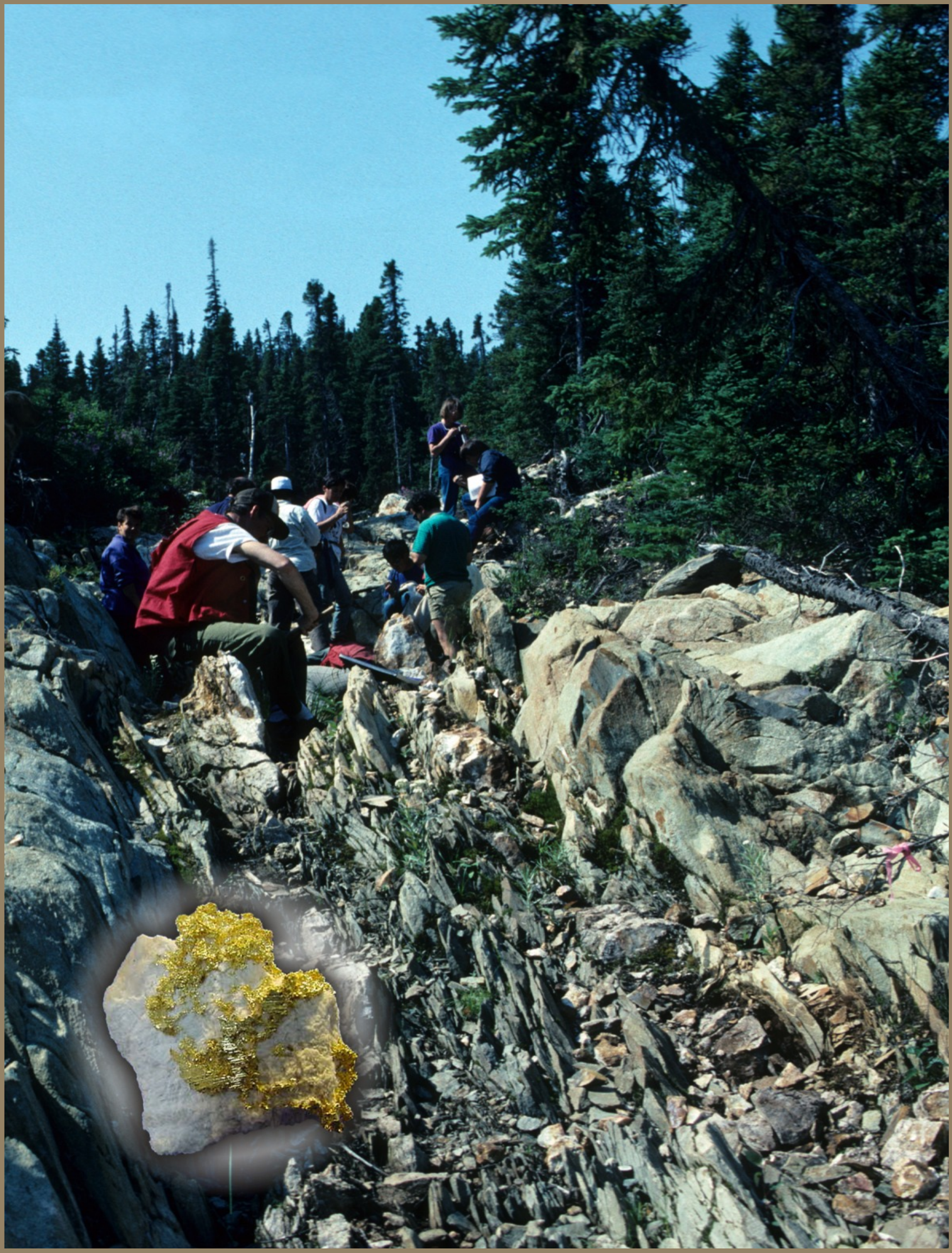
EPIGENETIC GOLD OCCURRENCES, BAIE VERTE PENINSULA, (NTS 12H/09, 16 AND 12I/01), NEWFOUNDLAND



GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
Department of Natural Resources
Geological Survey

D.T.W. Evans

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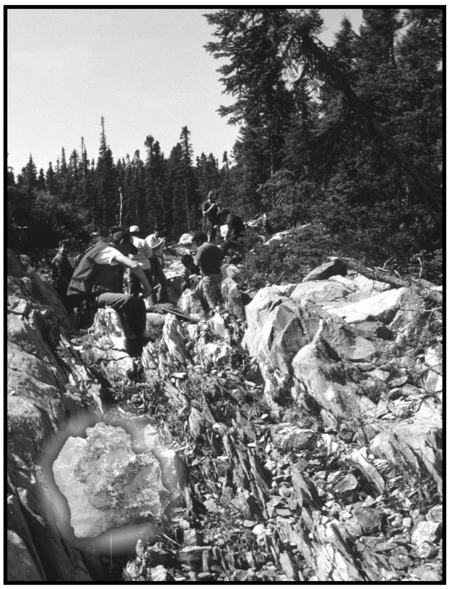
Mineral Resource Report 11

St. John's, Newfoundland, 2004



COVER

Background: Gold fever strikes field trip participants visiting the Dorset prospect circa1990.

Inset: Gold in quartz from the Dorset Prospect. Photo courtesy of Paul Crocker and Grayd Resource Corporation. The sample measures approximately 2 cm x 2 cm.

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EPIGENETIC GOLD OCCURRENCES, BAIE VERTE PENINSULA, (NTS 12H/09, 16 AND 12I/01) NEWFOUNDLAND

D.T.W. Evans P.Geo

Mineral Resource Report 11

St. John's
Newfoundland and Labrador
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ABSTRACT

Epigenetic, structurally controlled gold mineralization forms a distinctive and extensive style of mineralization on the Baie Verte Peninsula (NTS map areas 12H/09, 12H/16 and 12I/01). This gold mineralization is spatially associated with the major regional structures such as the Baie Verte Line. However, about 98 percent of the occurrences are located within rocks of the Baie Verte Belt lying to the east of the Baie Verte Line. These gold occurrences share many of the characteristics typical of mesothermal lode gold deposits, including the Californian Mother Lode Belt.

Vein-hosted and altered wall rock-hosted or replacement styles of epigenetic gold mineralization have been recognized within the study area and these share many common characteristics, and a great deal of overlap exists. The vein-hosted mineralization is subdivided, based on gangue mineralogy, into: 1) quartz veins containing free gold, 2) quartz–pyrite veins and 3) base-metal-rich quartz veins; economic concentrations of gold are generally restricted to these veins. The altered wall rock or replacement style of gold mineralization are further subdivided as follows: i) carbonate–quartz–pyrite, ii) silica–sulphide, and iii) talc–carbonate. Economic concentrations of gold occur mainly in the wall rock, but significant gold may also be found within the accompanying quartz veins. The style of replacement is mainly dependent upon the original host rock composition. Carbonate–quartz–pyrite replacement is typical of mafic rocks associated with the Cambro-Ordovician ophiolitic and cover sequences; silica–sulphide replacement is typical of felsic sequences; and the talc–carbonate replacement is associated with the Cambro-Ordovician ultramafic rocks. The structurally controlled gold mineralization is related to Siluro-Devonian deformation and postdates emplacement of the Taconic allochthons by 80 to 100 million years.

Pyrite sulphur isotopic analyses, from the epigenetic gold mineralization, show little variation between either the styles of gold mineralization or tectonic affiliation/host rock. Nevertheless, this data does appear to discriminate between sedimentary–biogenic pyrite, and epigenetic pyrite associated with gold mineralization.

The Baie Verte Peninsula continues to be a focus of gold exploration and large areas remain virtually unexplored. Most of the known mineralization was found in the five-year period, subsequent to 1984, and many of the known occurrences described in this study have received only a cursory examination.

INTRODUCTION

OBJECTIVE

One of the most significant outcomes of the 1980s gold exploration boom was the recognition of Newfoundland's potential to host economically viable gold deposits. In a five-year period (1984-1989), focussed exploration efforts combined with flow-through financing resulted in more than a tenfold increase in the number of gold occurrences found on the island. In 1989, the Geological Survey of Newfoundland and Labrador initiated a metallogenic study directed at documenting gold occurrences located within the eastern and central parts of the Dunnage Zone, the results of which were presented by Evans (1996).

Gold occurrences within the western Dunnage Zone, in particular those occurrences located on the Baie Verte Peninsula, were the focus of academic and/or federal government sponsored studies. These detailed deposit-level studies, which concentrated on some of the more significant gold occurrences, produced a wealth of data. However, this information dealt with only a fraction of the known gold occurrences within the western Dunnage Zone. Data concerning the remaining smaller occurrences was lacking and often limited to brief descriptions in mineral exploration assessment reports. Therefore, in 1997 the provincial geological survey initiated a project to document all the known gold occurrences located on the Baie Verte Peninsula for which information was lacking. This report deals only with epigenetic gold occurrences. For a detailed account of the regional geology, academic and government studies, and the history of mineral exploration and production prior to 1983, the reader is referred to Hibbard (1983).

Field work during 1997 and 1998 concentrated on NTS map areas 12H/09, 12H/16 and the Mings Bight Peninsula portion of 12I/01 (Figure 1; Table 1). As a result, more than 100 epigenetic gold occurrences have been documented. The large number precluded conducting detailed work on each occurrence, but detailed work involving mapping, structural studies, logging of diamond-drill core and sampling, was undertaken where deemed necessary (i.e., different style or setting of mineralization). Also, detailed studies were not undertaken where sufficient data were viewed to already exist (i.e., thesis or GSC studies). Descriptions and information from previous studies are compiled and incorporated to provide a comprehensive database of Baie Verte Peninsula epigenetic gold occurrences. A joint study was undertaken in conjunction with Dr. A. Sangster of the Geological Survey of Canada comparing the various iron formation-hosted gold occurrences located throughout the Notre Dame Subzone. Similarly, a joint study with Dr. D.H. Wilton of the Department of Earth Sciences at Memorial University was undertaken to develop a sulphur isotopic database for the gold occurrences on the Baie Verte Peninsula and this information will be used in comparative analyses with existing data for other central Newfoundland gold occurrences. The Baie Verte area has tremendous potential for further gold discoveries and large areas remain to be explored and many of the known occurrences have received only preliminary-level exploration. Recent exploration activities, after 2000, have identified a number of new gold occurrences, but unfortunately these could not be included and remain to be documented in future studies. Much detailed work remains to be done, and detailed regional and deposit-level mapping and university thesis studies are needed to thoroughly understand the geology and mineralization of the area.

HISTORY OF GOLD EXPLORATION

The Island of Newfoundland has a long and colourful mining history, the roots of which can be traced to the Baie Verte Peninsula on the northeast coast of the island. This area has long been the focus of mineral exploration and mining activity, beginning with the Dorset people who exploited the soapstone deposits at Fleur de Lys more than 2000 years ago. More recent activity, particularly during the eighteenth and nineteenth century, was often limited by international treaties. In the 1713 Treaty of Utrecht, France was granted fishing rights to that part of the coast of Newfoundland that extended from Cape Bonavista to Point Riche. In the 1783 Treaty of Versailles, these fishing rights were changed to the area extending from Cape St. John westward to Cape Ray. These treaties prohibited any English settlement or development within one half mile of the coast. Early mining activity west of Cape St. John was often disrupted by French warships. Successful operations were either located well inland or to the east of the French Shore. In 1904, the Anglo-French Convention or the “Entente Cordiale” abrogated France's treaty rights in Newfoundland, opening the way for development.

Historically, gold production in Newfoundland was in the form of a by-product from the mining of volcanogenic massive sulphide deposits. The modern mining era on the Baie Verte Peninsula started in 1860 with the opening of the Terra Nova copper mine. Subsequent activity focussed on the Betts Cove and Tilt Cove copper deposits, both located near tidewater outside of the French Shore. In total, eight of these volcanogenic massive sulphide deposits, including the Rambler Camp, were mined in the years between 1860 and 1996 (Table 2). For more than 100 years, these volcanogenic

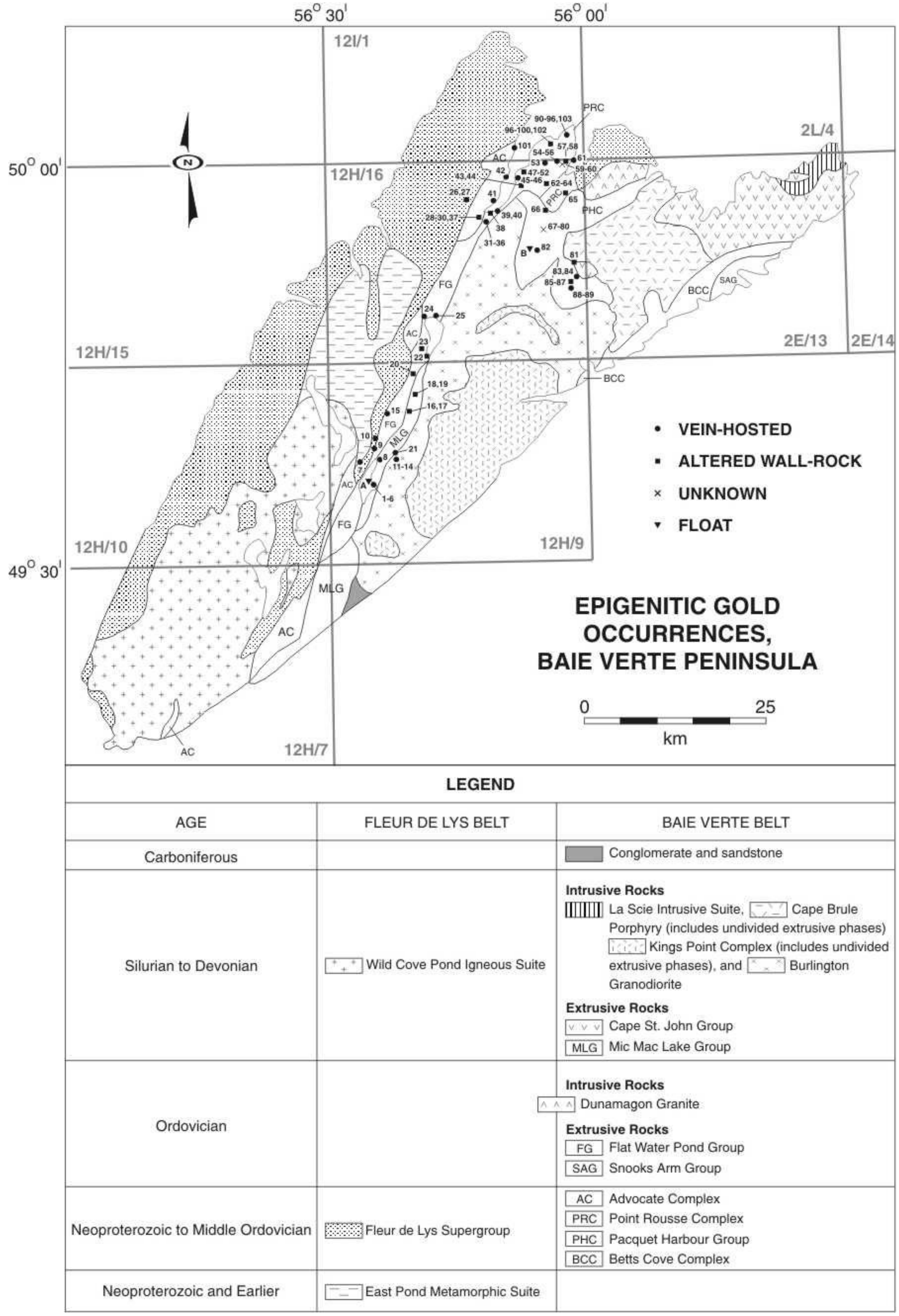


Figure 1. *Simplified geological map of the Baie Verte Peninsula (modified after Hibbard, 1982); also shown are the gold occurrences listed in Table 1.*

Table 1. Listing of gold occurrences, Baie Verte Peninsula, Newfoundland (keyed to Figure 1)

Kings Point Map Area (NTS 12H/09)

1. El Strato
2. Pandora
3. Mega Vein
4. MicMac Lake NE
5. Tornado
6. Tamsworth
7. MicMac Lake West
8. Clydesdale
9. MicMac Lake (NW)
10. Wild Cove Pond East
11. Bedford
12. Kreuger
13. Mackenzie
14. Sidewinder
15. Kidney Pond South
16. Crow Hill South
17. Raven Zone
18. Crow Hill North
19. Crow Hill NE
20. Bear Pond
21. Strugglers Pond

Baie Verte Map Area (NTS 12H/16)

22. Flatwater Pond Park
23. Gossan Zone
24. Flatwater Pond NW
25. Burlington Road
26. Breezeway
27. Castor Brook
28. Phoenix/Phoenix Ext.
29. Casa Loma
30. Albatross
31. Central Carb
32. Braz
33. The Gunshot
34. Dorset Extension
35. Dorset # 1, Dorset # 2, Dorset # 3
36. Powerline
37. TN-89-01
38. Barritz
39. Tidewater
40. Powder House
41. Sisters Point
42. Baie Vista
43. Anoroc/Anoroc Extension
44. Pine Cove 1) Lightening Zone 2) Thunder Zone
45. Romeo & Juliet
46. Iron Formation
47. Corner Shore
48. Pumbly Point
49. Pumbly Point Carbonate Zone and Fuel Bog Zone
50. Penny Cove/Cuvier
51. Corkscrew
52. Big Bear
53. Green Cove Brook
54. Goldenville Mine Main Shaft
55. North Shaft
56. East Shaft
57. Maritec # 1
58. Maritec # 2
59. Maritec # 3 and #4
60. Maritec # 5
61. Barry & Cunningham
62. Stog'er Tight (Cliff, Gabbro West, Gabbro East, Stog'er Tight and Magnetic zones)
63. Main Zone
64. Massive Sulphide
65. Shear #1
66. Carrol Option
67. Stuckey Vein
68. Uncle Hank
69. Footwall Zone, Rambler Main Mine
70. Uncle Enos
71. Hill Bog
72. Uncle Bill
73. Uncle Theo
74. Uncle Angus
75. Uncle Will
76. Uncle Mike
77. Mink
78. Wellsdale
79. Spillway
80. Mallard
81. Rambler Brook
82. Krissy Trend
83. WJ-660
84. FDR-263
85. Brass Buckle
86. Brass Buckle South
87. BBT
88. Skidder Pond
89. Tie Line Krissy Trend

Fleur De Lys Map Area (NTS 12I/01)

90. Main Zone, Deer Cove
91. AK-2 Zone
92. Deer Cove Block
93. Deer Cove North
94. #11
95. Eastern Point
96. Devils Cove
97. Fox Pond #1
98. Fox Pond #2
99. Fox Pond North
100. Muskeg Linear/Gabbro Zone
101. Marble Cove Point
102. Fox Pond West
103. Devils Cove Pond NW

Float:

A Voodoo (NTS 12H/09)

B Krissy Boulder (NTS 12H16)

Table 2. Production statistics for volcanogenic massive sulphide deposits, Baie Verte Peninsula (after Evans *et al.*, 1992; Dimmell *et al.*, 1999)

Deposit	Host Rock	Years Mined	Grade and Tonnage
Terra Nova	Advocate Complex	1860-1864, 1902-1906, 1913-1915	2-2.5 % Cu, 226 700 tonnes
Tilt Cove	Betts Cove Complex	1864-1917, 1957-1967	1-12 % Cu, 8 160 000 tonnes (42 425 oz of gold recovered 1957-1967)
Betts Cove	Betts Cove Complex	1875-1886	2-10 % Cu, 118 528 tonnes
Main Mine	Pacquet Harbour Group	1961-1967	1.3 % Cu, 2.16 % Zn, 29 g/t Ag, 5.1 g/t Au, 399 000 tonnes
East Mine	Pacquet Harbour Group	1967-1974	1.04 % Cu, 1 933 079 tonnes
Big Rambler Pond	Pacquet Harbour Group	1969	1.2 % Cu, 45 000 tonnes (reserves 15 000 tonnes at 1.5 % Cu)
Ming Mine	Pacquet Harbour Group	1971-1982	3.66 % Cu, 22 g/t Ag, 2.4 g/t Au, 1 991 592 tonnes (15 240 tonnes of low grade Cu mined from Crown Pillar 1996)
Ming West	Pacquet Harbour Group	1995-1996	4.5 % Cu (appreciable gold and silver), 150 000 tons
Main Zone Crown Pillar and Footwall	Pacquet Harbour Group	1996	35 000 tonnes grading 6.2 g/t Au (actual production unknown)

massive sulphide deposits helped form the core of the Newfoundland mining industry. Many of these deposits were auriferous and an appreciable amount of gold was recovered particularly during the latter years. Prior to 1890, it was unlikely that gold was either detected or recovered from these early copper mining operations (Snelgrove, 1935). However, it is estimated that between the years 1896 and 1906, about 46 736 oz. of gold were recovered from the Notre Dame Bay copper mines (Snelgrove, 1935). Copper metal shipped from the Tilt Cove mine is reported to have averaged 2 ounces of gold per ton. More recently, significant concentrations of gold were also recovered from the Tilt Cove (1957-1967) and Rambler (1964-1982 and 1995-1996) mines (Tuach *et al.*, 1988; Dimmell *et al.*, 1999).

Gold-bearing quartz veins were first discovered in the Mings Bight area of the Baie Verte Peninsula prior to 1867 (Murray and Howley, 1881). In 1879, Adolph Guzman discovered a gold-bearing quartz vein while trenching for copper in the Mings Bight area (Martin, 1983). Snelgrove (1935, page 21), reported that thin quartz–calcite veins "...found to be well charged with gold." were intersected during pre-1892 mining attempts at the Barry and Cunningham prospect. All attempts at either mining or exploration suffered from either litigation between the property owners or from interference limitations agreed upon by international treaties as the following account describes. Around 1883, Captain A.B. Cunningham was stopped during the examination of a mining property in the Mings Bight area by a party of French marines. His description of the event is taken from Martin (1983).

> "...I visited the workings in order to report progress and take reliable samples of the minerals obtained. I was thus occupied when one morning a French man-o'-war steamed into the Bight, a party of armed blue-jackets landed, and planted the French flag over the principal shaft. I very naturally demanded of the lieutenant in command an explanation of these high-handed doings, and was by him referred to the admiral, who was on board the man-o'-war.
>
> "I promptly interviewed the latter on his ship and was received with greatest politeness. A copy of the French Treaty was produced, by which I found out that work of a permanent character could not be carried on without one half mile of the foreshore..."

In 1903, gold was discovered at the Goldenville site and, with the settlement of the French Shore issue, mining commenced at the Goldenville Mine in 1904 (Martin, 1983).

A tramway was constructed and a trial shaft was sunk from which 23 tons of ore were raised. The ore was processed at the Brookfield Mine in Nova Scotia and 11 ounces of gold were recovered (Hibbard, 1983). With the encouraging results from the bulk sample, the main shaft was deepened to 100 feet and a second inclined shaft was sunk on the mineralized zone. A third shaft was sunk on a separate zone to the north, and in 1906, a ten stamp gold mill and Wilfley Concentrator were installed at the Goldenville site. Equipment breakdowns and less than anticipated gold recoveries permanently halted mining operations in 1906 after 158 oz. of gold had been recovered (Hibbard, 1983). During the early 1930s, interest in gold was revived and exploration was unsuccessfully renewed in the Goldenville area. Since then, periodic interest in the area has been closely tied to fluctuations in the price of gold.

In the early 1930s, the Newfoundland Department of Natural Resources undertook an appraisal of the known gold occurrences on the island. Field work was undertaken in 1934 by A.K. Snelgrove and C.K. Howse, and the results of this study, entitled “Geology of Gold Deposits of Newfoundland, Bulletin No. 2”, was published in 1935 (Snelgrove, 1935). This report listed 26 named gold occurrences for Newfoundland; a number of other minor gold occurrences were also mentioned. A listing of Newfoundland mineral occurrences (Douglas, 1976) reflects the dearth of gold exploration during the 41 years after the publication of Snelgrove’s report. Douglas (*op. cit.*) lists just 29 gold-only occurrences for the island. Despite more than 120 years of almost continuous mining activity, there had been no systematic exploration for gold other than in a few small areas adjacent to the handful of known gold occurrences.

The 1984 BP Resources Canada Limited discovery of the Hope Brook Deposit on the south coast of the province (McKenzie, 1986), focussed attention on Newfoundland’s long-overlooked gold potential. Almost immediately, exploration activity (funded mostly by flow-through financing), focussed on the Baie Verte Line and the Gander River Ultrabasic Belt (GRUB Line). The GRUB Line marks the eastern boundary of the Dunnage Zone. These two structurally complex areas drew comparisons with the Californian Mother Lode Belt and exploration centred mainly on mesothermal and metamorphogenic types of gold mineralization.

In 1986, Noranda Exploration Company Limited discovered the Deer Cove gold prospect on the Baie Verte Peninsula, the first significant new gold find in that area since the discovery of the Goldenville Mine 83 years before. This new discovery initiated a period of intensive gold exploration that resulted in the discovery of approximately 120 new gold occurrences on the peninsula. By 1988, a number of significant discoveries had been announced. These included:

i) the Stog’er Tight zone, discovered by the Noranda–Impala joint venture (Huard, 1990a);

ii) the “Lightening Zone” discovered by South Coast Resources Incorporated and Varna Gold Inc. and subsequently optioned to Corona Corporation in 1988. Follow-up diamond drilling led to the discovery of the Thunder Zone, and outlined what is the now referred to as the “Pine Cove” deposit having an estimated (undiluted, geologically inferred) reserve of 2.75 million tonnes at 3.0 g/t gold (Dimmell and Hartley, 1991a, b); and

iii) the “Nugget Pond” deposit discovered by Bitech Resources Limited and since developed by Richmont Mines Inc.

The 1980s gold boom lasted until about 1990 and at its peak, gold exploration expenditure on the island amounted to greater than $40 million. By 1991, total exploration expenditures (combined gold and base metals) had dropped to less than $24 million (Mining Association of Canada, 1992). Exploration activity within Newfoundland was sluggish during the early 1990s, but the industry slowly rebounded and by 1995, Ming Minerals Incorporated was successfully mining the Ming West volcanogenic massive sulphide deposit. The same company also mined, with limited success, the auriferous Footwall Zone to the Rambler Main Mine, and the Stog’er Tight Zone, which had been purchased from Noranda Exploration Limited (Bradley, 1997).

In April, 1997, Richmont Mines opened the Nugget Pond gold mine. One of the lowest cost gold producers in Canada, the mine produced 537,661 tons of ore grading 0.31 oz per ton before it closed in 2001 (Richmont Mines Inc., Annual Report, 2002).

Since 1998, there has been renewed interest in the gold potential of Newfoundland with several new occurrences reported by local prospectors and junior mining companies.

REVIEW

For a complete review of geological work, including government, academic and industry, prior to 1983, the reader is referred to the comprehensive and highly regarded memoir entitled ‘Geology of The Baie Verte Peninsula, Newfoundland’ by James Hibbard (1983). This memoir has served the mineral exploration industry well and will continue to be a source of information. Since its publication, Newfoundland and, in particular, the Baie Verte Peninsula, underwent a surge of exploration aimed at gold mineralization. Prior to the 1980s, mineral exploration companies had focussed mainly on volcanogenic massive sulphide mineralization. In the early 1980s, this focus shifted to structurally controlled gold mineralization, as a result of high gold prices and the availability of flow-through financing to fund exploration. On the Baie Verte Peninsula, extensive gold exploration programs were conducted by companies such as Noranda Exploration Company Limited, South Coast Resources Incorporated, Varna Resources Incorporated, Bitech Energy Resources Corporation, Lacana Mining Corporation, International Corona Corporation, Cuvier Mines Incorporated, Canaustra Gold Exploration Limited, Inco Gold Management Incorporated and Granges Exploration Limited.

This exploration focus on the Baie Verte Peninsula led to a number of government- and academic-sponsored, deposit-level studies. These included: the Nippers Harbour area (Hudson, 1988), the Tilt Cove/Cape St. John area (Al, 1990), the Albatross prospect (Field, 1990), the Deer Cove prospect (Patey, 1990), the Stog'er Tight Zone (Ramezani, 1992), Rambler Footwall gold zones (Wieck, 1993), and the Nugget Pond deposit (Lavigne, 1993). The Geological Survey of Canada completed structural and metallogenic studies of the Dorset prospect (Bélanger *et al*., 1992), the Stog'er Tight prospect (Kirkwood and Dubé, 1992), and the Deer Cove prospect (Dubé *et al*., 1993). Much of this work is summarized in Dubé *et al.*, (1992). Dr. J. Lydon of the Geological Survey of Canada examined the setting of gold mineralization hosted by ophiolitic rocks on the Baie Verte Peninsula (Lydon *et al*., 1988, 1990). Dr. A. Sangster, also of the Geological Survey of Canada, has conducted deposit-level studies of gold mineralization in the Betts Cove Complex. That study was undertaken in conjunction with detailed 1:20 000-scale mapping of the Betts Cove Complex and the Snooks Arm Group by Bédard *et al*. (1997).

REGIONAL GEOLOGY

Newfoundland forms part of the extensive Paleozoic Appalachian–Caledonian Orogenic Belt. Williams (1964) was the first to recognize the tripartite nature of the Newfoundland portion of this orogenic belt. The island is subdivided into three broad geological zones, which represent a two-sided orogenic system. These zones, which include the Western platform, the Central Mobile Belt and the Avalon platform, are related to the formation and destruction of a late Precambrian–early Paleozoic ocean known as Iapetus (Harland and Gayer, 1972). The orogenic belt is now subdivided into Humber, Dunnage, Gander and Avalon tectonostratigraphic zones (Williams, 1979; Williams *et al.*, 1988; Figure 2).

The Humber Zone represents the passive continental margin of Paleozoic North America and it comprises shelf-facies carbonate and siliciclastic rocks that were deposited upon crystalline Precambrian basement. The Dunnage Zone is often referred to as the vestiges of Iapetus because it contains sequences of ophiolitic rocks and volcanic, volcaniclastic and sedimentary rocks of island-arc and back-arc origins. The Gander Zone comprises sedimentary rocks deposited at, or near, the eastern Iapetan margin, proximal to the Gondwana continent. The Avalon Zone comprises Neoproterozoic volcanic, sedimentary and plutonic rocks that are overlain by early Paleozoic platformal sedimentary rocks.

The Dunnage Zone is bounded on the west by the Baie Verte–Brompton Line and to the east by the GRUB Line (redefined as the Gander River Complex, O'Neill, 1991). Williams *et al*. (1988) further subdivided the Dunnage Zone, based on contrasting geological elements, into Notre Dame and Exploits subzones. The two subzones formed independently, possibly on opposite sides of Iapetus, and were not linked until the late Llanvirn–early Llandeilo along the extensive Red Indian Line fault system.

The Baie Verte Peninsula occupies portions of both the Humber Zone and the Notre Dame Subzone (Figure 2). Rocks of these zones form two contrasting and distinct structural and lithic belts that are separated by a major arcuate, structural zone known as the Baie Verte Line (Hibbard, 1983). Rocks to the west of the Baie Verte Line belong to the Fleur de Lys Belt. This belt is part of the Humber Zone and comprises a sequence of polydeformed Neoproterozoic to Early Ordovician schists and gneisses, formed in a continental-rise prism that developed along the eastern margin of Laurentia. The belt is subdivided into three (Figure 1) main lithic sequences: i) high-grade metamorphic basement rocks of the East Pond Metamorphic Suite; ii) a metaclastic cover sequence referred to as the Fleur de Lys Supergroup; and iii) post-kinematic granitic rocks of the Devonian Wild Cove Pond igneous suite.

The rocks lying to the east of the Baie Verte Line belong to the Baie Verte Belt (Figure 1) of the Notre Dame Subzone and consist of four main lithic elements: i) Cambro-Ordovician ophiolitic sequences of the Advocate, Point Rousse and Betts Cove complexes and the Pacquet Harbour Group; ii) Ordovician volcanic cover sequences of the Flat Water Pond and Snooks Arm groups and parts of the Advocate and Point Rousse complexes and the Pacquet Harbour Group; iii) Silurian terrestrial volcanic and sedimentary rocks of the Mic Mac Lake and Cape St. John groups and the Kings Point Complex that unconformably overlie the Ordovician sequences; and iv) Siluro-Devonian intrusive rocks (e.g., the Burlington granodiorite, Kings Point Complex, Dunamagon granite and the Cape Brulé Porphyry). The Cambro-Ordovician sequences represent vestiges of Iapetus and formed in supra-subduction zone ophiolitic and primitive island-arc environments (Jenner and Fryer, 1980; Swinden, 1991; Piercey *et al*., 1997; Bédard *et al*., 1997).

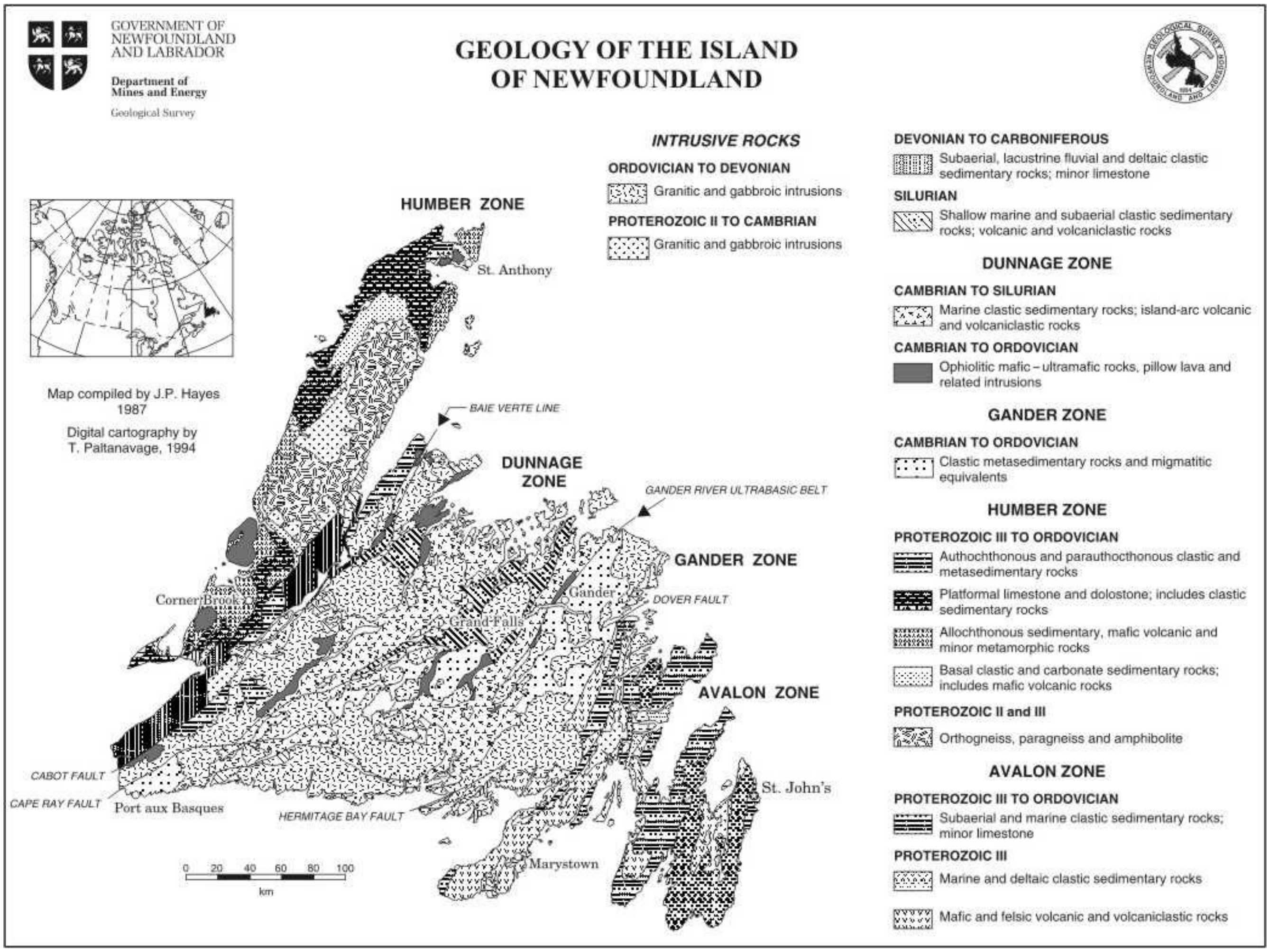


Figure 2. *Tectonostratigraphic map of Newfoundland (Hayes, 1987).*

The geology of the Baie Verte Peninsula is regionally correlated southward to the Glover Island area of Grand Lake, where rocks of both the Humber and Dunnage zones are juxtaposed (Cawood and van Gool, 1993). The boundary between the zones is defined by the Keystone shear zone, which is part of the Baie Verte–Brompton Line. On Glover Island, the Dunnage Zone sequences are host to thirteen significant epigenetic, structurally controlled gold prospects (Barbour and French, 1993).

STRUCTURAL GEOLOGY

Hibbard (1983) defined the Baie Verte Line as a tectonic zone, which separates the Fleur de Lys and Baie Verte belts, considered to be the early Paleozoic continent–ocean interface. Regionally, all pre-Carboniferous rocks and structures on the Baie Verte Peninsula, including the Baie Verte Line, are folded around a major structure referred to as the Baie Verte Flexure (Hibbard, 1983). Structural and lithological trends vary from north-northeasterly, south of Baie Verte, to easterly, east of Baie Verte. This flexure is interpreted to reflect the shape of the ancient Laurentian continental margin.

The Baie Verte Line exhibits a protracted history of deformation. Initial movement along the line was the result of west-directed thrusting of the Baie Verte ophiolitic rocks over the Fleur de Lys Belt during the Ordovician. Three phases of deformation are present within the Fleur de Lys Belt and Ordovician thrusting was responsible for much of this deformation and metamorphism. These rocks have been regionally metamorphosed in the upper-greenschist to middle-amphibolite facies. Based on radiometric cooling ages for metamorphic minerals, deformation within most of the Fleur de Lys Belt is related to westward obduction of the Taconic allochthons (Hibbard, 1983). Evidence within the Fleur de Lys Belt for this obduction includes the emplacement of ultramafic rocks along shear zones and pre-kinematic ophiolitic mélanges that are thought to mark the early onset of imbrication of the ophiolitic complexes. The ophiolitic Birchy Complex of the Fleur de Lys Supergroup formed the lower portions of an imbricate stack that overrode the Fleur de Lys rocks during the Early Ordovician (Hibbard *et al*., 1995).

Subsequent Siluro-Devonian deformation centred on the Baie Verte Line and served to accentuate the structural zone. South of Baie Verte, a system of late faults, which collectively form the Baie Verte Road Fault system (Hibbard, 1983), follow the trace of the Baie Verte Line. These younger faults typically exhibit reverse, west-over-east polarities. This reversal in structural polarity produced much of the deformation observed within the Baie Verte Belt. The belt has been regionally metamorphosed up to the lower-greenschist facies and the rocks typically display a single penetrative fabric.

