quartz float was found in Bellechasse Township on the claims of Emile Bolduc, at what today is known as the Bellechasse deposit. The occurrence was discovered and initially investigated with trenching and diamond drilling by N.A. Timmins (1938) Ltd. and the A.E. Rosen interests during 1952-1953, and subsequently by Black Hawk Mining Ltd. during 1960-1961. In 1976, Privex Mines Ltd. conducted bulk sampling and metallurgical testing.

A deposit of massive sulphide mineralization containing gold, silver, zinc, lead and copper, known as the Champagne deposit, occurs at the Bellechasse-Panet townships boundary. The deposit was discovered in 1952 and was developed by diamond drilling until about 1957. Some minor work followed in 1964 and 1970.

During 1952-1953, the initial period of interest, and again during 1960-1961, exploration was conducted along the Bellechasse belt across the full width of Bellechasse and Panet townships. Numerous additional gold and base metal occurrences were discovered but none was seriously tested by drilling or modern exploration methods.

Exploration work on the Bellechasse Project completed by Golden Hope Mines Limited during 1984-1989 includes: airborne electromagnetic and vertical gradient magnetic surveys; soils geochemical surveys specific to gold, arsenic, copper, lead, zinc, and locally mercury; lithochemical surveys of all outcrop areas specific to gold, arsenic, copper, lead, and zinc; geological surveys at reconnaissance scales and in mineral zones, at detailed scales; and till sampling surveys in known mineral centers. Diamond drilling, totalling 31,822 feet as 58 holes was directed to known mineral centers and an assortment of mineral related anomalies.

During 1985-1987, J.R. Clark, Thrust Resources Inc. and Profco Resources Ltd. performed geological, geophysical and geochemical surveys in Langevin and Panet townships. Gold was found in Langevin Township at two locations associated with gabbro (Cavey and Lebel, 1986; Chapman and Floyd, 1987; Clark and Wares, 1985).

In 1986, Noranda Explorations Ltd. and Finneth Exploration Inc. acquired major land positions in Rolette and Talon townships, centered on the Eastern Metals deposit and other ultramafic occurrences along the Serpentinite Belt where previously unrecognized gold, silver and cobalt associations had been detected (Gauthier, 1988b, and Gauthier *et al.*, 1987c). Considerable work was done but there have been no reports of significant results.

A new gold discovery was made by Golden Hope Mines Limited in Panet Township in 1987 (Burzynski, 1989a). The North Zone auriferous quartz-stockwork system was uncovered in a previously unexplored geological environment. Visible gold has been seen in drill core (Burzynski, 1988b) as well

as in till pits dug along the laterally extensive zone (M.J. Schaaf, 1988).

Drilling conducted by private interests in early 1990 extended the North Zone gold mineralization near the initial discovery into Rolette Township (Burzynski, 1991m). Additional drilling approximately six miles southwest in Bellechasse Township also discovered North Zone-style mineralization, and indicates the zone continues almost unchanged in its stratigraphic location over a strike length of nearly 13 kilometres.

In 1990 Golden Hope Mines Limited and partner Ressources Ste-Genevieve Ltée. conducted detailed work on claims in Ware, Bellechasse, and Panet townships. New grids were established over most of the Golden Hope claims. Ground geophysical surveys, lithochemical sampling, till surveys, drilling and stripping was conducted in numerous locations on the claims. A new gold discovery, the 88 Zone, was made 1600 feet southeast of the previously known Timmins Zone at the Bellechasse deposit (Burzynski, 1990c and Schaaf, 1990d). Drilling in early 1991 also discovered a new massive sulphide lens, the Champagne West lens, 650 metres southwest of the previously known Champagne deposit (Dupuis and Burzynski, 1991). The success of the exploration programs in the areas of both the Bellechasse deposit and the Champagne deposit indicates that the current geological models appear to be working.

## **DISTRICT MINERALIZATION**

Gold-quartz lode-type mineralization is localized near the stratigraphic contact between turbiditic coarse grained sequences of the Frontiere Formation and siliceous fine grained sequences of the Etchemin Formation. The contact zone is marked by magnetic lean iron formation and is repeated on opposite limbs of the St-Victor Synclinorium. The south limb contact zone is further characterized by a high degree of structural complexity and numerous diorite to gabbro sills (Mafic Igneous Complex) which host the Bellechasse deposit and numerous other gold occurrences along the Bellechasse belt. The Bellechasse deposit is a partially defined concentration of gold-sulphide and gold-quartz mineralization localized by intricately folded and sheared gabbro and diorite. Gold is preferentially distributed in quartz veins associated with sulfide mineralization, mainly arsenic, iron and base metal sulphides. Visible gold is abundant. The deposit, as defined, reports well as gold, arsenic, copper, lead, zinc and mercury anomalies in associated soils and till.

The Frontiere-Etchemin formation contact zone on the north limb of the St-Victor Synclinorium appears to be through-going without noticeable structural complexity. Regardless, profound zones of gold mineralization, the North Zone system, follow the trace of the lean iron formation continuously for distances measured in miles. The North Zone mineralization consists of multiple sulfidic quartz stockwork systems ranging in excess of 100 feet in width and trending approximately parallel to stratigraphy and major fold axes. The remarkable strike continuity is known from outcrop, core, geophysical data and geochemical data. The quartz stockwork systems are highly anomalous in gold and trace elements. The cursory testing to date has yielded some potentially economic values and some visible gold has been encountered.

Massive pyritic sulphide mineralization containing copper, lead, zinc, gold and silver occurs in extensive black carbonaceous-sulfidic mudstone sequences of the lower Beauceville Formation. The principal occurrence of this type, the Champagne deposit, is typical of the class of exhalative, stratigraphically localized massive sulphide deposits in sedimentary terranes (SEDEX) and serves as a local exploration model.

Gold-bearing sulphide mineralization known as the PT-type, also occurs as zones within the Etchemin Formation. It is characterized by inch-to foot-scale lenses of massive pyrite accompanied by stringers and disseminations of pyrite-sphalerite and intense silicification. The mineralization is geochemically rich in trace elements and highly anomalous in gold. As presently known, individual occurrences of the PT-type are widely distributed but poorly defined for want of detailed investigation.

## **THE BELLECHASSE GRID**

### **Field Procedures**

Geological field work was performed by C. Wilson, B.Sc., J.F. Burzynski, M.Sc., B. Brassard, M.Sc. Two junior geologists also assisted with re-establishing the grid and collecting samples. The geology was interpreted by C. Wilson. Consulting, supervision and support services were provided by Robert E. Schaaf & Associates, geological consultants to the Bellechasse Project.

All work was conducted between May 1993 - February 1994. During field work, all areas of exposure were mapped and selectively sampled. Base maps for the area were developed from Ministère de l'Énergie et des Ressources du Québec air photos (scale 1:15,000), carte cadestral (scale 1:20,000), and topographic maps (scale 1:50,000). These maps and an existing grid were used for field control during the mapping.

Detailed geological mapping of the grid was conducted at a scale of 1:2400 (1" = 200').

Twelve trenches were dug using John Deere 490 and 790 backhoes to evaluate untested geochemical, geophysical and geological exploration targets.

Lithochemical samples collected were guided by rock type and mineralization. Fifty-five (55) samples were collected. In total, 74 gold analyses (including initial and check analyses) and nine (9) arsenic analyses were conducted.

## Exploration History of the Bellechasse Deposit: 1951-1992

Serious exploration in the region did not occur until 1951, when the discovery of the Eastern Metals copper-nickel (zinc-gold-cobalt) deposit was made near the village of St-Fabien-de-Panet (Bergmann, 1960a, and Gauthier *et al.*, 1989). Following the discovery, large tracts of land were staked by numerous companies and prospectors in the adjoining Bellechasse township. The Timmins Zone was first staked in 1951 after a local prospector found native gold in loose blocks of quartz float. The claims were subsequently optioned to N.A. Timmins (1938) Ltd. late in 1951, who is credited with the discovery of the "Timmins" Zone through trenching in early 1952. Following the discovery, N.A. Timmins (1938) Ltd. started a major program of prospecting, stripping, trenching and magnetometer surveying, and drilled eleven diamond drill holes in the main deposit area. The drilling discovered an additional gold-bearing diorite body immediately to the south of the Timmins Zone (the "Timmins Zone South").

The existing record of the work carried out by N.A. Timmins (1938) Ltd. is incomplete; almost all of their analytical data was not filed and has been lost, and there are no formal summary reports of the work. Select sampling results are restricted to larger quartz veins. A problem encountered by N.A. Timmins (1938) Ltd. was poor core recovery: hundreds of feet of drill core, much of it in the mineralized gabbro, was lost due to inefficient non-wireline drilling. Drill logs indicate that in some instances, continuous sections of over 40 feet of core were lost.

The ground immediately to the north of the Timmins Zone was explored by Ascot Metals Corporation Ltd. in 1952. Prospecting turned up mineralized float, and the discovery of the "Ascot Zone" was made through subsequent trenching. The trenches uncovered diorite and sediments hosting very large quartz veins which gave "encouraging" assay results (reportedly over 0.1 opt gold, Béland, 1957). The mineralized zone was extended through trenching and was found to be at least 750 feet in length averaging 20 feet wide. A series of eight drill holes totalling 1,447 feet were put down on the Ascot Zone in 1952. In 1953, prospecting turned up four new areas with richly mineralized float containing visible gold northeast of the Ascot discovery area (Bergmann, 1953). Assay values of up to 7.02 opt gold were obtained and additional trenches were dug to investigate the source of the material, however all of the locations were not investigated. Bergmann (1953) gives the only recorded results from the trenches: chip and channel sampling returned values including 10 feet @ 0.18 opt gold, 10.5 feet @ 0.25 opt gold, and 4 feet @ 0.26 opt gold. Though the records contain little analytical data, the trenches are still accessible and have yielded some useful geological information and confirmation of the character of the zone.

N.A. Timmins (1938) Ltd. relinquished their option in 1953, likely because of their inability to define a regular, consistent mineralized vein. As N.A. Timmins were deemed to have the better part of the gold showing, their decision to discontinue work may have also caused the decision to stop work on the Ascot Zone.

The claims covering the two zones were acquired by Blackhawk Mining Ltd. in early 1960. The work done by Blackhawk created the second major staking rush in the "Bellechasse Mineral Belt". In 1960, Blackhawk conducted test geophysical surveys and did local stripping and trenching. A drilling campaign was planned but abandoned when the first drill site was being cleared and a large vein (Blackhawk's "discovery" or No. 1 vein) carrying "free gold in considerable quantity" (Blair, 1960) was discovered. Blackhawk also trenched a second major vein (the "sulphide" or No. 2 vein - known more recently as the "Rico" vein). Individual bulk samples of up to almost nine short tons were taken from three of seven areas trenched, and all returned high grade gold values (Figures 5 & 6). Following the bulk sampling, Blackhawk commenced their drill program, which consisted of 13 holes on the Timmins Zone. H.J. Bergmann, consulting mining engineer to Blackhawk, was the first to recognize that there was a sampling difficulty associated with the Bellechasse deposit (Bergmann, 1960b). He notes in a letter to the directors:

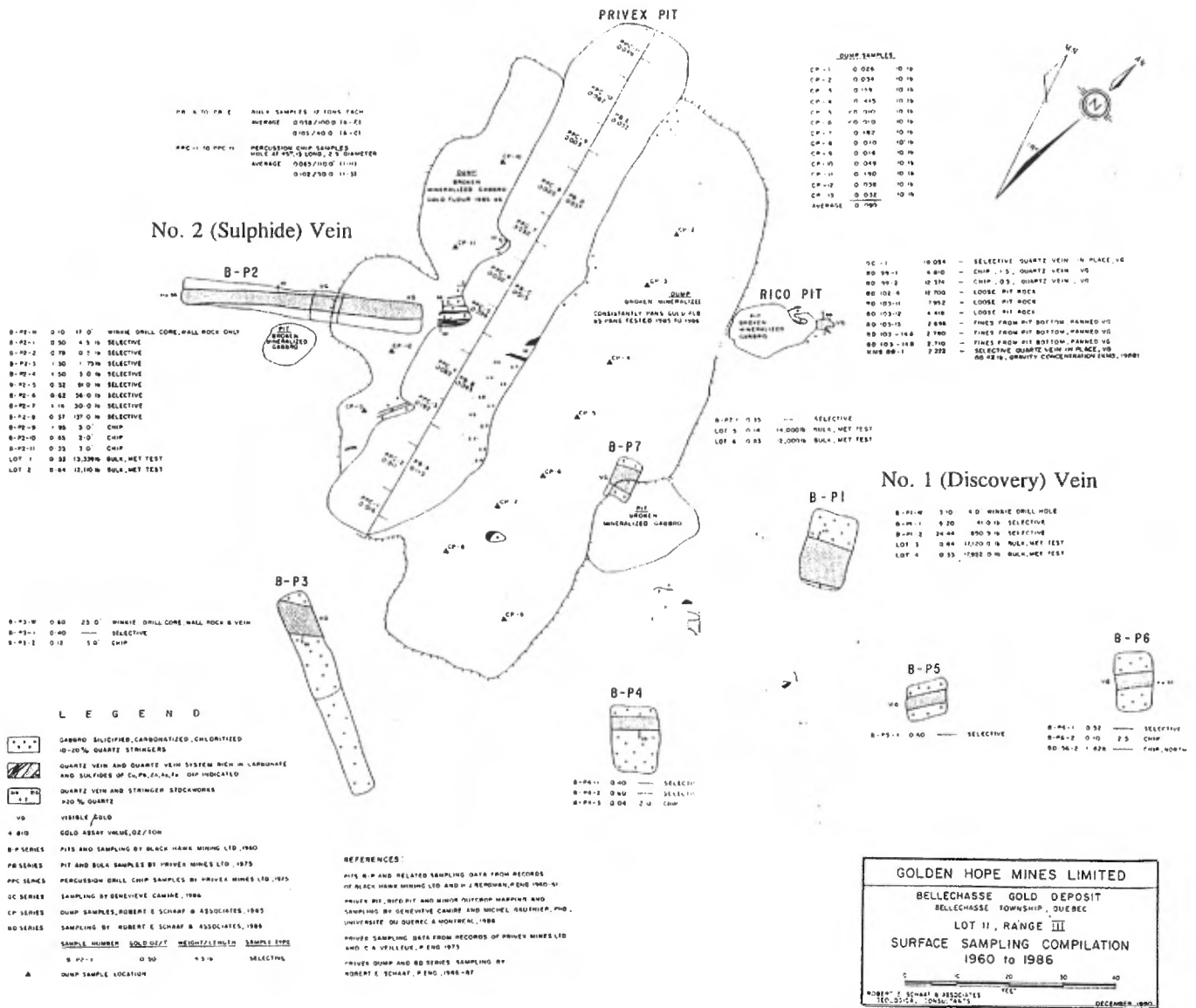


Figure 5. Blackhawk and Privex bulk sampling results, Timmins Zone.

"The gold in (the) vein(s) is largely in the free state and is not associated with sulphides though there are minor amounts of sphalerite with associated gold. Bulk sampling is thus the most accurate method of sampling the vein(s) as both channel and diamond drilling tend to give erratic results."

Bulk sampling on the No. 1 vein averaged 0.58 opt gold in approximately 17.5 short tons, and bulk sampling from the No. 2 ("sulphide") vein also averaged 0.58 opt gold in approximately 12.7 short tons. Bergmann noted that the sampling results from the sulphide vein were more consistent due to, he believed, the association of the gold with the sulphides. Based on the results of the bulk, chip and grab samples from this vein, he speculated its ultimate grade would range between 0.50 opt to 0.75 opt gold. A third major vein, No. 3 (or the "south" vein) was uncovered in the course of stripping; it reportedly averaged three feet in width and was followed for over 130 feet strike length. The No. 3 vein was only partially sampled, but one 25 foot winkle drill intersection returned 0.60 opt gold. Just prior to the start of their diamond drilling program, Blackhawk also conducted Winkle drilling below several of the bulk sample trenches. The holes did not penetrate much deeper than 15 feet on average and were viewed by Blackhawk as "not being too successful". Interestingly though gold values were found in the gabbro in an attempt to drill under vein No. 2: a 17 foot inclined Winkle hole sampled only wall rock material returned a value of 0.10 opt gold over the full 17 feet.

Like N.A. Timmins Ltd., Blackhawk were also exploring on the premise of trying to delineate an underground vein-style deposit, and they restricted the sampling of drill core mainly to larger quartz veins. Following standard "cutting" practices of the time, they also removed all visible gold from the drill core when it was encountered. In a memorandum to the directors, Bergmann (1960) made note of the difficulty in obtaining representative assay results from the drilling:

"Sampling of the drill holes has shown sections carrying visible gold to give only low assays in gold and check sampling has shown that by screening the pulp through 100 mesh and assaying the -100 and +100 mesh products, a more representative value is obtained. The gold apparently becomes flattened in the pulverizing operation and is usually found in the +100 mesh product. By using the two assays and the respective weights, an average can be obtained which should be fairly accurate."

Bergmann goes on to state:

"(Hole No. 5) intersected four separate sections showing visible gold within the first hundred feet of core. These intersections gave low values which is not surprising with the gold in the free state. Check samples of the rejects using the -100 and +100 mesh products showed fair values in the +100 mesh product but the weighted averages were still relatively low. However, the presence of the visible gold is sufficient to brand the intersections as important."

In his reports and memoranda it is apparent that Bergmann was having great difficulty in correlating geological and analytical results from hole to hole, and in correlating the drill hole information with the three main veins uncovered in the surface work. The seeming lack of continuity of the major quartz veins and erratic distribution of the quartz and gold made it impossible for him to calculate an ore reserve. Drilling continued into the spring of 1961, and despite numerous intersections containing good mineralization and visible gold, Blackhawk chose to cease exploration operations. Although they also controlled the Ascot Zone, Blackhawk did not conduct any work on it in their 1960-1961 program.

Blackhawk's failure to delineate an ore reserve in the Timmins Zone set a precedent for the perception of the Bellechasse deposit as being a gold showing with no additional potential. Their

conclusion was the result of several factors: they did not understand the geology of the deposit, and they were trying the wrong approach in attempting to delineate an "Abitibi" type underground gold mine. They were also frustrated in trying to correlate non-correlatable disassociated quartz stockwork veins, and were hampered by poor sampling procedures.

Following the end of the Blackhawk work, little exploration work of consequence was conducted at the Bellechasse deposit until 1975.

In 1975, Privex Mines Ltd. optioned the Timmins Zone and collected five contiguous bulk samples weighing 12 tons each from a 110 foot long trench (the "Privex Pit"). In a detailed report regarding processing of the sample, Richard (1976) lists the results from south to north in the pit, as: 0.113 opt, 0.093 opt, 0.015 opt, 0.037 opt, and 0.032 opt gold. The composite 60 ton sample averaged 0.058 opt gold over the 110 foot length of the Privex Pit. Cyanidation tests showed a gold recovery rate of 96% at a grind of 60% -200 mesh with an agitation time of 24 hours (*N.B.*: review of the testing has indicated that errors may have been made in the preparation of the subsample material prior to the final determination of grade; the 0.058 opt result likely represents the background grade of the sample).

The southern end of the Privex Pit (which gave the highest values) was located in the area of the Blackhawk No. 2 (sulphide) vein. The 12.7 ton Blackhawk bulk sample of the No. 2 vein returned 0.58 opt gold compared to the 0.113 opt gold obtained by the similarly located Privex 12 ton sample; however, the Blackhawk sample consisted almost entirely of quartz vein material while the Privex sample was dominantly wall rock with minor quartz. Another interesting comparison in this case is the Blackhawk Winkie drill hole in the No. 2 vein wall rock: the 17 foot long hole averaged 0.10 opt gold, a value very similar to the result obtained by the 12 ton Privex bulk sample of the same material.

In 1975 Auley Mines Limited controlled the Ascot Zone. A report written by J.A. McCuaig (1975) includes interesting arguments for the possibilities of mining the Bellechasse deposit as a low to medium grade open-pit mine. McCuaig also noted the lack of consistent sampling of the old drilling, and the need for a more representative sampling technique.

Rights to the Bellechasse deposit and a large surrounding area were acquired by the current claim holders, Golden Hope Mines Limited, in the early 1980's as part of a large scale regional exploration program in the Bellechasse area.

Golden Hope compiled all the pre-existing information on the property area and did some initial sampling and analyses on the Timmins and Ascot zones in late 1980. In 1980 and 1981, an orientation soil survey specific to arsenic was performed over the Timmins and Ascot zones (Depatie, 1981) to determine whether the deposit and similar potentially mineralized zones on the property would respond to soil sampling. Previous work on the deposit had indicated a strong association between gold and arsenopyrite. The orientation survey was successful, indicating strong arsenic in soil anomalies over both zones. An orientation VLF-EM survey was conducted by Labreque in 1983; results were inconclusive. Labreque also conducted some very minor reconnaissance mapping in Range II and in the area of the Colfax occurrence in 1983.

Large scale work on the Bellechasse Project began in 1985. In the course of property-wide examinations, additional test sampling was conducted on the Timmins Zone (Schaaf, 1986a, p. 20-24). The results of this work showed a relationship between sulphides and gold (*i.e.* high gold values are consistently associated with sulphides). High grade gold values were also found in quartz samples devoid of sulphides. The sampling also indicated that lower grade mineralization (*i.e.* 0.05 opt Au) is found in gabbro with very minor amounts of quartz stringers. Traces of gold (up to 0.006 opt) were also found in massive gabbro containing no quartz or sulphides.

As part of the property-wide work in 1985-86, the Bellechasse deposit was covered by a detailed soil survey specific to gold, arsenic, copper, lead, zinc and mercury. The survey confirmed and expanded the results of the earlier orientation survey, showing a large and strong gold and arsenic

anomaly across the Timmins and Ascot zones. Very strong gold and arsenic anomalies were also detected approximately 1600 feet south of the Timmins Zone. Strong arsenic anomalies with associated gold were also shown to the immediate southwest and northeast of the known deposit area.

Airborne geophysical surveys conducted over the Bellechasse Project in 1984 and 1987 indicated a sudden and complex disturbance of the regular belt stratigraphy in the area of the deposit, apparently due to intense folding and faulting. Geophysical anomalies were likewise associated with the newly defined soil anomalies proximal to the deposit.

Minor preliminary detailed mapping of the main deposit area was conducted in 1986-87. All surface exposure, pits and trenches were cleared by hand, mapped and locally sampled. Lithochemical results confirmed previous work. Abundant visible gold was encountered and a large number of high-grade assay values were obtained.

Eleven reconnaissance drill holes (8701C to 8711C) totaling 8,406 feet were put down in the area surrounding the Timmins and Ascot zones in early 1987 as part of a property-wide program (Burzynski, 1988b). Two of the drill holes intersected the Ascot Zone, and showed local gold values of over 1 g/t in both gabbro and sediments, associated with quartz and sulphides. Five holes were drilled northeast-southwest in the middle of chemin St-Joseph between the Ascot and Timmins zones. The holes intersected gabbro mineralized with quartz-carbonate veining containing pyrite, arsenopyrite, pyrrhotite, sphalerite, galena and locally visible gold. Numerous sections contained gold values, with the best result being 8.65 g/t. Two holes were also drilled southwest of the deposit. For the most part, only traces of gold were encountered in weakly mineralized sediments and thin gabbro sills. However, hole 8711C detected highly anomalous arsenic from 282.1 ft - 305.0 ft and from 343.0 ft - 881.0 ft (including anomalous gold from 624.6 ft - 768.3 ft). This mineralization underlies and explains the soil anomaly southwest of the Timmins Zone. Anomalous arsenic and gold values of this extent are unusual in the sediments hosting the deposit, and there were no visible indications of arsenopyrite or significant sulphide mineralization in these intersections. A mineralized source at depth may be responsible for "leaking" the anomalous arsenic and gold into the overlying units.

Additional orientation work on the deposit in the summer of 1987 included till sampling, humus sampling, several MAG and VLF-EM lines, and a trial survey using a mercury "sniffer" (Walker, 1987a). The purpose of the till orientation survey was to attempt to define the direction of glacial dispersion from the Timmins and Ascot zones, so that till sampling might be used as a method of evaluating the large inventory of property-wide arsenic +/- gold anomalies more cost effectively than drilling or trenching. The till survey was extremely effective, but the glacial dispersion direction was not detected: the entire survey grid, approximately 2400 feet x 1650 feet over the Timmins and Ascot zones, contained an average background gold content of over 1 gm/t in the till concentrates, and visible gold grains were seen in almost all of the 60 till pits (M.J. Schaaf, 1987). The Timmins Zone reported as a strongly anomalous center, with one till sample obtaining over 117 g/t Au. Two additional sample centers, BDP-16 and BDP-46, located 1200 ft. and 1600 ft. southeast of the Timmins Zone, contained more visible gold grains than the Timmins Zone samples, and returned values of approximately 56 g/t and 46 g/t respectively. Most of the till pits were dug to bedrock (where possible), and representative rock samples were collected for analysis. None of the bedrock samples returned significant gold values, though gabbro was observed in the pits in the southern portion of the survey area, notably at the bottom of pits BDP-16 and BDP-16. It was felt at the time that the gold and arsenic anomalies shown in both the soil and till sampling south of the Timmins Zone were likely the result of southeasterly glacial dispersion from it.

Results from the humus sampling and mercury sniffer were of little practical value. Repeat surveys determined the results were unsuitable for use in this area, showing no consistent or conclusive indications of the known mineralized areas. The test geophysical surveys confirmed the use of magnetics as a useful tool to delineate stratigraphy, but the VLF-EM results were inconclusive.