Polydeformed and polymetamorphosed rocks that Hibbard (1983) referred to as the "eastern orthotectonic block", are exposed along the eastern limb of the Baie Verte Flexure. The block is bounded to the northwest by the Scrape Thrust and to the north by the sea. The southern margin is gradational into less deformed rocks of the Baie Verte Belt. Metamorphic grade within the block, varies from lower-amphibolite facies in the north to upper-greenschist facies in the south. The block is underlain by rocks of the Mings Bight Group of the Fleur de Lys Belt, and portions of the Pacquet Harbour Group, Cape St. John Group and the Cape Brule Porphyry of the Baie Verte Belt. Since Siluro-Devonian age rocks are deformed, deformation is considered to be related to regional Acadian deformation. This is supported by $^{40}Ar/^{39}Ar$ age spectra for metamorphic minerals (Hibbard, 1983). The intensity of the Acadian event along the eastern limb of the flexure has obliterated most of the evidence of prior deformation. Hibbard (1983) attributed this localization of intense deformation to a combination of the following: i) northward-directed strike–slip movement of the Baie Verte Belt, ii) elevated heat flow in the Siluro-Devonian terranes located in the northern Baie Verte Belt, and iii) uplift of the Fleur de Lys Belt that resulted in southerly directed thrusting of Baie Verte Belt sequences over the "eastern orthotectonic block". Thrusting of the Point Rousse Complex over the Pacquet Harbour Group along the Scrape Thrust was part of this Acadian event. Strike–slip movements related to Carboniferous deformation may have further modified the various faults, in particular the Baie Verte Road Fault System (Hibbard, 1983; Goodwin and Williams, 1990).

GOLD MINERALIZATION

INTRODUCTION

This report documents gold occurrences on the Baie Verte Peninsula (NTS map areas 12H/09, 12H/16 and 12I/01) based upon, 1) field work undertaken on occurrences for which there was a paucity of published information, and 2) a compilation of data, from various published sources including university theses. Most of these gold occurrences are classified as epigenetic, structurally controlled, mesothermal or metamorphogenic lode-gold mineralization. The Baie Verte occurrences share many of the characteristics typical of Archean lode-gold deposits, and the Californian Mother Lode Belt has long been considered analogous to the Baie Verte Belt (O'Driscoll, 1986). Shared features include: 1) a spatial association with major regional structural breaks, 2) juxtaposition of marine volcanic/volcaniclastic and sedimentary sequences with deformed and metamorphosed siliciclastic rocks of miogeoclinal origin along a major crustal suture, 3) structurally controlled vein systems often localized in secondary shear zones, 4) wall-rock alteration assemblages characterized by carbonate, quartz, sericite, albite and pyrite, and 5) gold ore composed of both vein and altered wall-rock style mineralization. The possible exception are the Crow Hill prospects that exhibit some features analogous to epithermal-style low-sulphidation mineralization. The following section provides a review of mesothermal-style lode gold mineralization and a detailed review of gold mineralization associated with the Californian Mother Lode Belt.

MESOTHERMAL LODE GOLD: A REVIEW

The following summary is based upon a review article by Hodgson (1993). Mesothermal deposits form in the Earth's crust, at depths of between 1 and 4.5 km, and, temperatures between 200 and 300°C. Gold deposits within this classification are typically quartz vein-hosted and accompanied by extensive carbonate alteration. They are typical of deformed, low- to medium-grade metamorphic supracrustal sequences (greenstone and younger orogenic belts) that are intruded by felsic rocks. However, the most productive of these deposits are associated with Precambrian supracrustal rocks, particularly the late Archean greenstone belts. The Precambrian lode gold deposits are noted for their great vertical continuity, extensive wall-rock carbonatization and size (individual deposit may contain in excess of 1000 tonnes of gold). Lode gold deposits are distinguished from epithermal gold deposits by their high gold/silver ratios, distinctive alteration, and their overall lack of open-space vein textures (i.e., vuggy, comb and hydrothermal breccia textures).

Hodgson (1993) subdivided mesothermal gold deposits (based upon supracrustal host lithology) into two broad groups: 1) deposits in volcanic-dominated supracrustal belts, and 2) deposits in clastic sedimentary-dominated supracrustal belts. He reported that three styles of lode gold mineralization are associated with the volcanic-dominated belts; these are: 1) quartz vein and veinlet systems, 2) disseminated pyritic, quartz–albite and/or potassium feldspar–carbonate replacement zones, and 3) breccia, stockwork and bedding replacement zones in oxide-facies iron formation. Lode gold mineralization, within the clastic sedimentary-dominated belts, comprises quartz stockwork and replacement zones within silicate/carbonate-facies iron formation, and as breccia, stockwork and bedding replacement zones within oxide facies iron formation and clastic sedimentary rocks.

Within the volcanic-dominated belts, lode gold mineralization appears to be spatially associated with three main rock groups (Hodgson, 1993). These are: 1) high-magnesian mafic to ultramafic volcanic and intrusive rocks (komatiite and variolitic basalt), 2) sedimentary belts, particularly fluviatile rocks that unconformably overlie the volcanic belts, and 3) felsic intrusions. The high-magnesian mafic and ultramafic rocks form the lower portions of many of allocthonous greenstone belts. Dehydration, decarbonization and possibly partial melting of the lower slab due to thermal equilibrium is thought to have liberated gold and CO_2-rich fluids. These fluids would have migrated into transcrustal fault zones common in orogenic belts that acted as fluid conduits.

The lode gold deposits associated with the sedimentary belts are unconformably deposited upon the older volcanic belts. They are considered to be genetically related to major regional fault zones that are also thought to have controlled the deposition of the sediments (Hodgson, 1993).

There is a well known association between many lode gold deposits and felsic rocks of alkali gabbroic and trondhjemitic composition that intrude the supracrustal sequences (Hodgson, 1993). Many of the felsic intrusions show a spatial association with the major fault systems. Studies of lode gold mineralization within these intrusions have indicated that the gold can range from approximately contemporaneous with intrusion of the felsic rocks to as much as 100 million years younger. This lode-gold felsic intrusion association has produced two "often-times divided" schools of thought concerning the origin of the gold. One group has the gold related to the magmatic hydrothermal event related to the emplacement of the intrusion, while the second group has the gold overprinting, and genetically unrelated to the intrusion. Hodgson (1993) indicates that, whatever the origin of the gold, oceanic crustal sequences that lack felsic intrusive rocks typically lack economically significant gold deposits.

Within the supracrustal sequences, the lode gold deposits are associated with major structural zones (transcrustal faults) that may range up to several kilometres in width and extend for hundreds of kilometres (Hodgson, 1993). These zones can be braided, anastomosing systems that encapsulate blocks of relatively undeformed rock. Generally, the gold is localized within splays, off the main structure that typically exhibit evidence of brittle–ductile deformation and are more conducive to dilation. The splays often exhibit an oblique reverse sense of movement relative to an overall strike–slip movement along the major fault zone.

Within the brittle–ductile fault system, gold can occur in association with: 1) shear veins and associated disseminations in the adjacent wall rock, 2) extensional veins in less deformed rock between shears, and 3) as tabular and linear veinlet systems localized within more competent rock adjacent to the shears. The veins are typically laminated and contain a broad suite of minerals including quartz, carbonate, alkali feldspar, sericite, pyrite, minor chalcopyrite, sphalerite and galena, telluride, tourmaline, arsenopyrite, scheelite, molybdenite and pyrrhotite. A characteristic zone of carbonitization is associated with the quartz veins. However, the composition of the protolith controls the resultant alteration assemblages and within mafic volcanic rocks, this alteration typically exhibits the following progression (Hodgson, 1993): 1) an outer zone in which the regional greenschist-facies minerals, amphibole and epidote, are replaced by calcite and chlorite, 2) a proximal facies, in which the rock is typically bleached and composed mainly of ankerite or ferrodolomite, ± sericite, alkali feldspar and pyrite, and 3) an innermost facies (not always developed) where decarbonitization has produced silicification and/or albitization (less commonly K-feldspathization). Ultramafic rocks composed of serpentine and tremolite are altered to an assemblage of talc–chlorite and carbonate. Felsic and intermediate volcanic and sedimentary rocks typically contain less Fe- and Mg-bearing minerals, therefore, the resulting alteration typically contains lower concentrations of carbonate and pyrite.

In summary, mesothermal lode gold deposits develop within sequences that formed within prograding arc–trench complexes that are intruded by felsic rocks. The mineralization develops after the main period of accretion-related contractional deformation when auriferous fluids are released through devolatilization of subcreted volcanic and sedimentary rocks. The fluids migrate into structural zones and interact variously with wall rock before reaching the site of gold deposition.

COMPARISON BETWEEN THE BAIE VERTE PENINSULA AND THE CALIFORNIAN MOTHER LODE BELT

In 1848, James Marshall found placer gold in the South Fork of the American River in northern California. Since that discovery, the Mother Lode Belt (Figure 3) has yielded approximately 13.4 million ounces of gold that have been recovered from placer deposits, quartz veins and large low-grade altered wall-rock deposits (Field Trip Guide to California Gold Country and Mines, 1998). However, while the potential for further discoveries is very high, environmental concerns and permitting restrictions have curtailed exploration and mining activity. The tectonic evolution of the Californian Mother Lode region closely parallels the development of the Baie Verte Peninsula. The following section, on the geological evolution of the Mother Lode area, was drawn mainly from the Field Trip to California Gold Country and Mines (1998) guidebook.

During much of the Paleozoic, the western continental margin of North American was passive and covered by miogeoclinal sedimentary sequences. In Newfoundland, the clastic sedimentary sequences of the Fleur de Lys Belt were deposited along a similar passive margin and by the end of the Paleozoic, eastward-dipping subduction was initiated along the western continental margin. Subduction of oceanic crust created an accretionary-wedge complex composed of submarine volcanic and sedimentary rocks and lasted about 100 million years, from the late Paleozoic to the Late Jurassic, when subduction ceased and a crustal suture belt formed. This event is analogous to Taconic accretion and juxtaposition of the Baie Verte and Fleur de Lys belts along the Baie Verte Line.

At about 150 Ma, renewed subduction was initiated about 100 km to the west, along the Franciscan Subduction Zone. This subduction coincided with the onset of the Nevadan Orogeny, which lasted from the Late Jurassic into the Early Cretaceous and was accompanied by intrusion of the composite Sierra Nevada Batholith, beginning about 210 Ma and continuing until 80 Ma. The Nevadan Orogeny produced widespread deformation, metamorphism, and plutonism throughout the Sierra Nevada. The previously accreted terranes were strongly deformed, folded and metamorphosed to form the Foothills Metamorphic Belt. Suture zones between the accreted terranes were reactivated to form the Foothills Fault System, one of the more significant of these faults is the Melones Fault Zone. In central Newfoundland, the Nevadan Orogenic event would be comparable to the Late Silurian Salinic Orogeny, which produced much of the deformation, metamorphism and plutonism that effected the Baie Verte Belt.

The Melones Fault Zone is about 195 km long, dips 40 to 60° to the east, and is marked by elongate slivers of serpentinite, serpentinite mélange, greenstone, slate and bull-quartz veining. The fault zone is a suture/subduction zone along which two distinct geological terranes of similar age are juxtaposed; polydeformed and metamorphosed rocks lie to the east of the fault and less deformed and metamorphosed rocks, which host the Mother Lode Belt, lie to the west. It is believed that progressively deeper stratigraphic levels are exposed from north to south along the Melones Fault Zone. The fault zone varies from sheared serpentinite melange in the south, to a broad zone of shearing up to 3.5 km wide along central portions, to a mylonite–phyllonite zone up to 1 km wide in the north. The Melones Fault Zone is comparable in style and length to the portion of the Baie Verte Line extending from Glover Island in the south to Baie Verte in the north. Juxtaposition of the polydeformed and metamorphosed Fleur de Lys Belt with the less deformed Baie Verte Belt along the Baie Verte Line roughly mirrors the evolution of the Melones Fault.

The gold mineralization of the Mother Lode Belt is believed to have occurred between 108 and 120 Ma in an oblique stress regime. Large volumes of CO_2-rich fluids were generated during regional deformation and metamorphism. Regionally extensive brittle fault zones, such as the Melones Fault Zone, provided fluid pathways for the gold-bearing fluids.

Two styles of gold mineralization are associated with the Melones Fault Zone, high-grade gold-bearing quartz veins, and low-grade altered wall-rock gold referred to as ‘grey ore’. Veining is developed discontinually along the entire strike length of the fault zone. The veins occur as lenticular bodies hosted by a linked and anastomosing system of faults and shear zones that make up the larger Melones Fault Zone. The veins are typical mesothermal style quartz veins (i.e., milky-white braided or *en échelon* tension-gash veins). Veins typically exhibit ribbon textures indicative of multiple vein generations and typically pinch and swell both along strike, and down dip. Ore shoots occur where the veins curve or intersect. Vein widths can vary from a few centimetres up to 30 m and individual ore shoots can exceed 1.8 km in length. The concentration of veins increases from south to north along the Melones Fault Zone.

The veins most commonly occur in slates of the Mariposa Formation, but veins also occur in greenstones. Hydrothermal alteration surrounding the veins typically comprises sericitization and carbonitization accompanied by pyrite, albite, ankerite, and locally arsenopyrite. Along the southern Mother Lode, quartz veining is also hosted by mariposite (named after the town of Mariposa), a rock composed of quartz, carbonate and bright green chrome mica.

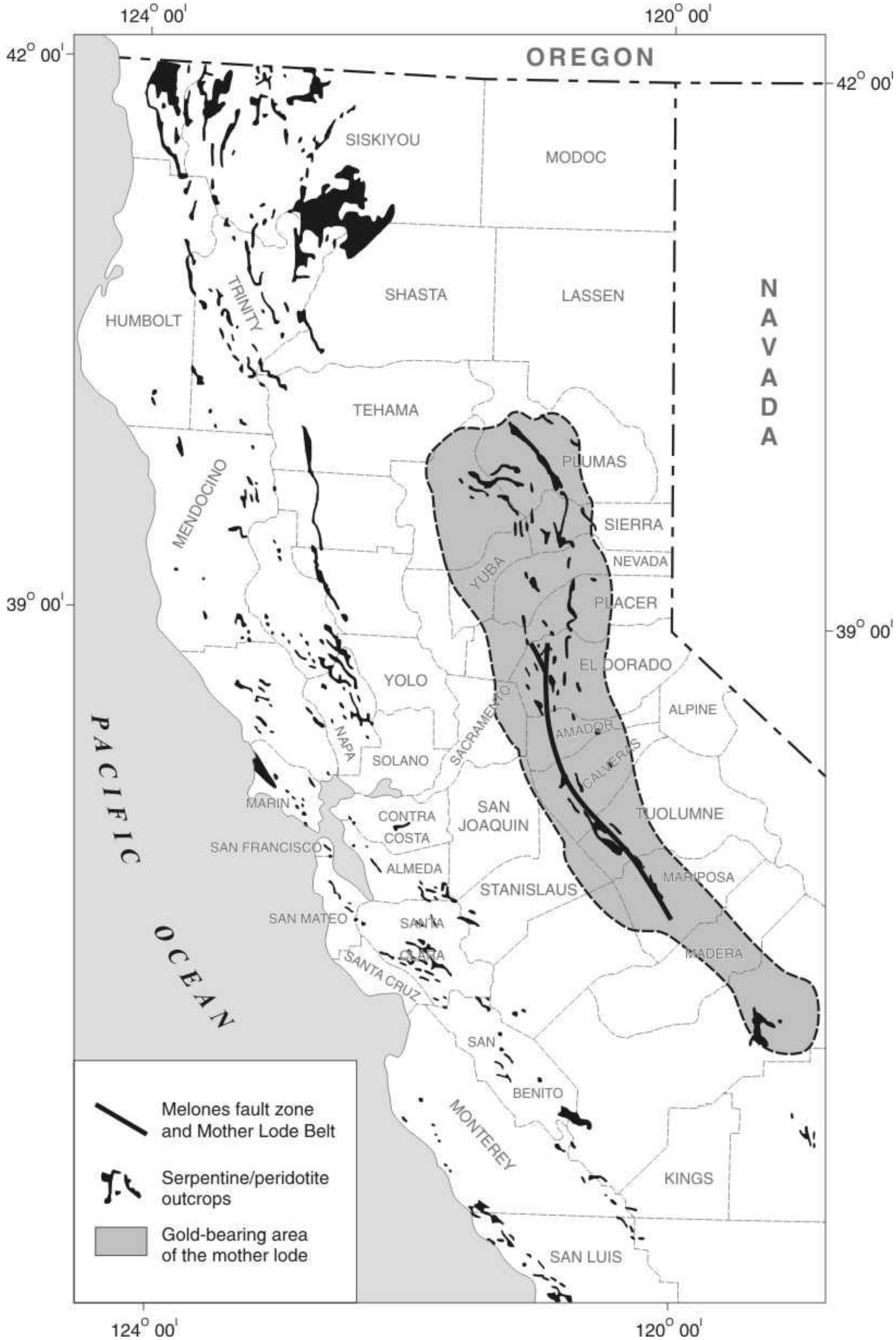


Figure 3. *Map of the Mother Lode Belt, California, showing the location of the Malones Fault Zone (*modified after *Peabody, 1991).*

These altered ultramafic rocks are identical to the virginite exposures located near Flat Water Pond on the Baie Verte Peninsula.

Gangue minerals in the Mother Lode veins typically include pyrite, arsenopyrite, chalcopyrite, sphalerite and galena. Pyrite locally can form 1 to 2 percent by volume of the ore. The average gold grade of the veins varies from 0.14 to 0.33 oz/ton. Free gold can occur as pockets, seams and in quartz stockworks. The Mother Lode Belt is renowned for its large gold specimens with many mines producing nuggets up to 1500 oz. and placer nuggets up to 50 lbs. A 44 lb crystalline gold specimen, which is currently on display at the Ironstone Vineyards in Calaveras County, was part of 1568 oz of coarse gold recovered from the Crystalline Pit, Jamestown Mine on December 26, 1992.

The lower grade ore or "grey ore" is commonly hosted by carbonate–sericite–pyrite-altered rocks. Low-grade ore commonly accompanies the gold-bearing quartz veins. However, in the southern Mother Lode Belt, the low-grade style of mineralization forms relatively large ore bodies, a number of which have recently been mined by open-pit methods. As of 1990, reserves in the five deposits comprising the Jamestown Mine were 20.8 million tons having an average grade of 0.063 oz/ton gold (Allgood, 1990). The gold typically is associated with pyrite, occurring as surface coatings, fracture fillings and micro-inclusions, and rarely as free gold.

CLASSIFICATION OF GOLD MINERALIZATION ON THE BAIE VERTE PENINSULA

The Baie Verte Peninsula is host to both syngenetic and epigenetic gold mineralization. The syngenetic gold occurs as an accessory mineral associated with the volcanogenic massive sulphide (VMS) deposits. The ophiolitic-hosted massive sulphide deposits, with the exception of Tilt Cove, are generally small, but many are gold-rich (Table 2). Deposits associated with the volcanic cover sequences tend to be more polymetallic, but they also contain significant amounts of gold at appreciably lower concentrations (Table 2). The Rambler deposits are an exception as the Ming, Ming West and the Main deposits all contained significant concentrations of gold. As well, zones of quartz–sericite schist spatially associated with the VMS locally contain economically interesting gold values. In particular, the Footwall Zone to the Main Mine contained enough gold to warrant its extraction. Evidence for the origin of this gold is lacking and it has not been resolved if the gold is syngenetic and related to the VMS system or is part of a later gold mineralizing event that has overprinted the VMS system, capitalizing on zones of structural weakness and the presence of abundant sulphide minerals. Descriptions of these gold occurrences are included here.

The epigenetic occurrences comprise structurally controlled mesothermal (metamorphogenic) mineralization that is spatially associated with major regional-scale structures such as the Baie Verte Line. Prospects tend to cluster where perturbations, such as the Baie Verte Flexure or cross structures, affect the regional structure.

The mesothermal gold occurrences are subdivided (Dubé, 1990; Evans, 1996, 1999) into two classes: 1) vein-hosted, in which the gold is restricted to quartz veining, and 2) altered wall rock or replacement style mineralization, in which the gold is disseminated throughout the altered rock. The vein-hosted style can be further subdivided based on gangue mineralogy into the following three subclasses: 1) quartz–gold veins, 2) quartz–pyrite veins, and 3) base-metal-rich quartz veins. The altered wall-rock hosted replacement style is comprised of the following four subclasses: 1) carbonate–quartz–pyrite, 2) silica–sulphide, 3) talc–magnesite–magnetite, and 4) red albite–ankerite–pyrite.

Quartz–Gold Vein Subclass

The quartz–gold vein subclass comprises primarily milky-white shear veins that commonly form some very large auriferous vein sets. The veins are typically weakly laminated, exhibit multiple generations of veining, contain only traces of sulphide and locally contain wall-rock fragments. Fe-carbonate wall-rock alteration and silicification are locally present and minor disseminated pyrite may be present in the wall rock adjacent to the vein. Gold occurs in these veins as free gold and commonly as coarse flecks and clots.

Quartz–Pyrite Vein Subclass

The quartz–pyrite vein subclass comprises shear, quartz breccia and tension-gash style veins. The veins are typically milky white and contain weakly disseminated to coarse patches, clots and bands of pyrite. Wall-rock alteration varies from weak to locally intense, along with the Fe-carbonatization of mafic rocks and the sericitization and silicification of felsic rocks. Disseminated pyrite may be present in the altered wall rock. Economically significant gold values are associated only with the veining and can generally be correlated with sulphide concentration. These veins, while typically small, often contain very high concentrations of gold. Free gold occurs locally in some of these veins particularly within the quartz–pyrite breccia veins at the Main Zone, Deer Cove.

In areas dominated by volcanic sequences, such as the Baie Verte Peninsula and in the area underlain by the Victoria Lake Group in central Newfoundland, pyrite is the dominant sulphide mineral in this subclass (Evans, 1996, 1999). However, throughout the eastern Dunnage Zone, an area dominated by siliciclastic sequences, arsenopyrite is the dominant sulphide species (Evans, 1996). Similarly, the arsenopyrite-rich quartz veins in the eastern Dunnage Zone (Evans, 1996) locally contain appreciable concentrations of stibnite and this zonal variation appears to reflect buffering of the mineralizing fluids by the local geology. Arsenopyrite and/or stibnite do not form significant constituents within the epigenetic gold occurrences on the Baie Verte Peninsula.

Base-Metal-Rich Quartz Vein Subclass

The base-metal-rich quartz vein subclass occurs typically as shear veins or tension-gash veins that are generally smokey grey to milky white and banded. The base metals occur as clots and laminations consisting of galena, chalcopyrite and ± sphalerite. Wall-rock alteration is generally weak but where developed, comprises sericitization and silicification.

Gold generally occurs as coarse flecks and clots and assay values can be quite impressive, e.g., hundreds of ounces. Silver concentrations can be quite variable, ranging from nothing to 150 g/t, and can locally be correlated with the concentration of galena in the veins. This subclass is restricted to the Ordovician volcanic cover sequences. The presence of galena indicates a significant felsic volcanic/intrusive or sedimentary component within the fluid-source area and precludes an ophiolitic source.

Carbonate–Quartz–Pyrite Replacement Subclass

The carbonate–quartz–pyrite subclass is marked by extensive and distinctive wall-rock alteration. The distribution of the alteration appears to be, in part, shear controlled and often the entire alteration zone is strongly deformed. These zones typically occur as clusters of structurally modified lenses; the individual lenses can be up to 40 m thick and over 100 m long. These alteration zones typically act as the loci for subsequent deformation, which often affects the continuity of the mineralization. Exposed zones are quite impressive with the altered rocks weathering to a distinctive orange-rust. Drill core from these zones, or rock newly exposed by trenching, soon oxidizes making the Fe-carbonate alteration relatively easy to identify. This style of alteration and mineralization is widespread within the mafic volcanic and gabbroic units of the ophiolite complexes on the Baie Verte Peninsula. Similar styles of mineralization are common in the eastern Dunnage Zone (Evans, 1996).

This subclass typically exhibits a zoned alteration assemblage ranging from an outer chlorite–calcite halo, which replaces the regional greenschist-facies metamorphic mineral assemblage, inward to an iron-rich carbonate zone. Quartz veining can form a significant component within the alteration zone. Shear, quartz breccia and tension-gash vein styles can be present and the veins typically consist of milky-white quartz ± carbonate. Pyrite is generally weakly disseminated throughout the carbonate alteration zone and concentrations are typically less than one percent. However, pyrite concentrations may locally reach ten percent and pyrite may also occur within the quartz veins as weak disseminations, coarse patches, clots and bands. Elevated to economically significant gold concentrations can be correlated with pyrite content, both in the veins and in the altered wall rock. The gold occurs within fractures and as inclusions within the pyrite crystals.

Also included in the carbonate–quartz–pyrite replacement subclass are non-stratiform banded iron formation-hosted gold occurrences. These form when auriferous shear zones cut oxide-facies iron formation (bedded magnetite); the resulting gold is restricted to late crosscutting structures and veins developed within the iron formation (Kerswill, 1993). Orebody-scale mesothermal style alteration is often associated with these occurrences. Pyrite after magnetite is the dominant sulphide species and can occur within the quartz veins marginal to the veins or as disseminations in the wall rock. These deposits are often comprised of small discrete ore shoots that tend to be difficult to mine.

Silica–Sulphide Replacement Subclass

The characteristics of the silica–sulphide subclass are fairly broad and, it closely overlaps with the quartz vein-hosted subclass and the carbonate–quartz–pyrite replacement subclass. In the silica–sulphide subclass, the gold is not restricted to veins but also occurs as disseminations throughout the altered wall rock. Carbonate alteration is not widely developed and this distinguishes this subclass from the carbonate–quartz–pyrite replacement subclass. The silica–sulphide subclass is also structurally controlled, but the alteration and mineralization are not necessarily confined to the shear zone and their distribution is controlled by the permeability of the wall rock adjacent to the shear. The alteration assemblages typically consist of intense, and often pervasive, silicification and sericitization. Within ultramafic rocks, the silicification is accompanied by strong hematization, resulting in a jasper-like alteration. Fine-grained disseminated pyrite is associated with the alteration and unlike similar occurrences within the eastern Dunnage Zone (Evans, 1996) the Baie Verte examples of this subclass are not accompanied by significant concentrations of arsenopyrite and/or stibnite.

Extensive quartz veining may or may not be present, and where developed, it generally occurs as shear or tension-gash veins that are often mantled by disseminated sulphides. In some instances, both the vein and the sulphide halo contain economically significant gold concentrations. In other occurrences, the gold may be associated with late-stage micro-fracturing, which is developed within the intensely silicified zones. These microfractures are often infilled by a fine hairlike stockwork of quartz–pyrite veinlets. In other examples the gold is only associated with the disseminated sulphides.

Talc–Magnesite–Magnetite Replacement Subclass

This subclass is not areally extensive and appears to be restricted to the Point Rousse Complex. The gold is associated with narrow shear-controlled, talc–magnesite–dolomite tension-gash veins and stockwork-like veinlets developed within serpentinized ultramafic rocks. The veins contain clots and disseminations of magnetite and locally visible gold.

Red Albite–Ankerite–Pyrite Replacement Subclass

The red albite–ankerite–pyrite subclass appears to be unique to a cluster of five gold occurrences, which includes the Stog'er Tight Zone, located within the Point Rousse Complex just west of the community of Mings Bight. The mineralization and alteration have been examined as part of an M.Sc. thesis study by Ramezani (1992). He defined four alteration zones based on distinct mineral assemblages. These are: i) a chlorite–calcite zone, ii) an ankerite–sericite zone, iii) a chlorite–magnetite zone, and iv) a red albite–pyrite (+ gold) zone. The red albite–pyrite zone is termed a replacement vein. Abundant quartz veins occur within the mineralized zones both as barren tension-gash veins, which are interpreted to postdate the mineralization, and as shear-parallel, quartz–albite–ankerite veins. The gabbroic wall rock adjacent to the shear veins is characterized by intense red-albite alteration and by coarse auriferous pyrite. The intensity of the alteration diminishes within 5 to 15 cm from the shear-parallel veins.

The following sections detail some of the more significant gold occurrences examined in this study; the number proceeding the occurrence name is keyed to Figure 1. Information on occurrences not covered in the text is presented in Appendix 1 and these are similarly keyed to Figure 1.

MICMAC LAKE AREA, KINGS POINT MAP AREA (NTS 12H/09)

Exploration History

With the 1986 discovery of the Deer Cove gold prospect, Noranda Exploration Company Limited initiated an aggressive land acquisition program that resulted in the staking of much of the Baie Verte Line between Black Brook in the south, and Marble Cove Point in the north (Figure 4). The Micmac Lake area was part of the property acquired by Noranda Ltd. and reconnaissance mineral exploration was initiated in 1987 as part of a Noranda–Muscocho joint venture (MacDougall, 1988a). This joint venture covered the area extending from Black Brook to Baie Verte. Noranda Ltd. exploration projects within the NTS map area 12H/9 were referred to as the Wolverine Pond, Traverse Pond, Trap Pond and Struggler's Pond properties. In 1987, Noranda Ltd. conducted airborne magnetic, VLF and electromagnetic surveys, heavy mineral concentrate till and stream sampling, prospecting, rock and soil geochemistry and trenching. Exploration initially focused on a zone of strong quartz–carbonate–fuchsite alteration outcropping near Black Brook. Trenching and chip sampling failed to identify significant concentrations of gold (MacDougall, 1987a). In 1988, exploration concentrated on detailed prospecting of anomalies outlined in 1987 and trenching, mapping, channel sampling and Winke drilling of the Clydesdale prospect (MacDougall, 1988a).

In 1988 and 1989, Noranda Ltd. conducted reconnaissance prospecting and a panned heavy-mineral concentrate stream and till-sampling program on the Traverse Pond property (MacDougall, 1989a). Prospecting the islands in Micmac Lake, led to the discovery of the El Strato prospect. Also in 1989, Noranda established the Green Acres north and south grids on its Wolverine Pond property, as a result of gold anomalies discovered during the 1988 exploration program (MacDougall *et al.*, 1989). The Green Acres north grid was established to test high-grade gold–silver mineralization at the Kruger showing, located within the Burlington granodiorite.

The Green Acres south grid was established over an area of abundant high-grade gold in quartz vein float, referred to as the Voodoo showing (Figure 5), which had been discovered by prospectors along the eastern shore of Micmac Lake and along a brook, informally named Voodoo Brook, which flows into Micmac Lake (Plate 1).The quartz blocks, which were reported to be angular and up to 2.0 m

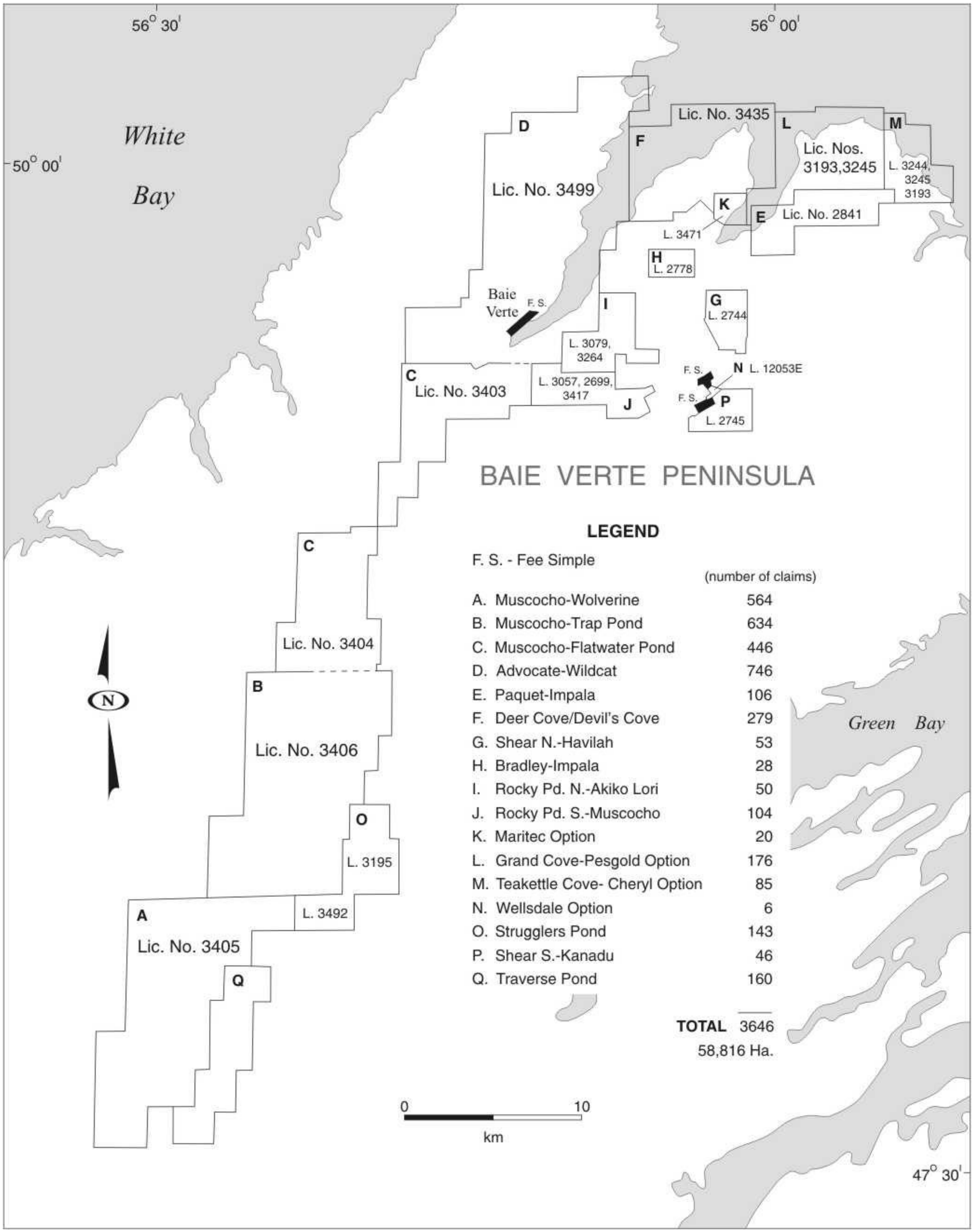


Figure 4. *Noranda Exploration Company Limited claims map, ca. 1988, Baie Verte Peninsula (*modified after *MacDougall, 1988a).*

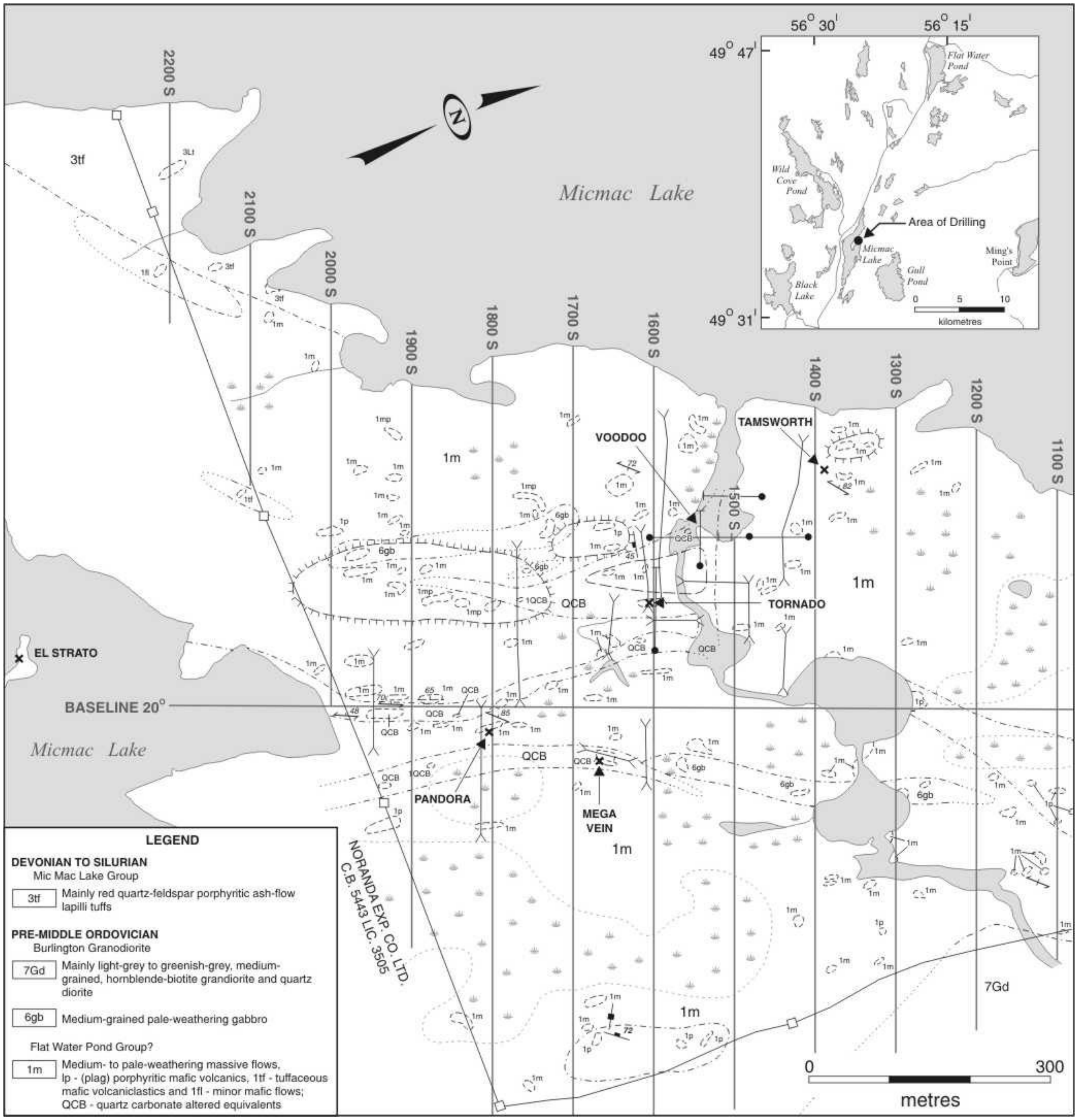


Figure 5. *Geology of the Voodoo area showing the locations of gold occurrences, trenches and diamond drillholes (*modified after *MacDougall* et al.*, 1989).*

long, contained abundant, banded to disseminated pyrite, galena, lesser chalcopyrite and, locally, visible gold (Plate 2). The preservation of altered wall rock, which comprises an assemblage of carbonate, sericite, and minor quartz, magnetite and pyrite adjacent to the vein, suggests limited glacial transport of the boulders. Grab samples collected from the float assayed up to 105.3 g/t Au, 0.8% Cu, 17.1% Pb, 7.1% Zn and 3.88 oz/t Ag. Channel samples collected from some of the larger blocks assayed up to 5.93 g/t Au over 1.5 m. Noranda Ltd. conducted an extensive exploration program consisting of detailed soil- and till-geochemistry, magnetic, VLF and IP resistivity surveys, an extensive trenching program totaling 1500 m in 13 trenches, and 6 short diamond-drillholes totalling 693 m (MacDougall *et al.*, 1989).