In the summer of 1988, additional detailed mapping was conducted in the area of the Colfax showing and the Bellechasse deposit. For the first time since being stripped by Coderre in the 1960's, a reliable structural map of the complex Colfax showing was produced (Daigle, 1988). Daigle noted shears representing a change from ductile to brittle deformation, traced from zones of ductile deformation to the zone of rupture, dilation and infilling with quartz. The change in competency of rock type preferentially controlled the location of quartz veining. Some veins had been rotated by progressive ductile deformation such that they folded in the shear zone within the stratigraphic package. Identical observations have also been made at the North Zone gold occurrence which exists in a companion environment for Bellechasse-style mineralization on the opposite, northern limb of the St-Victor Synclinorium (Burzynski, 1989a). Sampling of the Colfax quartz-carbonate veins showed pyrite, chalcopyrite and galena, confirming to some extent the mineralization reported by Coderre. New analytical results showed anomalous gold values of approximately 1 g/t.

Concurrently mapping in the area south of the Timmins Zone uncovered additional gabbro outcrops and key stratigraphic marker horizons. Angular gabbro float mineralized with quartz-carbonate veining, galena, pyrite and pyrrhotite was also found in the vicinity of the till pits dug the previous summer. Assays of some of the material sampled returned values of over 0.2 opt Au. The mineralized float was somewhat different in character to the mineralized outcrops in the Timmins Zone, and with the evidence from the soil and till surveys, it was now felt that the float might indicate a new zone.

In early 1989, all historical and recent information was recompiled to produce the first working geology map of the Bellechasse deposit area. On the basis of magnetics, limited surface mapping and structural/stratigraphic revelations from the previous summer, the new interpretation extended the potential size of the deposit to include the new 88 showing located to the south including the areas inbetween the Timmins Zone and the showing. The interpretation also suggested possible extensions of the deposit at depth to the northwest, and for repetitions of the host rock stratigraphy to the northeast and southwest.

In 1990, Golden Hope Mines Limited entered into a joint venture agreement with Ressources Ste-Genevieve Ltée. to further explore the Bellechasse deposit and other claims of the Bellechasse Project. In the first work to be conducted at the deposit since 1988, a backhoe was brought to the area of the 88 showing in the summer of 1990 to dig a short trench across the areas including the soil and till anomalies (BDP-46) where the gold-bearing float had been found. The 88 Zone discovery outcrop was immediately uncovered, having been buried under only five feet of overburden. This outcrop contained abundant coarse visible gold in narrow quartz-carbonate veins with sphalerite, pyrrhotite, galena and pyrite. Initial sampling returned values of over 27 opt Au.

Following the discovery, work was intensified in and around the Bellechasse deposit. A cut and chained grid on 200 foot spacings (50 foot spacings in the immediate area of the deposit) totalling over 100 line-miles was erected. Extensive stripping, trenching and washing operations were conducted over the new discovery and the Timmins Zone (Burzynski, 1991a and LaForest, 1990). Preliminary detailed mapping was conducted in parts of the 88 Zone and Timmins Zone (Figures 6 & 7), initial orientation "character" sampling was done on the new exposures in the 88 Zone and locally in the Timmins Zone, channel sampling took place in the 88 Zone (Bray, 1991), an orientation IP survey was performed in the general area of the deposit (Lavoie, 1991), orientation Pionjar till sampling was carried out over the deposit to compare with the previous orientation survey (Burzynski, 1991j), till studies of the exposed areas were done by government and academic visitors (Laurus, 1991), a production ground magnetics survey was carried out over the Bellechasse grid (Lavoie, 1991), and 12 new drill holes (9101C to 9111C) totalling 4,698.5 feet were put down in the area surrounding the deposit (including seven in the area of the 88 Zone) (Burzynski, 1991n).

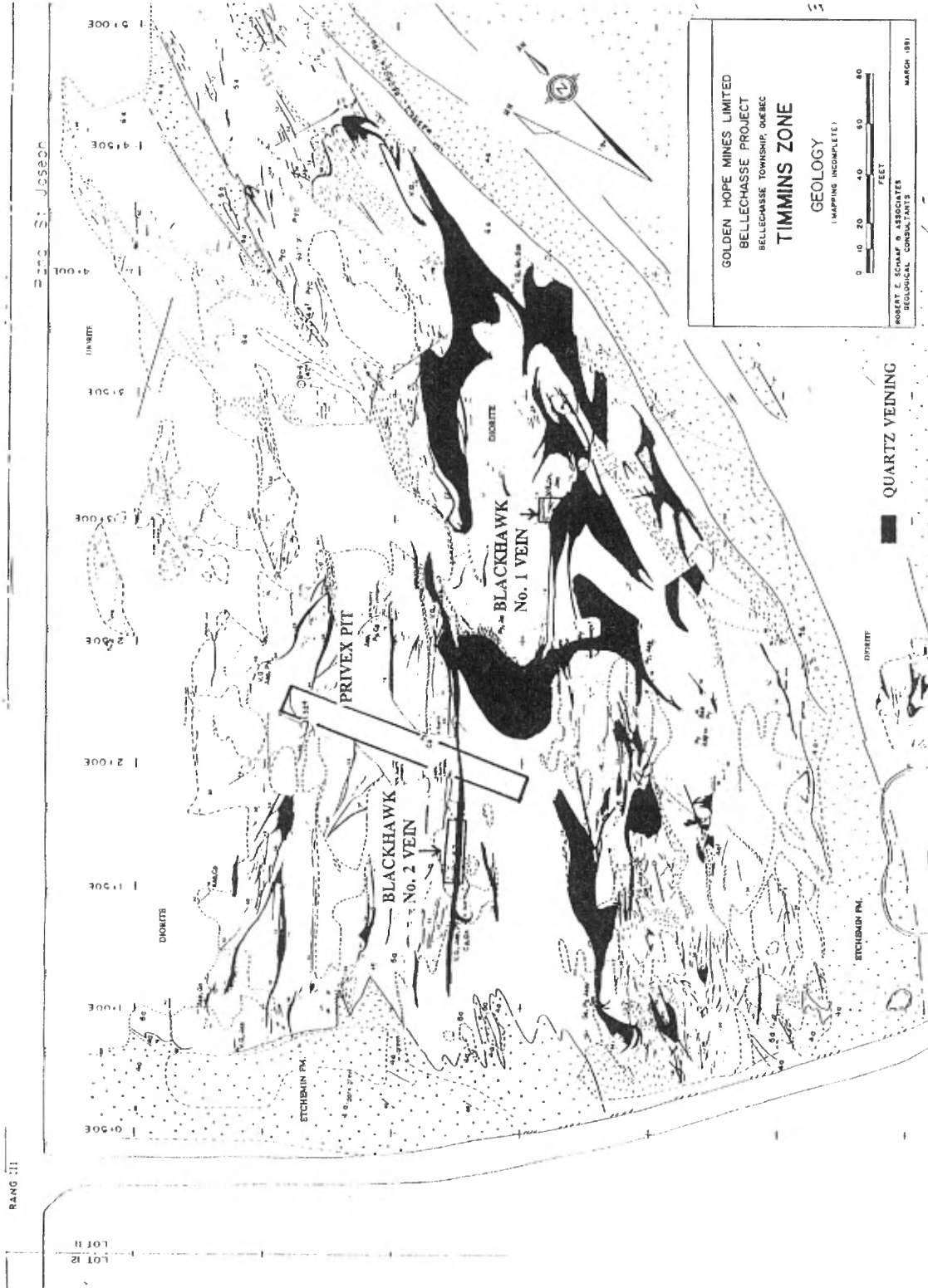


Figure 6. Plan geology of the Timmins Zone.

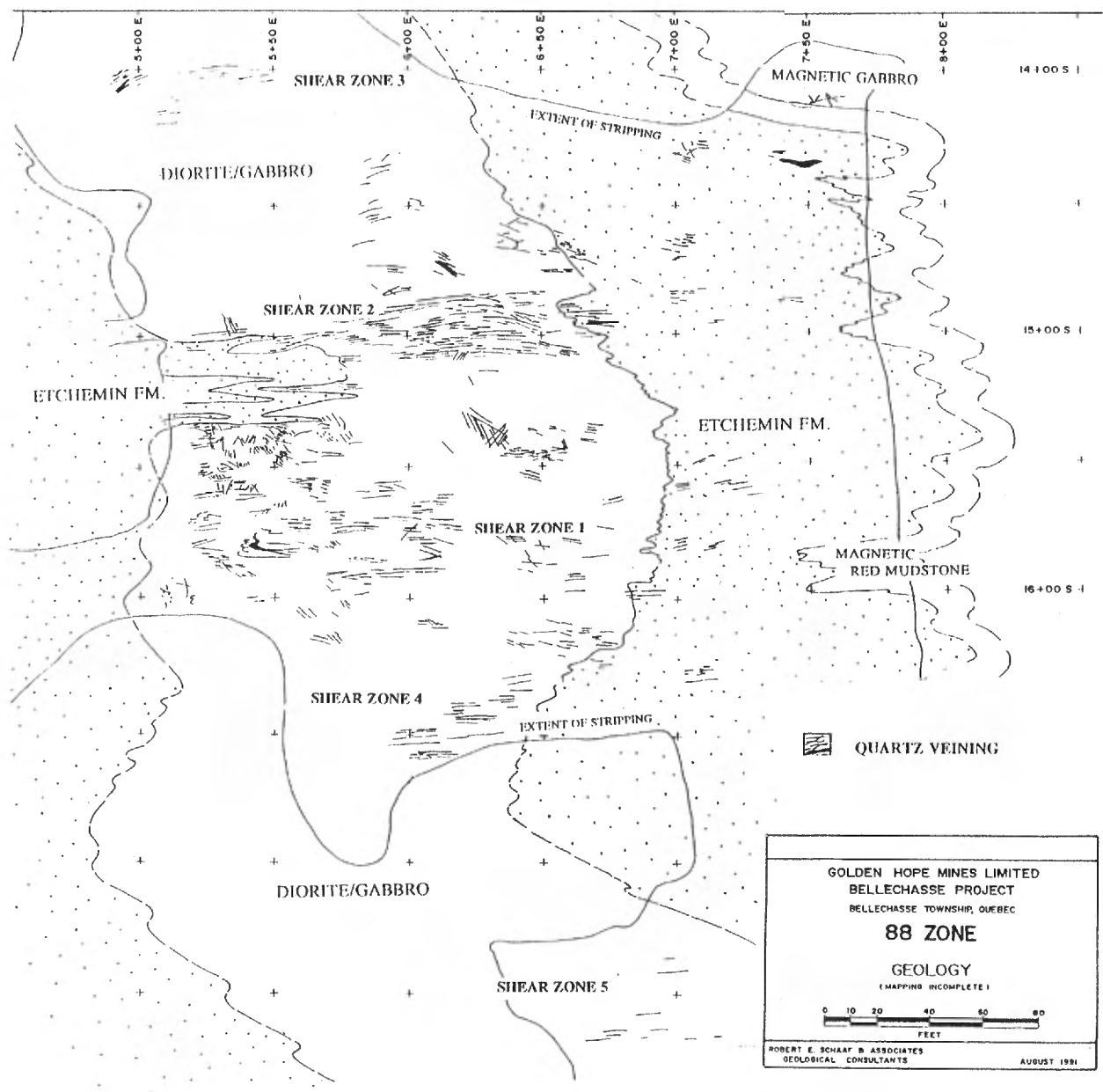


Figure 7. Plan geology of the 88 Zone.

The ground magnetics survey provided higher definition of magnetic stratigraphy, and additionally indicated the possibility of stratigraphic and structural repetitions of the deposit to the southwest. The orientation IP survey outlined the Timmins and 88 zones, and indicated the possible presence of other zones coincident with soil anomalies yet to be investigated. The new till survey confirmed the existing anomalous zones and indicates the possible presence of mineralized zones further south of the 88 Zone. Channel sampling results on the 88 Zone indicated grades approximating 0.05 opt or greater for the areas sampled. Drilling in the vicinity of the 88 Zone indicated there is further potential for continuations of the 88 to the southeast. The drilling also confirmed the dimensions of the central portion of the 88 Zone to be in the order of 200 feet wide and minimally 347 feet deep (one vertical hole to 347 feet was drilled in the middle of the zone. Visible gold was encountered in several places, including at the bottom of the hole. Quartz-carbonate veining with sphalerite, galena, pyrrhotite, pyrite and visible gold was encountered in the holes (two inclined, one vertical) drilled in the center of the stripped area in the 88 Zone.

New results from the current survey are detailed in the following sections.

## GEOLOGY

### Stratigraphy and Lithologies

The Bellechasse deposit area is underlain by the Magog Group. The Magog Group is comprised of a syn- to post-orogenic flysch sequence deposited in a basin that formed between an island-arc complex to the southeast and the continental margin to the northwest. It is subdivided, in stratigraphically ascending order, into the Frontiere, Etchemin, Beauceville and St-Victor formations. The Lower Magog Group, *i.e.* the Frontiere, Etchemin and Beauceville formations, is a fining upward sequence largely derived from the island-arc complex situated to the southeast. The Saint Victor Formation belongs to the Upper Magog Group. It consists of turbiditic sequences of mudstone with interbeds of feldspathic sandstone, lithic sandstone, felsic tuffs and conglomerate. The Saint Victor Formation is interpreted to be largely derived from the northwest *i.e.* from the nappes first obducted onto the continental margin. The Saint Victor Formation is not present in the Bellechasse area due to erosion.