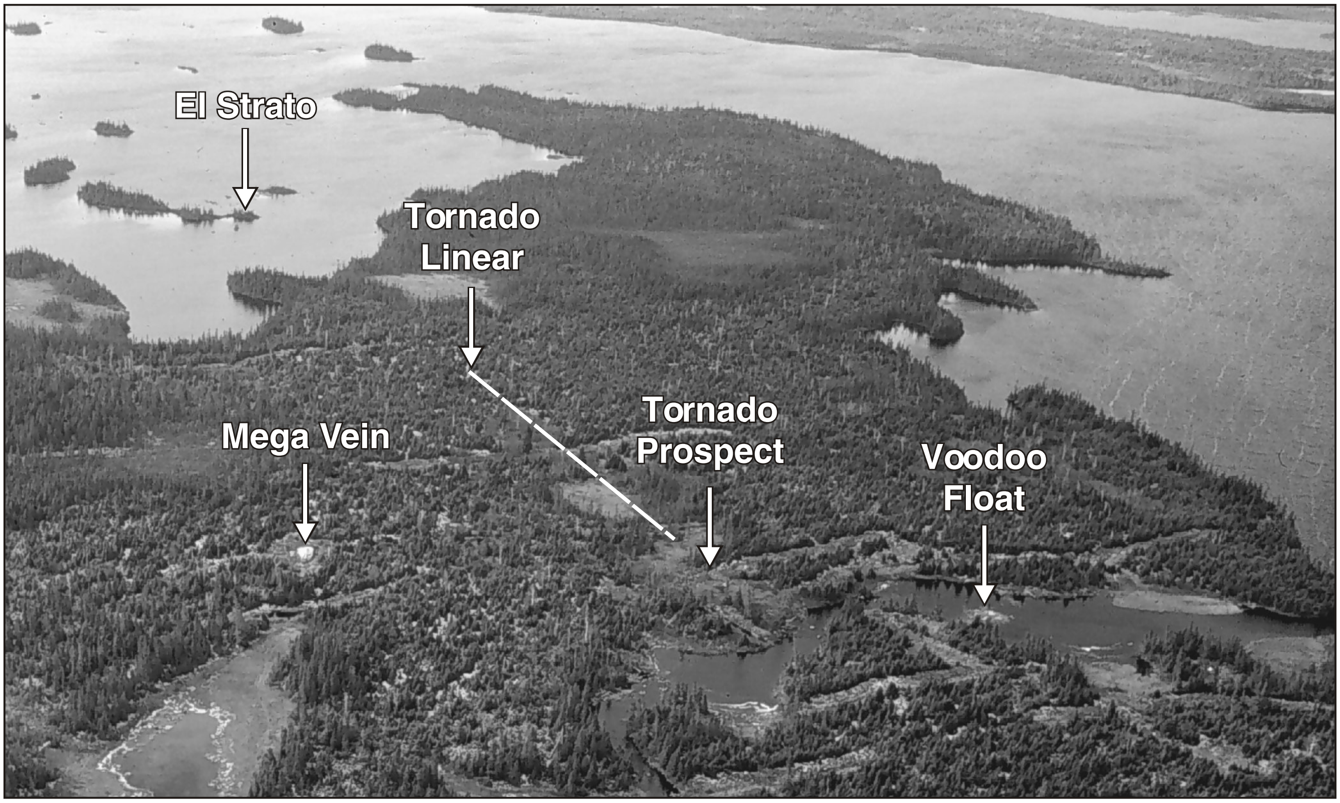


Plate 1. *Aerial view (looking southwest) of the Voodoo area showing trenching carried out by Noranda Exploration Company Limited. Mineralized zones are shown.*

Plate 2. *Voodoo quartz boulder float area, Micmac Lake (Peter Dimmell for scale).*

A number of alteration and minor mineralized zones were exposed in trenches, including the Tamsworth, Tornado, Pandora and Mega Vein. Diamond drilling to test for possible east–west trending mineralization beneath the Voodoo float intersected a narrow base-metal-bearing quartz vein that assayed 2.08 g/t Au. However, this work failed to explain the high-grade mineralized float. Data obtained from these zones indicated that the mineralized zones are characterized by a 020° strike direction (MacDougall *et al*., 1989). This orientation parallels a number of prominent topographic linears that extend throughout the Voodoo area. However, based on glacial striae, gold grain studies and the general distribution of mineralized float along Voodoo Brook, MacDougall *et al*. (1989) favoured an up-ice source to the west or southwest for the float. The source area was interpreted to lie beneath Micmac Lake within 500 m of the Voodoo showing. In late 1989, a 13.6 km winter grid was established on Micmac Lake to conduct ground magnetic, VLF and HLEM geophysical surveys over the El Strato prospect (MacDougall, 1990a). No further work was undertaken and subsequently much of the area was dropped.

The area to the west of the Voodoo float was staked by Bay Roberts Resources and, in 1987, prospecting along Voodoo Brook upstream from the Noranda Ltd. property resulted in the discovery of two narrow quartz veins that assayed up to 32.7 g/t Au (Dawson, 1989). In 1988, the company conducted magnetic and VLF-EM surveys, but high water levels in the brook hampered Bay Roberts Resources' exploration work and no further work was undertaken (Dawson, 1989).

In 1993, Rex Resources (Canada) Limited staked the area surrounding Noranda Ltd.'s Voodoo property. The company conducted a winter geophysical survey over the ice to the west of the Voodoo float to test for a possible source for the boulders (McKenzie, 1994). A total of 15 till samples were collected from 8 of the anomalies outlined. During 1994 and early 1995 the company conducted regional till-geochemistry, soil-geochemistry, grid-magnetics and VLF-EM and deep-overburden sampling surveys, prospecting and rock geochemistry (McKenzie, 1995). In March 1995, the company completed 448.6 m of diamond drilling in 5 holes to test a number of IP chargeability anomalies (McKenzie, 1996). Four of the holes intersected narrow intervals of anomalous gold.

In 1993, the El Strato prospect was staked by local prospector Chris Verbiski (Verbiski, 1994) and a limited prospecting program was carried out on the many small islands in the El Strato area. The ground was subsequently dropped and in late 1997 it was staked by Timothy Froude, a local geologist. In 1997, the El Strato vein was chip sampled and in 1997 and 1998 a reconnaissance soil sampling program was carried out on the mainland to the east of the El Strato prospect. This program outlined a greater than 700-m-long, north-northeast-trending gold anomaly having an approximate width of 200 m (Froude, 1999). Values of up to 2520 ppb Au, 50 ppm Cu, 242 ppm Zn and 199 ppm Pb were identified from the zone. In December 1998, the property was optioned to Noveder Incorporated and the company carried out an exploration and diamond-drill program. Two diamond-drillholes were collared to test the El Strato vein and two holes were collared 550 m apart, to test the coincident IP/gold-in-soil anomaly originally outlined by Froude (1999).

In 1988, Noranda conducted heavy mineral concentrate till and stream sampling, reconnaissance prospecting and rock geochemistry surveys over its Struggler's Pond property (MacDougall, 1989b). Cut grids were established on the various anomalous areas outlined by these surveys and Mag and VLF surveys were undertaken. Prospecting led to the discovery of the Kruger, MacKenzie and Bedford gold showings and, in 1989, further prospecting activities centred on the areas of known mineralization outlined in 1988 (MacDougall, 1990b). This work resulted in the discovery of the Sidewinder showing. Detailed grid mapping was recommended but no further work was undertaken.

In 1986 and 1987, Noranda personnel conducted reconnaissance panned concentrate till and stream sampling, prospecting, rock geochemistry and follow-up till-geochemistry surveys of the Trap Pond Property (MacDougall, 1987b). Anomalous areas were gridded and detailed soil geochemistry surveys were conducted on these areas and an airborne geophysical survey of the property was also undertaken. Follow-up work in 1988 included reconnaissance prospecting, rock geochemistry, detailed soil geochemistry, geophysics, geological mapping, trenching and diamond drilling (MacDougall, 1988b). Work during this period focussed on three areas: 1) Bear Paw, where four trenches failed to explain high concentrations of gold in the soils; 2) Crow Hill North and Crow Hill South, where two significant zones of gold mineralization were outlined; and 3) East Kidney Pond.

In 1988, a detailed soil-geochemical survey was conducted over the Crow Hill grid (MacDougall, 1988b) and a total of 799 samples were collected at 25 m intervals on lines with a 100 m spacing. Results from the known areas of gold mineralization varied from 10 to 1035 ppb at Crow Hill North and 10 to 200 ppb at Crow Hill South. A number of other anomalies were identified but not explained. Ground magnetic and VLF surveys were also conducted over the grid and the magnetic survey identified a number of northeast-trending breaks considered to be related to dextral fault displacement along the Crow Hill linear. The VLF data identified a northeast-trending conductor that also corresponded with the Crow Hill linear. Both the Crow Hill North and Crow Hill South zones were tested by trenching, which was followed up with five diamond-drillholes (MacDougall, 1988b). Anomalous zones outlined in the 1988 surveys were followed-up in 1989 by reconnaissance prospecting, rock geochemistry, detailed soil geochemistry, geophysics, geological mapping and trenching (Deering and MacDougall, 1989). The geophysical survey included an IP survey over the Crow Hill grid that identified a number of anomalies that corresponded with lithological or structural contacts. The 1989 survey identified a new zone of gold mineralization referred to as the Raven Zone and the Crow Hill North, Crow Hill South and Raven zones were tested with a further three diamond-drillholes.

Regional Geology

The Micmac Lake area straddles the Baie Verte Line and is underlain by rocks of both the Baie Verte and Fleur de Lys belts. Serpentinized ultramafic rocks of the Advocate Complex outcrop to the west of Micmac Lake and form a continuous belt extending from Birchy Lake in the south to approximately 1 km north of Micmac Lake. These serpentinite rocks are in fault contact, to the west, with metamorphic rocks of the Rattling Brook Group and intrusive rocks of the Wild Cove Pond Intrusive Suite. To the east, the Advocate Complex is in fault contact with mafic volcanic, volcaniclastic and sedimentary rocks of the Flat Water Pond Group.

In the Micmac Lake area, the Flat Water Pond Group is composed of three units: a sequence of mainly mafic volcaniclastic rocks, gabbro-boulder conglomerate, minor pillow lava, and diabase dykes; a sequence of dominantly pillow lava and minor pillow breccia, cut by diabase dykes and sills; and the Kidney Pond Conglomerate, a sequence of polymictic black shale boulder conglomerate, polymictic conglomerate, gabbro boulder conglomerate, minor epiclastic rocks, black shale and argillite. The Kidney Pond Conglomerate forms the stratigraphic base of the Flat Water Pond Group (Hibbard, 1983) and to the east, the Flat Water Pond Group is in fault contact with the Silurian Mic Mac Lake group.

The Mic Mac Lake group comprises three sequences: 1) a unit of unseparated felsic volcanic and volcaniclastic rocks, sandstone, conglomerate and mafic flows that outcrop mainly to the south of Micmac Lake; 2) the Upper Sequence, comprising red, quartz–feldspar porphyritic ash-flow tuff, massive mafic flows, conglomerate, sandstone and lesser trachyte flows and maroon rhyolite sills; and 3) the Lower Sequence, comprising maroon, flow-banded massive non-porphyritic rhyolite and ash-flow tuff, conglomerate, sandstone and minor mafic flows. To the east, the Mic Mac Lake group nonconformably overlies the Burlington granodiorite (Hibbard, 1983).

The Burlington granodiorite comprises grey to greenish-grey, medium-grained hornblende–biotite granodiorite and quartz diorite. Hibbard (1983) reported that various radiometric isotope studies yielded a wide range of ages for the intrusion, but he assigned an approximate magmatic age of 460 Ma for the granodiorite. Subsequently, Cawood and Dunning (1993) reported a Silurian U/Pb zircon age of 432 ± 2 Ma for the intrusion.

The rocks underlying the islands and eastern shore of Micmac Lake were originally included in the Silurian Mic Mac Lake group (Kidd, 1974). However, Neale and Nash (1963) reported that pillow lavas outcropped on a number of islands within Micmac Lake (Plate 3). The Mic Mac Lake group comprises subaerial volcanic and sedimentary rocks; pillow lava is more typical of the Ordovician volcanic sequences. Reconnaissance geological mapping of the islands, a portion of the eastern shoreline, and an examination of trenches and diamond-drill core from the Voodoo area (Plate 4) indicate that much of the area is underlain by an assemblage of pillow lava, breccia and mafic intrusive rocks (Figure 5). Mapping also indicates that this mafic volcanic unit is sandwiched between granodiorite to the east and Mic Mac Lake group polymictic conglomerate to the west (Plate 5). These mafic volcanic rocks, therefore, do not form part of the Mic Mac Lake group as defined by Kidd (1974); they are lithologically similar to the dominantly submarine mafic volcaniclastic and volcanic rocks of the Flat Water Pond Group to which they should be reassigned.

Plate 3. *Epidotized pillow lava exposed on islands within Micmac Lake.*

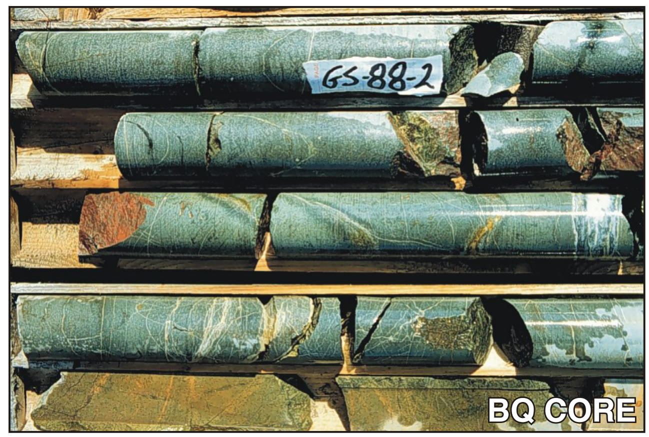


Plate 4. *Pillow lava intersected in diamond-drillhole GS-88-2, Voodoo showing, Micmac Lake.*

Plate 5. *Interbedded polylithic conglomerate and greenish-red sandstone of the Mic Mac Lake group that is exposed on the westernmost islands of Micmac Lake.*

Plate 6. Possible Burlington granodiorite exposed along the eastern shore of Micmac Lake.

Along portions of the easternmost shore of Micmac Lake, a number of exposures of granodiorite were observed (Plate 6) and these outcrops are located approximately 600 m west of the mapped contact of the Burlington granodiorite as shown by Hibbard (1982). It is not known if these exposures are contiguous with the Burlington granodiorite, but they occur close to a northeast-trending topographic linear, which may mark the western contact of the granodiorite.

The pillow lavas exposed on the islands and intersected in diamond drilling are relatively undeformed, but are variably epidotized. The pillows are grey-green, locally vesicular and contain quartz-filled amygdules having slightly purplish cores and darker coloured selvages. Inter-pillow greenish chert occurs locally and breccias are mainly composed of pillow fragments.

Polymictic, red to maroon conglomerate of the Mic Mac Lake group was noted on some of the most westerly islands. The clasts are typically well rounded, up to 20 cm in diameter, and are slightly flattened parallel to bedding. Disrupted sandstone beds occur throughout.

A number of significant showings and prospects that occur within the area were previously considered to be underlain by the Mic Mac Lake group (Figure 5). These include the El Strato base-metal-rich quartz vein, and the Tamsworth, Mega Vein, Tornado and the Pandora carbonate–quartz–pyrite veins. Abundant high-grade float was reported from numerous localities along, and to the east of, the eastern shore of Micmac Lake (MacDougall, 1988a). The most significant occurrence is referred to as the Voodoo float, which comprises unsourced metre-scale angular blocks of quartz containing visible gold and base metals. The size of the blocks indicates the potential for large vein systems. All of the known occurrences are hosted by mafic volcanic and intrusive rocks which do not occur within the Mic Mac Lake group.

Gold Mineralization

1. The El Strato Prospect

Location and Access

The El Strato prospect (NTS 12H/9 Au020 UTM 541500E 5494675N) is an auriferous base-metal-rich quartz vein that is located on a small island near the eastern shore of Micmac Lake, approximately 2 km east of the Baie Verte Highway, Route 410. The prospect can only be accessed by boat.

Local Geology and Mineralization

There is a paucity of exposure on the island that hosts the El Strato prospect (Plate 7). Mafic volcanic rock outcrops on the eastern shore of the island. Exposure at the El Strato prospect is limited to two small shoreline exposures (Figure 6; Plates 8 and 9). Wall rock adjacent to the El Strato prospect is poorly exposed, but appears to comprise a medium- to light-green, mafic, feldspar–porphyritic volcanic rock. Bailey (1999) examined thin sections of the wall rock and described the host rock as a crystal-lithic tuff. Pla-

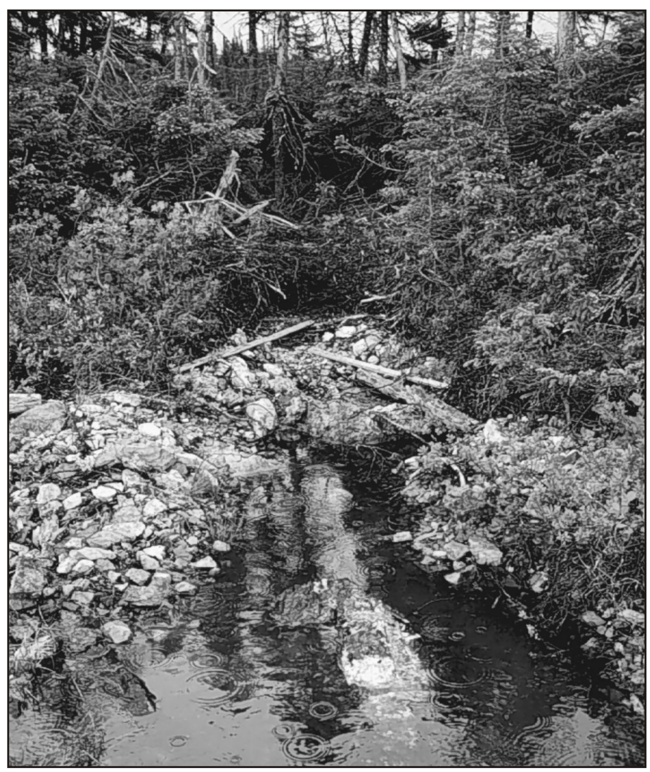


Plate 7. *The El Strato prospect exposed by trenching on the southwestern shore of the island, Micmac Lake.*

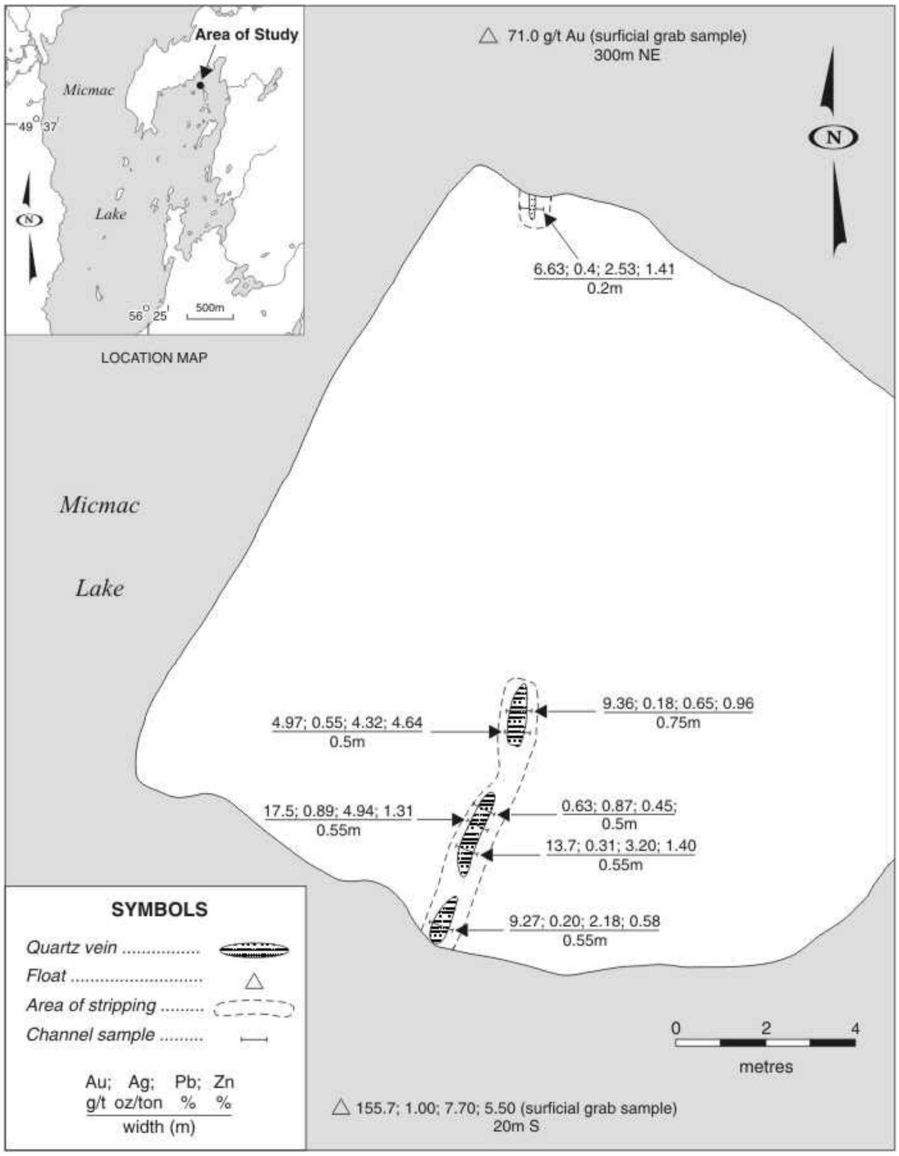


Figure 6. *Trench map of the El Strato prospect showing channel-sample locations and assay results (*modified after *Mac-Dougall* et al., *1989).*

gioclase phenocrysts, probably albite, occur in a fine-grained glassy matrix. Along the vein margins, the wall rock is sheared and varies from a rusty buff to a pale green. Sericite and minor disseminated pyrite occur in the wall rock adjacent to the vein. From thin-section studies, Bailey (1999) indicated that the wall rock was altered to an assemblage of fine-grained quartz, carbonate, sericite, pyrite and minor chlorite and fuchsite. Pyrite within the altered wall rock exhibits pressure shadows filled with quartz and chlorite.

Limited trenching has exposed less than 1 m of the vein on north side of the island and about 3 m of the vein on the south side of the island. The vein has been traced discontinuously over a strike length of approximately 40 m (MacDougall, 1990a), of which about less than 20 m is on the island.

The vein, which has a maximum exposed width of 0.75 m (MacDougall, 1990a), consists of milky-white, weakly laminated and locally vuggy quartz that appears to pinch and swell. The vein trends at 025 to 035° and is vertical to steeply east-dipping and contains abundant sphalerite, galena and pyrite, which occur as coarse clots, bands and disseminations (Plate 9). The following description of the mineralization is taken from Bailey (1999).

> "The vein displays recrystallization along quartz boundaries, and contains up to 10% sulfides. Sulfides range from 1-2 centimetre, euhedral pyrite

Plate 8. *El Strato vein as it is exposed on the northeastern shore of the island, Micmac Lake. Vein consists of milky-white quartz containing abundant coarse-grained base-metal mineralization. Altered wall rock comprises silicified and sericitized mafic volcanic rocks.*

> crystals along the margins of the veins to disseminated anhedral pyrite, chalcopyrite, galena, and sphalerite throughout the vein... Sulfides are intergrown with inclusions of one type within the other (euhedral pyrite inclusions in galena...). Pyrite tends to be euhedral in several of the occurrences, suggesting that pyrite was formed in an open space environment, during dilation of the shear zone."

Gold values of up to 155.7 g/t Au have been reported from grab samples (MacDougall, 1990a), and Froude (1999) reported chip sample assay results of up to 239.6 g/t Au over 0.5 m from the El Strato vein. Visible gold has not been reported from the showing. Tables 3 and 4 list assay results from the showing; the location of the Noranda samples is shown on Figure 6.

In December 1999, Noveder announced the results of the diamond-drill program on its Micmac Lake property (Noveder Incorporated, December 7, 1999). Holes ML-99-07 and 08 were drilled to test the El Strato prospect but both failed to intersect the mineralized vein. However, ML-99-07 intersected a new vein that assayed 9.96 g/t Au, 15.6% Pb, 1.88% Zn and 41.48 g/t Ag, over a core length of 30 cm and, ML-99-08 intersected a zone of silicified basalt that assayed 2.01 g/t Au over 82 cm. Two holes drilled to test the coincident soil/IP anomaly identified by Froude (1999) intersected a new zone of gold mineralization. Hole ML-99-09 intersected a zone of quartz–carbonate–galena–pyrite stockwork veining that assayed 4.62 g/t Au over 30 cm and ML-99-10 intersected an upper quartz–pyrite–galena vein that assayed 5.99 g/t Au over 0.41 m and a lower silicified zone that assayed 3.59 g/t Au over 67 cm.

Plate 9. *Closeup of the El Strato prospect showing altered wall rock and mineralized quartz vein.*

3. The Mega Vein Showing

Location and Access

The Mega Vein showing (NTS 12H/9 Au022 UTM 541850E 5495250N) is a carbonate–quartz–pyrite replacement style of gold mineralization that is located near the eastern shore of Micmac Lake approximately 2 km east of the Baie Verte Highway, Route 410. The prospect is best accessed by boat.

Local Geology and Mineralization

The Mega Vein occurs within sheared fine-grained gabbroic rocks. To the southeast, shearing within the high-strain zone extends at least 2.5 m beyond the Mega Vein. The vein is mantled by a zone of pervasive quartz–carbonate alteration up to 2 m wide, which contains abundant quartz–carbonate–chlorite tension-gash veinlets that locally form anastomosing zones. The Mega Vein is composed of massive milky-white quartz, is weakly laminated and locally characterized by patchy hematitic staining. Angular wall-rock fragments are incorporated in the vein along its margins and

Table 3. Noranda Exploration Company Limited channel-sample results from the El Strato prospect (MacDougall, 1990a)

Sample	Au (g/t)	Ag (oz/t)	Zn (%)	Pb (%)
0.2 m channel sample, north side of island	6.63	0.4	1.41	2.53
0.75 m channel sample, south side of island	9.36	0.18	0.95	0.65
0.6 m channel sample, south side of island	4.97	0.55	4.64	4.32
0.5 m channel sample, south side of island	0.63		0.45	0.87
0.55 m channel sample, south side of island	17.5	0.89	1.31	4.94
0.55 m channel sample, south side of island	13.7	0.31	1.4	3.2
0.55 m channel sample, south side of island	9.27	0.2	0.58	2.13
grab sample, 20 m south of island	155.7	1	5.5	7.7

Table 4. Channel-sample results from the El Strato prospect, all samples were collected over a width of 0.5 m (Froude, 1999)

Sample	Au (g/t)	Ag (g/t)	Zn (%)	Pb (%)	Cu (%)
RML-98-6	2.94	4.8	1.13	0.31	0.07
RML-98-7	4.96	3.7	1.6	1.51	0.05
RML-98-8	17.82	4.2	2.72	1.43	0.09
RML-98-9	3.69	2.8	2.1	0.07	0.2
RML-98-10	55.96	2.6	0.85	0.16	0.1
RML-98-11	207.1	29.82	3.1	0.46	0.45
RML-98-12	239.6	31.2	1.48	0.6	0.36

minor, euhedral pyrite occurs as fine to coarse disseminations within the wall rock adjacent to the vein margins.

Noranda personnel interpreted the vein to be approximately 8 m wide (MacDougall *et al*., 1989). However, a cross-section of the vein, which is exposed in the trench wall, shows that the vein is folded and exhibits a sigmoidal S-shape (Plate 10). The trench exposes the long axis of the fold, which is approximately horizontal, and this accounts for the apparent 8 m width. An axial–planer fracture cleavage cuts the long axis of the fold and a series of almost perpendicular fractures offset the Mega Vein along the long axis. The folding is probably related to movement within the shear zone subsequent to the formation of the vein. The S-shaped fold appears to plunge about 40° toward 060° and the vein trends 30° and dips about 80° to the east.

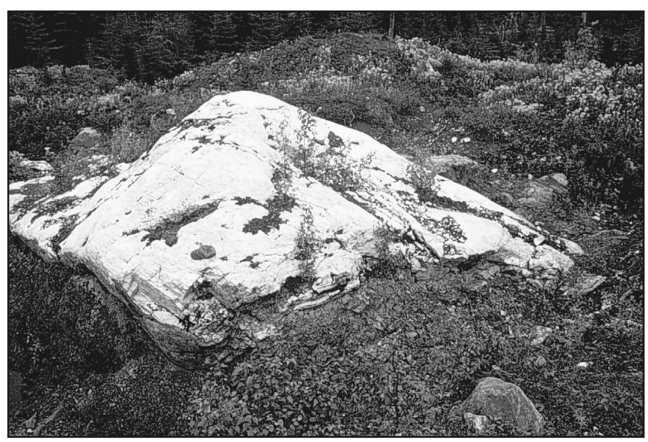


Plate 10. *Sigmoidal-shaped Mega Vein, Micmac Lake area.*

MacDougall *et al.* (1989) reported that grab samples form the Mega Vein containing the coarse pyrite assayed up to 0.325 g/t Au. The quartz–carbonate–chlorite veinlets, which are developed in the quartz–carbonate zone along the eastern margin of the Mega Vein, were reported to contain blebs of chalcopyrite and grab samples collected from this zone assayed up to 0.469 g/t Au, 2.5% Cu and 0.56 oz/t Ag (MacDougall *et al.*, 1989). Channel samples across this zone returned much lower values of 0.035 g/t Au, 0.145% Cu and 1.0 g/t Ag over 1.0 m.

Table 5. Assay data for quartz veins, altered mafic volcanic rocks and quartz float, Voodoo Brook area (Dawson, 1989)

Sample	Au ppb	Cu ppm	Ag oz/ton
MD88-26 vein	12500	1260	0.53
MD88-27 vein	8300	6400	0.25
MD88-25 mafic volcanic with 1% pyrite, 30 m upstream from veins	570		
MD88-30 mafic volcanic, silicified with 1-3% pyrite, collected near quartz float	510		
Three quartz boulders	12 900 - 32 700	660 - 4200	0.82 - 0.92

4. Micmac Lake NE Showing

Location and Access

The Micmac Lake NE showing (NTS 12H/9 Au023 UTM 542300E 5495800N) is an auriferous base-metal-rich quartz-vein system exposed in the stream bed of Voodoo Brook, approximately 0.8 km upstream from where the brook flows into Micmac Lake.

Local Geology and Mineralization

MacDougall (1988a) described the mineralization as a poorly exposed zone of silicified and carbonitized mafic volcanic rock containing up to 5 to 10 percent pyrite. The showing was located in the bed of Voodoo Brook near the eastern boundary of the Noranda claims. Grab samples from the zone assayed up to 4.62 g/t Au. MacDougall *et al.* (1989) reported that Noranda prospectors had also discovered two narrow, 0.3- and 0.6-m-wide, quartz veins in the brook just to the east of the Noranda claim boundary. These are probably the same veins discovered by Bay Roberts Resources personnel in 1987. Dawson (1989) described the mineralization as comprising several narrow mineralized quartz veins, which are about 12 to 14 cm in width, and strike approximately 200 to 210°. A number of angular, mineralized quartz boulders, up to 50 cm in diameter, were discovered about 30 m downstream from the veins. Sulphides within the boulders and the veins were described as forming scattered bunches, fine disseminations and massive lenses and having concentrations typically between 1 to 3 percent and locally up to 20 percent (Dawson, 1989). Pyrite is the most common sulphide mineral with up to 1 percent chalcopyrite occurring locally. Dawson (1989) reported that the veins and boulders are typically stained with malachite and locally azurite. Grab sample results from the boulders and the veins are listed in Table 5.

Rex Resources (Canada) Limited drilled a 103.6-m-long diamond-drillhole to test an IP anomaly located immediately northeast of the Micmac Lake NE showing (McKenzie, 1996). This hole intersected a 0.9 m interval of quartz–carbonate stringers containing trace pyrite within a mafic dyke, which assayed 2893 ppb Au. A 30 cm interval of this intersection contains about 10 to 15 percent pyrite, sphalerite, chalcopyrite and galena. The IP anomaly was interpreted to extend approximately 300 m to the northeast where similar veins, which assayed up to 12.4 g/t Au over 0.3 m, are exposed in the brook.

During this study, exceptionally low water levels in Voodoo Brook resulted in the discovery, or rediscovery, of a series of narrow, base-metal-rich quartz veins exposed within the stream bed. The veins showed no evidence of prior sampling and it is not known with certainty if this is a new zone or the same zone previously reported by both Noranda and Bay Roberts Resources. These veins are located a few metres upstream from a cutline, which appears to mark the eastern boundary of the Noranda property. The zone, which has an exposed width of 5 to 6 m, was found to contain a series of laminated base-metal-rich quartz veins up to 10 cm thick. The veins trend 40° and dip steeply to the north. Sulphides within the veins comprise clots and bands of pyrite, galena, sphalerite and chalcopyrite. Bailey (1999) indicated that, in thin section, sphalerite exhibits "chalcopyrite disease". No mention of galena was made in the description of the mineralized quartz veins discovered by Bay Roberts Resources, possibly indicating that these are not the same vein set. Locally, heavy concentrations of sulphides mantle the veins and wall rock to the veins comprises bleached-looking, fine-grained gabbro(?) containing clots and disseminations of pyrite. A thin-section examination of weakly altered wall rock by Bailey (1999) revealed a mineral assemblage comprising 40 percent chlorite, 30 percent plagioclase (saussauritized), 25 percent carbonate and 5 percent opaques. The rock is described as weakly carbonitized and cut by multiple vuggy and comb-textured calcite veinlets. The zone trends to the northeast and southwest, but away from the brook the zone is covered by overburden. Grab samples collected by the author assayed 5950 ppb Au, 3310 ppb Au and 1230 ppb Au from quartz veins; and 14 ppb Au and 6 ppb Au from altered wall rock.

5. Tornado Prospect

Location and Access

The Tornado prospect (NTS 12H/9 Au024 UTM 541750E 5495400N) is a carbonate–quartz–pyrite replacement-style of gold mineralization exposed by trenching less than 100 m south of the outflow of Voodoo Brook on the eastern shore of Micmac Lake. The area is best accessed by boat.

Local Geology and Mineralization

The Tornado prospect is located on the western side of a prominent 020°-trending topographic depression referred to as the Tornado Linear (MacDougall *et al*., 1989). The occurrence comprises a 15-m-wide zone of carbonate–chlorite alteration developed within fine-grained gabbro. On fresh surfaces the gabbro is bleached and contains 1 to 2 percent disseminated pyrite. Several 1- to 10-cm-wide, 020°-trending, milky-white quartz veinlets cut the carbonate alteration. The veins, which contain disseminated pyrite and galena, assay up to 5.2 g/t Au over 5 cm. Pyrite locally occurs as coarse clots, marginal to, and within, the quartz veins and pyrite also mantles wall-rock fragments within the veins. Pyrite-bearing quartz veins up to 15 cm thick, trending 050° and dipping 70° to the south are associated with an approximately 1-m-wide shear zone, which cuts the carbonate-altered gabbro.

Trenching on the Tornado Linear, near the Tornado prospect, uncovered numerous, up to 2.0 m in diameter, angular blocks of weakly carbonitized mafic volcanic rock and fine-grained gabbro cut by multiple mineralized quartz veins up to 1.0 m wide (Plate 11; MacDougall *et al*., 1989). The veins are vuggy, contain carbonate and exhibit breccia-like textures and sulphides that form clots and laminations defined by semi-massive bands. The following thin-section description is taken from Bailey (1999, page 37).

> "Thin sections reveal the alteration to be pervasive carbonate, sericite, quartz, with chlorite occurring only in veinlets. Albite has two forms in this occurrence, it occurs as subhedral crystals displaying Carlsbad twinning and saussauritization in the altered wall rock, suggesting a primary igneous origin, and as large (2-3 millimetre) euhedral crystals in veinlets. The quartz vein contains approximately 5% pyrite."

Channel sampling of the blocks returned assay values of up to 1.5 g/t Au over 1.0 m.

The 020°-trending Tornado Linear was tested by a single west-directed, shallow diamond-drillhole (GS-89-2). The hole intersected numerous, less than 10-cm-wide mineralized quartz veins but did not intersect the carbonate alteration zone (MacDougall *et al*., 1989).

Plate 11. *Quartz vein float, Tornado Linear, Micmac Lake.*

Soil geochemical surveys undertaken by Noranda indicate that the Tornado Linear is anomalous with respect to gold over a 400 m strike length (MacDougall *et al.*, 1989) and values of up to 542 ppb Au were reported. An analysis of gold grains indicated that many of the grains were considered to be of proximal origin and a gold source located to the west was determined from glacial data and gold grain wear.

8. Clydesdale Prospect

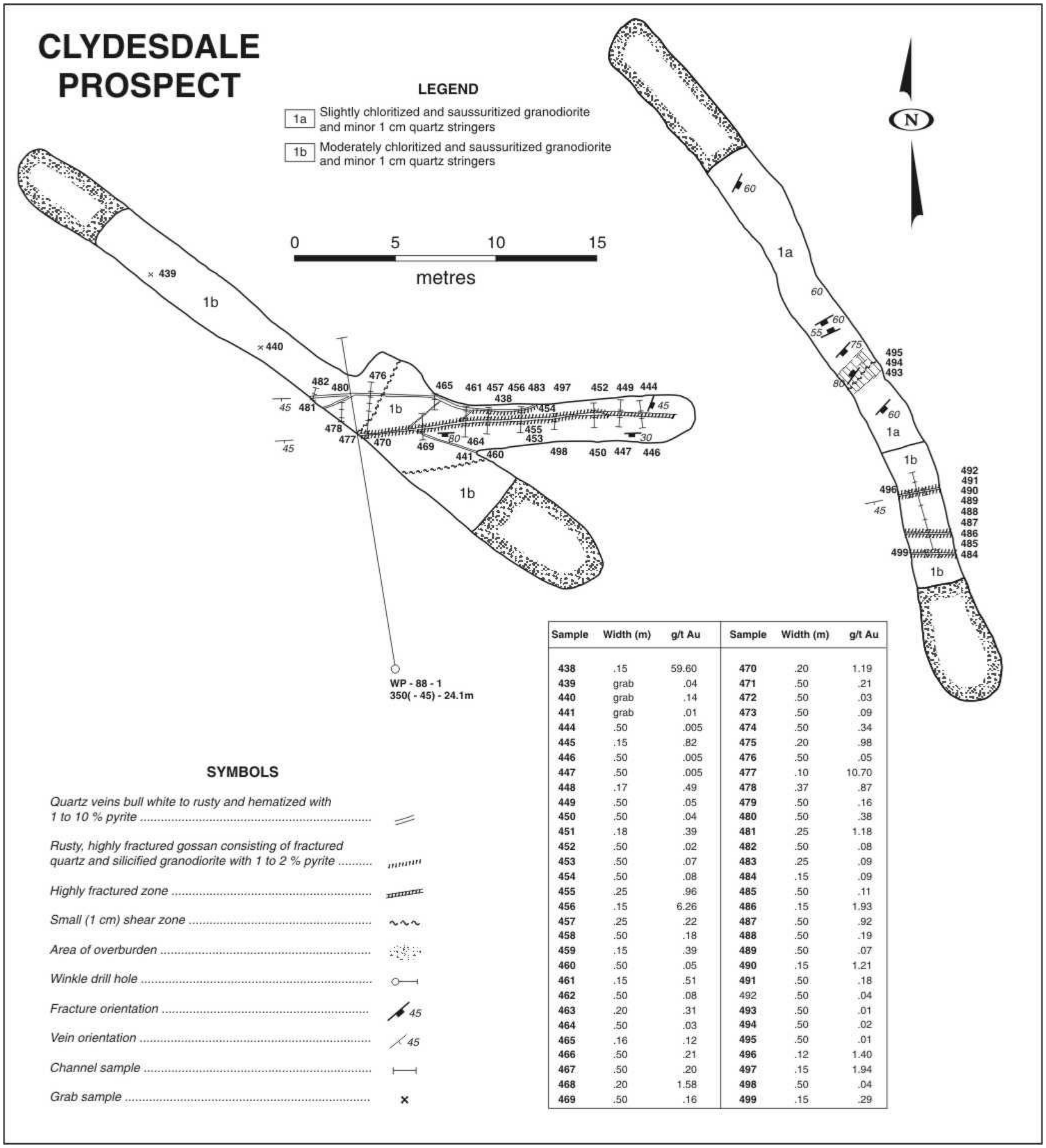
Location and Access

The Clydesdale prospect (NTS 12H/9 Au027 UTM 543070E 5497580N) is an auriferous quartz–pyrite vein system exposed by trenching approximately 1.8 km east of the Baie Verte Highway (Route 410). The prospect can be accessed by farm trails and old logging roads, which originate from the Baie Verte Highway, approximately 0.5 km north of Micmac Lake.

Local Geology and Mineralization

The Clydesdale prospect as exposed by trenching (Figure 7) comprises two, hematitic, 5- to 20-cm-wide, milky to steel-grey quartz veins developed over a 1.4-m-wide interval within chloritized and saussauritized Burlington granodiorite (?) (MacDougall, 1988a). The veins are laminated, exhibit comb-textures and contain up to 30 percent coarse disseminated pyrite and minor chalcopyrite. The wall rock adjacent to the veins contains up to 1 to 2 percent disseminated pyrite. The veins strike 080°, dip 45° to the south and appear to be fracture-controlled. The prospect occurs approximately 50 m southeast of a major topographic linear that may mark the contact between the Flat Water Pond Group and the Burlington granodiorite (MacDougall, 1988a).

The Clydesdale prospect has been tested by three trenches, only two of which exposed bedrock, and a single 24-m long Winkie diamond-drillhole (WP-88-1), (Figure 8). Channel and chip sampling of the mineralized veins have



Sample	Width (m)	g/t Au	Sample	Width (m)	g/t Au
438	.15	59.60	470	.20	1.19
439	grab	.04	471	.50	.21
440	grab	.14	472	.50	.03
441	grab	.01	473	.50	.09
444	.50	.005	474	.50	.34
445	.15	.82	475	.20	.98
446	.50	.005	476	.50	.05
447	.50	.005	477	.10	10.70
448	.17	.49	478	.37	.87
449	.50	.05	479	.50	.16
450	.50	.04	480	.50	.38
451	.18	.39	481	.25	1.18
452	.50	.02	482	.50	.08
453	.50	.07	483	.25	.09
454	.50	.08	484	.15	.09
455	.25	.96	485	.50	.11
456	.15	6.26	486	.15	1.93
457	.25	.22	487	.50	.92
458	.50	.18	488	.50	.19
459	.15	.39	489	.50	.07
460	.50	.05	490	.15	1.21
461	.15	.51	491	.50	.18
462	.50	.08	492	.50	.04
463	.20	.31	493	.50	.01
464	.50	.03	494	.50	.02
465	.16	.12	495	.50	.01
466	.50	.21	496	.12	1.40
467	.50	.20	497	.15	1.94
468	.20	1.58	498	.50	.04
469	.50	.16	499	.15	.29

Figure 7. *Trench map of the Clydesdale prospect illustrating channel-sample assay results (*modified after *MacDougall, 1988a).*

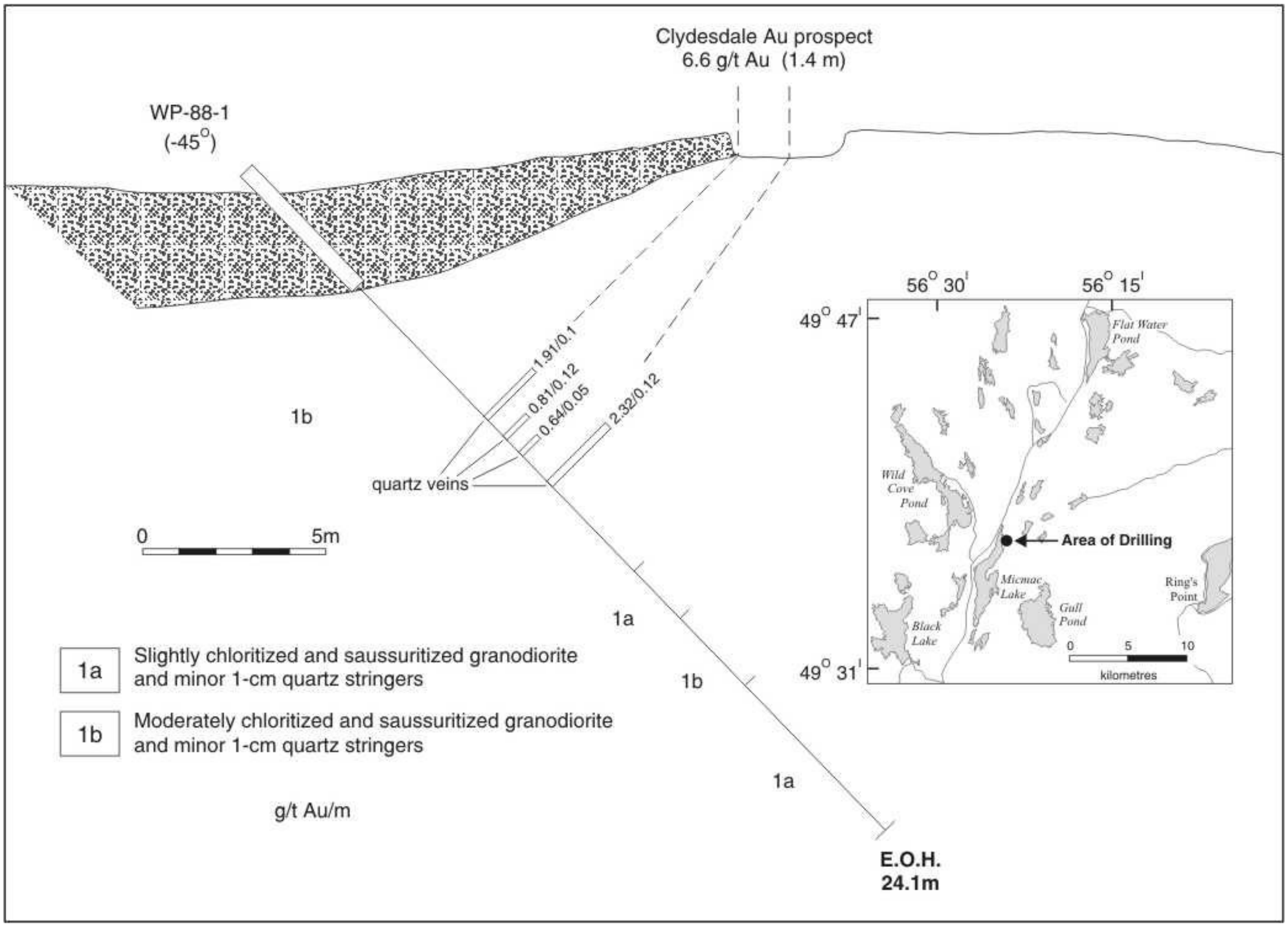


Figure 8. *Drill section looking west, Clydesdale prospect (*modified after *MacDougall, 1988a).*

assayed up to 59.6 g/t Au over 0.15 m, 29.0 g/t Au over 0.2 m and 10.7 g/t Au over 0.1 m. The best combined assay across the two veins averaged 6.6 g/t Au over 1.4 m. The other channels typically averaged 1.0 g/t Au over the 1.4 m interval (MacDougall, 1988a). The Winkie drillhole intersected four mineralized quartz veins over a 2.4 m interval (MacDougall, 1988a). The veins varied from 5 to 20 cm in width and contained up to 10 percent disseminated pyrite. Assay results for the veins ranged from 0.6 to 2.3 g/t Au and up to 0.1 g/t Au for the altered wall rock adjacent to the veins.

12-14. Struggler's Pond

Location and Access

The Struggler's Pond area is underlain by rocks of the Burlington granodiorite, which is host to three gold showings (Figure 9); these are the Sidewinder (NTS 12H/9 Au031 UTM 547400E 5498300N); MacKenzie (NTS 12H/9 Au032 UTM 547010E 5497990N); and the Kruger (NTS 12H/9 Au033 UTM 546800E 5497690N). A forest access road, which originates from the Baie Verte Highway (Route 410) just to the north of Micmac Lake, passes within about 1 km to the west of the occurrences. Skidder trails and cut lines lead directly to the showings.

Local Geology and Mineralization

MacDougall (1989b, 1990b) interpreted all these showings to be structurally controlled and localized along joint and fracture sets within the granodiorite. Whereas these showings are fairly small and of limited extent, they are significant because they indicate a potential for economic gold mineralization within the Burlington granodiorite. In the past, gold exploration has focused mainly on the ophiolitic and volcanic cover sequences on the Baie Verte Peninsula and has largely excluded the extensive Burlington granodiorite.

Kruger Showing

The Kruger showing is an auriferous base-metal-rich vein that forms a 0.45-m-wide by 1.0-m-high lensoidal-shaped zone (Plate 12), and contains patches and clots of chalcopyrite–pyrite in quartz veinlets, developed within the Burlington granodiorite. Up to 5 percent disseminated molybdenite (Plate 13) is associated with the zone and is concentrated along joints and fractures within both the lensoidal zone and the adjacent wall rock (Macdougall, 1989b). The granodiorite adjacent to the veining is hematized, silicified and contains minor disseminated chalcopyrite and molybdenite. Grab samples collected from the veinlets assayed 32.9, 13.4 and 11.2 g/t Au and up to 6.3 percent

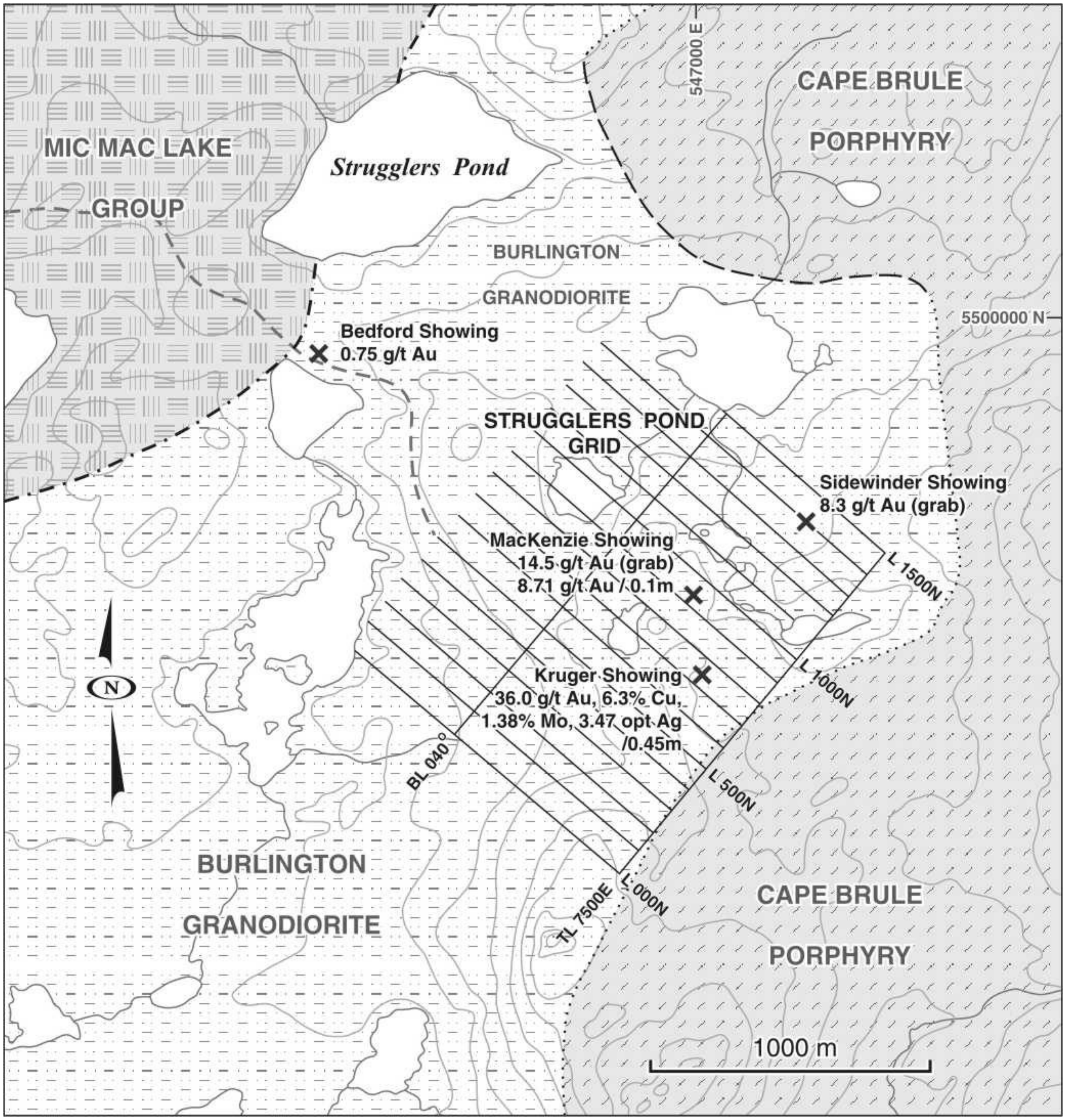


Figure 9. *Geological map showing the location of the Bedford, Sidewinder, MacKenzie and Kruger showings (*modified after *MacDougall, 1990b).*

Plate 12. *The Kruger showing comprises a small lensoidal zone, which is hosted by the Burlington granodiorite, containing chalcopyrite and pyrite in quartz veinlets (note hammer for scale).*

Plate 13. *Disseminated clots of molybdenite, Kruger showing.*

Cu, 1.38 percent Mo and 3.74 oz./t Ag (MacDougall, 1989b). Grab samples collected from the altered wall rock assayed up to 1.17 g/t Au and chip samples collected from the veins assayed 36.0 g/t Au, 2.49 percent Cu, 0.96 percent Mo and 1.63 oz./t Ag over 0.45 m (MacDougall, 1990b).

MacKenzie Showing

The MacKenzie showing is a silica–sulphide replacement style of gold mineralization that comprises five silicified, northeast-trending diabase dykes within the Burlington granodiorite. The dykes, which contain up to 5 percent fine disseminated pyrite, are cut by thin quartz veins and stringers (MacDougall, 1989b). Locally hematized, quartz veins, containing up to 10 percent fine, disseminated pyrite, are developed along 110°-trending and 35° NE-dipping, conjugate joint sets within the granodiorite (MacDougall, 1990b). Wall rock adjacent to the veins exhibits patchy silicification with up to 5 percent disseminated pyrite. Grab samples collected from the silicified dykes assayed 3.73 and 1.34 g/t Au and chip samples collected across the silicified dykes assayed 8.71 g/t Au over 0.1 m and 5.94 g/t Au over 0.2 m, with a best combined assay of 4.0 g/t Au over 0.5 m. The highest gold values occur where the veins intersect the dykes, and grab samples collected from the hematized quartz veins, assayed 14.5 and 13 g/t Au, and a grab sample of the silicified wall rock assayed 3.3 g/t Au.

Sidewinder Showing

The Sidewinder showing is a quartz–pyrite vein style of gold mineralization that consists of three, 2- to 4-cm-wide quartz veins developed over a 5 m interval within the Burlington granodiorite (MacDougall, 1990b). The veins trend 095°, dip 50° southwest and contain up to 10 percent pyrite. Grab sample assays of 8.3, 8.3 and 1.3 g/t Au from each of the quartz veins, respectively, and 0.29 g/t Au from altered wall rock.

16-18. Crow Hill Prospects

Location and Access

The Crow Hill prospects are silica–sulphide replacement styles of gold mineralization that comprise three zones referred to as: 1) Crow Hill South (NTS 12H/9 Au035 UTM 547010E 5505050N); 2) the Raven Zone (NTS 12H/9 Au036 UTM 546990E 5505250N); and 3) Crow Hill North (NTS 12H/9 Au037 UTM 547680E 5506940N) (Figure 10). A fourth minor occurrence, Crow Hill NE, is described in Appendix 1. All of the occurrences are spatially associated with a prominent northeast-trending topographic features known as the Crow Hill Linear (Plate 14).

Local Geology and Mineralization

The Crow Hill area is host to four gold occurrences developed along a 3.5 km strike length. The mineralization is hosted by felsic volcanic rocks of the Silurian Mic Mac Lake group just to the east of its faulted contact with the Flat Water Pond Group. The felsic rocks are mainly pink to maroon, quartz–feldspar porphyritic lithic tuffs.

Crow Hill South Zone

The Crow Hill South Zone occurs within a sequence of strongly sheared, felsic volcanic rock that is altered to an assemblage of quartz and sericite. The zone has been traced along strike for 70 m and is reported to be greater than 20 m in width (MacDougall, 1988b). A second zone (East zone) was exposed by trenching approximately 25 m east of the

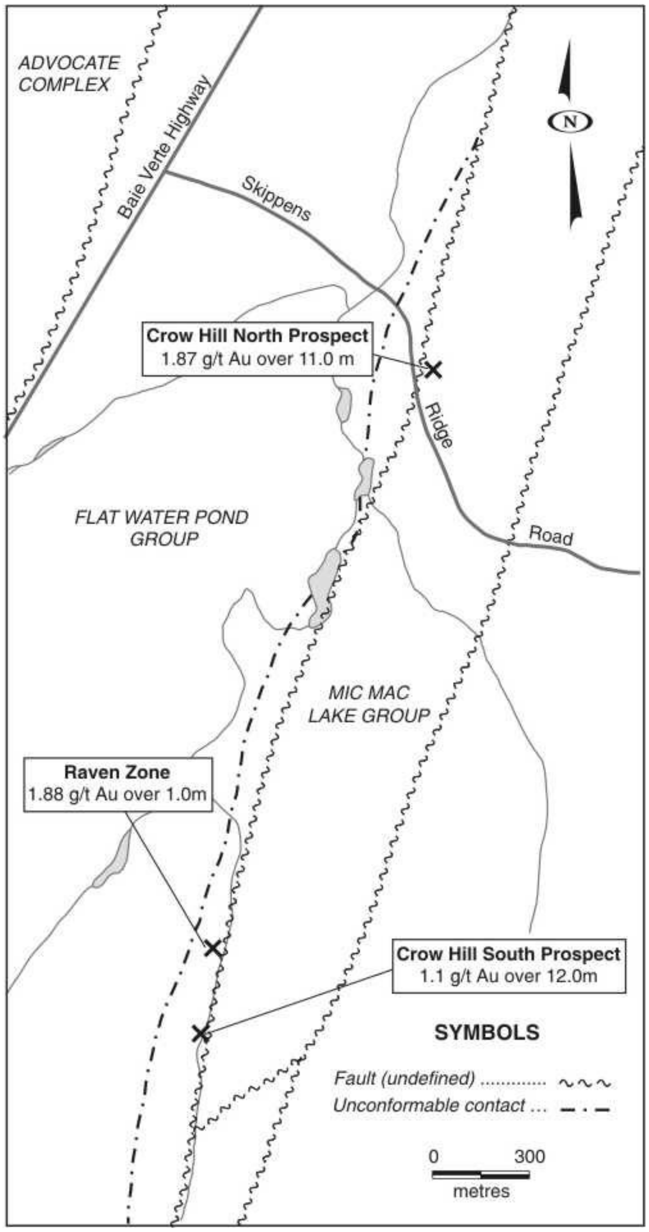


Figure 10. *Geology map showing the locations of the Crow Hill North, Crow Hill South and Raven zones (*modified after *Deering and MacDougall, 1989).*

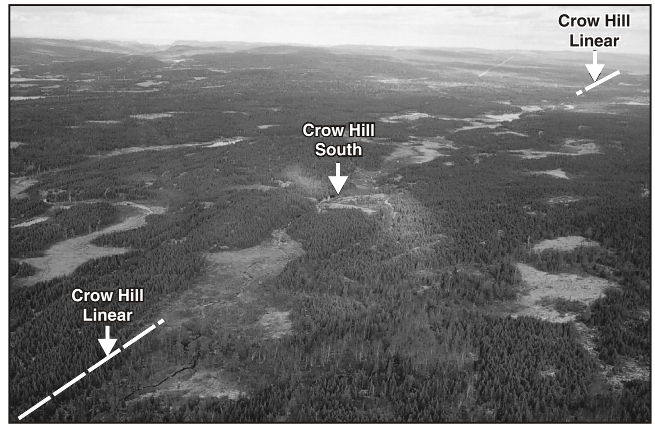


Plate 14. *The Crow Hill Linear, a northeast-trending zone defined by the aligned string of bogs. The trenched area in the middle of the photo is the Crow Hill South Zone.*

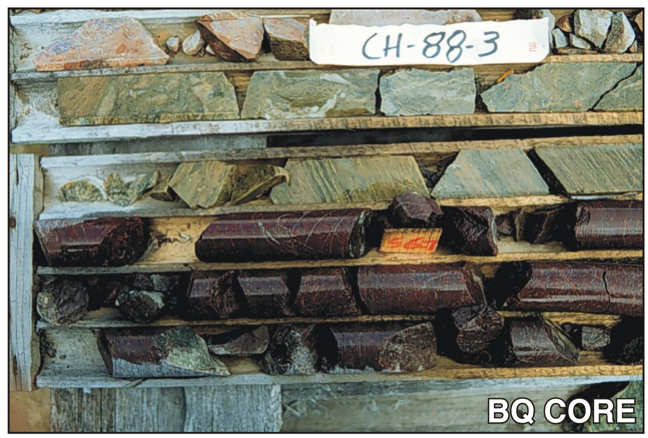


Plate 15. *Diamond-drillhole CH-88-03, Crow Hill South illustrating both the typical unaltered maroon felsic crystal tuffs of the Mic Mac Lake group and the intense yellowy-green sericite alteration associated with the prospect.*

Crow Hill South Zone. Where sericitized and silicified, the altered tuffs are bleached-looking and have a yellowish-green cast (Plate 15) and a strong northeast-trending, steeply west-dipping penetrative fabric overprints the sericitic zones, indicating post-alteration deformation. Milky-white quartz tension-gash veins are common and locally contain coarse specularite (Plate 16). Locally, small quartz veinlets were noted to contain a bright pink-red mineral tentatively identified as adularia, which is a low-temperature hydrothermal K-feldspar (Plate 17). The alteration, particularly within more sericitic zones, is typically accompanied by 1 to 5 percent medium-grained disseminated and stringer pyrite. Pyrite also occurs with chlorite in small crosscutting vein-filled fractures.

The Crow Hill South Zone has been tested by five trenches and four diamond-drillholes (Figure 11). Exploration is hampered by thick overburden and limited exposure. Gold values associated with the Crow Hill South Zone are typically low with values of up to 1.03 g/t Au over a 12.0 m channel sample (MacDougall, 1988b) and 1.87 g/t Au over 11.0 m reported from diamond drilling (Figure 12; Deering and MacDougall, 1989). A 1.0 m channel sample collected from an East zone trench, assayed 6.0 g/t Au and a grab sample assayed 16.0 g/t Au. This zone was tested with a single diamond-drillhole that intersected a zone of sericitized felsic volcanic rocks containing up to 2 percent pyrite and assayed up to 2.08 g/t Au over 0.5 m (Figure 13). Assay

Plate 16. *Typical tension-gash style milky quartz veining developed within strongly sericitized felsic volcanic rocks, Crow Hill South.*

Plate 17. *Pink feldspar (adularia ?) associated with the quartz veinlets, diamond-drillhole CH-88-03 Crow Hill South.*

results of up to 5.6 g/t Au have been reported from mineralized float in the Crow Hill area (MacDougall, 1988b). A summary of assay data is presented in Table 6.

Raven Zone

The Raven Zone was discovered in 1989 as a result of prospecting and trenching carried out approximately 150 m north-northwest of the Crow Hill South Zone (Deering and MacDougall, 1989). The discovery trench exposed the fault contact between the Flat Water Pond and Mic Mac Lake groups (Plate 18). This contact corresponds with an IP anomaly that extends the full length of the Crow Hill grid (Deering and MacDougall, 1989). In the trench, the fault is marked by a zone of iron carbonate-altered mafic volcanic rocks, containing 1 to 5 percent disseminated pyrite to the west and a zone of brecciated felsic volcanic rocks containing 1 to 3 percent disseminated and stringer pyrite to the east (Figure 14). Small quartz veins up to 2 cm wide cut both rock types. Channel samples across the Raven Zone assayed 1.88 g/t Au over 4.0 m and included a 0.4 m interval that assayed 8.0 g/t Au.

The Raven Zone was tested by single diamond-drillhole (CH-89-8) that was collared in carbonitized mafic volcanic rocks containing up to 5 percent disseminated pyrite. The section assayed 2.19 g/t Au over 1.0 m. Deering and MacDougall (1989) reported that no alteration or mineralization were observed where the drillhole intersected the fault contact between the Flat Water Pond and Mic Mac Lake groups. Likewise, an unaltered and unmineralized section of the fault zone was exposed in a trench excavated 100 m to the south of the Raven Zone. Based on this data, they interpreted the mineralization to be either independent of the fault zone or to have an unrecognized plunge component. A second drillhole was recommended to test the possible down-plunge extension of the zone, but this work was not undertaken.

Crow Hill North Zone

The geological setting, alteration and mineralization exposed at the Crow Hill North Zone is similar to that of the Crow Hill South Zone. The north zone is located on the east side of the Crow Hill Linear (Plate 19) and the host rocks are variably sericitized and silicified quartz–feldspar porphyritic lithic felsic tuff of the Mic Mac Lake group (Plate 20). The felsic rocks are typically bleached looking and contain up to 3 percent disseminated and stringer pyrite and rare specularite (MacDougall, 1988b). Fractures coated with black chlorite and fine disseminated pyrite are common throughout the zone. MacDougall (1988b) reported that the intensity of the alteration increased westward toward the Crow Hill Linear, whereas to the east the alteration was gradational into unaltered felsic volcanic rocks. He also reported that geochemical analyses of the alteration zone indicated that the bleached zones exhibited a slight increase in both SiO_2 and Na_2O and a depletion in K_2O.

The alteration zone, which is up to 20 m in width, has been traced by trenching over a strike length of 365 m. The zone has been tested by seven trenches (Figure 15) and two diamond-drillholes (Table 6). Channel sample assay results from the Crow Hill North Zone include 1.87 g/t Au over 11.0 m, 2.27 g/t Au over 8.0 m and 1.1 m over 10 m (MacDougall, 1988b).

Plate 18. *Carbonate altered volcanic rocks exposed by trenching at the Raven Zone. The alteration is developed marginal to the low faulted (area left side of the photograph) contact between Flat Water Pond Group (bottom right) mafic volcanic rocks and felsic rocks of the Mic Mac Lake group (top left).*

Plate 19. *View to the southeast across the Crow Hill Linear. Trench exposes strongly sericitized felsic volcanic rocks of the Mic Mac Lake group at the Crow Hill North Zone.*

MacDougall (1988b) interpreted the movement on the Crow Hill linear to be dextral with a dip–slip component. This interpretation was based on fracture patterns within the alteration zone that were interpreted to resemble pinnate fracture systems, and slickensides on the vertical to steeply dipping fractures.

Noranda Ltd. personnel interpreted the alteration associated with the Crow Hill prospects to be epithermal-like (MacDougall, 1988a-c). However, trace-element geochemi-

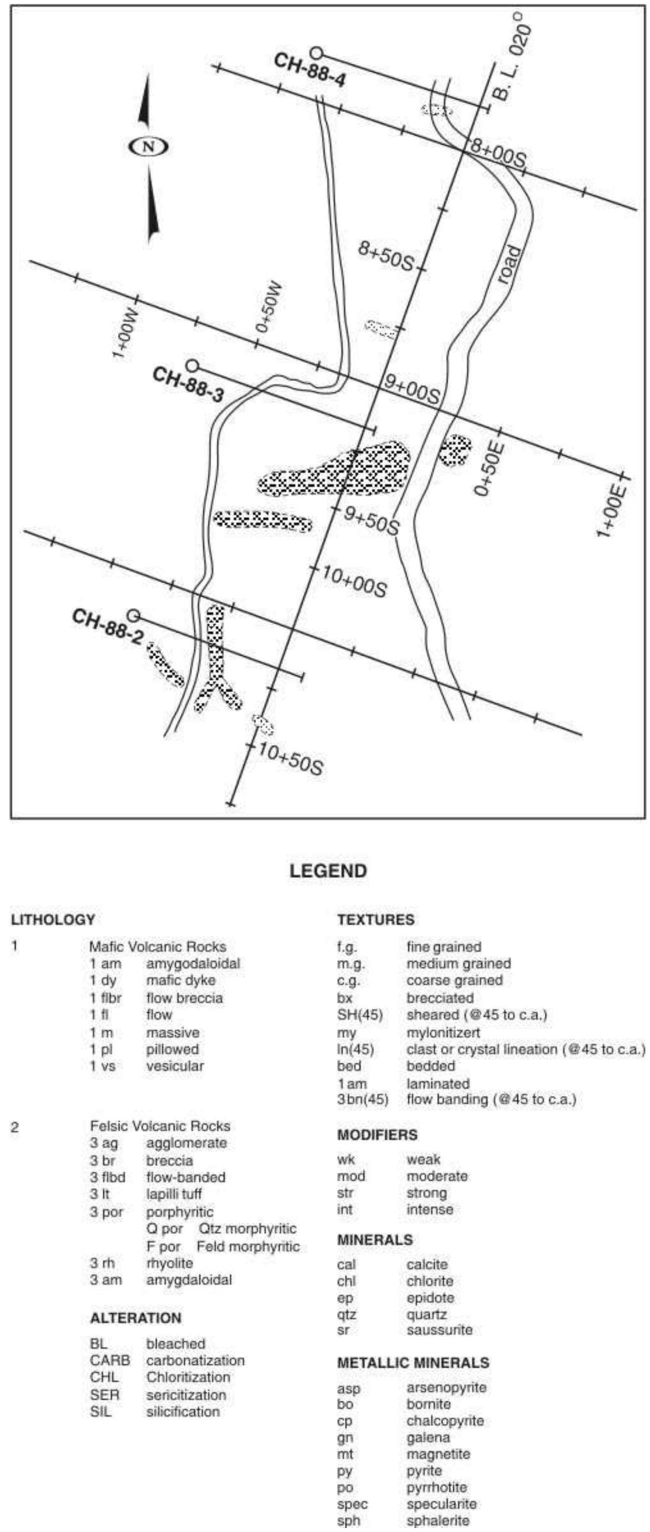


Figure 11. *Trench map, Crow Hill South, showing trench and diamond-drillhole locations; Figures 11a through 11d are detailed trench maps. (All maps* modified after *Deering and MacDougall, 1989).*

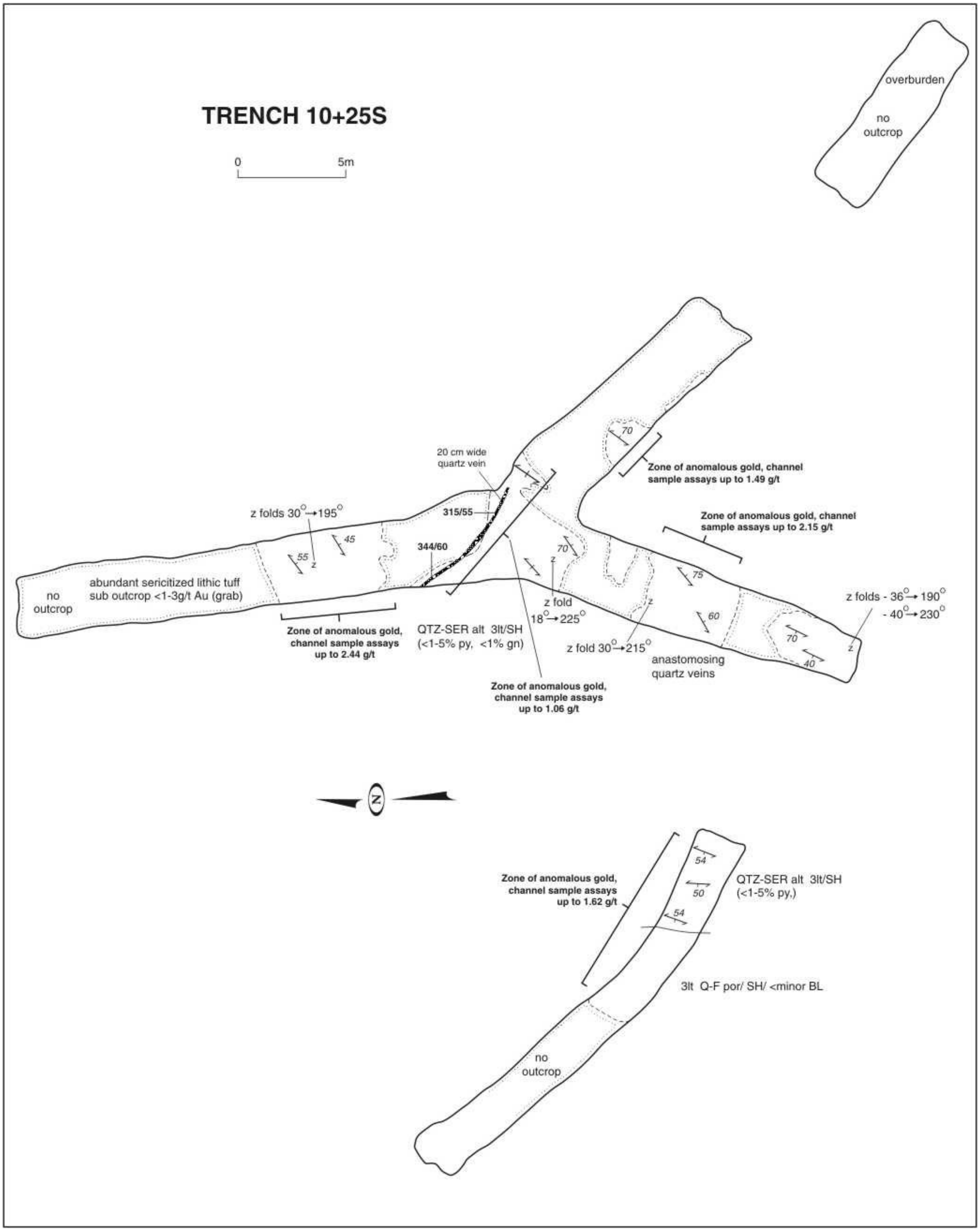


Figure 11a. *Trench map 10+25S, Crow Hill South.*

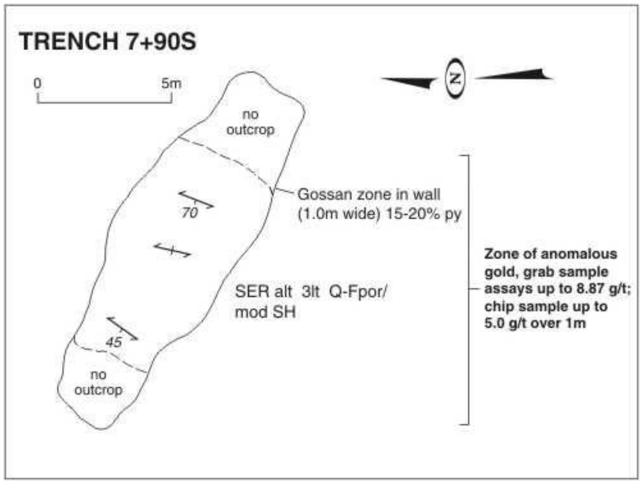


Figure 11b. *Trench map 7+90S, Crow Hill South.*

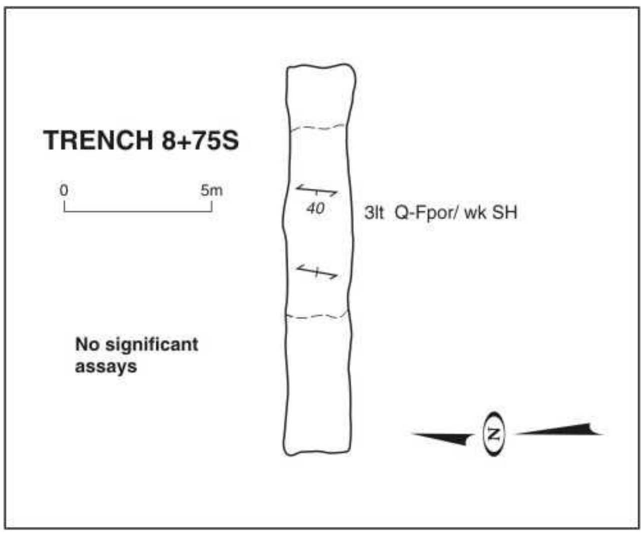


Figure 11c. *Trench map 8+75S, Crow Hill South.*

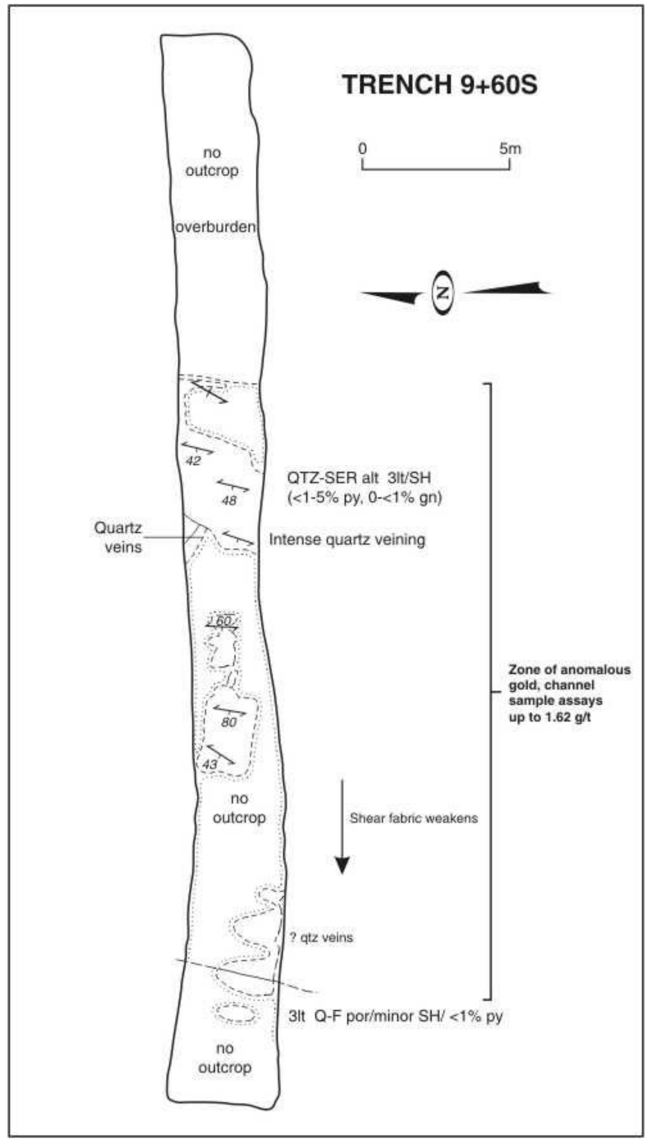


Figure 11d. *Trench map 9+60S, Crow Hill South.*

cal data indicated that the alteration zones exhibited no enrichment in Hg, As or Sb, elements typically associated with epithermal deposits.