**The Frontiere Formation** consists of turbiditic sequences of volcanoclastic rocks and lithic greywacke with mudstone horizons.

**The Etchemin Formation** is composed of turbiditic sequences of siliceous siltstone, mudstone and shale alternating with units of fine-grained greywacke and volcanoclastic rock. The contact between the Frontiere Formation and the Etchemin Formation is gradational and conformable. The base of the Etchemin Formation (as defined by Cousineau (1990) throughout the Magog Group) is marked by a volcanogenic magnetic green and hematitic red to beige shales and siltstone. These beds act as a mappable marker horizon and are geophysically distinctive.

**The Beauceville Formation** is characterized by graphitic, phyllitic and sulphidic pelagic black shale containing minor chert. Volcanoclastic and tuffaceous horizons occur irregularly in the shale. Slump breccias are commonly observed in the Etchemin-Beauceville contact zone.

**Gabbro and diorite** occur as swarms of largely conformable sills within the Etchemin and Beauceville Formations. Individual sills vary from centimeter scale to over 250 meters in thickness. The sills have a pre-deformational, subvolcanic to locally extrusive, submarine origin. Their emplacement likely predates the deposition of the Saint Victor Formation (upper Magog Group) and may be related to rifting and subsequent magmatism. Syn-sedimentary faulting is indicated by the sudden appearance of intraformational slump breccias at the top of the Etchemin Formation and abundant evidence of hydrothermal activity and the formation of sedimentary exhalative deposits in the lower Beauceville stratigraphy.

### Structure

The folding of the St-Victor Synclinorium reflects the continuing continental convergence following the collision of the Taconic island-arc (Ascot Complex) with the passive continental margin. The Synclinorium plunges shallowly to the southwest and is characterized by tight to isoclinal folds exhibiting axial planar cleavage ( $S_2$ ) developed during the Acadian Orogeny (Cousineau, 1990). Most of the rocks are weakly to moderately foliated; a phyllitic texture characterizes most fine- to medium-grained sedimentary rocks. The cleavage is steeply dipping and trends northeast-southwest. A weak  $S_3$  crenulation cleavage may be related to local linear trends of intense shearing which developed sub-parallel to the regional tectonic fabric during progressive deformation. Numerous doubly plunging antiformal-synformal  $F_2$  structures present throughout the area may also be related to shearing during progressive deformation.

Evidence suggests that the diorite sills were initially intruded into the Magog Group during

Middle Ordovician time prior to the lithification of the sediments (Figure 8). Local explosive contacts and vesicular tops on some of the sills indicate they were intruded at shallow depths under low confining pressures, likely while the sediments were still unconsolidated. They do not intrude the Saint Victor Formation and the presence of possible extrusive equivalents in lower comparable stratigraphy outcropping in the Memphremagog region to the southwest argues that they were emplaced prior to the deposition of the Saint Victor Formation. The intrusives followed bedding planes or formational contacts, such as the Frontiere-Etchemin contact for great distances. Multiple injections and step-ups into higher stratigraphy created a series of stacked sills with local diking or non-conformable relationships in the host sediments.

With compression, the Magog Group sediments and sills were tightly folded, with maximum deformation possibly being focused at formational or lithological contacts or in areas of pre-existing hydrothermal alteration. The sediments deformed more or less plastically, while the sills, being more competent and locally strongly altered, deformed in a brittle-ductile to brittle fashion.

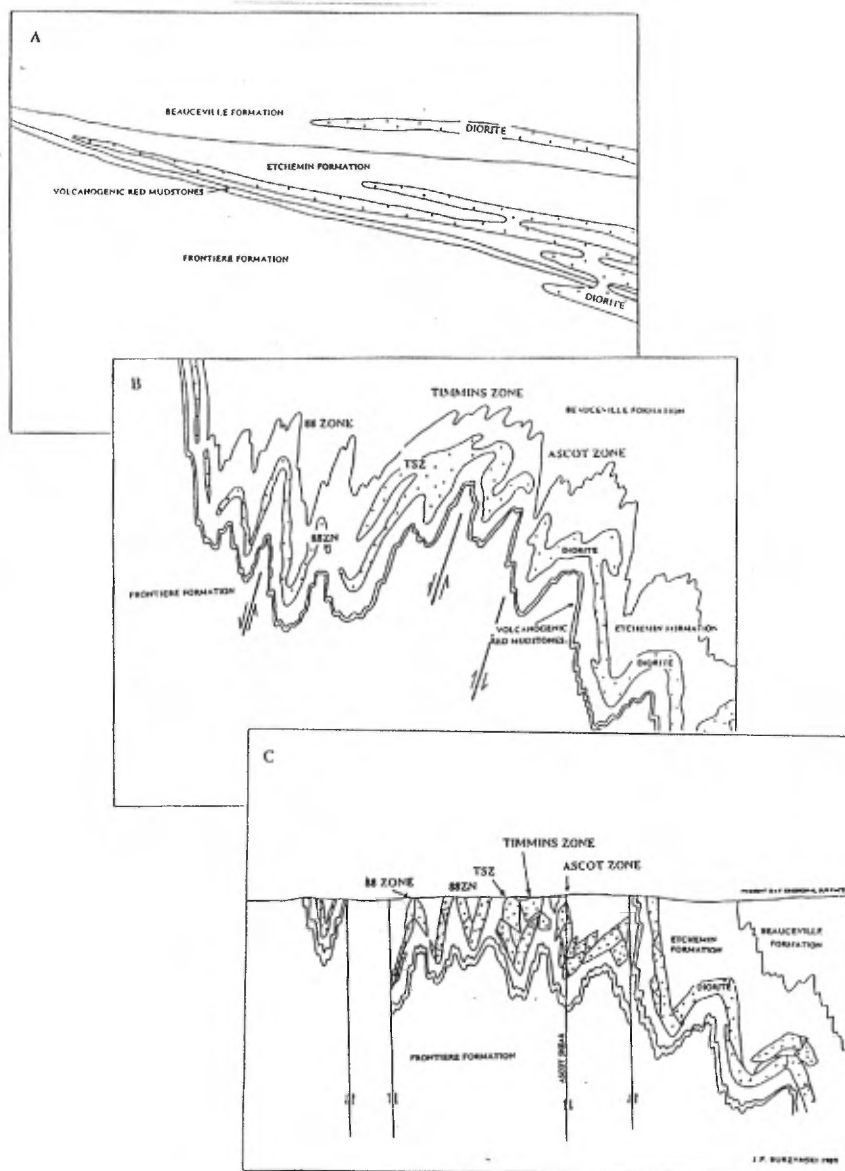


Figure 8. Structural evolution of the Bellechasse deposit.

## **The Bellechasse Deposit Area**

Map 4 is based on detailed mapping conducted in the Bellechasse deposit area in 1993 and a compilation of available pre-existing data. Extensive stripping and trenching has provided excellent exposure in the Timmins and 88 zones and a comprehensive view of the deposit's surface geology is now available. However large portions of the map area show little to no outcrop. In these areas the geological interpretation is based on other available data; in particular ground magnetics, IP and the distribution of boulders and subcrop at surface (see Map 3). The lean iron formations and some of the gabbros are magnetic, providing geophysical marker horizons. In addition IP and VLF anomalies are interpreted to represent fault zones and either cross-cut the general stratigraphy or run parallel to the tectonic fabric (northeast-southwest). Boulders (identified on Map 3) generally reflect nearby outcrops.

The Bellechasse gold deposit occurs on the southern limb of the Saint Victor Synclinorium just to the north of a major thrust fault, the Guadeloupe Fault. The gold mineralization consists largely of coarse native gold associated with quartz stockwork veining hosted by gabbro and diorite sills located at the base of the Etchemin Formation. The deposit is composed of four principal centers of gold mineralization (Map 4): the Ascot Zone, the Timmins Zone, the Timmins Zone South, and the 88 Zone.

### **The Frontiere Formation**

The Frontiere Formation is composed of green to grey coloured medium to coarse grained lithic greywackes with white feldspar and quartz grains and a chloritic matrix (locally the matrix is sericitic). Bedding thicknesses are decimetric to metric and are locally observed to be interbedded with mudstone horizons. Calcareous concretions are common and there are very few sedimentary structures. At the 88 zone and to its south a mafic sill intrudes Etchemin sediments located just below the redbed horizon and it is observed to cross into the upper Frontiere Formation at several localities near to the 88 zone. This suggests that the mafic sills at the 88 zone were emplaced lower in the stratigraphy prior to folding and shearing.

### **The Etchemin Formation**

The Etchemin Formation is represented by volcanoclastic sandstones, siliceous siltstones, mudstones and "nodular" siltstones (a structural feature where thin carbonate or cherty interbeds have been transposed by folding). Generally the rocks tend to be greenish in colour. Strong silicification (+/-albitization?) often occurs near the contacts of the diorites bleaching them. Volcanoclastic sandstones are medium-grained and are composed of feldspathic and volcanic fragments generally without quartz grains. In the deposit area the Etchemin sediments often show a characteristic manganese stained deep weathering surface, and locally these units are preferentially silicified. The siltstone and mudstone locally host thin millimetre to centimetre wide bleached white seams containing traces of pyrrhotite in the center, perhaps linked to the overall mechanisms involved in the formation of the deposit (they have also been noted in the vicinity of several other Bellechasse-type occurrences). Bedding features are well preserved in the finer-grained units, and much of the useful structural information has been obtained from observation of their bedding/cleavage relationships.

### **The Beauceville Formation (?)**

A strip of Beauceville-like sediments skirts the northern edge of the Timmins Zone, extending approximately 2,200 feet to the southwest and approximately 3,000 feet to the northeast of the deposit. Several outcrops are visible along chemin St-Joseph (between the Timmins and Ascot zones), but the Beauceville Formation proximal to the deposit is mainly known from drilling. It is also reflected in ground and airborne geophysics as a narrow electromagnetic band of short strike length. The Beauceville

sediments are composed of fine-grained and discretely laminated black shale with silicic Etchemin (?) carbonate interbeds. These sediments may represent the transition zone between the Beauceville and Etchemin formations. The beds are all of sub-centimetre scale and locally contain trace to one percent euhedral to anhedral masses of pyrite. Small quartz-carbonate stringers have been strongly transposed and locally occur as cleavage parallel milky white lenses. The possible Beauceville-Etchemin contact zone appears to be conformable, however drill sections in this area show faulting and shearing trending northeast-southwest at the contacts. The mafic sills in this zone may have been emplaced higher in the stratigraphy than in the 88 zone, prior to folding and shearing.

### **The Mafic Igneous Complex**

The primary host for mineralization at the deposit, the Mafic Igneous Complex, is predominantly dioritic, and varies compositionally from diorite, albite diorite, quartz diorite, to gabbro. The mafic rock appears to differ from one mineralized zone to the next (from quartz diorite to albite diorite to diorite/gabbro moving from northwest to southeast). Mapping indicates that the deposit is located in more than one major sill and at different stratigraphic horizons. The intrusives have the following general petrographic composition, based on observations made by Camire (1986), Lewczuk (1987), and Lacoste (1987):

**Major constituents:** albitized, saussuritized, twinned plagioclase (up to 50%), Fe-chlorite

**Accessory minerals:** uralite after mafic minerals, pyroxene, hornblende, stilpnomelane, leucoxene, tremolite-actinolite, epidote-zoisite, sericite, white mica, calcite, ankerite, quartz, alkali feldspar, sphene, micro-ilmenite, magnetite, titano-ilmenite, apatite, zircon

**Trace minerals:** pyrrhotite, pyrite, native silver, native tin (cassiterite ?)

Weakly deformed areas may be fine- to coarse-grained (average grain size 1.5 mm) and fairly massive. Ferromagnesian minerals inter-penetrate the feldspars showing an ophitic texture. Plagioclase is regularly twinned (up to 30%) and slightly altered, sometimes showing myrmekitic texture. Fine dusty inclusions of epidote occur in the plagioclase. Sixty-five to 70% of the ferromagnesian minerals are composed of amphibole (tremolite-actinolite) which is partially chloritized. Chloritized hornblende can account for up to 15% of the rock, and trace amounts of opaques (pyrrhotite and pyrite) occur interstitially and within the mafic minerals. Anhedral pyrrhotite and less frequent cubic (sub-mm) pyrite is ubiquitous, disseminated predominantly in chlorite and calcite.

Strongly deformed zones in the intrusive regularly display intense ferro-carbonate alteration and contain 35-40% amphibole, up to 5% altered pyroxene, and minor epidote. The rock contains abundant euhedral apatite intergrown with chlorite; Lewczuk (1987) believes that this could have formed during an autometamorphic (deuteric) stage of crystallization of the rock. The rocks also locally contain granophyric intergrowths of quartz/feldspar (albitization), high modal contents (5%) of Fe-Ti (Mn) oxides, and native silver and cassiterite dispersed in the carbonate altered areas, mainly associated with microveinlets. Silver and tin also occur in the Beauceville Formation associated with the syn-sedimentary massive sulphide mineralization, and their presence in the Bellechasse deposit may show that the two types of deposits have a related source.