The pervasive sericite–silica alteration, the presence of chlorite, the quartz–specularite–adularia (?) veins and broad zones of gold enrichment are features typically associated with low sulphidation-style epithermal systems (Heald *et al*., 1987; Hedenquist *et al*., 1996). The Silurian sequences of the Baie Verte Peninsula may offer potential for large tonnage, low-grade epithermal-style gold mineralization.

FLAT WATER POND AREA, BAIE VERTE MAP AREA (NTS 12H/16)

Exploration History

The Noranda–Muscocho joint-venture Flat Water Pond property, which was staked in 1986, extends from about 1 km south of the town of Baie Verte, southward to Flat Water Pond, a distance of about 18 km. In 1987 and 1988, Noranda Ltd. conducted reconnaissance exploration work consist-

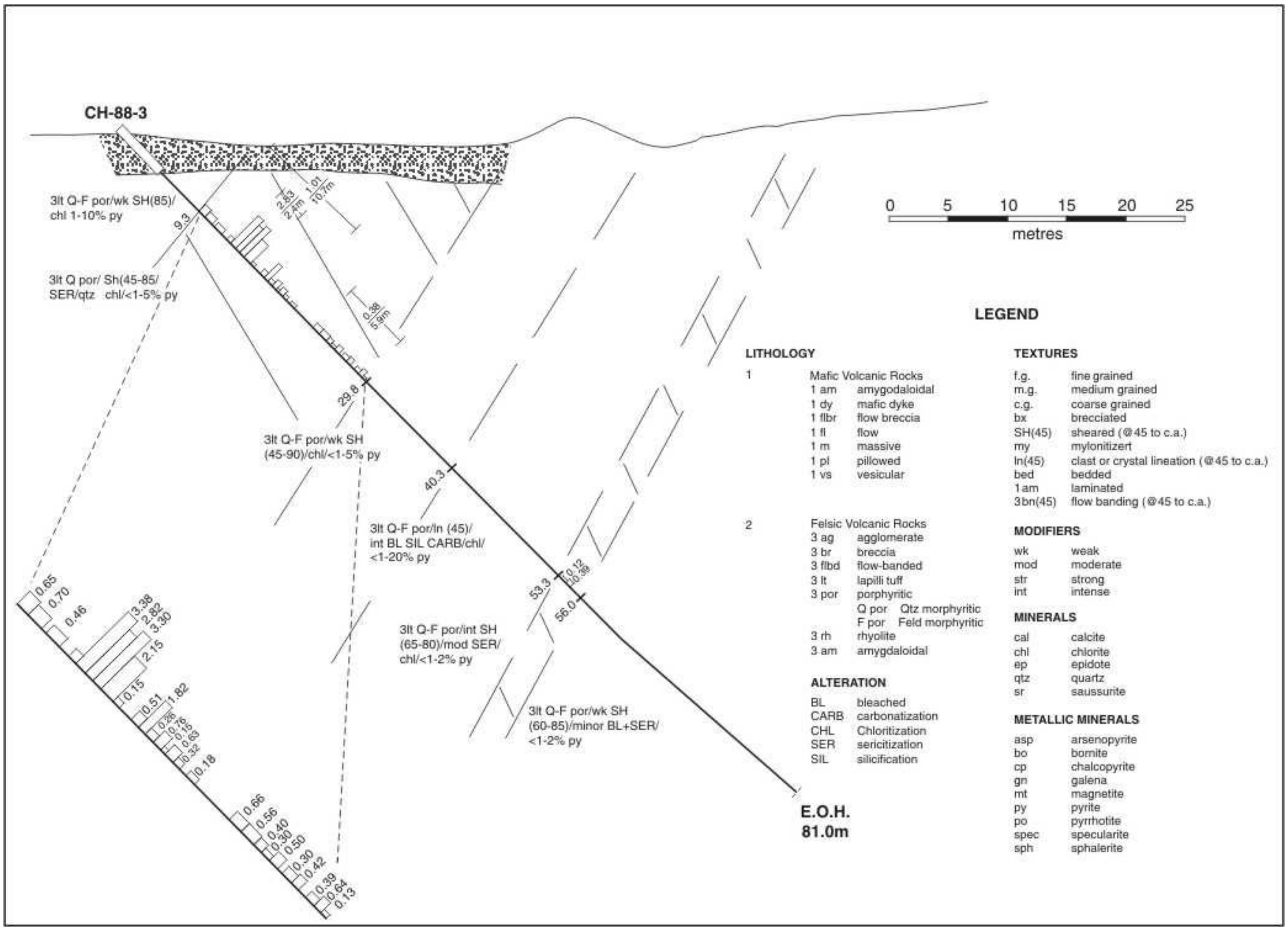


Figure 12. *Diamond-drillhole CH-88-03, Crow Hill South; section looking north (*modified after *Deering and MacDougall, 1989).*

Plate 20. *Diamond-drillhole CH-88-01 that intersected sericitized and quartz veined felsic crystal tuff of the Mic Mac Lake group, Crow Hill North. Note the unaltered maroon felsic crystal tuff at the top of the photograph.*

ing of airborne geophysical surveys (Mag, VLF, EM), heavy mineral concentrate (HMC), till and stream sampling, prospecting and rock and soil geochemistry studies (MacDougall, 1987c). This work resulted in the discovery of the Castor Brook, Breezeway, Phoenix and Dorset gold occurrences, all located in the northern portion of the property. This northern portion was subsequently referred to as the Dorset property (*see* Baie Verte Area section). In the Flat Water Pond area, geophysical surveys (ground VLF and HLEM) in the area south of the abandoned section of the Wild Cove road and west of Flat Water Pond Park defined a strong conductor. Prospecting follow-up to these surveys resulted in the discovered of the Gossan Zone (MacDougall and Churchill, 1989).

In 1985, H.J. Coates staked much of the area underlying Flat Water Pond, including the virginite outcrops located near the junction of the Westport (Route 411) and the

Baie Verte highways (Route 410). No exploration work was undertaken, and in 1986 the claims reverted to the Crown. The area was subsequently staked by Canaustra Gold Exploration Limited (Bradley, 1988a) and in 1987 the company conducted soil and till sampling, geological mapping, prospecting and minor trenching.

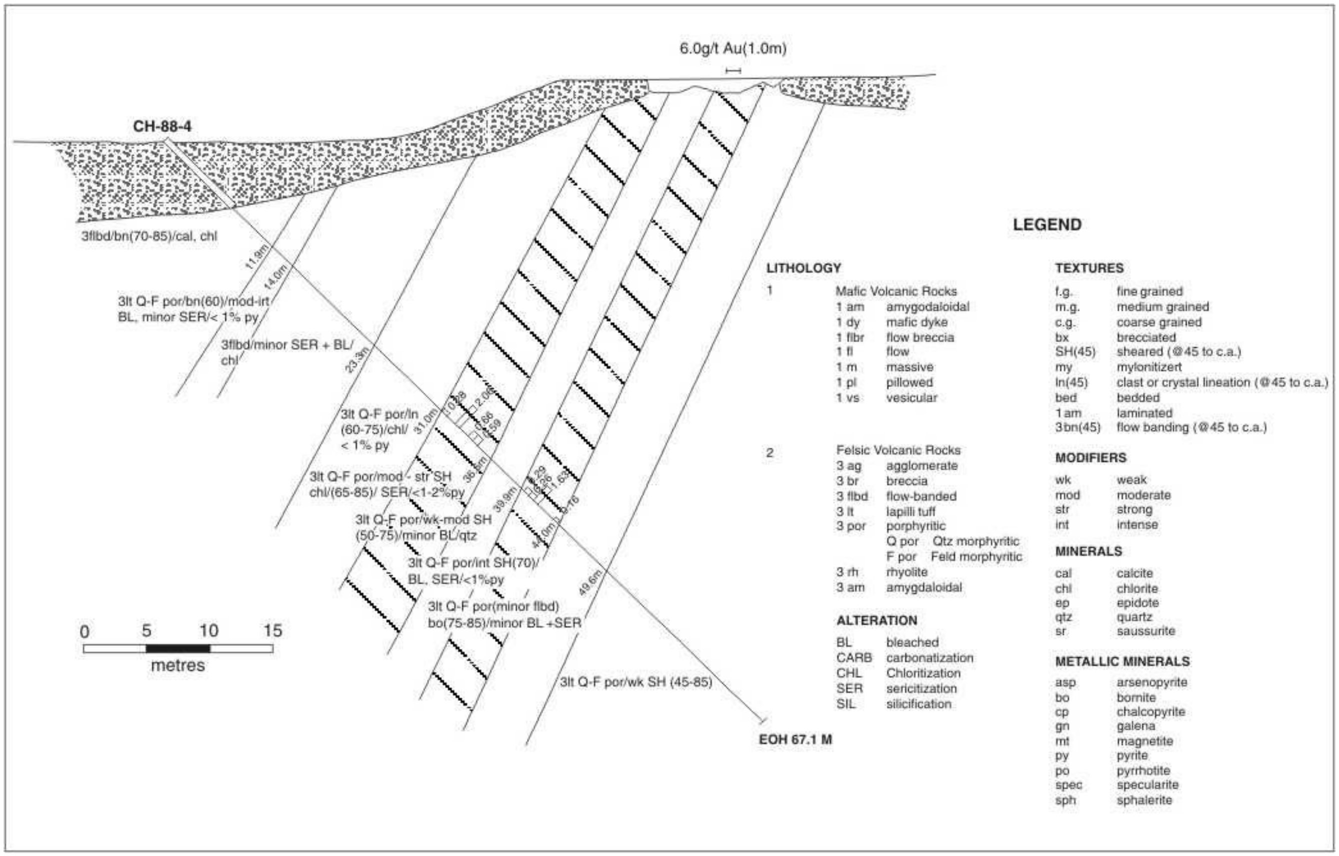


Figure 13. *Diamond-drillhole CH-88-04, Crow Hill South; section looking north (*modified after *Deering and MacDougall, 1989).*

Table 6. Assay results from diamond drilling, Crow Hill area (MacDougall, 1988b; Deering and MacDougall, 1989)

Hole	Interval (m)	Width (m)	Grade (g/t Au)
CH-88-01 Crow Hill North	No significant assays		
CH-88-02 Crow Hill North	30 to 41	11	0.5
CH-88-03 Crow Hill South	9.3 to 20	10.7	1.01
	12.9 to 15.3	2.4	2.83
CH-88-04 Crow Hill South	32.5 to 35	2.5	0.69
	32.5 to 33	0.5	2.08
	39.9 to 42.8	2.9	0.4
CH-88-05 Crow Hill Southeast	30.2 to 36.9	3.6	0.42
CH-89-06 Crow Hill area	Intersected zone of graphitic argillite		
CH-89-07 Crow Hill South	No significant assays		
CH-89-08 Raven Zone	N/A	1	2.18

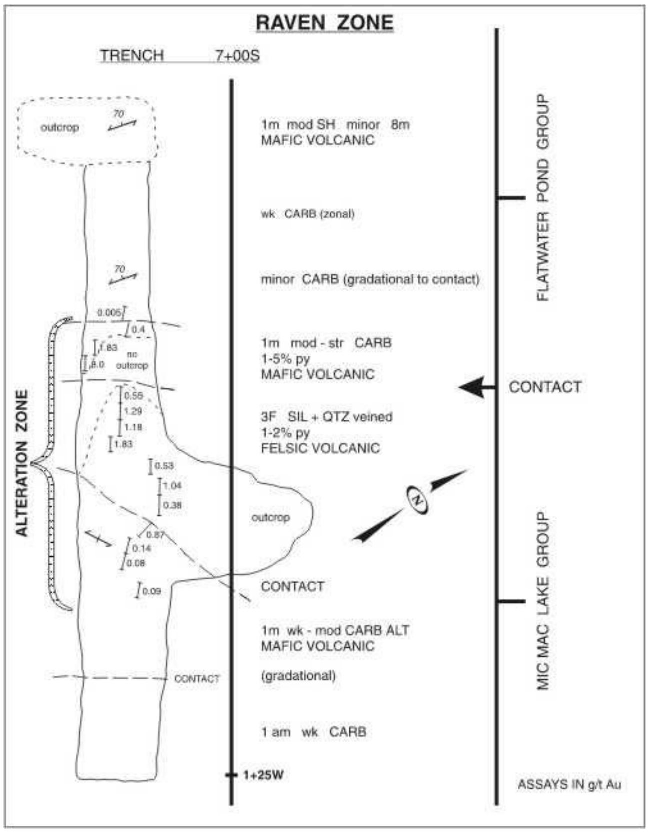


Figure 14. *Trench map, Raven Zone, showing channel-sample locations and assay results (*modified after *Deering and MacDougall, 1989).*

Discovered in the 1950s high-grade copper–silver mineralization is hosted by sericite schists of the Flat Water Pond group to the northeast of Flat Water Pond. The base-metal potential of the area has been examined by Falconbridge Nickel Mines Limited, M.J. Boylen Engineering and Kerr Addison Mines. Records of this exploration work are not in the Department of Mines and Energy assessment files; however, a brief review of this activity was obtained from TerraGold Resources Incorporated (1989a). M.J. Boylen Engineering is reported to have conducted geological mapping, line cutting, geophysical surveys and diamond drilling in the area. Kerr Addison is believed to have carried out airborne VLF-EM, line cutting, ground magnetometer, and (radem) VLF surveys and drilled a single 114 m diamond-drillhole to test a VLF-EM anomaly. The hole was reported to be located approximately 200 m southwest of the roadcut (TerraGold Resources Inc., 1989a). The area was staked by J. Tuach and T. Lever in 1976; VLF-EM, detailed geological mapping and prospecting surveys, trenching and geochemical soil- and lake-sediment surveys were carried out (Tuach and Lever, 1976).

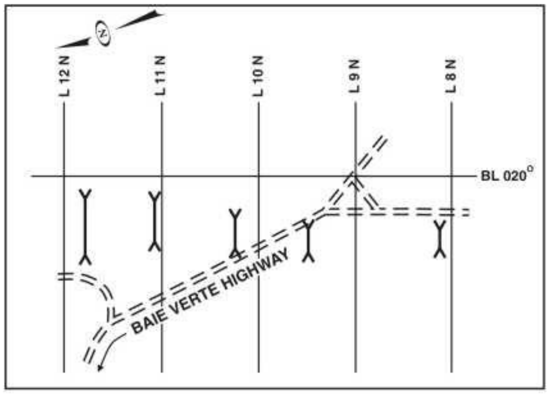
In 1984, Pacific Coast Mines Incorporated, a subsidiary of US Borax and Chemical Corporation, staked the area northeast of Flat Water Pond, after preliminary sampling showed high silver values (Mercer, 1986). An exploration grid was established and soil sampling, prospecting, geological mapping and geophysical surveys were undertaken. Results of the soil sampling indicated that the soils overlying the sericite schist were significantly enriched in gold. Two parallel EM conductors corresponded with the area of known mineralization and these were flanked to the east by a magnetic anomaly. In 1987, the property was acquired by Atlantic Goldfields Incorporated and Jascan Resources Incorporated. Exploration work was undertaken by A.C.A. Howe International Limited (Mercer, 1988). TerraGold Resources Incorporated acquired a 100 percent interest in the property in 1989 from Atlantic Goldfields and Jascan Resources (TerraGold Resources Incorporated, 1989a). They subsequently tested the sericite schist and associated geophysical conductor with two diamond-drillholes having a total length of 275 m.

Regional Geology

The geology of the Flat Water Pond area is similar to that exposed farther to the south in the Micmac Lake area. The area is underlain by rocks belonging to both the Fleur de Lys and Baie Verte belts (Figure 16). The western portion of the area contains polydeformed metamorphic rocks of the Fleur de Lys Belt and include pelitic and psammitic schists of the Rattling Brook Group and amphibolites and greenschists of the Birchy Complex. These units are in fault contact to the east with the Advocate Complex, along the Baie Verte Road Fault system.

The Cambro-Ordovician ophiolitic Advocate Complex in the Flat Water Pond area is composed of gabbroic and serpentinized ultramafic rocks. Locally, the ultramafic rocks have been metasomatized to an assemblage of quartz–magnesite–fuchsite, locally known as virginite. This alteration is characterized by the introduction of large amounts of CO_2, SiO_2 and minor K_2O. Similar metasomatized rocks are associated with lode-gold mineralization in the Mother Lode Belt of California where it is referred to as “Mariposite”. To the east, the Advocate Complex is in fault contact with the Flat Water Pond Group.

In the Flat Water Pond area, the Middle Ordovician Flat Water Pond Group is composed of four units, which from west to east are: 1) the Kidney Pond Conglomerate; 2) a unit of dominantly mafic volcaniclastic rocks; 3) a sequence of pillow lava and pillow breccia, which outcrops to the southwest of Flat Water Pond; and 4) a unit of mafic and sericitic felsic volcaniclastic rocks. This fourth unit is bounded to the east by a major west-dipping thrust, which separates these rocks from the Mic Mac Lake group and the Burlington granodiorite.



Trench Location Map

LEGEND (for 15a-g)

LITHOLOGY

1 **Mafic Volcanic Rocks**

1am	amygdaloidal
1dy	mafic dyke
1flbr	flow breccia
1fl	flow
1m	massive
1pl	pillowed
1vs	vesicular

2 **Intermediate Volcanic Rocks**

2da	dacite
2am	amygdaloidal

3 **Felsic Volcanic Rocks**

3ag	agglomerate
3br	breccia
3flbd	flow banded
3lt	lapilli tuff
3por	porphyritic
	Q por - quartz porphyritic
	F por - feldspar porphyritic
3rh	rhyolite

Alteration

BL	bleached
CARB	carbonitization
CHL	chloritization
EP	epidotization
SER	sericitization
SIL	silicification

SYMBOLS

Geological contact ....
Fault ....
Outcrop ....
Rock sample ....
Fractures ....
Shear fabric ....
Water ....

Textures

f.g.	fine grained
m.g.	medium grained
c.g.	coarse grained
bx	brecciated
SH(45)	sheared (@45° to core axis)
my	mylonitized
ln(45)	clast or crystal lineation (@45° to core axis)
bed	bedded
lam	laminated
3bn(45)	flow banding (@45° to core axis)

Modifiers

wk	weak
mod	moderate
str	strong
Int	intense

Minerals [including vein (vn) minerals]

cal	calcite
chl	chlorite
ep	epidote
qtz	quartz
sr	saussurite

Metallic Minerals

asp	arsenopyrite
bo	bornite
cp	chalcopyrite
gn	galena
mt	magnetite
py	pyrite
po	pyrrhotite
spec	specularite
sph	sphalerite

Figure 15. *Trench map, Crow Hill North; Figures 15a through 15f are detailed trench maps. (All maps* modified after *Deering and MacDougall, 1989).*

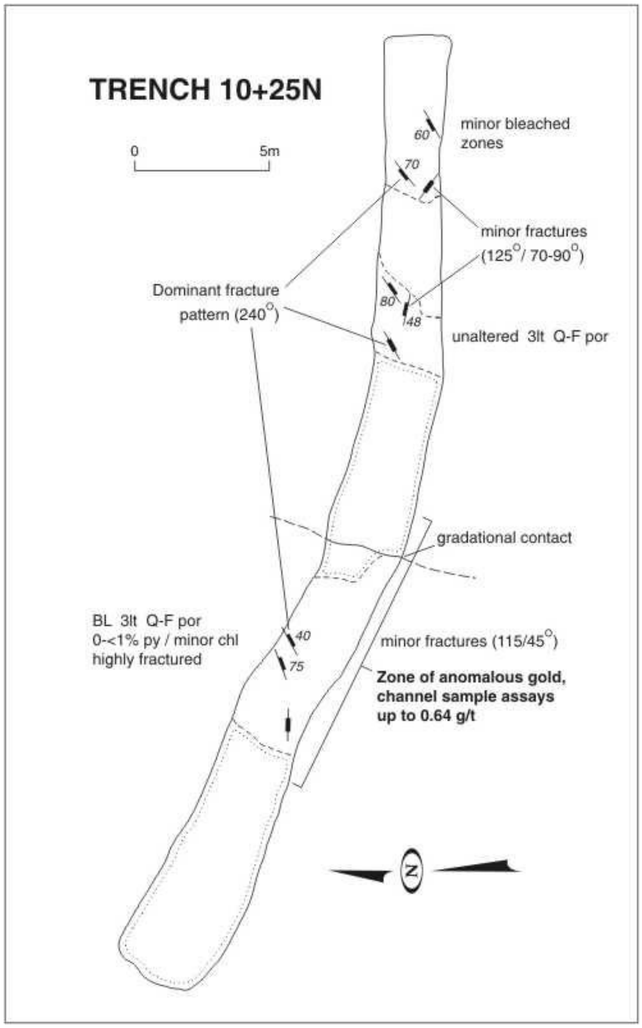


Figure 15a. *Trench map 10+25N, Crow Hill North.*

North of Flat Water Pond, the Mic Mac Lake group is composed of felsic volcanic and sedimentary rocks of the Upper Sequence (Hibbard, 1983). These rocks are restricted to a small, fault-bounded, wedge that non-conformably overlies the Burlington granodiorite to the east.

Gold Mineralization

23. Gossan Zone

Location and Access

The Gossan Zone (NTS 12H/16 Au002 UTM 548575E 5513950N) is a silica–sulphide replacement style of gold mineralization that is located approximately 200 m south of an abandoned section of the Westport Road (Route 411) and about 0.8 km west of the Baie Verte Highway (Route 410).

Local Geology and Mineralization

The Gossan Zone consists of 5.0-m-wide zone of intercalated, strongly sheared and quartz-veined mafic volcanic and graphitic sedimentary rocks belonging to the Flat Water Pond Group (Figure 17). These rocks contain 5 to 30 percent disseminated, stringer and patches of semi-massive pyrite and pyrrhotite. The sulphides also occur within and marginal to the quartz veins. The sequence is intruded by a unit of medium-grained gabbro. The zone has been trenched and in 1989, it was tested with a single, 71.9-m-long, diamond-drillhole that intersected a 12.0-m-thick zone containing disseminated to stringer pyrite–pyrrhotite mineralization. Grab samples collected from the zone assayed up to 3.14 g/t Au, but assay results were typically less than 0.1 g/t Au (MacDougall and Churchill, 1989). Channel samples collected from the trenching assayed up to 0.1 g/t Au over 5.0 m and included a narrow interval that assayed 2.45 g/t Au over 0.6 m. No significant base-metal values were reported.

24. Flat Water Pond NW Showing

Location and Access

The Flat Water Pond NW showing (NTS 12H/16 Au003 UTM 549030E 5517500N) is an example of an auriferous talc–carbonate replacement style of mineralization that is located approximately 200 m west of the intersection of the Baie Verte (Route 410) and Burlington highways (Route 413).

Local Geology and Mineralization

The area surrounding the Flat Water Pond NW showing is underlain by serpentinized peridotite of the Advocate Complex. Till and soil geochemistry surveys conducted by Canaustra Gold Exploration Limited (Bradley, 1988a) and Cliff Resources Corporation (Bradley, 1989) outlined a large low amplitude gold in soil anomaly ranging from 21 ppb to 113 ppb Au. Detailed bulk sampling and panning of glacial till over the anomaly outlined a high-grade zone that averaged 6.5 g/t Au, with a maximum value of 126.5 g/t Au. This work resulted in the discovery of numerous gold grains, with grain counts as high as 100 grains per sample (Bradley, 1988a). These grains were interpreted to be fresh and of local derivation, possibly within a few hundred metres of the source. Trenching on the most prominent of the anomalies exposed quartz–carbonate veins associated with brecciated serpentinite. Channel samples collected from these zones assayed up to 0.99 g/t Au over 2.0 m (Bradley, 1988a). Till samples collected from the trenching contained up to 500 to 600 grains in selective areas. In 1988, further soil sampling, prospecting, trenching, test pitting and VLF surveys failed

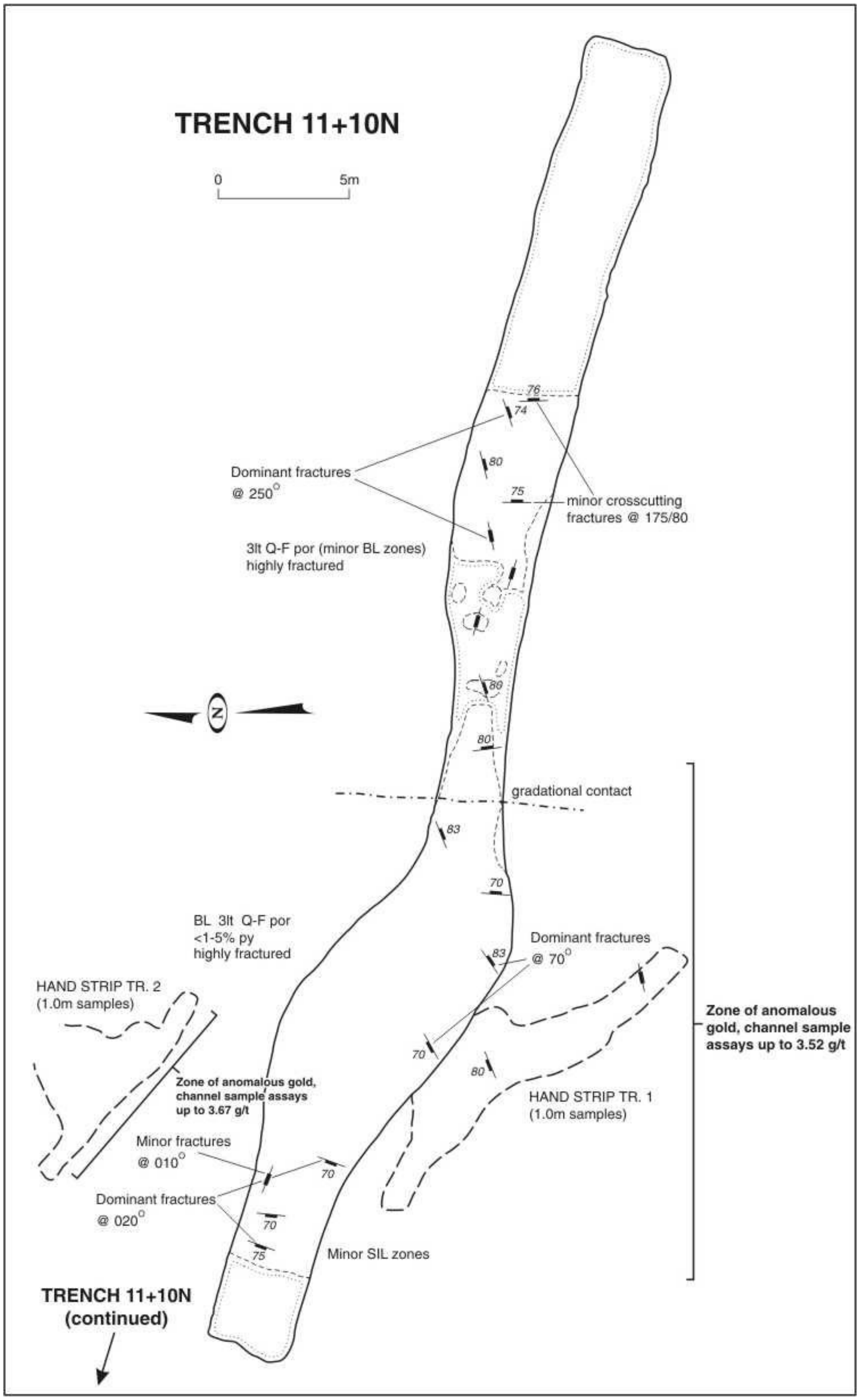


Figure 15b. *Trench map 11+10N, Crow Hill North.*

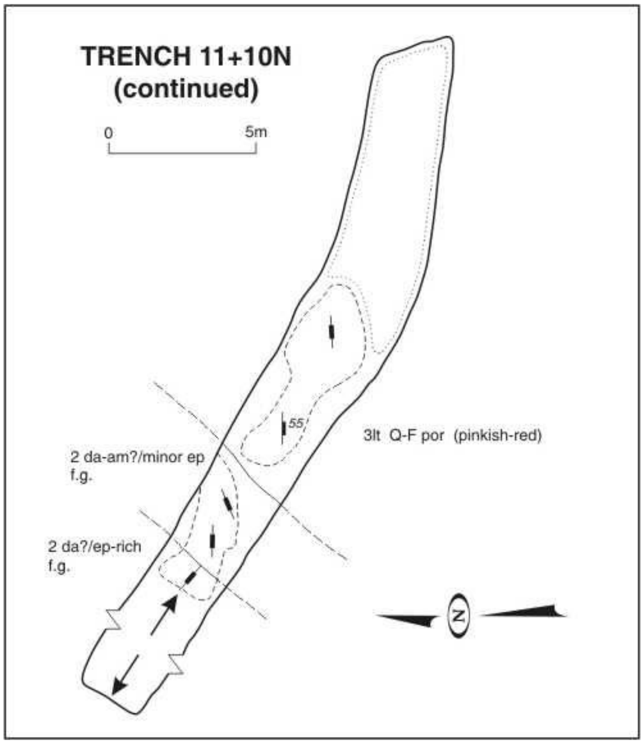


Figure 15c. *Trench map 11+10N, Crow Hill North, continued.*

to identify the source of the gold (Bradley, 1989). During the winter of 1989, a magnetometer survey was conducted over the cove at the northwest end of Flat Water Pond in an attempt to delineate possible diamond-drill targets (Al, 1989a). A single 84-m-long diamond-drillhole failed to intersect either alteration or mineralization. Exploration has failed to delineate the source of the abundant delicate gold grains in the tills.

25. Burlington Road Prospect

Location and Access

The Burlington Road prospect (12H/16 Au004 UTM 551275E 5517150N) is an auriferous base-metal-rich quartz vein system exposed in a long roadcut on the Burlington Highway (Route 413) approximately 2.3 km east of the Baie Verte Highway (Route 410).

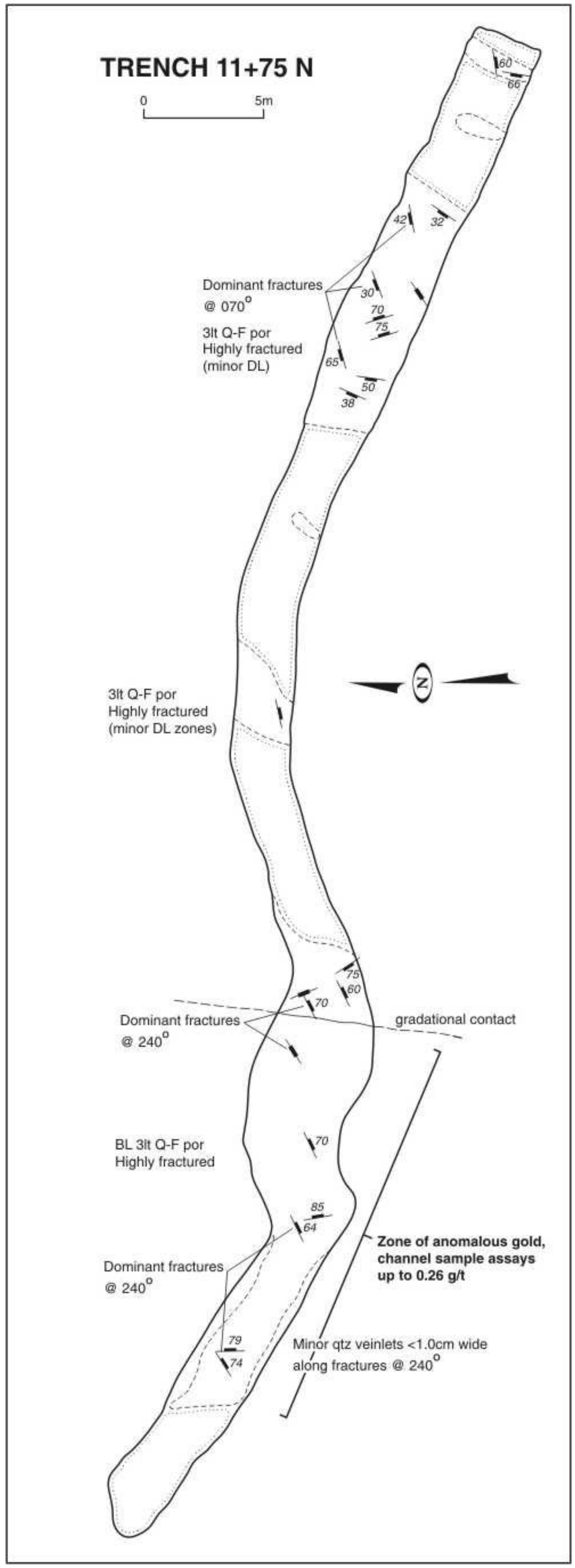


Figure 15d. *Trench map 11+75N, Crow Hill North.*

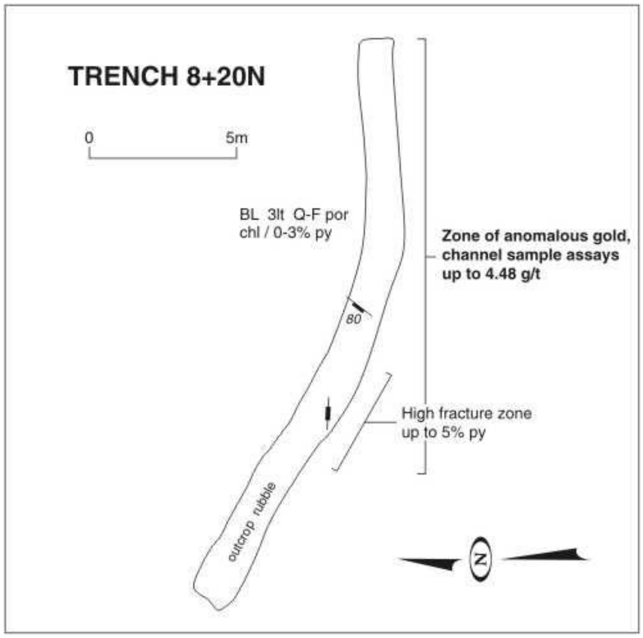


Figure 15e. *Trench map 8+20N, Crow Hill North.*

Local Geology and Mineralization

The Burlington Road prospect occurs within a sequence of sericitic and silicified schist of the Flat Water Pond Group (Figure 18). The schists are in fault contact with semi-massive serpentinite, serpentinite schist and talc–serpentinite schist of the Advocate Complex. The original showing, which was exposed in the roadcut, consisted of narrow quartz veins containing lead and copper mineralization. M.J. Boylen workers reported that a sample collected from a small quartz vein hosted by quartz sericite schist assayed 19 oz/t Ag (McKillop, 1970). A 3-m channel-sample collected from the roadcut was reported to have assayed 0.38 oz/t Ag and 0.13 percent Cu (Tuach and Lever, 1976). Upgrading of the highway created a new roadcut that further exposed the mineralized schist and the unit is also exposed in a large quarry located to the north of the highway.

In 1984 and 1985, U.S. Borax conducted geochemical and geophysical surveys and sampling (Mercer, 1986). Results of this work indicated that the sericite schist was anomalous with respect to Cu, Au and Ag. The mineralization consists of chalcopyrite, bornite, pyrite, malachite, azurite and galena hosted by narrow, irregular fracture-filling quartz veins and as fracture coatings. The best mineralization was described as being located at the northeast end of the large roadcut (Mercer, 1986).

The mineralization exposed in the roadcut is described in a preliminary prospectus (TerraGold Resources Incorporated, 1989a), as comprising narrow, less than 1-cm-wide, discontinuous quartz stringers that contain bornite, chalcopyrite and locally galena. Grab samples collected from this zone assayed up to 1.96 percent Cu and 2.3 oz/t Ag. Semi-massive bornite mineralization, which assayed 8.24 percent Cu, 8.68 oz/t Ag and 1.0 g/t Au, was reported to occur in a blasted area approximately 10 m south of the original roadcut showing (TerraGold Resources Incorporated, 1989a). A grab sample of quartz vein containing galena, which was collected about 60 m west of the original showing, assayed 1.95 g/t Au. Grab samples of bornite–chalcocite–malachite-bearing, narrow, fracture-filled quartz veinlets, collected in 1984 by U.S. Borax, assayed up to 12.34 g/t Au (TerraGold Resources Incorporated, 1989b).

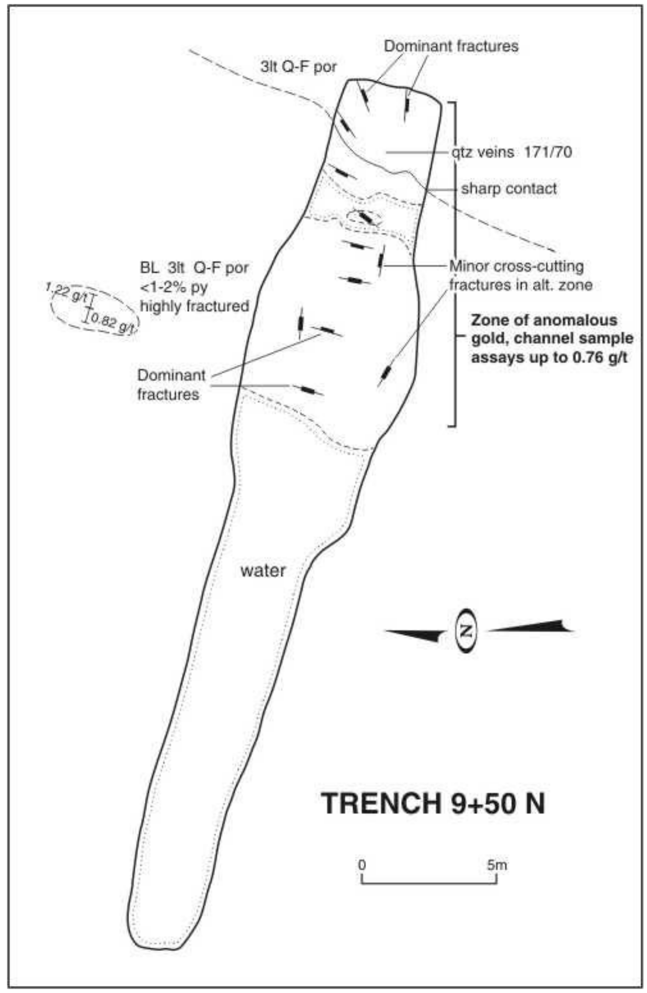


Figure 15f. *Trench map 9+50N, Crow Hill North.*

In 1989, TerraGold Resources Incorporated tested the geophysical conductor associated with the sericite schist with two diamond-drillholes totalling 275 m (TerraGold Resources Incorporated, 1989b). Both holes intersected a sequence of silicified and seriticitized schist containing minor disseminated pyrite, in fault contact with semi-mas-

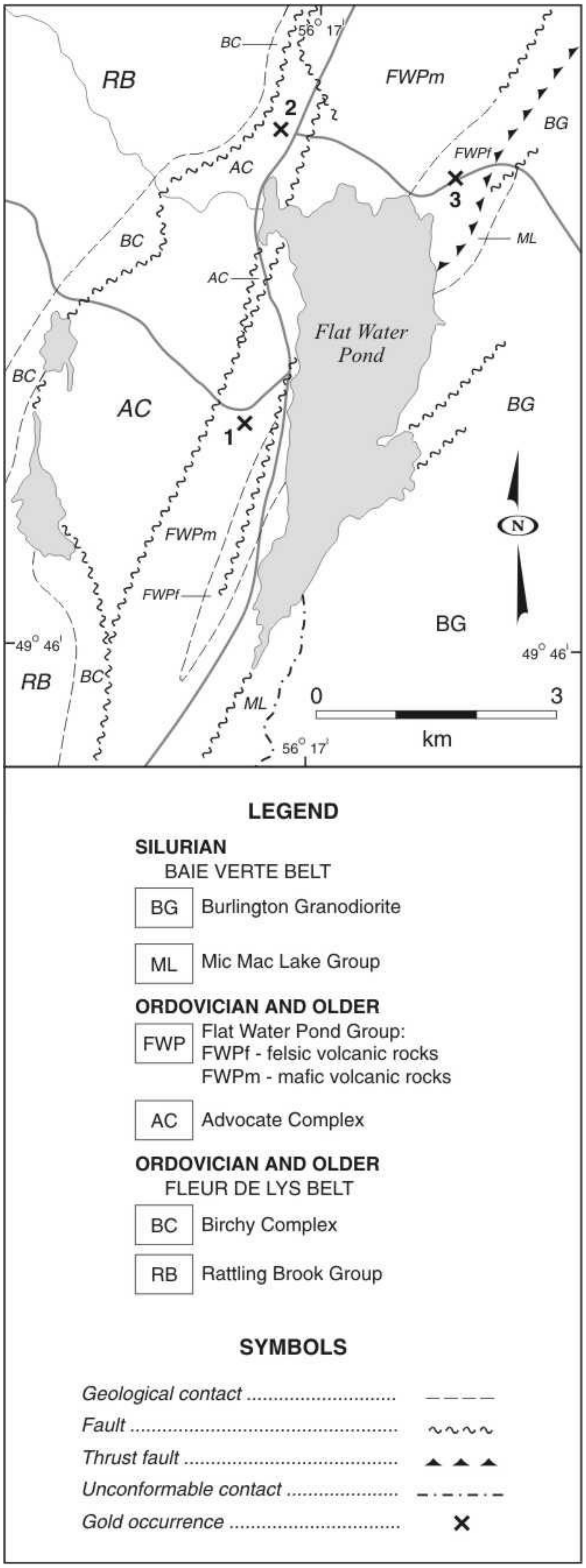


Figure 16. *Geological map of the Flat Water Pond area showing the location of the Gossan Zone, Flat Water Pond NW, and Burlington Road gold occurrences (*modified after *Hibbard, 1982).*

sive serpentinite, serpentinite schist and talc–serpentinite schist. The ultramafic rocks passed downhole into a sequence of chlorite schist, interbedded chlorite schist and mafic volcaniclastic rocks, and gabbroic and diabase dykes. The sericite schists contained narrow quartz veins that contained traces of bornite, chalcopyrite and galena. Samples of the mineralized veins and sericite schist were found to contain anomalous gold with values up to 200 ppb (TerraGold Resources Incorporated, 1989b).