In the 88 Zone, the sill ranges from gabbroic to dioritic in composition. It varies from very fine- to coarse-grained, with individual mafic minerals approaching five millimeters in length. Ferromagnesian minerals are the primary constituents, composing on average over 50% of the rock. The second major constituent is normally chlorite, in some cases accounting for more than 30% groundmass. The feldspar is albite, locally constituting up to 30% of the rock mass. The plagioclase in diorite would normally be oligoclase, so the albite indicates the sills have undergone alteration or metamorphism, or

both. Carbonate (as calcite and ankerite) may occupy 5-8% of the matrix, and hornblende occurs in traces to usually less than 5%. Pyrrhotite (locally but erratically magnetic) is generally present in quantities from trace to 3%.

In the Timmins Zone, the intrusive has a widely varying character, largely reflecting its complex alteration and structural history. Generally it is an albite diorite to diorite and is composed predominantly of pyroxene and chlorite, with secondary hornblende, pyrrhotite, and abundant carbonate and ankerite. Locally it is a quartz-diorite containing 5-8% quartz in its matrix. The sill has been strongly altered near some of the major shears and locally it contains greater than 75% chlorite and/or carbonates.

In the Ascot Zone, the intrusive is very strongly deformed and altered, and is compositionally an albite diorite to quartz diorite to diorite. Albite, quartz, and chlorite can respectively account for up to 60%, 8%, and 10% of the rock.

### **Alteration**

The Magog Group rocks and those at the Bellechasse deposit have been subjected to lower greenschist facies regional metamorphism. Chloritization, saussuritization and epidotization are the most common manifestations. Sericite is occasionally seen, most often in conjunction with shears and fault zones.

In the Bellechasse deposit area, intensity of metasomatic alteration varies and is marked by increasing degrees of chloritization, carbonatization (calcite and ankerite), silicification/albitization, propylitization, and sericitization (Camire, 1986), and is probably related to hydrothermal activity during the mineralizing event. Alteration likely initiated with bleaching (introduction of silica and/or albitization), followed by sericite-chlorite development and subsequent quartz-sulphide-gold-ankerite mineralization. Close to mineralized zones, the sericite overprints bleaching (silica and albite), which in turn is overprinted by quartz-sulphide-gold. Sericite occurs on an occasional basis in the major stockwork zones, and is generally associated with high-grade gold values. Camire (1986) shows that the carbonate was a relatively late-stage alteration, cross-cutting the mineralization and post-dating the gold emplacement. Metasomatic alteration preceded the structural deformation and regional metamorphism. There are proximal and distal envelopes around the deposit, consisting of chlorite/carbonate alteration (decreasing in intensity away from the mineralized center), and veins and veinlets have a pervasive to selective replacement style moving away from the deposit center (*i.e.* vein intensity decreases as alteration diminishes outwards from the Timmins Zone).

The sediments generally display weak to moderate chloritization, with epidotization being fairly rare and restricted in scope. Pervasive silicification and carbonate alteration are more common in the Etchemin Formation than in either the Frontiere or Beauceville formations, and is a likely result of hydrothermal activity in mid-Ordovician time. In the immediate deposit area a strong chloritic alteration halo is observed as flattened and irregularly mottled chloritic patches unevenly distributed in the Etchemin Formation sediments. The main mineralized structures have intensely bleached margins, a possible result of albitization.

Oxidation products include hematite, goethite, leucoxene, and a late ferruginous alteration along fractures (Camire, 1986).

## Mineralization

Mineralization at the Bellechasse deposit is predominantly stockwork in nature (Figures 6 and 7). Gold-bearing veins range from millimetre scale stringers to major veins over eight metres wide. Some important disseminated sulphide mineralization occurs in zones of intense alteration and shearing.

The mineralization was superimposed on early barren hydrothermal alteration (bleaching, sericite-chlorite veinlets and early carbonate alteration). Petrographic work by Camire (1986) shows that following the initial quartz-sulphide-gold emplacement, a second phase of carbonate veining cut the quartz veining and sulphide-gold mineralization.

The overall sulphide content in the deposit averages 2-3%, the sulphides are found in both the veins and disseminated throughout the host diorite. Gold is principally associated with the veining, and also with all forms of sulphides in the deposit. Within sulphidic material, gold shows a preferential association with arsenopyrite, galena and sphalerite. Pockets of massive arsenopyrite have been found in the Timmins and 88 zones which contained percentages visible gold interspersed with the sulphide. Visible gold has more rarely been observed intergrown with pyrite cubes and masses of pyrrhotite, galena, and sphalerite.

The sulphide assemblage is identical in the principal zones, but comparative abundances of the relative sulphides differs slightly:

<b>Timmins Zone</b>	<b>Py &gt; Po &gt; Asp &gt; Sph ≥ Gn &gt; Cp</b>
<b>88 Zone</b>	<b>Po &gt; Py &gt; Asp &gt; Sph &gt; Gn &gt; Cp</b>
<b>Ascot Zone</b>	<b>Py &gt; &gt; Asp &gt; Po &gt; Sph &gt; Gn</b>

High-grade mineralization in the form of disseminated fine- to locally very coarse-grained native gold is regularly found in quartz in the absence of sulphides. Also, when sericite is present, visible gold is almost always noted.

Visible gold has also been noted in the massive diorite and in a number of areas high gold values may occur in them. These occurrences are likely related to mineralized chlorite or quartz-filled microfractures, and some such zones in the deposit are observed to be well mineralized with very discrete sub-millimetre scale chlorite and quartz-sulphide stockwork stringers.

The Etchemin Formation sediments, and quartz veining in the sedimentary rocks surrounding the Bellechasse deposit generally do not carry gold mineralization, although several important exceptions exist.

## TRENCHING AND SAMPLING RESULTS

Twelve trenches were dug to explore untested soil and till geochemical anomalies, geophysical anomalies, and to test the geological model.

Trenches 93137, 93138, 93139, 93140 and 93158 were put down over strong gold in soil anomalies and a magnetic anomaly west of the 88 Zone. The juxtaposition of these anomalies strongly suggested that the 88 Zone gabbro may extend into this area. However, no gabbro was uncovered.

Trenches 93141 and 93142 were put down over small gabbro outcrops, one of which had previously returned low gold values. The trenching in this area (trench 93141 and 93142) has uncovered the extension of the 88 Zone to the north (the "Zone à Corps Mort"). Visible gold, galena and sphalerite and some encouraging gold results were obtained in the Zone à Corps Mort (see table below). Trench 93143 shows that the 88 Zone gabbro does not connect with the Timmins Zone to the north, but rather that the 88 Zone gabbro continues northeastward to the Zone à Corps Mort (88 Zone Extension).

A series of trenches were put down on line 8+00E to the north of station 20+00S. They tested favourable magnetic anomalies and pionjar till gold anomalies. Two new gabbro horizons were unearthed. Trench 93145 uncovered altered and locally sheared, sulphidic gabbro.

### TRENCH CW-93141

#### Zone à Corps Mort

Sample Number	Au OPT Assay Ton	Au PPM Metallic Stere	As PPM
CW-93141-1	<0.001	-	-
CW-93141-2	<0.001	-	-
CW-93141-2B	0.002	0.38	-
CW-93141-3	0.094	2.79	-
CW-93141-3B	0.019	0.09	-
CW-93141-4	<0.001	-	-
CW-93141-5	0.002	0.22	-
CW-93141-6	0.004	0.18	-
CW-93141-7	<0.001	-	-
CW-93141-8	<0.001	-	-
CW-93141-8B	0.005	0.12	-
CW-93141-9	<0.001	-	-
CW-93141-10	0.003	0.07	-
CW-93141-11	<0.001	-	-
CW-93141-11B	0.005	0.42	-
CW-93141-12	0.003	0.07	-
CW-93141-13	<0.001	-	-
BB-93004-1	0.054	0.91	-
BB-93004-2	0.001	0.06	-

**TRENCH CW-93142**

Sample Number	Au OPT Assay Ton	Au PPM Metallic Sieve	As PPM
CW-93142-1	<0.001	-	-
CW-93142-2	<0.001	-	-
CW-93142-3	<0.001	-	-
CW-93142-4	<0.001	-	-
CW-93142-5	<0.001	-	-

**TRENCH CW-93143**

Sample Number	Au OPT Assay Ton	Au PPM Metallic Sieve	As PPM
CW-93143-1	<0.001	-	-
CW-93143-2	<0.001	-	-
CW-93143-3	<0.001	-	-
CW-93143-4	<0.001	-	-
CW-93143-5	0.002	0.06	-
CW-93143-6	0.010	0.44	-
CW-93143-7	<0.001	-	-
CW-93143-8	<0.001	-	-
CW-93143-8B	<0.001	-	-
CW-93143-9	<0.001	-	-
CW-93143-10	<0.001	-	-
CW-93143-11	<0.001	-	-

**TRENCH CW-93145**

Sample Number	Au OPT Assay Ton	Au PPM Metallic Sieve	As PPM
CW-93145-2	0.001	<0.03	-
CW-93145-3	0.001	<0.03	-
CW-93145-4	0.001	<0.03	-
CW-93145-5	<0.001	-	-
CW-93145-6	<0.001	-	16.0
CW-93145-7	0.001	<0.03	23.0
CW-93145-8	<0.001	-	9.0
CW-93145-9	0.001	<0.03	-
CW-93145-10	0.002	<0.03	22.0
CW-93145-11	<0.001	-	<1.0
CW-93145-12	<0.001	-	8.3

**TRENCH CW-93146**

Sample Number	Au OPT Assay Ton	Au PPM Metallic Sieve	As PPM
CW-93146-1	<0.001	-	2.9

**TRENCH CW-93147**

<b>Sample Number</b>	<b>Au OPT Assay Ton</b>	<b>Au PPM Metallic Sieve</b>	<b>As PPM</b>
CW-93147-1	<0.001	-	2.8
CW-93147-2	<0.001	-	3.0
CW-93147-3	<0.001	-	-
CW-93147-4	<0.001	-	-
CW-93147-5	<0.001	-	-
CW-93147-6	<0.001	-	-
CW-93147-7	<0.001	-	-



## CONCLUSIONS AND RECOMMENDATIONS

New geological mapping and trenching has been conducted on the northeast half of the Bellechasse grid, the area immediately surrounding the Bellechasse deposit. The mapping and trenching has confirmed that the mafic sills, the host rock of the deposit, are repeated by folding and faulting. This discovery has significant implications, in that if these new areas of confirmed and interpreted mafic host (between L24+00W to L69+00E, between 18+00S to 30+00S) are found to contain tenors similar to the previously discovered zones, the overall size of the Bellechasse deposit may be very substantially increased. Gold in soil, and gold in till (in a limited number of test lines) have been shown in this area by previous surveys.

The overall results of the trenching have confirmed and elucidated the geological model, testing only some of the existing geochemical and geophysical anomalies proximal to the gold deposit. Several promising anomalies have not seen any historical trenching or drilling and remain to be investigated, as follows:

**L56+00E/18+00S:** favorable stratigraphy with gabbro and quartz float, underlying IP anomaly and nearby gold in soils anomalies

**L30+00E/3+00N:** historical reports of gold float (Bergmann, 1953) lying on the northeast extension of a main shear passing south of the Timmins Zone, near a magnetic anomaly interpreted to represent underlying gabbro and arsenic in soils anomalies

**L44+00E/3+00N:** historical reports of gold float (Bergmann, 1953) lying on the northeast extension of a main shear passing south of the Timmins Zone, near a magnetic anomaly interpreted to represent underlying gabbro and arsenic in soils anomalies

**L62+00E/3+00N:** historical reports of gold float (Bergmann, 1953) lying on the northeast extension of a main shear passing south of the Timmins Zone, near a magnetic anomaly interpreted to represent underlying gabbro

**L22+00E to L48+00E, between 0+00 to 11+00S:** a large area of gabbro interpreted on the basis of magnetics anomalies and extensive gabbro boulder fields, locally in conjunction with gold in soil and gold in till anomalies

**L72+00E/20+00S:** combined arsenic and gold in soil anomalies in conjunction with gabbro float containing 2 to 3% pyrite, in an area of favorable stratigraphy with high potential to contain the mafic host.

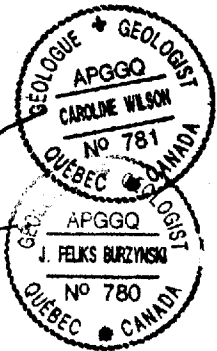
The Bellechasse deposit appears to be an economically viable mining prospect when evaluated from a bulk-minable, large tonnage-low grade open-pit perspective. Large tonnages of variably mineralized diorite, with erratic grades ranging up to multiple-ounces per ton are indicated by historical and recent exploration work. Although a definitive grade has not yet been determined for the mineralization, economic modeling indicates that at very low grades, a viable deposit can be defined if a sufficiently large tonnage is outlined (Burzynski, 1993). Further work is necessary to determine the outer limits of the currently known mineralized zones (*i.e.* through completion of exploring the anomaly inventory mentioned above), with a view to delineating the full extent of the mineralized system. Tonnage is the key factor for determining the deposit economics. While high-grades are a standardly perceived necessity for economically mining any small gold deposit, this is not the case when very large tonnage open-pit scenarios are considered, such as exists at the Bellechasse deposit. An economically viable open-pit mine could be defined at overall grades of less than one gram per tonne - very low grades - if a sufficiently large body of mineralization, in the order of 30 to 50 million tonnes, can be defined.

Precedents in the Appalachians exist for the scale of mineralization considered to be hosted by the Bellechasse deposit: two currently profitable open-pit gold mines, Hope Brook in Newfoundland (11.2 M t @ 4.65 g/t Gauthier *et al.*, 1989) and Ridgeway in Carolina (approximately 55 M t @ 1.25 g/t, Gauthier *et al.*, 1989; *The Northern Miner*, Feb. 14, 1994) serve as excellent examples within the range of parameters considered likely to exist at Bellechasse.


The next stage of work should be focused on completion of the evaluation of the anomaly inventory, in conjunction with establishing the grade and tonnage of the currently known mineralized areas within the deposit. Systematic drilling and bulk sampling (*i.e.* in the Timmins, Timmins South, 88 and Ascot zones) should be conducted to determine if a sufficiently large reserve currently exists.

Respectfully submitted,

  
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Ste-Justine, Québec  
February 21, 1994

  
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## **SECTION SIX: HISTORICAL ASSESSMENT WORK RELATING DIRECTLY TO THE PROPERTY AREA COVERED BY THIS REPORT**

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## **APPENDIX A: SAMPLE DESCRIPTIONS**

### **CW-93141-1**

Deformed quartz vein with chlorite pockets in altered gabbro. Seventy-five percent milky quartz vein 4-10 cm thick with minor white feldspar. Fifteen percent dark green chlorite pockets, 10% bleached medium grained gabbro composed of 1 mm sized equant feldspar grains in a fine grained chloritic matrix.

### **CW-93141-2**

Altered gabbro with quartz veining in shear zone; 65% massive medium grained gabbro composed of approx. 1% acicular to lath shaped feldspar grains in a chloritic to iron carbonated groundmass. Chlorite micro-veinlets cross-cutting the gabbro; 35% milky quartz veinlets from 2 mm to 4 cm thick. Fibrous open-space filling with pockets of iron carbonate and chlorite. 2-4% pyrite in the veins and disseminated in proximity to the veins. Moderate to strong FeOx alteration throughout.

### **CW-93141-2b**

Altered gabbro with quartz-feldspar veining; 70% massive medium to fine grained gabbro composed of equant to acicular sericitized feldspars in a chloritic to iron carbonate groundmass. Feldspar microveinlets. 30% milky quartz, feldspar, chlorite, iron carbonate veins from 1 cm to 4 cm thick. Fibrous texture. 1% pyrite, moderate FeOx alteration throughout.

### **CW-93141-3**

Quartz-sulphide-gold veins with altered gabbro. 55% waxy milky quartz veins from 1 cm to 5 cm thick with minor chlorite pockets and 5-7% pyrite and sphalerite and four sights of **visible gold**. 45% altered gabbro, heavily altered and sheared proximal to the veins, consisting of bleaching due to silicification, feldspar enrichment, sericitization and pyritization. Minor iron carbonate at vein contacts. Moderate FeOx alteration associated with veins and coating fracture planes.

### **CW-93141-3b**

Milky quartz vein, 98% milky quartz vein up to 10 cm thick. 2% chlorite and trace pyrite and sphalerite. Moderate FeOx on some fracture planes.

### **CW-93141-4**

Milky quartz-feldspar vein in altered gabbro. 60% milky quartz vein with white opaque feldspar pockets. Feldspar enrichment at contacts and in wallrock. Trace pyrite and FeOx patches, 40% diorite - highly feldspathic with feldspar veining especially at quartz vein contacts. High feldspar content seems to be a result of alteration.

### **CW-93141-5**

Milky quartz vein in bleached diorite (similar to 93141-4). 70% milky quartz vein up to 6 cm thick. 30% diorite with irregular quartz pockets and some chlorite veinlets often parallel to the foliation. less than 1% disseminated pyrite in diorite. Weak FeOx on fracture planes.

### **CW-93141-6**

Sulphidic gabbro and quartz veins. 85% heavily altered gabbro with chlorite veinlets, disseminated masses of pyrite +/- arsenopyrite. Gabbro is dioritized, in proximity to the quartz veins. 15% milky quartz veins or silicified seams up to 4 cm wide with 1-2% pyrite +/- arsenopyrite in pockets with chlorite. Patchy strong FeOx alteration.

### **CW-93141-7**

Altered gabbro with quartz veins. 80% sheared, partially dioritized gabbro with chlorite and sericite on cleavage planes. 20% quartz veins less than 1 cm thick with some chlorite pockets. 1-2% pyrite as irregular masses in quartz veins and in cleavage planes associated with quartz. Heavy FeOx alteration associated with quartz veins.

**CW-93141-8**

Altered gabbro with quartz veins. 65% sheared gabbro with a strong chloritic foliation. Vein contacts are dioritized with 1-2% disseminated pyrite. 35% milky quartz veins less than 2 cm thick with 1-2% pyrite within and at vein contacts. Minor chlorite veinlets affected by deformation. Patchy heavy FeOx altn.

**CW-93141-8b**

Altered gabbro and quartz veins. 65% sheared gabbro with chlorite +/- sericite in cleavage planes. Some iron carbonate in groundmass. less than 1% pyrite disseminated near quartz or chlorite pockets. 35% irregular quartz and chlorite veins, <3 cm thick. Some strong FeOx patches.

**CW-93141-9**

Deformed milky quartz vein with minor silicified chlorite pockets and chlorite in fractures. Granular texture. No sulphides observed.

**CW-93141-10**

Sheared altered gabbro with quartz veins. 70% strongly foliated medium grained gabbro with sericite and chlorite in cleavage planes and strong iron carbonitization of the feldspars. Trace disseminated pyrite, 30% quartz veins <2 cm thick with iron carbonate at selvages and a 1 cm border of strongly carbonatized gabbro. Moderate FeOx alteration of iron carbonate.

**CW-93141-11**

Strongly altered gabbro with fine chloritic stockwork veining. Dioritized medium grained gabbro with quartz patches and silicification (quartz-diorite?). 15-20% chlorite stockwork veining. Weak FeOx staining on fracture planes. Trace sulphides.

**CW-141-11b**

Sheared altered gabbro with quartz-iron carbonate veins. 95% strongly foliated gabbro with sericite in cleavage planes and iron-carbonate and quartz replacing feldspars pervasively. 5% fine-grained pyrite concentrated in the cleavage planes. 5% quartz-iron carbonate vein <1 cm thick cross-cutting cleavage. Iron carbonate at selvages. Weak to moderate FeOx due to iron carbonate and pyrite alteration.

**CW-93141-12**

Altered gabbro and quartz veins. 70% massive medium grained gabbro to quartz diorite in proximity to veins. 2-3% pyrite disseminated throughout. Patchy chloritic groundmass. Criss-crossed by quartz and/or chlorite veinlets. 30% milky quartz veins <4 cm thick with pockets of chlorite. Spots of strong FeOx alteration of pyrite.

**CW-93141-13**

Folded layers of quartz vein and Etchemin sedimentary rocks. 65% deformed milky quartz veins <2 cm thick inter-layered with chloritic fine-grained Etchemin sediments <0.5 cm thick. 3-5% cubic pyrite disseminated throughout the sedimentary rock. Patchy strong FeOx alteration on cleavage planes and fracture surfaces.

**CW-93142-1**

Sheared altered gabbro. 100% fine to medium grained, medium grey gabbro with strong foliation. Pervasive iron-carbonatization and silicification, weakly sericitized. 3-5% fine grained pyrite disseminated throughout associated with quartz patches. Discontinuous quartz veinlets cross-cutting cleavage. Patches of FeOx alteration of pyrite and weak FeOx of iron carbonate.

**CW-93142-2**

Medium grained massive gabbro with minor quartz-chlorite veining. 1 mm equant feldspar grains in a dominant chloritic groundmass. 5-10% quartz-chlorite fibrous veins <1 cm thick. Strong FeOx and

manganese staining on fracture planes. 2-3% disseminated pyrite.

**CW-93142-3**

Milky quartz vein. Minor chlorite in fractures.

**CW-93142-4**

Altered gabbro with quartz veining. 65% irregular quartz-chlorite-feldspar veins <2 cm thick. 35% medium grained diorite. Minor patches of FeOx (represent sulphides <1%).

**CW-93142-5**

Gabbro with quartz-chlorite veins. 60% quartz-chlorite veins with minor white feldspar less than 2 cm thick. 40% medium grained massive gabbro. <1% sulphides associated with quartz veins. Weak FeOx on fracture planes.

**CW-93143-1**

Sheared altered gabbro. Medium grained with strong foliation. Chlorite and quartz in cleavage plane flattened feldspars deeply weathered. Strong manganese staining on cleavage and fracture planes.

**CW-93143-2**

Etchemin sedimentary rock and quartz veins. 60% irregular boudinaged quartz veins < 2 cm thick parallel to cleavage plane. 40% fine grained pale to medium grained siltstone with thin chloritic lamination. Moderate to strong FeOx and manganese staining in cleavage and fracture planes.

**CW-93143-3**

Quartz veins in sheared gabbro. 55% irregular boudinaged quartz +/- iron carbonate veins parallel and sub-parallel cross-cutting cleavage plane. Veins < 2 cm thick. 1-2% pyrite at vein selvages associated with chlorite. **Fine grained visible gold in quartz vein.** 45% strongly foliated medium-grained silicified gabbro. < 1% very fine grained pyrite disseminated throughout. Patchy FeOx alteration.

**CW-93143-4**

Sheared altered gabbro. 90% medium grained gabbro with anastomosing cleavage planes rich in chlorite and FeOx alteration. Pervasive silicification prior or syn-deformational. 1-2% pyrite disseminated throughout.

**CW-93143-5**

Altered gabbro with quartz-chlorite veining. 70% medium grained gabbro. Pervasive silicification. 3-% quartz-chlorite veins and veinlets <1 cm thick with patches of oxidized sulphides (1-2%). Several generations of veins.

**CW-93143-6**

Chlorite-quartz vein with minor altered gabbro. 50% massive fine-grained dark green chlorite with pockets of milky to transparent quartz (30%) and 20% strongly foliated medium grained gabbro. 1-2% oxidized pyrite at quartz-chlorite selvages. Moderate patchy FeOx alteration.

**CW-93143-7**

Quartz vein. 95% milky quartz vein up to 8 cm thick. Minor chlorite in fractures. Trace sulphides. 5% altered sheared gabbro. Minor patches of FeOx alteration.

**CW-93143--8**

Altered Etchemin sediment and quartz veins. 65% fine-grained, silicified, foliated siltstone criss-crossed by 35% quartz veins and veinlets <1 cm thick. Deeply weathered. Heavy manganese staining particularly on fracture and cleavage planes.

**CW-93143-8b**

Altered gabbro and quartz veins. 65A% irregular quartz, quartz-chlorite veins criss-crossing each other and the host rock foliation. Veins <2 cm thick. Trace oxidized sulphides. 35% strongly foliated and silicified medium grained gabbro. Minor FeOx staining.

**CW-93143-9**

Quartz vein. 100% fractured milky quartz vein about 6 cm thick. Trace pyrite at vein contacts.

**CW-93143-10**

Altered gabbro and quartz-chlorite veins. 65% sheared or massive chloritized and/or bleached medium grained gabbro. 35% quartz-chlorite veins and cross-cutting chlorite veinlets. Veins less than 1 cm thick, fibrous growth with chlorite concentrated at vein contacts. Veinlets perpendicular to quartz vein orientation.

**CW-93143-11**

Altered gabbro and quartz-chlorite veins. 70% massive to foliated medium grained gabbro. Chloritic cleavage planes at millimetric intervals. 30% quartz-chlorite veins and veinlets less than 1 cm thick, fibrous growth, trace disseminated pyrite at vein contacts. Weak FeOx alteration.

**CW-93145-2**

Altered sulphidic gabbro with minor quartz veining. 95% medium to coarse grained foliated gabbro composed of dark green amphibole crystals and pale green feldspar grains. 1-2% disseminated fine-grained masses of pyrite. 5% fibrous quartz +/- chlorite veins < 1 cm thick and patches with trace pyrite at contacts. Strong FeOx coating fracture planes.

**CW-93145-3**

Altered gabbro and quartz. 60% bleached medium grained moderately foliated gabbro. Plagioclase laths in a chloritic groundmass. 40% quartz veins less than 0.5 cm thick with chlorite pockets and fibrous growth textures. Trace oxidized sulphides.

**CW-93145-4**

Quartz vein. 98% milky quartz up to 4 cm thick with trace to 1% oxidized sulphides at vein contacts.

**CW-93145-5**

Siltstone and pyritic felsite vein. 60% fine-grained siliceous vein up to 3 cm thick containing 5-10% disseminated pyrite. 40% dark grey to green siltstone (Etchemin Formation) with strong cleavage cross-cut by vein. Vein contacts have strong FeOx alteration.