BAIE VERTE AREA, BAIE VERTE MAP AREA (NTS 12H/16)

History of Exploration

The Baie Verte exploration area included portions of the Noranda–Muscocho joint-venture Flat Water Pond property, which was staked in 1986 (*see* Flat Water Pond NW Showing section), and the Noranda Advocate/Wildcat property. The Flat Water Pond property also included a group of claims along South West Brook and the La Scie Highway (Route 414) that were optioned from West Coast Ventures. In 1987 and 1988, Noranda conducted reconnaissance exploration work consisting of airborne geophysical surveys (Mag, VLF, EM), heavy mineral concentrate (HMC), till and stream sampling, prospecting and rock and soil geochemistry studies over the Flat Water Pond property (MacDougall, 1987c). The 1987 exploration program resulted in the discovery of the Castor Pond, Breezeway, Phoenix and Dorset gold occurrences.

By 1987, three exploration grids had been established, *viz.*, the Castor Pond, Terra Nova and the Dorset, and trenching and channel sampling had been undertaken on the Castor Pond and Dorset prospects (MacDougall, 1987c; MacDougall and Walker, 1988). The Dorset prospect was tested by 8 diamond-drillholes and detailed geophysical (Mag, VLF and IP) and soil geochemistry surveys were carried out over the Dorset grid (MacDougall and Walker, 1988). In 1988, detailed mapping and prospecting surveys were carried out on the Dorset and Terra Nova grids and extensions to both these grids were followed by soil geochemical and ground geophysical surveys (MacDougall, 1989c). This work resulted in the discovery of the Gunshot, Biarritz, Albatross and Casa Loma gold occurrences on the Dorset Grid. Trenching, detailed mapping, channel sampling and

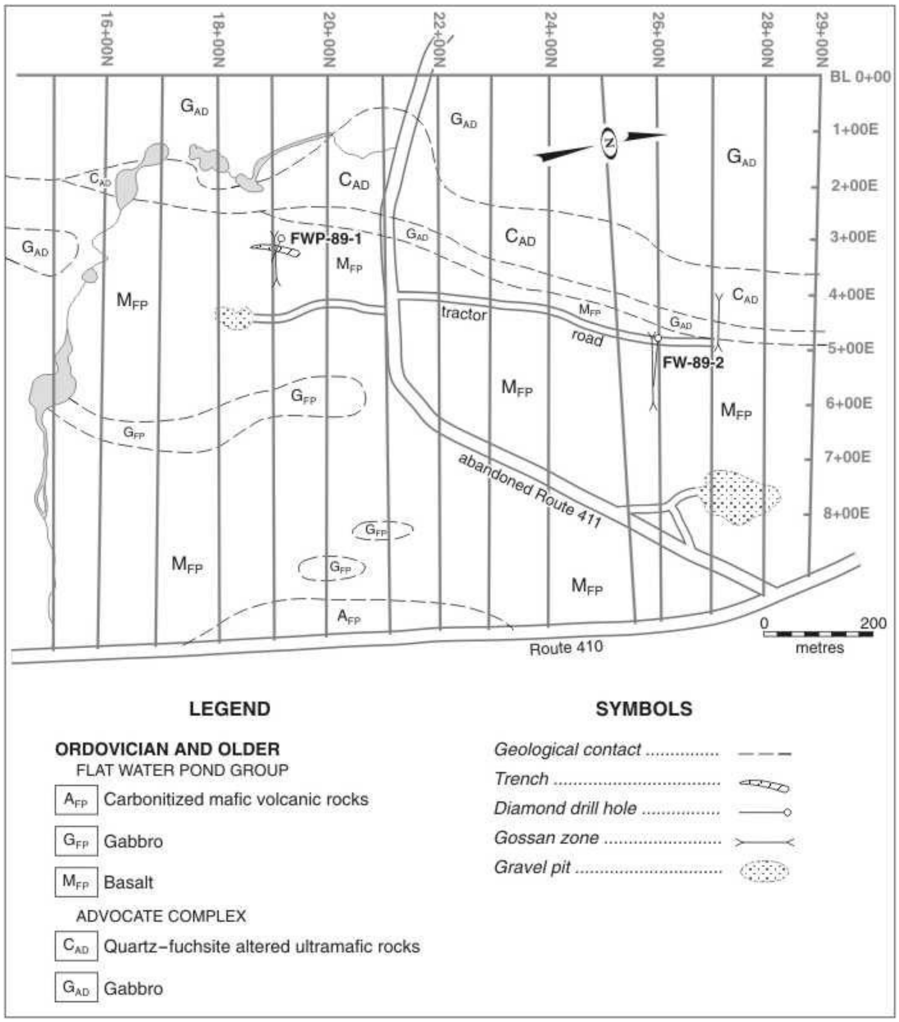


Figure 17. *Geological map of the Gossan Zone area showing trench and diamond-drillhole locations (*modified after *MacDougall and Churchill, 1989).*

1292.2 m of BQ diamond drilling in 13 holes and a single 30.8 m Winke drillhole were undertaken on the Dorset grid. A single 107.6 m diamond-drillhole was completed on the Castors Pond prospect.

In 1989, Noranda continued detailed mapping, prospecting and trenching on both the Dorset and Terra Nova grids (MacDougall, 1990c), and further detailed trench mapping and channel sampling of mineralized outcrop were undertaken on the Dorset grid. Gold occurrences discovered on the Dorset grid in 1989 included the Braz, Central Carbonate Alteration Zone, Power Line and Phoenix Extension. A diamond-drillhole on the Dorset property to test a HLEM geophysical anomaly intersected sulphide-bearing graphitic argillite. A HLEM geophysical anomaly located on the Terra Nova grid was also tested with a single diamond-drillhole and likewise intersected a zone of sulphide-bearing graphitic argillite, which assayed 2.01 g/t Au (MacDougall, 1989c).

Located immediately to the north of the Dorset property, Noranda's Advocate/Wildcat property extended from Baie Verte northward to Coachman's Cove. In 1987 and 1988, geological mapping and prospecting surveys were conducted over the property and a number of grids, including Powderhouse Pond, Pumbly Point and Sandy Point, were established (Huard, 1987a; Pollard, 1988; Smith, 1989). Detailed soil geochemistry and geophysical surveys (Mag and VLF-EM) were conducted over the gridded areas and resulted in the discovery of Powder House (Tidewater), Marble Cove Point, Baie Vista, Pumbly Point, Pumbly Point Carbonate Zone, Fuel Bog, Corner Shore and Sandy Point gold occurrences. In 1989, the Pumbly Point Carbonate and Fuel Bog zones were tested by a 149.6 m diamond-drillhole (Smith, 1989), and the Tidewater prospect was tested with a 61.9 m diamond-drillhole (Huard, 1989a).

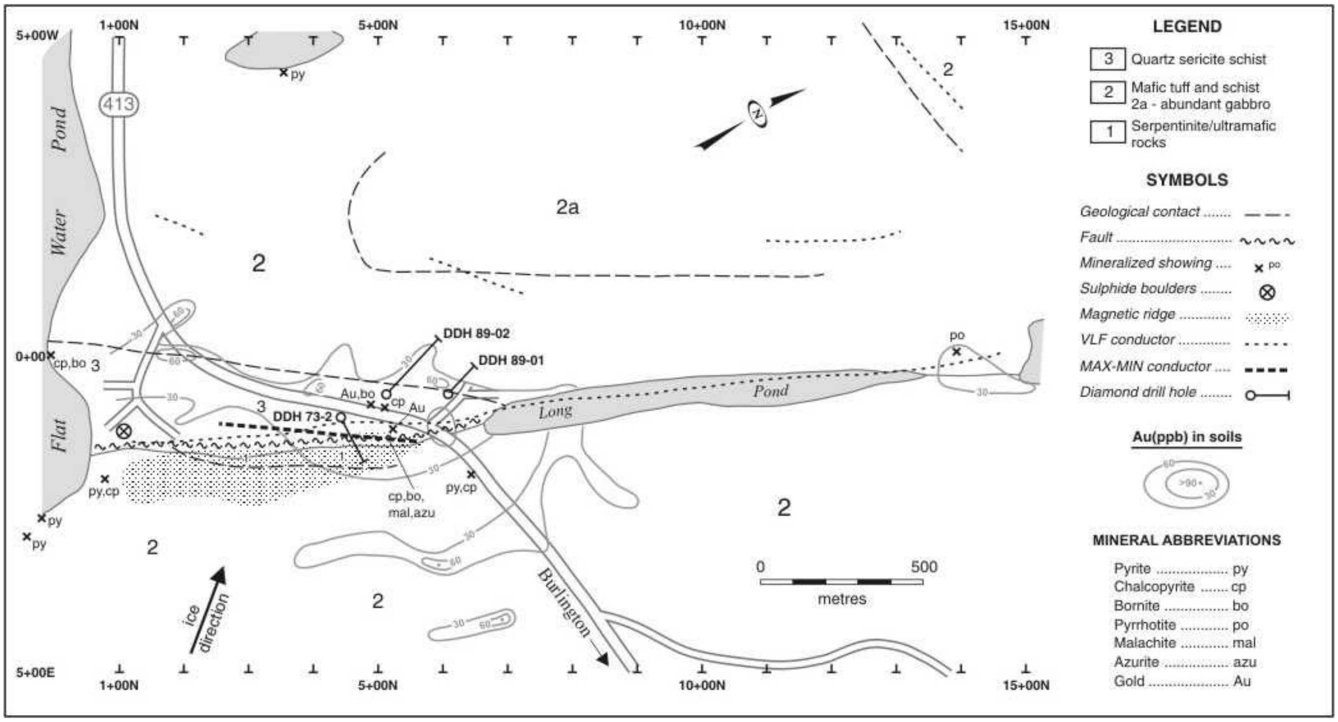


Figure 18. *Geology map of the Burlington Road prospect area illustrating geophysical conductors, gold in soil contours, mineralized outcrops and diamond-drillhole locations (*modified after *TerraGold Resources Incorporated, 1989a).*

Regional Geology

The Baie Verte area is bisected by the Baie Verte Line and is underlain by rocks of both the Fleur de Lys and Baie Verte belts (Figure 19). The western part of the area is underlain by polydeformed pelites and psammites of the Rattling Brook Group and greenschists of the Birchy Cove Complex. To the east, these rocks are in fault contact with the ophiolitic rocks of the Advocate Complex.

The Advocate Complex, as defined by Hibbard (1983), is a deformed and dismembered ophiolite; its cover sequence is composed of a northeasterly striking, steeply dipping assemblage of mafic and ultramafic plutonic rocks, mafic volcanic and volcaniclastic rocks, and dark grey to black slates. It extends from near Marble Cove Point in the north, southward discontinuously to Birchy Lake, a distance of about 70 km. In the Baie Verte area, the complex exhibits it's maximum exposed width of about 4 km. It is in this area that the complex can be subdivided, on a broad scale, into three imbricated, southwest-facing, incomplete and dismembered ophiolite sheets and their presumed volcanic cover sequence (Hibbard, 1983). These subdivisions include, from north to south, the Marble Cove Sequence, the Duck Island Cove Sequence and the Sisters Cove Sequence. Rocks of the Marble Cove Sequence are the most tectonized. Hibbard (1983) equated the Advocate Complex volcanic cover sequence with the Flat Water Pond Group. To the south of Baie Verte, the Sisters Cove Sequence is fault contact with the Flat Water Pond Group.

The Flat Water Pond Group, in the Baie Verte area, is composed of two sequences: these are an assemblage of dominantly mafic volcaniclastic rocks cut by gabbroic and diabasic dykes to the west, and a sequence of dominantly mafic and sericitic felsic volcaniclastic rocks in the east. Rocks of the Flat Water Pond Group have been metamorphosed to lower greenschist facies and typically display a single, strong, northeast-trending penetrative fabric (Hibbard, 1983). In the northwestern portion of the group, this fabric is accompanied by a strong lineation. To the east, the Flat Water Pond Group is in fault contact with the Burlington granodiorite. To the north, the group is also in fault contact with rocks of the volcanic cover sequence of the Point Rousse Complex.

Most of the gold occurrences within the Baie Verte area are clustered along the faulted contact between gabbroic rocks of the Sisters Cove Sequence of the Advocate Complex and mafic volcaniclastic rocks of the Flat Water Pond Group.

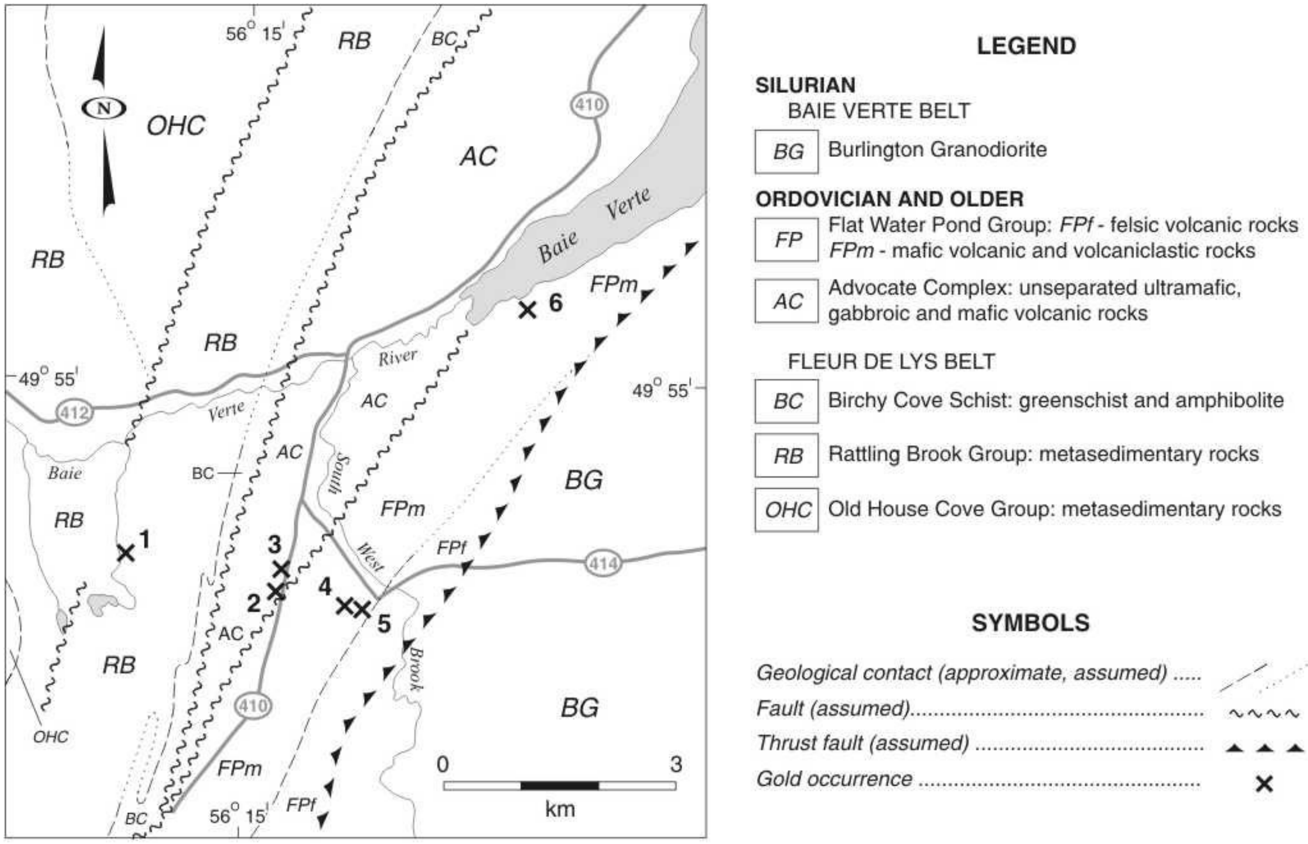


Figure 19. *Simplified geology map of the Baie Verte area (*modified from *Hibbard, 1982) showing the more significant gold occurrences; 1) Castor Brook, 2) Phoenix, 3) Albatross, 4) Gunshot, 5) Dorset, and 6) Tidewater/Powderhouse.*

Gold Mineralization

27. Castor Brook Prospect

Location and Access

The Castor Brook prospect (NTS 12H/16 Au006 UTM 552400E 5527460N) is an auriferous quartz–pyrite vein set that outcrops in the brook approximately 500 to 600 m north of Castor Pond (Figure 19). A trail, which originates from the Baie Verte Highway near the La Scie Highway intersection, leads to within about 700 m of the prospect.

Local Geology and Mineralization

The Castor Brook mineralization was discovered by Noranda personnel who were prospecting along Castor Brook. The mineralization comprises 0.6- to 3.9-m-wide milky-white quartz–pyrite breccia veins (Plate 21) that are hosted by quartz–mica and graphitic schists of the Rattling

Plate 21. *Milky-white quartz breccia veins developed within quartz-mica schists of the Rattling Brook Group, Castor Brook prospect.*

Brook Group. The veins trend between 150° and 170° and dip 70° to the east and are aligned slightly oblique to the regional cleavage within the schists. The veins are laminated and exhibit comb and crack and seal textures and wall rock occurs in the veins as thin laminae and angular fragments. Pyrite is present as disseminations developed marginal to the veins, as rare clots within the veins and as fine disseminations within the wall-rock fragments. The veins were also reported to contain traces of chalcopyrite (MacDougall, 1987a).

The prospect has been tested with five trenches, none of which are back-filled (Figure 20). Assay results from the prospect include 7.46, 4.65, 3.1, 1.4 and 0.9 g/t Au from grab samples (MacDougall, 1987a). Chip samples collected across the zone assayed up to 3.4 g/t Au over 1.5 m; the results are presented in Table 7. A 0.4 m interval assayed 8.49 g/t Au and the widest mineralized zone assayed 1.0 g/t Au over 3.9 m (MacDougall, 1989c). In 1988, a 107.6-m-long diamond-drillhole (C-88-1) was cored to test the down-dip potential of the prospect and the hole intersected approximately 14 m of sheared graphitic schist containing 1 to 2 percent disseminated pyrite. However, only minor quartz breccia and two narrow quartz veins containing 3 percent fine-disseminated pyrite were intersected, none of which contained significant concentrations of gold. Samples from the quartz breccia zone assayed up to 0.15 g/t Au and the two veins assayed 0.42 and 0.3 g/t Au over 0.2 m and 0.3 m respectively (MacDougall, 1989c).

Table 7. Chip-sample assay results, Castor Brook prospect (MacDougall, 1989c)

Trench	Width (m)	Grade (g/t Au)
1	2.1	1.84
2	3.9	0.9
3	0.7	3
4	0.65	1.49
5		Not Assayed

28. Phoenix and Phoenix Extension Prospects

Location and Access

The Phoenix prospect (NTS 12H/16 Au007 UTM 554275E 5526850N) is an auriferous carbonate–quartz–sulphide replacement style of gold mineralization exposed in a road cut on the Baie Verte Highway (Route 410), approximately 1.35 km south of the intersection with the La Scie Highway (Route 414) (Figure 21). The Phoenix Extension is of a similar style of mineralization and occurs along strike from the Phoenix approximately 650 m to the northeast.

Local Geology and Mineralization

Mineralization associated with the Phoenix and Phoenix Extension (Figure 21) property is hosted by strongly sheared ophiolitic gabbro of the Advocate Complex. The mineralization is developed immediately to the west of the Baie Verte Road Fault, which separates the gabbroic rocks from mafic volcanic rocks of the Flat Water Pond Group. The gabbro is altered to an assemblage of quartz and carbonate containing 1 to 10 percent disseminated euhedral pyrite and numerous quartz veinlets (Plate 22; MacDougall, 1987a, 1989c). The mineralization was reported to be exposed on both sides of the Baie Verte Highway indicating potential for width. However, the highway limited trenching activity and all trenches have been backfilled. Grab samples of the altered gabbro assayed up to 5.8 g/t Au and quartz-vein grab samples assayed up to 1.4 g/t Au (MacDougall, 1987a). In 1987, the Phoenix zone was tested with a diamond-drillhole that intersected a zone of altered gabbro that assayed 1.07 g/t Au over 5.45 m.

Between the Phoenix Extension and the Phoenix prospects, weakly altered and mineralized gabbro is exposed sporadically. The Phoenix Extension is described as a zone of weakly sheared, medium-grained gabbro that is cut by abundant calcite and quartz veins. The sheared gabbro contains up to 3 percent fine- to medium-grained disseminated pyrite (MacDougall, 1989c) and grab samples of altered gabbro assayed 3.2 g/t, 1.89 g/t, and 3.42 g/t with sporadic high values of up to 31.0 g/t Au. Detailed channel sampling returned a value of 0.22 g/t Au over 1.5 m. All trenches have since been backfilled.

30. The Albatross Prospect

Location and Access

The Albatross prospect (NTS 12H/12 Au009 UTM 554300E 5527000N) is a carbonate–quartz–sulphide replacement style of gold mineralization located approximately 1.1 km south of the junction of the La Scie (Route 414) and Baie Verte highways (Route 410) (Figure 21). The prospect was exposed in a series of trenches, located up to 50 m west of the Baie Verte Highway.

Local Geology and Mineralization

The Albatross prospect, which is located within the Noranda–Muscocho Dorset joint venture property, was discovered as a result of a 1987 trenching program on a gold-in-soil geochemistry anomaly (MacDougall, 1989c). The

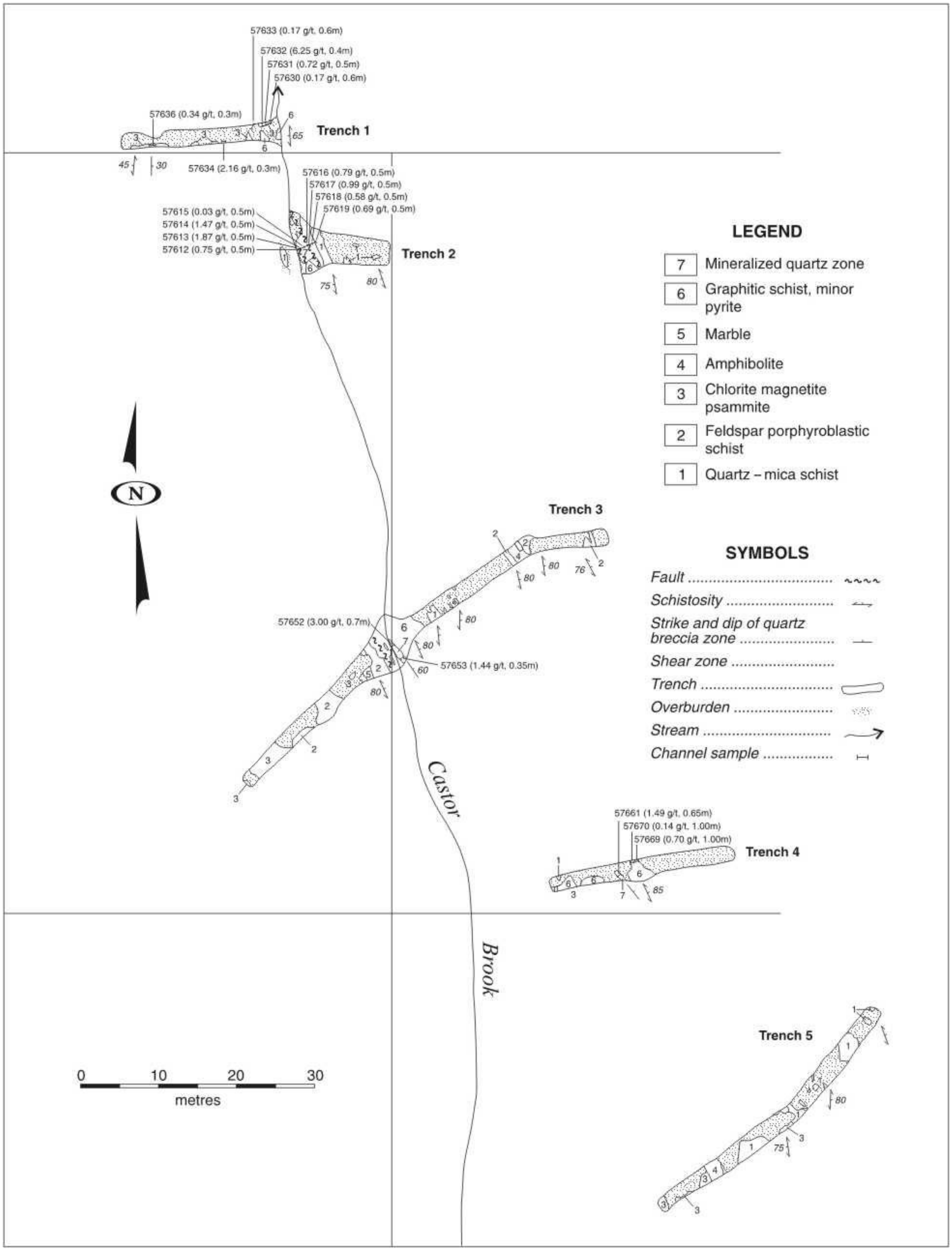


Figure 20. *Trench map of the Castor Brook prospect illustrating channel-sample locations and assay results (*modified after *MacDougall, 1987a).*

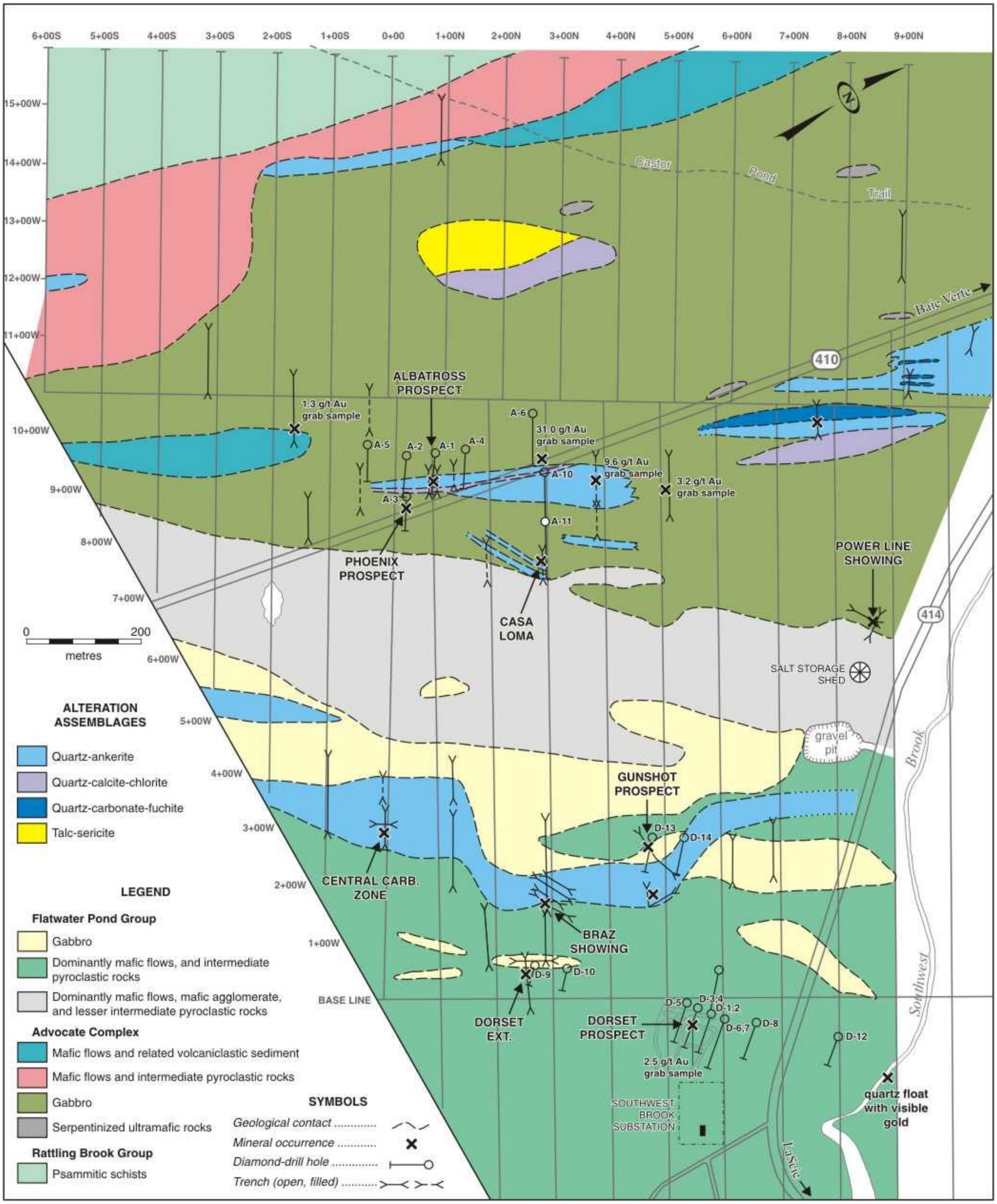


Figure 21. *Geology map of the Dorset Grid area showing the location of the Phoenix, Albatross, Casa Loma, Power Line, Gunshot, Dorset, Braz, Dorset Extension and Central Carbonate Zone gold occurrences (*modified after *MacDougall, 1989c).*

Plate 22. *Carbonitized and quartz-veined gabbro of the Advocate Complex, diamond-drillhole A-87-03, Phoenix prospect.*

Plate 23. *Medium-to coarse-grained gabbro of the Advocate Complex cut by diabase dykes, diamond-drillhole A-87-01, Albatross prospect. Note zones of epidotization.*

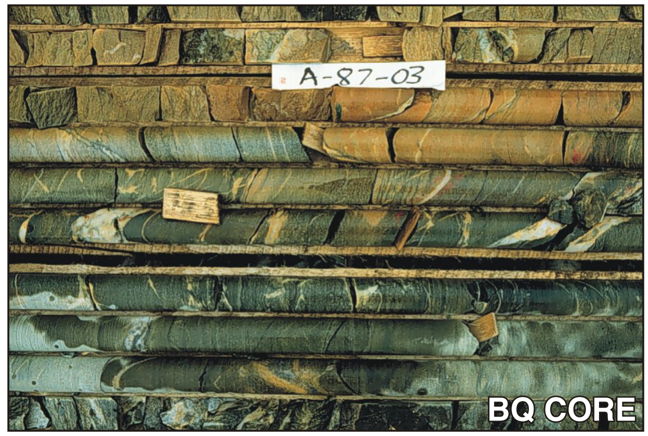


Plate 24. *Diamond-drillhole A-87-03 showing the gradational nature of the carbonitization, Albatross prospect.*

Plate 25. *Pervasive Fe-carbonate alteration, cut by narrow tension-gash quartz veins, diamond-drillhole A-87-03, Albatross prospect.*

prospect was trenched, channel and grab samples were collected, and the zone was tested with three diamond-drillholes. The prospect was the subject of a B.Sc. thesis by Field (1990).

The Albatross prospect is marked by extensive and distinctive zones of wall-rock alteration (Plates 23, 24 and 25). Within gabbroic and mafic volcanic rocks, this alteration shows weak to intense iron-carbonatization accompanied by variable pyritization. These zones typically occur as clusters of structurally controlled lensoidal zones of alteration and mineralization. The Albatross prospect has a minimum width of 20 m and a strike length of about 100 m. Diamond drilling has cut off possible strike extensions of the occurrence but it remains open at depth, and the potential for a plunging mineralized zone has not been evaluated.

Field (1990) concluded that the mineralization and associated alteration were typical of mesothermal-style gold deposits. He described the alteration as being composed of four distinct alteration facies, which are from least to most altered: 1) chlorite–calcite, 2) chlorite–calcite–ankerite, 3) sericite–ankerite–siderite, and 4) chlorite–ankerite–fuchsite. These alteration facies are superimposed upon a shear zone that cuts a fairly homogeneous unit of ophiolitic gabbro. Field (1990) attributed both the increase in the intensity of the alteration and the variations in the mineral chemistry associated with each facies to an increase in the water/rock ratios toward the centre of the shear. Fluids responsible for the alteration and mineralization were CO_2-rich. For example, both carbonate and chlorite became progressively more iron-rich with an increase in the intensity of the alteration. Later movement along the shear zone has subsequently deformed both the alteration and mineralization.

The gabbro unit varies from undeformed and massive to intensely mylonitized within the shear zones. Epidote is ubiquitous within the gabbro occurring in the groundmass, as fracture-fillings and veins. Field (1990) reported that modal mineralogical abundances for the gabbro are 40 percent plagioclase, 30 percent pyroxene–amphibole, 30 percent epidote, and less than 1 percent vein chlorite and carbonate.

The chlorite–calcite facies is the weakest and the most distal facies from the gold mineralization (Field, 1990). Relict plagioclase is the only silicate mineral preserved within this zone. Epidote is rare in this alteration phase and occurs only as veins and fracture fillings. Magnetite is also preserved, but titanium oxides are more common than in unaltered portions of the gabbro. Anatase–rutile occur as: 1) reaction rims around exsolved magnetite–ilmenite, 2) as intergrowths with chlorite, and 3) as blades that terminate at relict ilmenite–magnetite grain boundaries (Field, 1990). The chlorite–calcite facies is gradational into the chlorite–ankerite facies.

The chlorite–ankerite (Plate 26) facies is well exposed in the original discovery trench, but extensive iron oxidation almost totally masks the altered gabbro (Field, 1990). Based upon petrographic analyses of drill-core samples, Field (1990) reported that this facies has a modal mineralogy of up to 30 percent chlorite, 30 to 60 percent carbonate, about 30 percent albite and up to 20 percent quartz. No primary magnetite was reported from this facies, but hydrothermal magnetite–ilmenite was reported to be present in a crosscutting albite and pyrite-bearing quartz vein. Anatase–rutile occurs as inclusions within and marginal to some of the pyrite grains in the quartz vein. Patches of sericite and a gradual decrease in chlorite mark the transition from the chlorite–ankerite facies, over a width of 1 to 2 m, into the sericite–ankerite–siderite facies (Field, 1990). Locally, auriferous quartz–ankerite veins cut this alteration facies. One such vein was exposed in the discovery trench where grab and channel samples assayed up to 14 g/t Au and 11 g/t Au per metre respectively (Field, 1990). Sericite is developed in the wall rock adjacent to the vein. Bailey (1999) collected a sample from the Albatross prospect, which he described as a plagiogranite or tonalite the extent of which is not known. Petrographic analyses of the rock, which weathers a distinctive buff-white, revealed a modal mineralogy consisting of plagioclase (60 percent), quartz (>20 percent), epidote + chlorite (10 percent) and carbonate + opaques (10 percent). The plagioclase and quartz exhibit granophyric intergrowth textures.

Plate 26. *Example of the chlorite–ankerite alteration assemblage, diamond-drillhole A-87-01, Albatross prospect.*

33. The Gunshot Prospect

Location and Access

The Gunshot prospect (12H/16 Au012 UTM 554050E 5526850N) is an auriferous quartz–pyrite vein located approximately 350 m west of the Dorset prospect (Figure 21). The prospect is easily accessible from the La Scie Highway (Route 414) and a muskeg trail leads to the prospect from the Dorset area.

Local Geology and Mineralization

The Gunshot prospect was discovered during grid mapping of the Dorset property (MacDougall, 1989c). The prospect has been trenched (Figure 22) and tested by two diamond-drillholes (D-88-13 and 14) that total 183.5 m. The area is underlain by gabbroic rocks of the Flat Water Pond Group that are cut by a 60°-trending 80° north-dipping, 5- to 8-m-wide shear zone that has been exposed by trenching over a strike length of 25 m.