**CW-93145-6**

Heavily altered gabbro. Medium to coarse grained strongly chloritized, deeply weathered gabbro. Heavy FeOx alteration and manganese staining.

**CW-93145-7**

*Idem* CW-93145-6.

**CW-93145-8**

Deeply weathered chloritized/carbonatized? siltstone with quartz veinlets. 95% dark rusty brown porous, very light siltstone with preserved laminations. 5% quartz veinlets. Pervasive oxidation.

**CW-93145-9**

Heavily altered gabbro and quartz vein. 80% medium to coarse grained gabbro silicified and bleached in proximity to quartz vein. 20% milky quartz-actinolite? vein < 2 cm thick with fibrous texture. Heavy FeOx and manganese staining.

**CW-93145-10**

Heavily altered sulphidic gabbro *idem* CW-93145-3, -6, -7. 100% medium to coarse grained gabbro composed of plagioclase laths in a chlorite-actinolite groundmass. Almost completely recrystallized. 3-4% disseminated pyrite. Heavy FeOx and manganese staining. Weak patchy silicification.

**CW-93145-11**

Altered quartz diorite and minor quartz veining. 90% coarse grained diorite composed of plagioclase laths in a quartz-chlorite groundmass. 10% quartz veins <0.5 cm thick with fibrous texture and trace oxidized sulphides. Deeply weathered with moderate FeOx on fracture planes and as patches.

**CW-93145-12**

Heavily altered gabbro. *Idem* CW-93145-3, -6, -7, -10. Deeply weathered. Heavy FeOx alteration throughout.

**CW-93146-1**

Heavily carbonatized Etchemin siltstone. Massive, greenish brown siltstone with pronounced cleavage. 15% flattened elongated blebs of oxidized material (sulphides or more likely iron carbonate). Pervasive strong carbonatization. Strong FeOx in cleavage planes.

**CW-93147-1**

Altered gabbro. 100% medium grained, massive, silicified gabbro with patchy silicification and moderate to strong FeOx alteration. Trace disseminated pyrite.

**CW-93147-2**

Altered gabbro. *Idem* CW-93147-1. FeOx alteration.

**CW-93147-3**

Deeply weathered gabbro. 95% massive medium grained gabbro composed of amphibole crystals with a feldspar groundmass. 5% fine grained quartz-feldspar vein < 1 cm thick. Pervasive FeOx and manganese staining on fracture planes.

**CW-93147-4**

Silicified gabbro. 100% fine grained gabbro. Moderate silicification throughout with < 1 cm seams of strong silicification. Well developed cleavage cross-cutting silicification. Weak FeOx alteration on fracture and cleavage planes. May be altered sand-sized Etchemin volcanoclastic???

**CW-93147-5**

Heavily altered gabbro. 100% strongly silicified and albitized fine grained rock with medium grained remnant grains and 1% disseminated fine grained pyrite. Deeply weathered. Strong manganese staining on fracture surfaces.

**CW-93147-6**

*Idem* CW-93147-5. 5% quartz veinlets < 2 mm thick with 1% disseminated pyrite and strong FeOx alteration.

**CW-93147-7**

Altered Etchemin siltstone. 100% medium green to beige (altered surface) siltstone with well developed cleavage. Heavy manganese and FeOx on cleavage and fracture surfaces.

**BB-93004-1**

Altered sulphidic gabbro and quartz vein. Same outcrop as CW-93141. 65% milky quartz veins < 2 cm thick with iron carbonate and sulphides at vein contact (pyrite and pyrrhotite?). 35% medium grained gabbro composed of silicified and albitized feldspar grains in a chlorite-sericite matrix with pervasive iron carbonatization. Pyrite associated with quartz. 5-7% sulphide mineralization. Moderate to strong

FeOx alteration on fracture planes, at vein contacts and associated with sulphide mineralization and carbonatization.

**BB-93004-2**

Sheared altered gabbro and quartz and quartz veinlets. Same outcrop as CW-93141. 80% strongly foliated medium grained gabbro with chlorite in cleavage planes at millimetric intervals. Silicified and albitized. 20% quartz-feldspar-chlorite veinlets < 1 cm thick. Stronger silicification and albitization adjacent to the veins. Strong FeOx alteration in cleavage planes.

## **APPENDIX B: ANALYTICAL RESULTS**

RAPPORT: C94-50009.4 ( COMPLET )

RÉFÉRENCE: P.O. 132915+132916

CLIENT: ROBERT E. SCHAAF

SOUMIS PAR: RS

PROJET: BELLECHASSE

DATE DE L'IMPRESSION: 19-JAN-94

COMMANDE	ÉLÉMENT	NOMBRE LIMITE INFÉRIEURE		EXTRACTION	MÉTHOD
		D'ANALYSES	DE DETECTION		
I	Au Or	55	0.001 OPT		PYRO ANALYSE
TYPES D'ÉCHANTILLONS	NOMBRE	FRACTION UTILISÉE	NOMBRE	PRÉP. DE L'ÉCHAN.	NOMBRE
ROCHE	55	-150	55	CONCASSER, PULVERISE	55

COPIES DU RAPPORT A: C.P. 236  
A/S CAROLINE WILSON

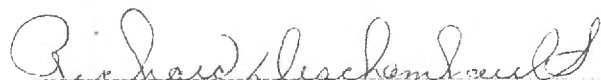
FACTURE A: C.P. 236

DATE DE L'IMPRESSION: 19-JAN-94

RAPPORT: C94-50009.4 ( COMPLET )

PROJET: BELLECHASSE PAGE 1

NUMÉRO DE L'ÉCHANTILLON	ÉLÉMENT UNITÉS	Au OPT	NUMÉRO DE L'ÉCHANTILLON	ÉLÉMENT UNITÉS	Au OPT
CW-93141-1		<0.001	CW-93145-08		<0.001
CW-93141-2		<0.001	CW-93145-09		0.001
CW-93141-2B		0.002	CW-93145-10		0.002
CW-93141-3		0.094	CW-93145-11		<0.001
CW-93141-3B		0.019	CW-93145-12		<0.001
CW-93141-4		<0.001	CW-93146-1		<0.001
CW-93141-5		0.002	CW-93147-1		<0.001
CW-93141-6		0.004	CW-93147-2		<0.001
CW-93141-7		<0.001	CW-93147-3		<0.001
CW-93141-8		<0.001	CW-93147-4		<0.001
CW-93141-8B		0.005	CW-93147-5		<0.001
CW-93141-09		<0.001	CW-93147-6		<0.001
CW-93141-10		0.003	CW-93147-7		<0.001
CW-93141-11		<0.001	BB-93004-1		0.054
CW-93141-11B		0.005	BB-93004-2		0.001
CW-93141-12		0.003			
CW-93141-13		<0.001			
CW-93142-1		<0.001			
CW-93142-2		<0.001			
CW-93142-3		<0.001			
CW-93142-4		<0.001			
CW-93142-5		<0.001			
CW-93143-1		<0.001			
CW-93143-2		<0.001			
CW-93143-3		<0.001			
CW-93143-4		<0.001			
CW-93143-5		0.002			
CW-93143-6		0.010			
CW-93143-7		<0.001			
CW-93143-8		<0.001			
CW-93143-8B		<0.001			
CW-93143-09		<0.001			
CW-93143-10		<0.001			
CW-93143-11		<0.001			
CW-93145-02		0.001			
CW-93145-03		0.001			
CW-93145-04		0.001			
CW-93145-05		<0.001			
CW-93145-06		<0.001			
CW-93145-07		0.001			



DATE DE L'IMPRESSION: 19-JAN-94  
PROJET: BELLECHASSE PAGE 2

RAPPORT: C94-50009.4 ( COMPLET )

# MESURE STANDARD	ÉLÉMENT UNITÉS	Au OPT
BLANC		<0.001
Nombre d'analyses		1
Valeur de moyenne		0.0005
écart-type		-
Valeur acceptée		0.001
MA-2B		0.068
Nombre d'analyses		1
Valeur de moyenne		0.0680
écart-type		-
Valeur acceptée		0.069
BCC GOLD STD 90-3		0.023
Nombre d'analyses		1
Valeur de moyenne		0.0230
écart-type		-
Valeur acceptée		0.022

DATE DE L'IMPRESSION: 19-JAN-94  
 PROJET: BELLECHASSE PAGE 3

RAPPORT: C94-50009.4 ( COMPLET )

NUMÉRO DE L'ÉCHANTILLON	ÉLÉMENT UNITÉS	Au OPT
CW-93141-4		<0.001
Duplicata		<0.001
CW-93142-1		<0.001
Duplicata		<0.001
CW-93143-7		<0.001
Duplicata		<0.001
CW-93145-04		0.001
Prep Duplicata		0.002
CW-93145-07		0.001
Duplicata		<0.001
CW-93147-5		<0.001
Duplicata		<0.001

NUMÉRO DE L'ÉCHANTILLON	ÉLÉMENT UNITÉS	Au OPT

✓

RAPPORT: C93-51117.0 ( COMPLET )

RÉFÉRENCE: P.O. 132913

CLIENT: SCINTILORE EXPLORATIONS LIMITED  
 PROJET: AUCUN

SOUIS PAR: RS  
 DATE DE L'IMPRESSION: 25-NOV-93

COMMANDE	ÉLÉMENT	NOMBRE LIMITE INFÉRIEURE		EXTRACTION	MÉTHOD
		D'ANALYSES	DE DETECTION		
1	Au Or	1	5 PPB	PYRO ANALYSE	PYROANALYSE Ø 30 G
2	As Arsenic	1	1.0 PPM		ACT. NEUTRONIQUE
3	Sb Antimoine	1	0.2 PPM		ACT. NEUTRONIQUE
4	Cu Cuivre	1	1 PPM	HCL:HNO3 (3:1)	ABSORPTION ATOMIQUE
5	Pb Plomb	1	2 PPM	HCL:HNO3 (3:1)	ABSORPTION ATOMIQUE
6	Zn Zinc	1	1 PPM	HCL:HNO3 (3:1)	ABSORPTION ATOMIQUE
7	Mo Molybdene	1	1 PPM	HCL:HNO3 (3:1)	ABSORPTION ATOMIQUE
8	Ag Argent	1	0.1 PPM	HCL:HNO3 (3:1)	ABSORPTION ATOMIQUE
9	Hg Mercure	1	5 PPB	HNO3-HCL-SNCL2	MERCURE

TYPES D'ÉCHANTILLONS	NOMBRE	FRACTION UTILISÉE	NOMBRE	PRÉP. DE L'ÉCHAN.	NOMBRE
ROCHE	1	-150	1	CONCASSER, PULVERISE	1

COPIES DU RAPPORT A: C.P. 236

FACTURE A: C.P. 236

DATE DE L'IMPRESSION: 25-NOV-93

RAPPORT: C93-51117.0 ( COMPLET )

PROJET: AUCUN

PAGE 1

NUMÉRO DE L'ÉCHANTILLON	ÉLÉMENT UNITÉS	Au PPB	As PPM	Sb PPM	Cu PPM	Pb PPM	Zn PPM	Mo PPM	Ag PPM	Hg PPB
BB01 = CW-930144		2030	44.0	<0.2	15	9	59	<1	<0.1	<5

DATE DE L'IMPRESSION: 25-NOV-93

RAPPORT: C93-51117.0 ( COMPLET )

PROJET: AUCUN PAGE 2

# MESURE STANDARD	ÉLÉMENT UNITÉS	Au PPB	As PPM	Sb PPM	Cu PPM	Pb PPM	Zn PPM	Mo PPM	Ag PPM	Hg PPB
STD GEOCHIMIQUE 2		-	-	-	179	18	58	18	33.4	-
Nombre d'analyses		-	-	-	1	1	1	1	1	-
Valeur de moyenne		-	-	-	179.0	18.0	58.4	18.0	33.40	-
écart-type		-	-	-	-	-	-	-	-	-
Valeur acceptee		-	8.0	7.0	190	15	62	17	34.0	30
BLANC		-	-	-	<1	<2	1	<1	<0.1	<5
Nombre d'analyses		-	-	-	1	1	1	1	1	1
Valeur de moyenne		-	-	-	0.5	1.0	1.0	0.5	0.05	2.5
écart-type		-	-	-	-	-	-	-	-	-
Valeur acceptee		5	<0.1	<0.1	1	1	1	1	0.1	5
STD GEOCHIMIQUE 4		-	28.0	0.6	-	-	-	-	-	29
Nombre d'analyses		-	1	1	-	-	-	-	-	1
Valeur de moyenne		-	28.00	0.58	-	-	-	-	-	29.0
écart-type		-	-	-	-	-	-	-	-	-
Valeur acceptee		-	28.7	0.5	290	33	255	4	0.5	35
1990 AU STD-2		287	-	-	-	-	-	-	-	-
Nombre d'analyses		1	-	-	-	-	-	-	-	-
Valeur de moyenne		287.1	-	-	-	-	-	-	-	-
écart-type		-	-	-	-	-	-	-	-	-
Valeur acceptee		260	-	-	-	-	-	-	-	-

**CHIMATEC LTEE**  
700 Rue Nérée Tremblay  
Ste-Foy, Québec G1N 4H7  
(418) 683-1777  
FAX: 383-7791

# CHIMATEC LTEE

RAPPORT D'ANALYSE  
GÉOCHIMIQUE

RAPPORT: C94-50009.1 ( COMPLET )

RÉFÉRENCE: P.O. 132915+132916

CLIENT: ROBERT E. SCHAAF  
PROJET: BELLECHASSE

SOUIS PAR: RS  
DATE DE L'IMPRESSION: 31-JAN-94

COMMANDE	ÉLÉMENT	NOMBRE D'ANALYSES	LIMITE INFÉRIEURE DE DETECTION	EXTRACTION	METHOD
1	As Arsenic	9	1.0 PPM		ACT. NEUTRONIQUE

TYPES D'ÉCHANTILLONS	NOMBRE	FRACTION UTILISÉE	NOMBRE	PRÉP. DE L'ÉCHAN.	NOMBRE
ROCHE	9	-150	9	TEL QUE RECU	9

COPIES DU RAPPORT A: C.P. 236

FACTURE A: C.P. 236

A/S CAROLINE WILSON

RAPPORT: C94-50009.1 ( COMPLET )

DATE DE L'IMPRESSION: 31 JAN 94  
PROJET: BELLECHASSE PAGE 1

NUMERO DE L'ÉCHANTILLON	ÉLÉMENT UNITÉS	As PPM
----------------------------	-------------------	-----------

CW-93145-6		16.0
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CW-93145-7		23.0
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CW-93145-8		9.0
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CW-93145-10		22.0
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CW-93145-11		<1.0
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CW-93145-12		8.3
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CW-93146-1		2.9
------------	--	-----

CW-93147-1		2.8
------------	--	-----

CW-93147-2		3.0
------------	--	-----

E  
 ee Tremblay  
 Québec G1N 4H7  
 J-1777  
 X: 051-3786 LOCAL 272

# CHIMITEC LTEE

CERTIFICAT  
D'ANALYSE

RAPPORT: C94-50009.5 ( COMPLET )

DATE DE L' IMPRESSION: 23-FEB-94  
 PROJET: BELLECHASSE PAGE 1

NUMÉRO DE L'ÉCHANTILLON	ÉLÉMENT UNITÉS	Au G/T	WT+150 g	Au+150 G/T	Au-150 G/T	Wt-150 g
CW93141-2B		0.38	21.88	0.14	0.41	220.7
CW93141-3		2.79	36.04	8.68	1.88	233.0
CW93141-3B		0.09	39.70	0.48	<0.03	230.0
CW93141-5		0.22	29.38	0.31	0.20	253.0
CW93141-6		0.18	31.69	0.22	0.17	225.7
CW93141-8B		0.12	33.08	0.24	0.10	234.2
CW93141-10		0.07	31.98	0.06	0.07	188.7
CW93141-11B		0.42	24.46	0.86	0.38	251.0
CW93141-12		0.07	30.40	0.43	<0.03	212.7
CW93143-5		0.06	27.56	<0.07	0.07	205.7
CW93143-6		0.44	20.67	<0.07	0.48	230.0
CW93145-02		<0.03	23.82	<0.07	<0.03	237.0
CW93145-03		<0.03	35.09	<0.07	<0.03	187.1
CW93145-04		<0.03	32.11	0.07	<0.03	225.7
CW93145-07		<0.03	31.12	<0.07	<0.03	206.0
CW93145-09		<0.03	32.97	<0.07	<0.03	213.0
CW93145-10		<0.03	18.64	<0.07	<0.03	213.6
BB-93004-1		0.91	21.29	6.72	0.34	216.3
BB-93004-2		0.06	26.45	<0.07	0.07	215.6


















*Richard A. S. S. S. S.*  
 \*\* PAGE TOTALE.004 \*\*

**APPENDIX**

**MAP LEGEND**

LEGEND

LITHOLOGY - STRATIGRAPHY

-  6 MAFIC IGNEOUS COMPLEX  
Intrusives (M. Ordovician)  
6a Gabbro  
6ab Basaltic  
6ap Porphyritic  
6b Diorite  
6bq Quartz-Bearing
-  5 BEAUCEVILLE FORMATION  
U.MAGOG Group (M. Ordovician)  
5a Mudstone  
5b Siltstone/Sandstone  
 5c Greywacke  
5e Conglomerate
-  4 ETCHEMIN FORMATION  
M.MAGOG Group (M. Ordovician)  
4a Mudstone  
4b Siltstone/Sandstone  
 4c Greywacke  
 4d Ferruginous Mudstone  
(Lean Iron Formation, Red Beds)  
 4e Conglomerate
-  3 FRONTIERE FORMATION  
L.MAGOG Group (M. Ordovician)  
3a Mudstone  
3b Siltstone/Sandstone  
3c Greywacke  
 3e Conglomerate
-  2 SAINT-DANIEL FORMATION  
Melange/Olistostrome (Cambrian -  
M. Ordovician)  
2a Mudstone  
2b Siltstone/Sandstone  
 2c Greywacke  
 2d Ferruginous Mudstone  
(Lean Iron Formation, Red Beds)  
 2e Sedimentary Melange/Olistostrome  
(Interbedded Mudstone, Siltstone,  
Greywacke)  
2ep Pebbly  
2eb Blocky  
 2f Ultramafic Volcanics  
(Precambrian-Cambrian)  
2fs Serpentinite
-  1 CALDWELL FORMATION  
(Cambrian)  
1a Mudstone  
1b Siltstone  
1c Sandstone  
(Precambrian - Cambrian)  
1d Mafic Volcanics  
 1e Ultramafic Volcanics  
1es Serpentinite
-  1M BENNETT FORMATION  
Metamorphosed Caldwell Rosaire and  
Armagh Formations  
1ma Mudstone  
1mb Siltstone  
1mc Sandstone (Quartzite-Schistose Quartzite)

LEGEND

ABBREVIATIONS

LITHOLOGY

tu Turbiditic  
tf Tuffaceous (volcanogenic sediments)

MINERALIZATION

VG Visible Gold  
ASP Arsenopyrite  
Cp Chalcopyrite  
Gn Galena  
Mag Magnetite  
Py Pyrite  
Po Pyrrhotite  
Sph Sphalerite  
Ll Limonite  
He Hematite  
Mn Manganese  
Sul Sulphides  
Zo Zoisite  
Ep Epidote  
Cn Carbon  
Cl Chlorite  
Cb Carbonate (Probable Mg-Fe)  
Cc Calcite  
Cr Rhodocrosite  
F Feldspar

VEINING

V Vein  
Stgrs Stringers  
Stk Stockwork  
VS Vein system  
Q Quartz  
QCb Quartz carbonate  
QF Quartz feldspar  
QCbf Quartz carbonate feldspar  
Bx Breccia

ALTERATION

Ser Sericitic  
Chl Chloritic  
Sil Silicious  
    Sil<sub>1</sub> weak to moderate  
    Sil<sub>2</sub> strong  
    Sil<sub>3</sub> hornfelsic or cherty  
Grp Graphitic  
Carb Carbonatized  
    Cal calcareous

METAMORPHISM

Sch Schistose  
Gn Gneissic

LEGEND

GEOLOGICAL SYMBOLS

BD90-133



Outcrop/Station and Sample Number



Boulder (erratic) Transported

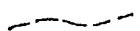


Float (locally derived)

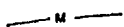
Lithological Contacts



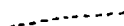
Observed, Defined



Approximate, Inferred



Inferred by Geophysics (M=Magnetics, EM=Electromagnetics)



Assumed, Concealed or Interpreted

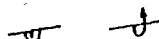


Contact Showing Inclined Dip; Vertical

Bedding



Bedding Plane: Inclined, Vertical, Horizontal



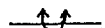
Bedding Plane with Younging Direction: Inclined; Overturned



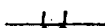
Anticline and Axial Trace



Syncline and Axial Trace



Overturned Anticline and Axial Trace

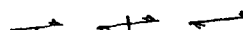


Overturned Syncline and Axial Trace

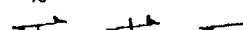
Cleavage and Foliation



S<sub>1</sub> Cleavage: Inclined; Vertical; Undetermined Dip



S<sub>2</sub> Cleavage: Inclined; Vertical; Undetermined Dip



S<sub>3</sub> Cleavage: Inclined; Vertical; Undetermined Dip

Lineations



Mineral Elongation; Quartz Elongation



Bedding-Cleavage Intersection Plunging; Horizontal



Crenulation S<sub>1</sub>/S<sub>2</sub> Intersection Plunging; Horizontal



Slickenside (Shown on Fault Plane) Normal; Reverse

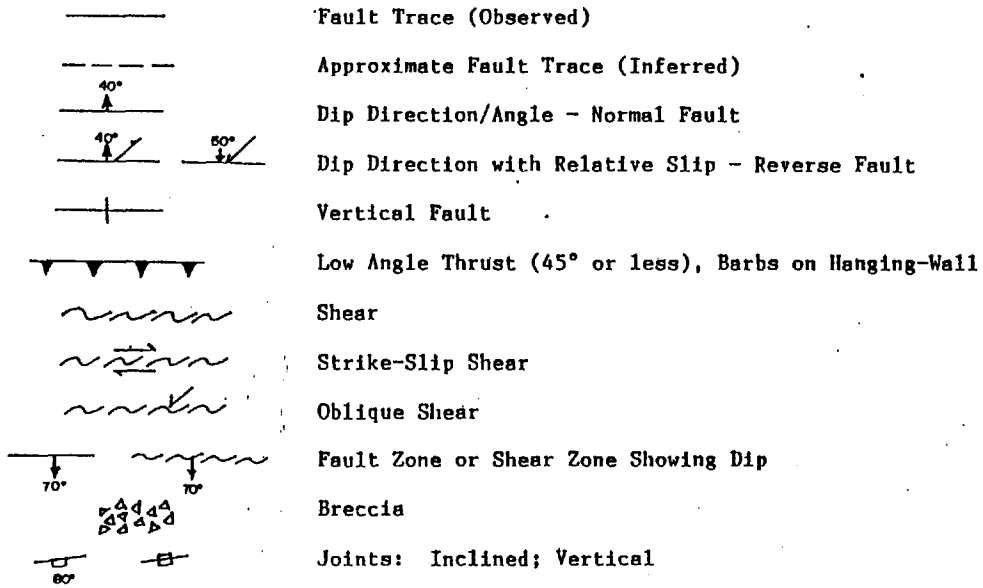


Mineral Striations (i.e. Rolled Vein with Grooved Surface)



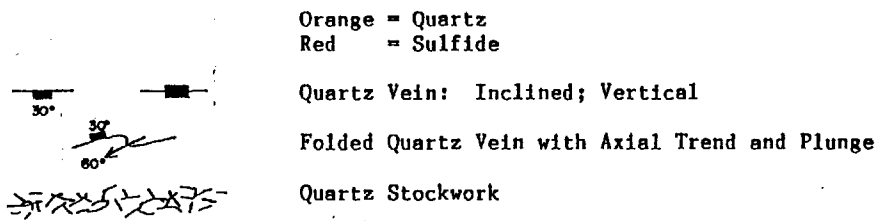
Quartz Vein Intersection with S<sub>1</sub>

Faults (blue)



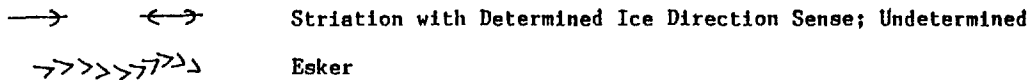
Fault Trace (Observed)  
 Approximate Fault Trace (Inferred)  
 Dip Direction/Angle - Normal Fault  
 Dip Direction with Relative Slip - Reverse Fault  
 Vertical Fault  
 Low Angle Thrust (45° or less), Barbs on Hanging-Wall  
 Shear  
 Strike-Slip Shear  
 Oblique Shear  
 Fault Zone or Shear Zone Showing Dip  
 Breccia  
 Joints: Inclined; Vertical

Mineralization



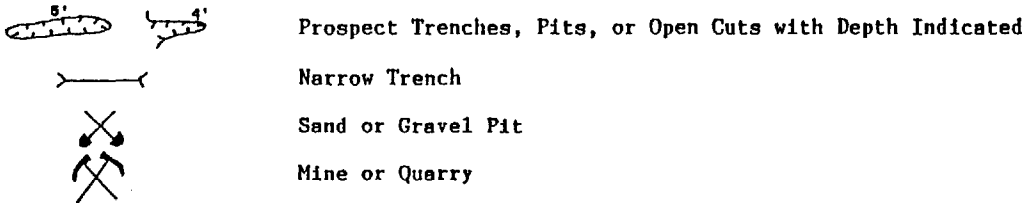
Orange = Quartz  
 Red = Sulfide  
 Quartz Vein: Inclined; Vertical  
 Folded Quartz Vein with Axial Trend and Plunge  
 Quartz Stockwork

Glacial Features



Striation with Determined Ice Direction Sense; Undetermined  
 Esker

Surface Openings



Prospect Trenches, Pits, or Open Cuts with Depth Indicated  
 Narrow Trench  
 Sand or Gravel Pit  
 Mine or Quarry