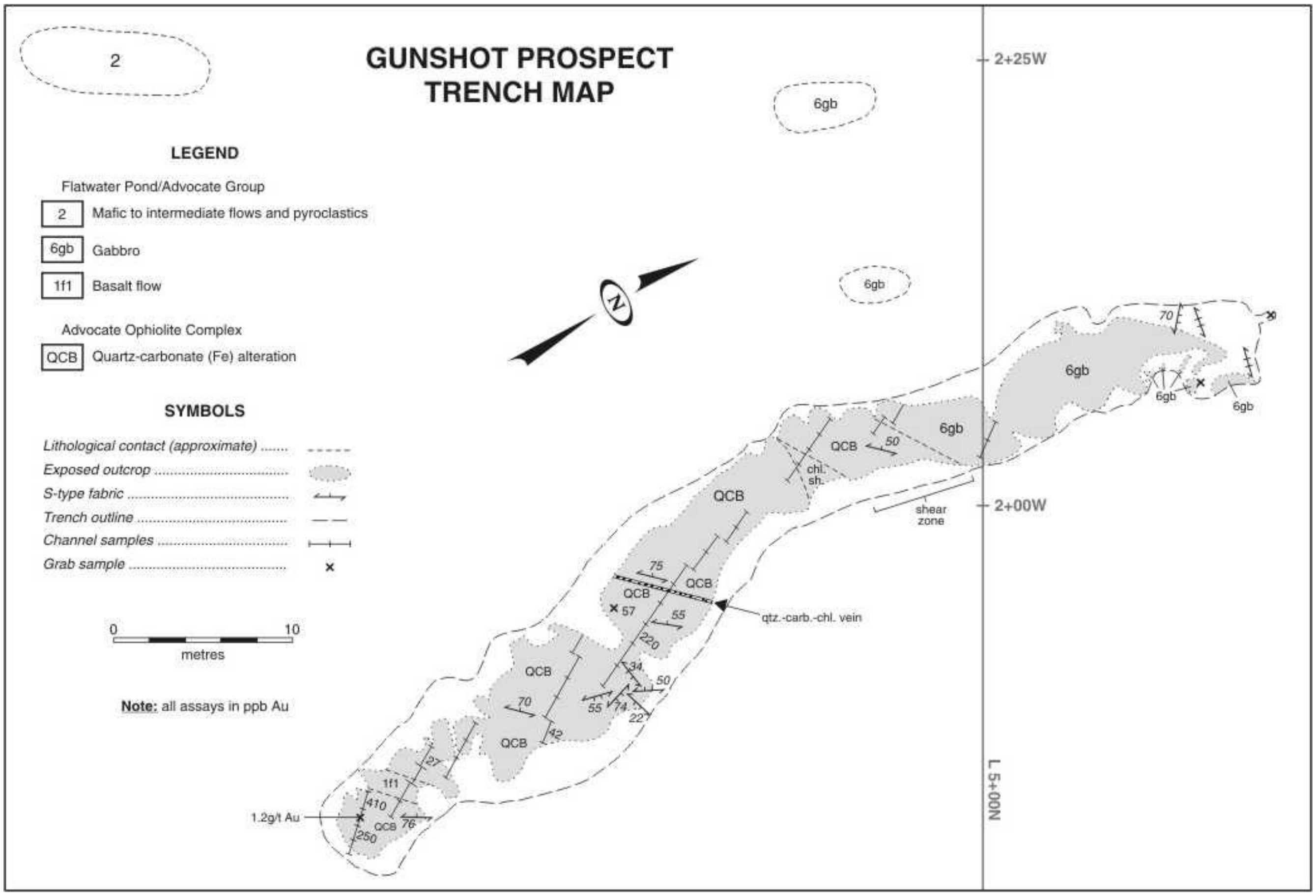


Figure 22. *Trench map of the Gunshot prospect (*modified after *MacDougall, 1989c).*

Multiple, broken and boudinaged quartz veins up to 1.0 m wide, are preserved within the shear zone (Plate 27). The veins comprise weakly rusty, milky-white, massive quartz, and pyrite occurs as laminations within the veins. The blocks and boudins parallel the trend of the shear, but some appear to have been rotated within the shear zone. The overall orientation of a number of the blocks suggests the veins were initially folded and subsequently boudinaged and broken. A sinistral sense of rotation is suggested by wrapping of the shear fabric around the blocks and the slightly oblique orientation of the veins (which trend 85° and dip 70° to the north) to the shear fabric (which trends 65° and dips 80° to the north). Some of the boudins exhibit a chocolate-block style boudinaging similar to that exhibited at the nearby Dorset prospect. The long axis of these boudins parallels the trend of the shear zone.

In the immediate vicinity of the veins, the gabbroic wall rock is altered to an assemblage of quartz–ankerite. Diamond-drillhole D-88-13 was drilled to test the down-dip extension of the prospect. The hole intersected a 20-m-wide shear zone, cut by small quartz veinlets, which did not contain significant gold values (MacDougall, 1989c). However, a 35-m-thick sequence of quartz–ankerite alteration was intersected at the top of the hole. Hole D-88-14 was drilled about 50 m to the northeast of hole 13. It intersected a 0.55-m-wide pyrite–arsenopyrite-bearing quartz vein that assayed 5.73 g/t Au (MacDougall, 1989c).

The Gunshot veins contain visible gold and pyrite and grab samples collected from the veins have assayed up to 162 g/t Au and channel samples have assayed up to 18.0 g/t Au over 0.4 m (MacDougall, 1989c). Assay results for samples collected from the altered wall rock include values up to 1.03 g/t Au.

35. The Dorset Prospect

Location and Access

The Dorset prospect (NTS 12H/16 Au0014 UTM 555400E 5526800N) is an auriferous base-metal-rich quartz vein located approximately 50 m northwest of the South West Brook substation (Figure 21). The prospect is easily accessible via a trail from the South West Brook substation located on the La Scie Highway (Route 414).

Plate 27. *Boudinaged quartz vein developed within strongly sheared gabbro, Gunshot prospect.*

Local Geology and Mineralization

The 1987 Noranda Ltd. Flat Water Pond reconnaissance till sampling program identified an area of anomalous gold along the La Scie Highway near South West Brook (MacDougall and Walker, 1988). An orientation survey was conducted along South West Brook from the waterfall, located just north of the highway, downstream for 450 m. Numerous gold grains were recovered including one heavy mineral concentrate stream sample that assayed 22 094 ppb Au. It was determined that the highest concentration of grains occurred less than 150 m downstream from the waterfall. Prospecting a small brook, which flows from the west, into South West Brook below the falls, resulted in the discovery of small, high-grade, quartz-shear veins hosted by mafic volcanic rocks of the Flat Water Pond Group. The prospect has been trenched and tested with 10 short diamond-drillholes. The following description is compiled mainly from the work of MacDougall and MacInnis (1990) and Dubé and Lauzière (1992).

The Dorset prospect is hosted by a mixed assemblage of thin, interbedded mafic basalt flows, flow breccias and pillow lavas intercalated with intermediate to mafic tuffaceous units, and related volcaniclastic sedimentary rocks of the Flat Water Pond Group (MacDougall and MacInnis, 1990). The sequence is intruded by numerous medium- to fine-grained, equigranular to porphyritic gabbro sills and dykes. The prospect is located approximately 700 m east of the Baie Verte Road Fault.

The gold mineralization is hosted by 3 subparallel, northeast-trending, steeply west-dipping quartz lode vein systems localized within 1- to 3-m-wide shear zones (Figure 23). The Dorset #1 vein comprises two narrow and discontinuous quartz veins, which have been trenched for 60 m along strike (MacDougall and Walker, 1988). The western vein varies from 2.0 to 15 cm in width and contains visible gold, pyrite and galena. Grab samples collected from this vein assayed up to 407.9 g/t Au (MacDougall and Walker, 1988). The eastern vein, which was reported to be up to 0.25 m wide, also contained disseminated pyrite and significant concentrations of gold.

The Dorset #2 vein system (Plate 28) is located 37 m to the west of the Dorset #1. It is the most significant of the mineralized quartz veins and has been trenched and tested by diamond drilling over a strike length of 110 m. Further trenching and limited diamond drilling have indicated a minimum strike length of 400 m. MacDougall (1989c) suggested a potential strike length on the order of 900 m extending from Southwest Brook to the Dorset Extension (NTS 12H/16 Au014), which is located 250 m to the southwest of the Dorset prospect. The Dorset #2 vein system is composed of two subparallel, boudinaged quartz veins. Assay results indicate that only the northwesterly vein contains significant gold mineralization (MacDougall and MacInnis, 1990). The veins range from 0.2 to 1.0 m in width and are restricted to a 2.5- to 3.0-m-wide, northeast-trending, 70° west-dipping shear zone. Figure 23 illustrates the geology and assay information over a 110 m strike length of the Dorset #2 vein.

Mineralization within the veins consists of visible gold, and up to 10 percent disseminated pyrite, galena, chalcopyrite, bornite, and minor sphalerite and arsenopyrite (Plate 29). Mineralization is most intensely concentrated along vein contacts, although gold may be distributed throughout the veins. Minor, non-auriferous disseminated pyrite mineralization, typically occurs in sheared country rock adjacent to the veins. Assays results of up to 407.9 g/t Au have been obtained from grab samples, whereas channel samples have returned up to 177.2 g/t Au over 0.35 m from individual veins. The best combined channels across the vein and the shear zone include high values of 56.0 g/t Au over 2.5 m, 41.6 g/t Au over 1.5 m, and 22.1 g/t Au over 1.5 m. The diamond drilling has confirmed the presence of high-grade gold values over narrow quartz vein widths (Table 8).

Located between 13 and 30 m to the west of the Dorset #2 is the 0.10- to 0.8-m-wide, boudinaged Dorset #3 quartz

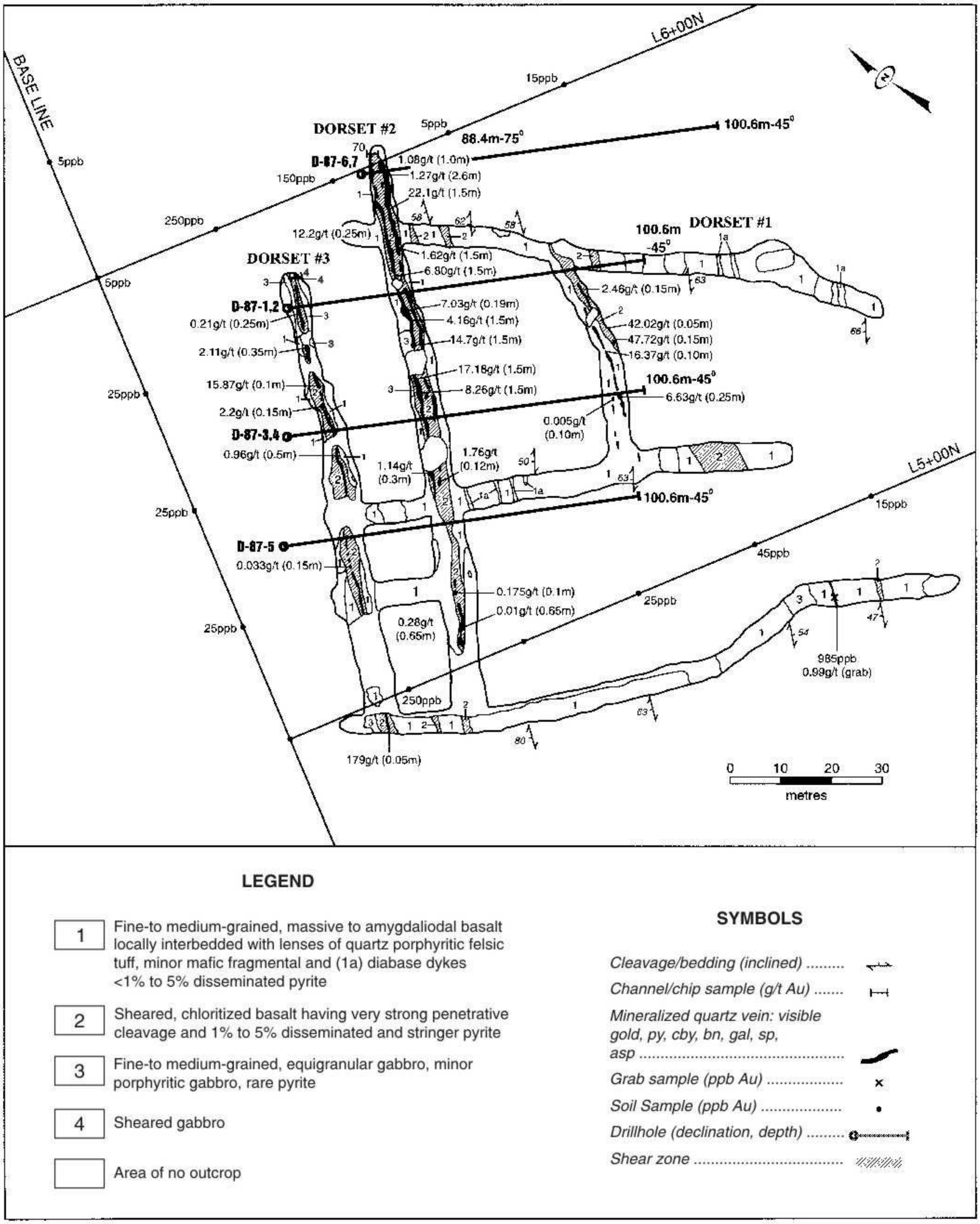


Figure 23. *Trench map of the Dorset prospect with channel- and grab-sample assay values (*modified after *MacDougall and MacInnis, 1990).*

Plate 28. *The Dorset #2 vein system, view to the southwest.*

vein system (MacDougall and Walker, 1988). The Dorset #3 is also hosted by a northeast-striking, 2-m-wide shear zone. The vein contains minor disseminated pyrite and chalcopyrite and grab samples collected from the vein have assayed up to 6.00 g/t Au.

Dubé and Lauzière (1992) reported that the earliest deformation to affect the Dorset area produced tight to isoclinal F_1 folds with an associated S_1 fabric. These folds plunge steeply to the north-northeast. The intensity of the S_1 fabric varies from a spaced cleavage to a well-developed schistosity. In the Dorset area, rocks of the Flat Water Pond Group strike northeast and dip, moderately to steeply, to the west. However, in the vicinity of the mineralized quartz veins the rocks trend approximately north (Dubé and Lauzière, 1992). In these areas, the S_1 fabric, shear zones and veins crosscut the lithological contacts at a relatively high angle indicating development within the hinge zones of F_1 folds. Dubé and Lauzière (1992) reported that the S_1 schistosity was related to discrete centimetre-scale brittle–ductile D_1 high-strain zones that formed in response to the F_1 folding. These D_1 high-strain zones host the mineralized quartz veins, indicating that the gold systems are controlled by the development of high-strain zones within the noses of folds. The Dorset #2, northwest vein, comprises a laminated shear vein developed within and oriented slightly oblique to the D_1 high-strain zone (Dubé and Lauzière, 1992). Dubé and Lauzière (1992) also reported that the veins were subjected to uniaxial compression producing extension in two directions and resulting in the “chocolate block boudinaging” observed in the Dorset #2 vein (Plate 29).

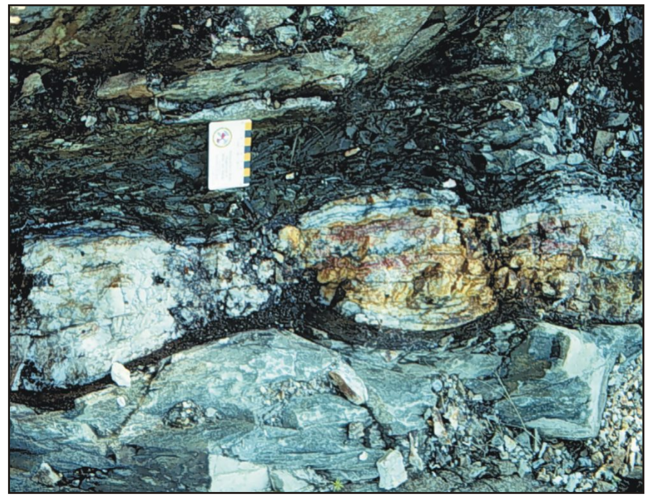


Plate 29. *Closeup of the Dorset #2 vein illustrating the base-metal-rich laminations and the strong boudinaging of the vein system.*

Kinematic indicators are lacking, but a 2 m offset of a gabbroic sill across the D_1 shear zone that hosts the Dorset #2 vein indicates a sinistral sense of movement. However, rotated quartz boudins observed at other occurrences on the property (Dubé and Lauzière, 1992) indicate a dextral sense of movement. Lineations on these quartz boudins are observed to plunge steeply to the north. Dubé and Lauzière (1992) reported that the S_1 fabric locally exhibited a down-dip stretching lineation, which is oriented at N358°/50° and elongated leucoxene grains within the gabbro sill provide the best example of this lineation. The second deformational event is marked by an S_2 fracture cleavage, which is developed within the high-strain zones.

39-40. Tidewater Prospect and Powderhouse Showing

Location and Access

The Tidewater prospect (NTS 12H/16 Au018 UTM 557475E 5530500N) and Powderhouse showing, an auriferous quartz–pyrite vein, (Figure 19) (NTS 121H/16 Au019 UTM 557550E 5530350N) are located approximately 1.3

Table 8. Diamond-drill assay results from the Dorset prospect (MacDougall and Walker, 1988; MacDougall, 1989c)

Hole No	Azimuth	Depth	Dip	Intersection	g/t Au	Length	Target
D-87-1	135	0.0 m	-45	27.2-27.8 m	0.58	100.6 m	#2
		45.7 m	-44	27.8-28.1 m	39.34		#2
		100.6 m	-41	28.1-28.5 m	0.42		#2
				27.2-28.5 m	9.48		Average
				52.5-52.8 m	0.29		
				64.6-64.65 m	2.31		#1
				66.9-67.0 m	2.48		#1
D-87-2	135	0.0 m	-65	3.95-4.2 m	0.15	91.4 m	#3
		38.1 m	-63	35.16-35.22 m	21.77		#2
		76.2 m	-57				
D-87-3	135	0.0 m	-45	7.95-8.1 m	0.19	100.6 m	#3
		45.7 m	-43	28.2-28.3 m	0.16		#2
		100.6 m	-39	67.5-67.55 m	1.18		#1
D-87-4	135	0.0 m	-65	9.1-9.15 m	0.26	94.5 m	#3
		38.1 m	-61	31.5-31.7 m	0.53		#2
		76.2 m	-53				
D-87-5	135	0.0 m	-45	11.6-11.66 m	1.37	100.6 m	#3
		38.1 m	-43	22.5-23.5 m	0.124		?
		100.6 m	-40	69.4-69.65 m	0.15		?#1
D-87-6	135	0.0 m	-45	5.7-5.8 m	3.49	100.6 m	#2
		50.3 m	-41	5.8-6.15 m	0.17		#2
		100.6 m	-38	6.15-6.22 m	13.33		#2
				6.22-6.32 m	0.13		#2
				6.32-6.62 m	1.13		#2
				5.7 -6.62 m	1.84		Average
				39.4-39.6 m	0.52		#1
				39.6-39.7 m	1.07		#1
D-87-7	135	0.0 m	-75	9.1-9.32 m	0.165	88.4 m	#2
		44.2 m	-69	56.07-56.17 m	4.95		#1
		88.4 m	-60				
D-87-8	135	0.0 m	-45	9.24-9.88 m	0.17	91.4 m	#3
		45.7 m	-46	9.88-10.01 m	94.15		?#3
		91.4 m	-45	33.49-34.00 m	0.162		#2
				34.00-34.08 m	0.319		#2
D-88-11	To test the Dorset veins at a vertical depth of 100 m			9.5-9.65 m	6.25		New
				41.0-41.22 m	2.03		Vein
				102.5-102.55 m	0.21		New
				143.6-143.7 m	0.55		Vein
							#2
							#1
D-88-12	To test the potential north extension of the Dorset veins			No significant assays reported			

km northeast of the Baie Verte Trailer Park. The area is best accessed from the shoreline of Baie Verte.

Local Geology and Mineralization

The Tidewater–Powderhouse area is underlain by mafic volcanic rocks of the Flat Water Pond Group. Prospecting and reconnaissance soil sampling led to the discovery of the Tidewater prospect, which consists of a 4-m-wide, fragmental gossan zone that caps pyritiferous chert and semi-massive sulphide (Plate 30). The fragments are grey, extremely fine grained and angular. Pollard (1988) reported that fragments collected from the gossan, which contain 6 to 8 percent fine-grained disseminated pyrite, assayed up to 8.2 g/t Au. Trenching 75 m to the southwest exposed the gossan, but a second trench excavated 25 m to the south of the discovery outcrop failed to reach bedrock. This second trench exposed numerous massive sulphide floats that assayed up to 2 percent Cu, 0.14 percent Zn and 0.65 g/t Au (Pollard, 1988).

In 1989, the Powderhouse Pond grid was extended to include the Tidewater–Powderhouse area (Smith, 1989). Soil geochemistry and ground geophysical surveys, prospecting and geological mapping were undertaken. A number of significant Cu and Zn soil anomalies were identified in the area. However, these anomalies are located in an area of thick overburden with a paucity of exposure and they remain unexplained. Smith (1989) reported that the proximity of the salt water/fresh water interface in the Tidewater area created difficulties in interpreting the data collected from the geophysical surveys. The VLF survey outlined a strong northeast-trending conductor that corresponded closely with the Tidewater prospect. The HLEM survey also identified a major conductor that corresponded with the VLF conductor and was interpreted to extend northeastward along the entire grid and deepen from north to south.

In 1989, the Tidewater prospect was tested with a single 61.9 m BQ diamond-drillhole (Huard, 1989). The hole intersected a 30-cm-thick interval of pyritiferous interpillow chert that was interpreted to be the down-dip extension of the mineralization exposed on surface. No significant assays were obtained either from samples collected from the chert or several narrow pyritiferous intervals (Huard, 1989a). The Tidewater horizon was interpreted to pinch-out rapidly down-dip and no further work was undertaken.

Trenching 200 m to the southwest of the Tidewater prospect exposed the Powderhouse showing. This mineralization consists of a northwesterly dipping quartz vein containing up to 5 percent stringer pyrite (Pollard, 1988). Grab samples collected from the vein assayed up to 2.71 g/t Au.

Plate 30. *Gossanous fragmental zone, Tidewater prospect. The fragments comprise angular siliceous blocks that locally contain up to 8 percent pyrite. Grab samples from the zone have assayed up to 8.2 g/t Au.*

PINE COVE AREA, BAIE VERTE MAP AREA (NTS 12H/16)

Exploration History

In July 1985, South Coast Resources Incorporated staked the Pine Cove area as a target for Mother Lode-style gold mineralization. The property was transferred to Varna Resources Incorporated on February 18, 1986. In 1986 and 1987, reconnaissance geological mapping, detailed prospecting, heavy mineral stream and soil geochemical surveys and magnetic surveys were carried out by Dearin Geological Consulting Limited (Christie and Dearin, 1987). In July, 1987, detailed follow-up panning of gold geochemical anomalies in stream heavy mineral concentrates by Charlie Dearin resulted in the discovery of several gold-bearing quartz veins that returned assay values between 6500 ppb to over 10 000 ppb gold (C. Dearin, written communication, June, 2002). Subsequent stripping, trenching, channel sampling and 1242.7 m of diamond drilling in 11 holes led to the discovery of the Lightening Zone. In November 1988, the property was optioned, from Varna Gold Incorporated, by Corona Corporation who completed detailed geological, geophysical and geochemical surveys, followed by trenching and 2812.6 m of diamond drilling in 24 holes. This work led to the discovery of the Thunder Zone. In 1990, an additional 6095 m of diamond drilling in 45 holes helped delineate a geological reserve for the Pine Cove deposit of 2 750 000 tonnes grading 3.0 g/t gold (Dimmell and Hartley, 1991a).

In the fall of 1991, NovaGold Resources Incorporated optioned Corona Corporation's 70 percent interest in the

Pine Cove Property with the view to mine the deposit by open pit and recover the gold through a vat leach process (Duncan and Graves, 1992). Peak Engineering Limited completed a positive feasibility study and NovaGold moved ahead with reserve definition. All previous drilling was relogged and a definition 32 hole, 2389.6 m diamond-drill program was initiated to complete the 25 by 25 m drill pattern over the deposit. In 1993, the property was transferred to Pine Cove Resources Incorporated. An independent review by Watts, Griffis and McOuat in 1993 calculated an open-pit mineable (diluted and recoverable) ore reserve of 1.865 million tonnes, grading 3.19 g/t Au, plus an additional 587 000 tonnes grading 1.40 g/t Au for a total gold content of 217 700 ounces of gold. A small amount of ore was mined and stockpiled near the Rambler tailings for vat leach processing, but no further work was undertaken. In November 2002, the property was transferred to New Island Minerals Incorporated.

In 1987, the Romeo and Juliet prospect was discovered by Varna geologist Wilson Jacobs during regional prospecting of the Pine Cove property (C. Dearin, personal communication, 1997). A series of grab samples collected from the vein assayed up to 2.15 g/t Au and in 1990, the prospect was trenched and tested by four diamond-drillholes (Dimmell and Hartley, 1991a). The Romeo and Juliet prospect is currently the property of Nova Gold Incorporated and New Island Minerals. Approximately 10 ounces of gold were recovered from a 10-tonne bulk sample collected from the Juliet South Zone (K. MacNeill, personal communication, 1997).

Corona Corporation also discovered the Anoroc prospect in 1990 and subsequently the showing was covered by an IP survey, trenched and tested by 5 diamond-drillholes. By 1990, a total of 90 diamond-drillholes had been drilled on the Pine Cove Property and geological mapping and geophysical and geochemical soil surveys were also conducted near Green Cove Pond, South Brook and Three Corner Pond (Dimmell and Hartley, 1991a). That year, Dr. T. Calon and J. Weick were contracted by Corona to complete a detailed structural analysis of the Pine Cove property and an interpretation of the structural setting of the ultramafic rocks located to the east of the Mings Bight Highway (Calon and Weick, 1990).

Regional Geology

The Corona Pine Cove property is underlain by rocks of the Cambro-Ordovician Point Rousse Complex and the Pacquet Harbour Group (Figure 24). The Point Rousse Complex comprises a dismembered ophiolite sequence conformably overlain by a mafic volcanic–volcaniclastic cover sequence (Hibbard, 1983). In the Pine Cove area, the Point Rousse Complex is composed of mafic tuffs and volcanic flows that have been intruded by gabbro and diabase. The gabbros are typically fine grained, and in the vicinity of the Romeo and Juliet prospect and the Pine Cove deposit, are strongly altered. At the Pine Cove deposit, gabbro is the inferred protolith due to the presence of abundant leucoxene (Dimmell and Hartley, 1991b). Rocks of the complex have been metamorphosed in the greenschist facies. Immediately south of the Pine Cove deposit and the Anoroc prospect, the Point Rousse Complex has been thrust southward along the Scrape Thrust over the Pacquet Harbour Group. In the Pine Cove area, the Scrape Thrust follows an arcuate pattern that defines the apex of the Baie Verte Flexure (Dimmell and Hartley, 1991b). The thrust plunges approximately 30 to 35° to the north and trends north-northeast to the west of the Pine Cove deposit and southeast to the east of the deposit.

The Pacquet Harbour Group, to the south of the Scrape Thrust, is composed of a moderately to steeply north-dipping sequence of mafic and intermediate volcanic rocks that are intruded by gabbro. These rocks are polydeformed, displaying up to three fabrics, and polymetamorphosed up to the lower amphibolite facies (Hibbard, 1983). Ultramafic rocks occur as tectonic slivers along the Scrape Thrust and Hibbard (1983) reported that isolated outcrops of pegmatitic gabbro within the Pacquet Harbour Group near the Scrape Thrust may also represent slivers of Point Rousse ophiolite.

Gold Mineralization

43. Anoroc/Anoroc Extension Prospect

Location and Access

The Anoroc/Anoroc Extension prospect (NTS 12H/16 Au022 UTM 561900E 5534000N and 561850E 5534200N) is a carbonate–quartz–sulphide replacement style of gold mineralization that is located about 600 m to the southwest of the Pine Cove Deposit (Figure 24). A drill road leads to the prospect from Pine Cove.

Local Geology and Alteration

The Anoroc prospect has been trenched and in 1990 was tested by 5 diamond-drillholes (Dimmell and Hartley, 1991b), but very little information is available on the Anoroc Extension. The geological setting of the Anoroc prospect is similar to that of the Pine Cove Deposit. The occurrence is hosted by sheared mafic volcanic rocks, tuffs and mafic intrusive rocks of the Point Rousse Complex immediately north of the Scrape Thrust and the mineralization comprises disseminated pyrite and pyritiferous quartz and quartz breccia veins associated with chloritization, iron carbonate alteration and minor silicification (Plate 31; Dimmell and Hartley, 1991a). The mineralization is also controlled by the geometry of the fold systems and the host rocks (Dimmell and Hartley, 1991b). Channel sample assay results from trenches on the Anoroc zone included 3.2 g/t Au over 3 m and 7.8 g/t Au over 2 m and this included a section that assayed 14.2 g/t Au over 1 m. Samples from diamond drilling (An-90-1) assayed up to 9.9 g/t Au over 2 m, which included 18.9 g/t Au over 1 m (Table 9). Grab samples collected from the Anoroc Extension assayed 7.5 and 6.0 g/t Au (Dimmell and Hartley, 1991b).

44. Pine Cove Deposit (Thunder and Lightening Zones)

Location and Access

The Pine Cove Deposit (NTS 121H/16 Au23 UTM 562350E 5534400N) is a carbonate–quartz–sulphide replacement style of gold mineralization located near the western side of the Mings Bight Peninsula, approximately 4 km northeast of the town of Baie Verte. The area is accessible via a rough gravel road that leads from the Ming's Bight Highway (Route 418) to Pine Cove on the eastern shore of Baie Verte.

Local Geology and Mineralization

The following description relies heavily upon the work of Dimmell and Hartley (1991a, b). The Pine Cove Deposit comprises two separate zones (Plate 32; Figure 24), the Thunder and the Lightning (Figure 25) zones, that are both hosted by mafic volcanic rocks, gabbro and hematitic arenite of the Point Rousse Complex cover sequence. The mineralized zones are restricted to a thrust sheet that is bounded to the north by the Pasture Pond thrust and to the south by the Scrape Thrust (Figures 26 and 27). The mineralized

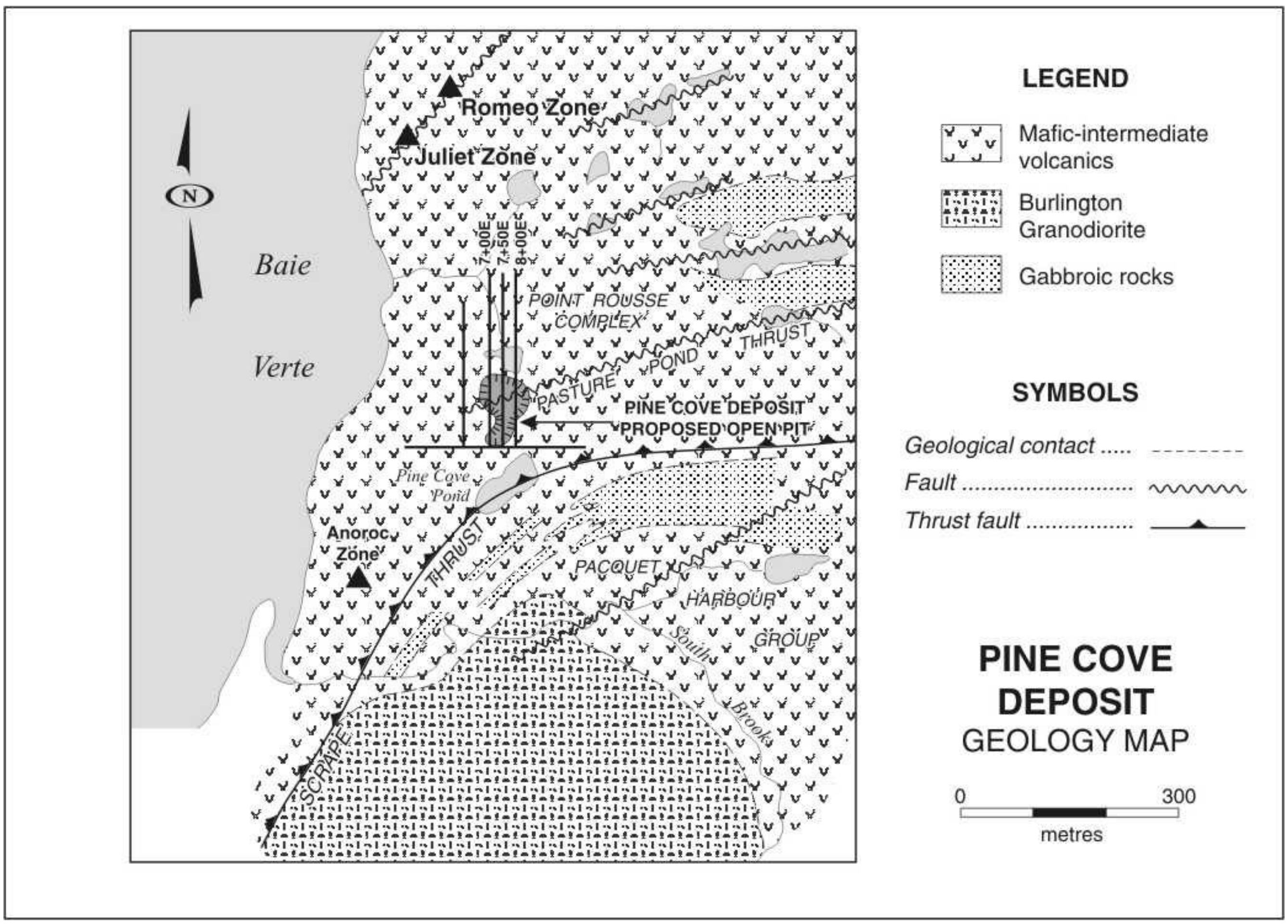


Figure 24. *Geology of the Pine Cove deposit area, showing the location of the proposed open-pit, the traces of the Scrape and Pasture Pond thrust faults, and the associated Romeo and Juliet, and Anoroc prospects (*modified after *Dimmell and Hartley, 1991b).*

Plate 31. *Zone of pyritiferous quartz and quartz breccia, Anoroc prospect. Channel samples from this zone have assayed up to 7.8 g/t Au over 2.0 m.*

zones occur a minimum of 75 m above the Scrape Thrust and dip approximately 30 to 35° to the north, subparallel to the thrust plane.

Calon and Weick (1990) identified four phases of deformation as part of a detailed structural analysis of the Pine Cove area. The earlier D_1 and D_2 folds are reclined, plunge to the north, and are the main controlling factors in the distribution of lithological units. D_3 deformation folds the regional foliation and is related to thrusting of the Point Rousse Complex southward over the Pacquet Harbour Group along the Scrape Thrust. Calon and Weick (1990) identified two styles of structurally controlled gold mineralization within the Pine Cove deposit: 1) gold is associated with pyrite in mesothermal tension-gash quartz veins and quartz breccia veins; and 2) auriferous pyrite occurs disseminated within sheared and altered wall rock. The following section, which is taken from Calon and Weick (1990), details the structural evolution of the auriferous veins and disseminated mineralization at Pine Cove.

Table 9. Diamond-drill assay results, Anoroc prospect (Dimmell and Hartley, 1991b)

Hole No.	Interval in m	Length in m	Au g/t
An-90-01	8.0-10.0 9.0-10.0 31.5-33.0	2.0 1.0 1.5	9.9 18.9 1.1
An-90-02	43-44 43.5-44 58-59.5 58-58.6 67.7-68.3 71.5-72.3	1.0 0.5 1.5 0.6 0.6 0.8	2.1 3.4 1.2 2.2 1.2 1.1
An-90-03	36412	1	0.94
An-90-04	16-17	1	1.07
An-90-05	27-28	1	1.07

"...The orientation patterns and distribution of auriferous quartz veins and the auriferous host rock zones are controlled by the geometry of the D_3 fold system and by the distribution of lithological units in the D_1, D_2 fold pattern. Most quartz veins are concentrated in the central and eastern part of the property, associated with the more competent sequences of mafic volcanic and volcaniclastic rocks and hematitic arenite. Veins in the western tuffaceous sequence are less frequent and more barren. This lithology-controlled distribution pattern reflects the reclined D_1, D_2 fold geometry and the more competent eastern sequence reacting in a more brittle way to the D_3 deformation than the less competent western sequence.

The D_3 deformation exerted geometrical controls on the orientations of quartz vein injections. The veins occur in two distinct sets of planes. One set represents steeply oriented, E-W striking

Plate 32. *The Pine Cove deposit, view to the east. The Lightening Zone lies beneath the bulldozed area to the left and the Thunder Zone underlies the bulldozed area to the right of Pine Cove Pond.*

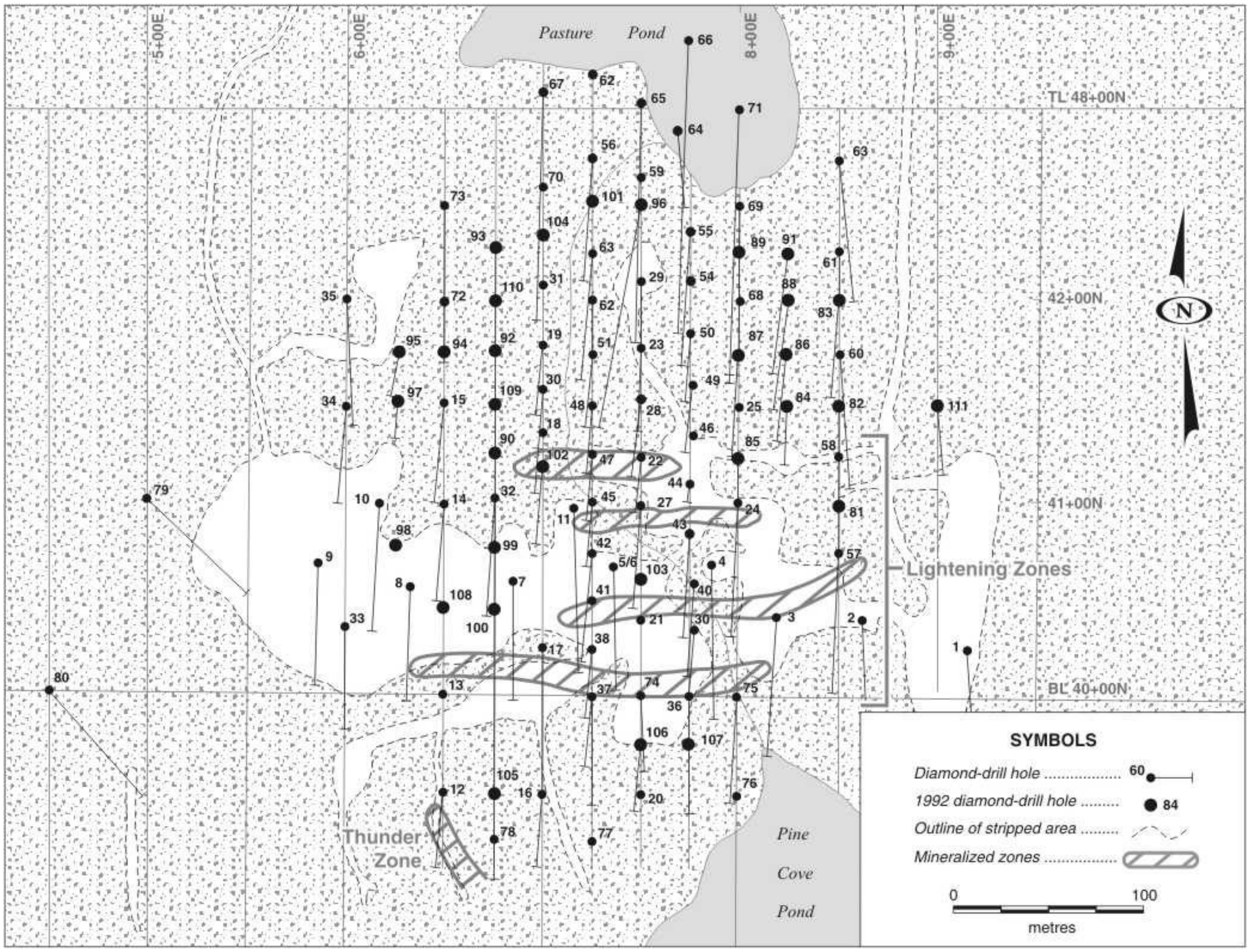


Figure 25. *Diamond-drillhole location map, Lightening Zone (stippled) (*modified after *Dimmell and Hartley, 1991b; Duncan and Graves, 1992).*

veins, with dilational features. This set is interpreted to represent an *en echelon* tension gash system developed in relation to the kinematic framework of D_3 folding and thrusting. In the central and eastern area, the veins are roughly perpendicular to the gently to moderately north-dipping axial surfaces of the D_3 fold system. The other set represents the thicker massive and brecciated veins which dip both steeply and moderately to the north in the central and eastern area. The breccia veins are generally more gently inclined than the massive veins. They are interpreted as injections into shear zones parallel to the axial surfaces of the D_3 folds.

The D_3 deformation represents a phase of folding associated with the development of the Scrape Thrust. It is essentially a mixed brittle-ductile structure interpreted as a thrust fault propagation fold system with associated shears. The brecciated veins are interpreted as discrete shear zones, whereas the more typical dilational vein systems represent steeply oriented tension gashes which developed in response to brittle extension in the more competent host rock units. The dilational vein systems developed at angles of 45° to the shear zone boundaries, which for the D_3 folds equate with the axial surfaces of the folds. During the progression of thrusting, the tension gashes rotate to new orientations with respect to the shear zone boundaries and may consequently buckle and then stretch, while new tension gashes form. The breccia vein systems parallel to the shear zones, will retain their orientation, but will get progressively more cataclastically deformed during continued thrusting; their sheared aspect, inclusion of sheared host rock fragments, and complex, multiple alteration sequences observed in the textures and mineralogy confirm their progressively sheared nature.

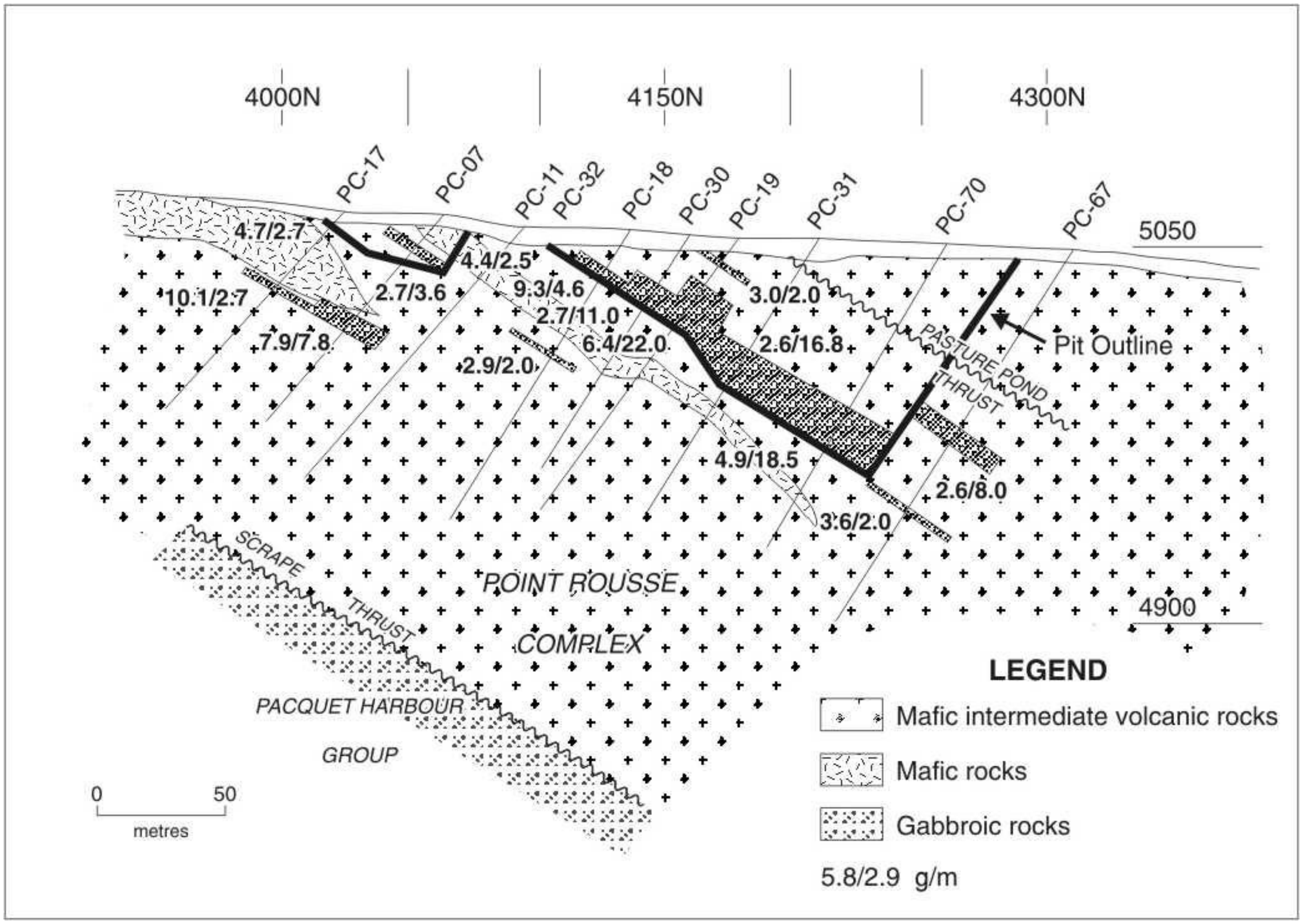


Figure 26. *Geological section along 7+00E showing Au 2.5 g/2.0 m cut-off blocks and proposed pit outline for the Lightening Zone. Vertical hatching shows mineralized zones (*modified after *Dimmell and Hartley, 1991b).*

Disseminated gold mineralization in the host rocks is related to effective fluid flow by fracture-enhanced secondary permeability in the competent lithologies which occur as screens between the veins. The fact that gold mineralization is best developed in specific lithologies (basalt and hematitic arenite) indicates that rock composition played an important role in concentrating the gold. The principal alteration features associated with gold dissemination in the host rocks appear to be silicification of the wall rocks of the veins, chloritization in basalts and massive fine grained pyroclastics, and oxidation and sulphidization in basalts and hematitic arenite. Direct correlation is noted between the occurrence of auriferous veins and the lithology and state of alteration of the host rocks with regard to the concentration of gold."

Subsequently, Duncan and Graves (1992), reported that the gold mineralization at Pine Cove is hosted by an intensely altered gabbro sill that has been altered to an assemblage of iron carbonate, albite and secondary pyrite with abundant quartz–carbonate veining. They indicate that the "remnant signature" of the gabbro is the presence of abundant white to light brown, 0.5- to 3-mm-long, leucoxene crystals. Gold mineralization is localized within the least deformed portions of the gabbro with gold deposition controlled not by proximity to D_1 shears as outlined above by Calon and Weick (1990).

"...The auriferous veins and alteration definitely post-date ductile deformation of the D_1 maximum as this fabric is seen in wallrock fragments within the veins and pre-dates the D_3 and D_4 of Calon and Weick (1990) as these deformations fold the veins. Contorted D_1 fabric in wallrock enclaves of the veins also implies that vein emplacement post-dated D_2 and constrains the timing on the veins to pre-D_3 or an early increment of that event."

Pyrite occurs marginal to the quartz veins or is disseminated within wall-rock fragments incorporated in the veins and minor disseminated pyrite occurs within the quartz

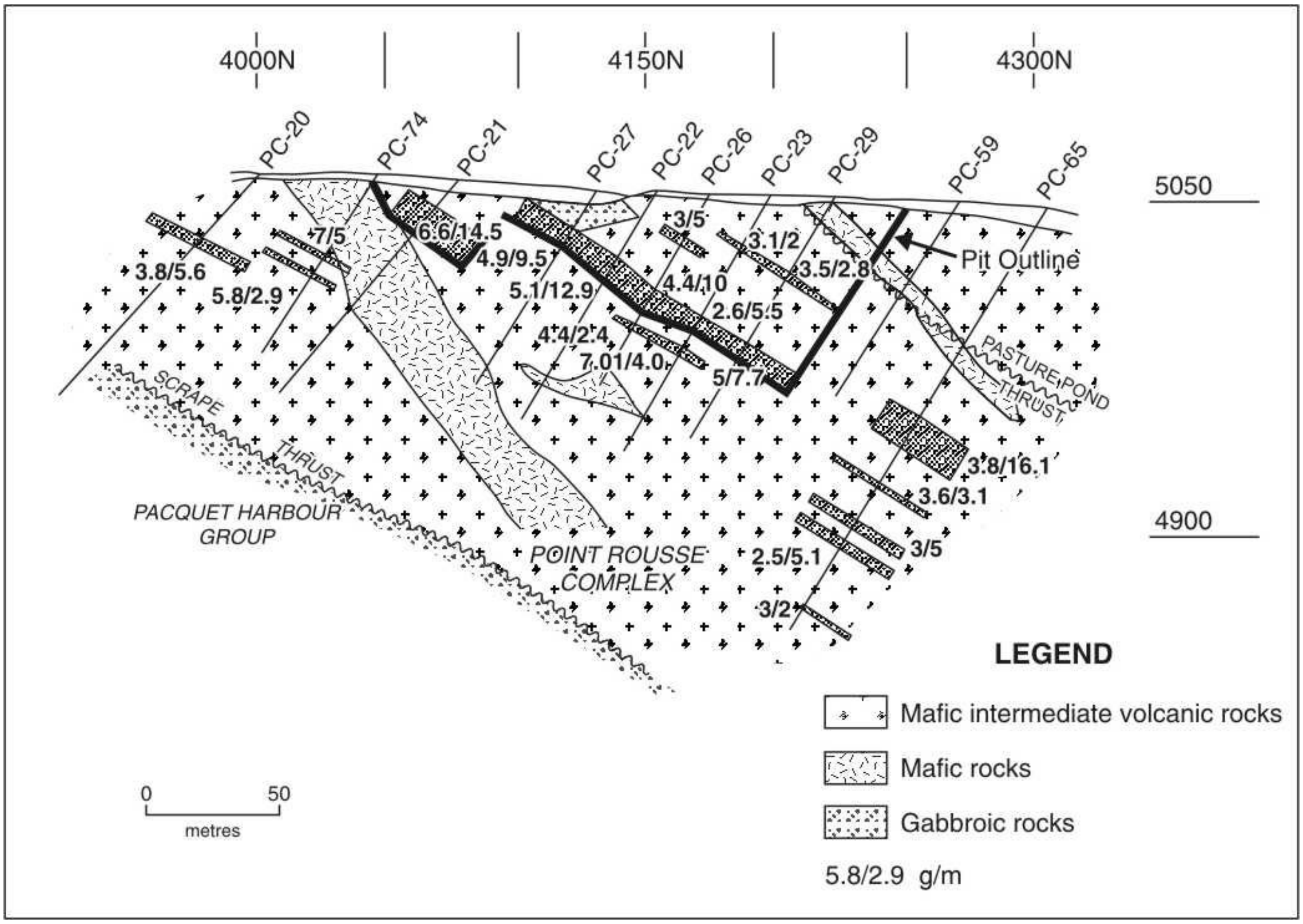


Figure 27. *Geological section along 7+50E showing Au 2.5 g/2.0 m cut-off blocks and proposed pit outline for the Lightening Zone. Vertical hatching shows mineralized zones (*modified after *Dimmell and Hartley, 1991b).*

veins. Gold concentrations are directly related to pyrite content and typically occur as small disseminated grains within pyrite, quartz veins and as thin stringers, possibly as a result of remobilization (Wilton, 1990; Lakefield Research, 1990). Gold grains range from less than 1 up to 50 micrometres. Dimmell and Hartley (1991a) reported that an average of 3 to 5 percent pyrite commonly indicated gold values in the 3 to 5 g/t range. Channel sampling of the Lightning Zone in 1988 by Varna returned assay values of up to 6.03 g/t Au over 12.8 m, and diamond-drill assay results of up to 11.1 g/t Au over 8.06 m (PC-89-07) (Dimmell and Hartley, 1991a). Channel sampling of the Thunder Zone in 1989 by Corona returned assay results that included, 6.3 g/t Au over 23 m in Trench #2 and 10.2 g/t Au over 36 m in Trench #5. Undiluted, geologically inferred reserves, based on 112 drillholes, are 2 921 845 tonnes at 2.95 g/t Au to 150 m vertical depth (Duncan and Graves, 1992). The mineralized zones remain open to the east along strike and down-dip to the north.

45. Romeo and Juliet Prospect

Location and Access

The Romeo and Juliet prospect (NTS 12H/16 Au24 UTM 561950E 5535700N) is a large auriferous quartz-vein system located on the Mings Bight Peninsula approximately 500 m north of Pine Cove (Figure 24). The area is accessed via a rough gravel road leading from the Ming's Bight Highway (Route 418) to Pine Cove on the eastern shore of Baie Verte. A skidder trail leads directly to the prospect from the Pine Cove deposit.

Local Geology and Mineralization

The Romeo and Juliet prospect is underlain by a sequence of relatively undeformed, massive fine-grained, non-variolitic and locally vesicular pillow basalts (Plate 33).

Fine-grained, gabbroic intrusive rocks are common in the area of the prospect and locally form the immediate host rock to the mineralization. The prospect consists of a series of three subparallel quartz-veined zones (Plate 34) as follows: i) Juliet South and Juliet North zones (Plate 35), ii) Connecting Zone, and iii) the Romeo Zone (Figures 28 and 29). These vein systems have been exposed over a strike length of 250 m, trending 030° and dipping approximately 60° to the southeast. The veins are associated with an intense north-northeast-trending shear zone. The large veins consist of smaller, multiple generations of parallel milky-white quartz, as indicated by crack-seal textures, comb textures, weakly preserved lamination and altered wall-rock fragments.

Juliet South Zone

The Juliet South Zone has a strike length of about 60 m and consists of a massive vein, composed of multiple generations of smaller veins (Plate 36). The massive vein and its component veins are offset by oblique strike-slip faults (Plate 37). The host rock comprises fine-grained, strongly epidotized green pillow lava and variably iron-carbonitized fine-grained gabbro (Plate 38; Figure 30). The wall rock adjacent to the veins is strongly fractured having well-developed cleavage trending subparallel to the quartz veins. The iron carbonate-altered wall rock weathers a rusty brown and displays a slight mineral lineation in the plane of the cleavage and parallel to the dip surface. The degree of host-rock fracturing and orientation of the quartz veins suggest that the veins developed in a shear zone parallel to the cleavage. The veins consist of fractured, milky-white quartz having local vugs containing well-developed quartz crystals.

The multiple vein margins look like fracture surfaces, but quartz crystal terminations give the surface its ragged, pitted or fractured appearance (Plate 39). It is along these surfaces that visible gold occurs as fine grains or blebs. Small flecks of gold were also observed along a cut surface of a quartz sample from the zone indicating that gold also occurs within the massive veins as well. Channel-sample results from this zone are typically low. However, a 1.0 m interval from the Juliet South Zone assayed 23 g/t Au (Dimmell and Hartley, 1991a). Diamond drilling on the zone also returned generally low values with the exception of a 0.5 m interval that assayed 11.1 g/t Au (Figure 30). Rare oxidized pyrite cubes with pyritohedrons up to 4 mm in diameter, but averaging 2 mm, also occur along these surfaces. The irregular vein margins are typically greyish having a greasy sheen, and are coated with minor green sericite and a soft clay-like mineral. Vein margins are locally a rusty red due to prominent hematite staining. Extensive milky-white veining is developed parallel to the shearing throughout the footwall rocks to the massive vein.

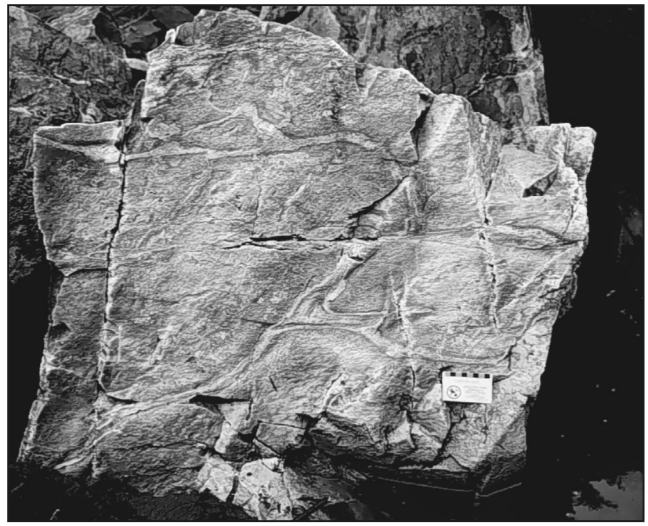


Plate 33. *Pillow lava of the Point Rousse Complex exposed at the Connecting Zone, Romeo and Juliet prospect.*

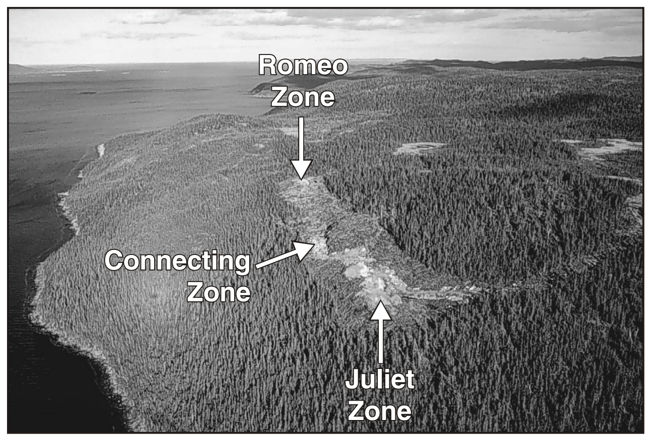


Plate 34. *Aerial view of the Romeo and Juliet prospect, view to the north. The zones from north to south are Romeo, Connecting Zone, Juliet North and Juliet South zones.*

Plate 35. *The Juliet North and South zones, view to the south.*

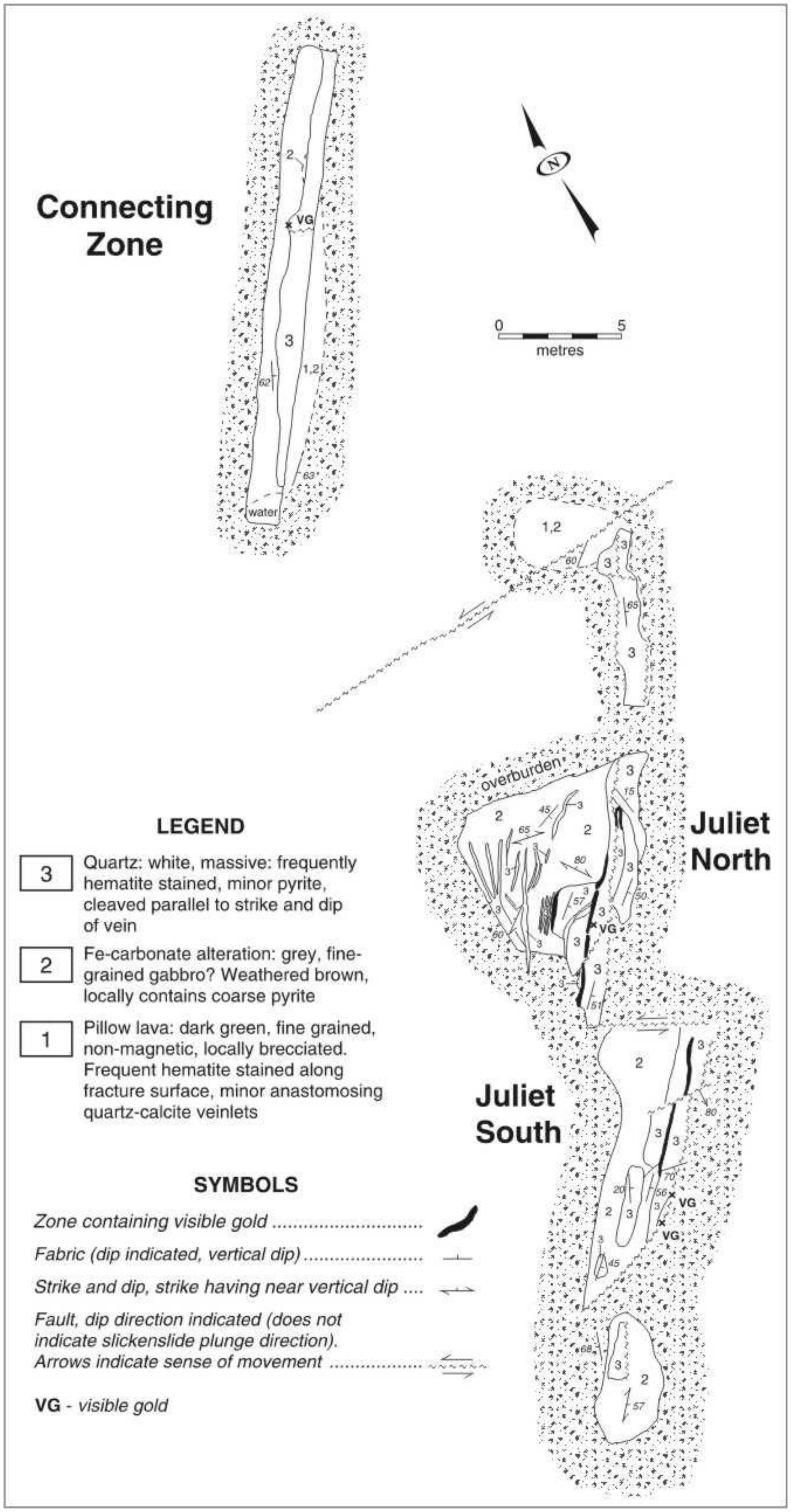


Figure 28. *Trench geology map of the Juliet north and south zones and the Connecting Zone (*modified after *Meade* et al.*, 1998).*

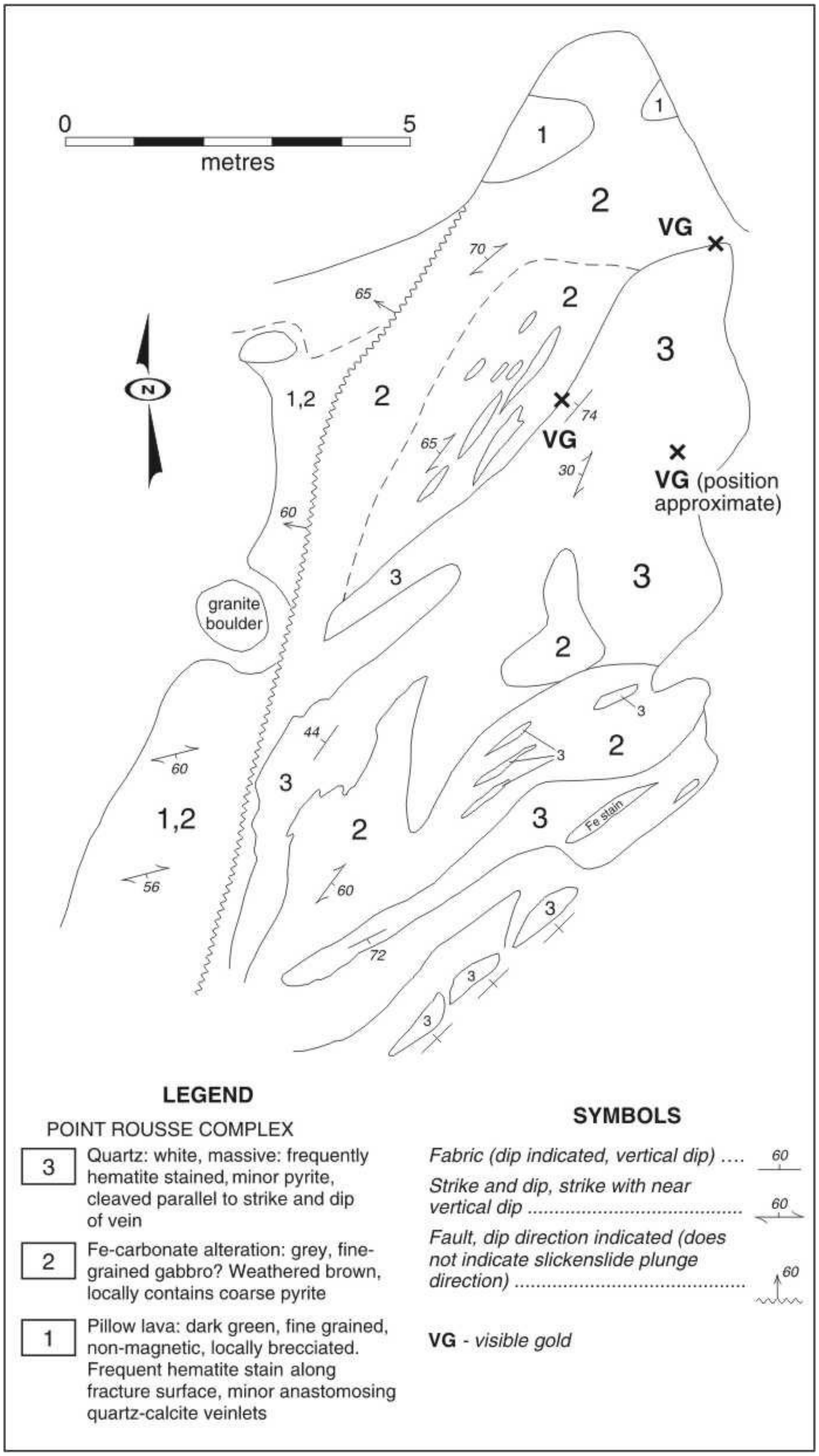


Figure 29. *Trench geology map of the Romeo Zone, which is located about 100 m north of the Connecting Zone (*modified after *Meade* et al., *1998).*

Plate 36. *Large, milky-white, laminated quartz vein, Juliet South Zone.*

Plate 37. *Oblique strike–slip fault that offsets the Juliet South Zone. Dextral offset on the vein is approximately 1 m.*

Plate 38. *Variably Fe-carbonitized gabbro cut by milky-white quartz veins developed in the structural footwall to the Romeo and Juliet prospect.*

Juliet North Zone

The hanging-wall rocks of the Juliet North Zone consist of mafic volcanic breccias and broken pillow basalts. Footwall rocks are strongly altered and well cleaved as in the Juliet South area. The contact between the pillow basalts in the hanging wall and the quartz vein is not exposed but is inferred to be within 6 to 8 m from the visible pillow basalt outcrop. As in Juliet South, the quartz is typically milky white. The veins trend 020° and dip 65° southeast and display weak banding. This portion of the Juliet North Zone contains no visible pyrite. The vein itself is cut by crosscutting fractures trending 125° and dipping 85° east. The northeast portion of the vein displays a 0.5 m sinistral offset, whereas the vein is cut off by a fault trending 025° and dipping 85° southeast. The fault trace disappears under overburden. The wall rock adjacent to the vein is highly cleaved from about 1.5 m into the hanging wall and about 5.0 m into the footwall.

Connecting Zone

The Connecting Zone (Figure 28) is composed of a 37-m-long, north-northwest-striking quartz vein having a maximum exposed width of 1.2 m. Pillow basalts are exposed in the trench face above the vein. Vein margins are strongly deformed in a fashion similar to that of Juliet North. Evidence of brittle deformation postdating vein formation is indicated by fracturing of the quartz vein and surrounding wall rock. Also, slivers of quartz broken from the main section of the vein during deformation are incorporated into the footwall. Brittle deformation is more pronounced in the hanging wall than in footwall rocks.

Spectacular visible gold mineralization is localized along the multiple vein margins. These surfaces also contain rare oxidized pyrite cubes, up to 4 mm across, as well as minor sericite along fresh fracture surfaces (Plate 40).

Romeo Zone

The Romeo Zone covers an area measuring approximately 20 by 40 m (Plate 41; Figure 29). The quartz veining is localized within a shear zone oriented at 040°. An intense Fe-carbonate alteration halo surrounds the veining (Dimmell and Hartley, 1991b).

The southern end of the Romeo vein system consists of a buff-coloured quartz vein with red hematite staining along fracture surfaces. Angular fragments of wall rock are trapped within quartz along vein margins. Sericite and euhe-

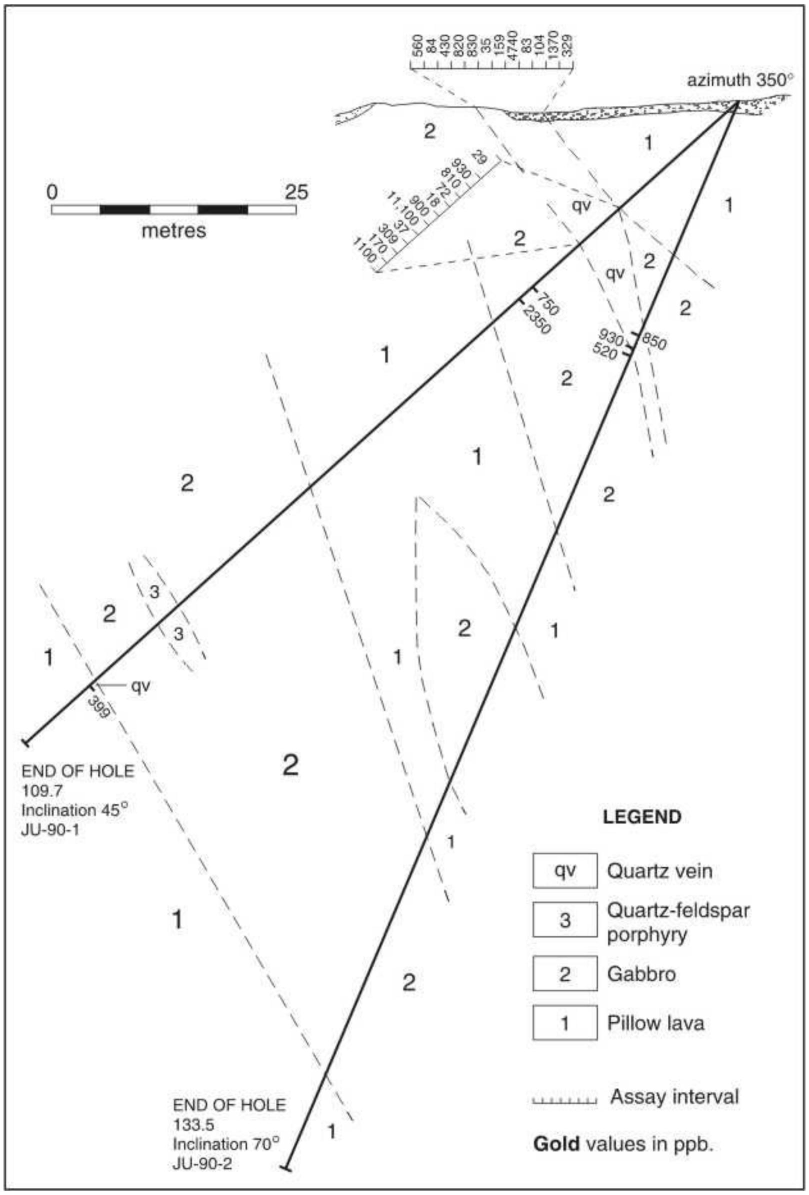


Figure 30. *Diamond-drill section, Juliet Zone, view to the north (*modified from *Dimmell and Hartley, 1991a).*

dral pyrite cubes and pyritohedrons up to 5 mm, but averaging 2 to 3 mm across occur along growth surfaces. The general trend of this portion of the vein is 062° dipping 72° southeast. A zone of strong iron-carbonate alteration trending 038° and dipping 60° south, with associated tension-gash quartz veins with multiple orientations and similar textures as described above, trends subparallel to larger veins.

Toward the north end of the Romeo Zone, the quartz vein becomes undulatory. Tension-gash veins trend roughly subparallel to the direction of shear at 036° and dip 44° northwest. Veins are locally curved in response to shear movement. Evidence of movement is provided by slickensides on fracture surfaces within quartz. The bulge at the north end of the prospect is a quartz breccia pod. Small pods of sericite occur locally along the fracture surfaces as does minor visible gold. Isolated flecks of visible gold are also present in small depressions similar to those at the Juliet prospect. A channel sample from the Romeo Zone assayed 1.15 g/t Au over 6 m (Dimmell and Hartley, 1991a). The prospect was tested with two drillholes that were collared in the footwall and as a result failed to intersect the vein. Approximately 20 m east of the Romeo Zone, the pillow lavas are intruded by a highly silicified mafic (?) dyke.

As part of a regional structural study for Corona Corporation, Calon and Weike (1990) interpreted the veins to have formed as large *en échelon*, dilational (antitaxial)

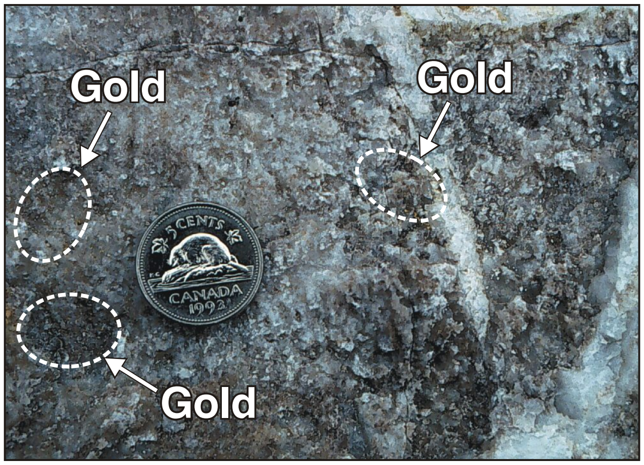


Plate 39. *Closeup of a mineralized vein margin, Juliet South Zone. The pitted surface is a vein margin containing fine flecks of gold and small patches of green sericite.*

Plate 40. *Fine-grained gold in quartz, Connecting Zone (photo courtesy of Derek Wilton).*

Plate 41. *Massive quartz veining within Fe-carbonate altered gabbro, Romeo Zone.*

quartz veins that formed at an oblique angle to a shear zone. Meade *et al*. (1998) interpreted the Romeo and Juliet prospects as a structurally controlled, auriferous, mesothermal shear-vein system that formed in response to regional deformation along the Baie Verte Line.

The abundant visible gold, which is consistently developed as fine clots along vein margins over a considerable portion of the exposed strike length of 250 m, makes this one of the most significant under-explored auriferous veins in the Newfoundland Dunnage Zone. The nuggety, fine-grained nature of the gold and its distribution along very narrow vein margins that parallel the trend of the main vein, makes it difficult to assay the vein system. This is supported by the typically low assay values obtained from the channel sampling and diamond drilling.

GOLDENVILLE HORIZON, BAIE VERTE MAP AREA (NTS 12H/16)

Exploration History

The Mings Bight area has a long and somewhat colourful mineral exploration history. Early exploration focussed on two areas: 1) the Bishop and Harvey Fee Simple Mining Grant (Volume 1, Folio 77), which covers the old Goldenville Mine and is still in the possession of the Harvey family; and 2) the Barry and Cunningham Fee Simple Mining Grant. The early history of this area is described in the section titled “Historical Overview of Newfoundland Gold”. Figure 31 shows the distribution of gold mineralization within the Goldenville area.

In 1961, the Newfoundland Government gave M.J. Boylen Engineering Limited exploration rights to an area that included both the Barry and Cunningham and Bishop and Harvey fee simple mining grants. During 1961 and 1962 the company carried out detailed geological mapping and geophysical (magnetic and self-potential) surveys. A limited diamond-drill program was conducted in the Goldenville area (de Geoffrey, 1962).

In 1971, a geological, petrographic and geochemical comparison of the Goldenville and Barry and Cunningham prospects was undertaken by Frew (1971). He indicated that the gold mineralization was strata bound and related to the deposition of an iron formation. In 1974, Dr. D.F. Strong entered into an agreement with the Newfoundland Government to conduct mineral exploration in the area of the Barry and Cunningham property. He subsequently optioned the ground to Consolidated Rambler Mines Limited who conducted chip sampling, geochemical soil sampling and a limited diamond-drill program (Tuach and Collins, 1974).

The Newfoundland Department of Mines and Energy carried out a geological, geochemical and geophysical eval-

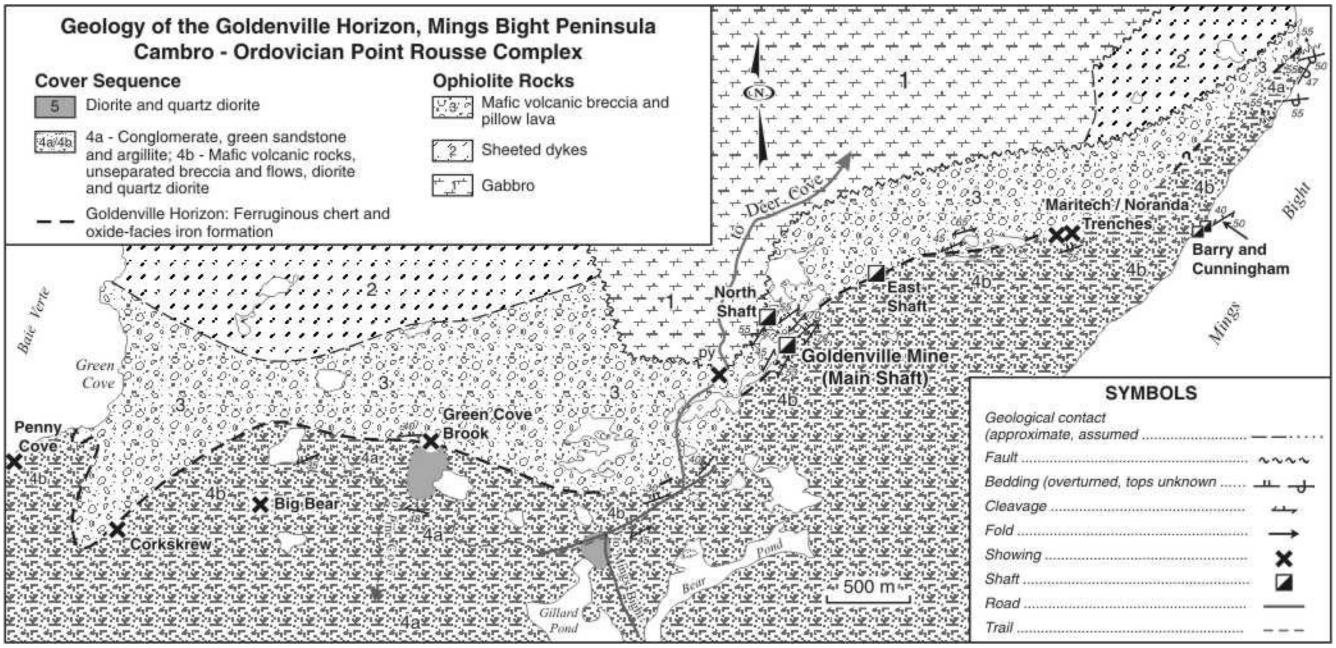


Figure 31. *Simplified geological map showing the distribution of the Goldenville Horizon and associated gold occurrences, Mings Bight Peninsula.*

uation of the Barry and Cunningham Fee Simple Mining Grant after the property had been declared undeveloped and had reverted to the Crown (Howse and Collins, 1978). Most of the sulphide mineralization was determined to be volcanogenic in origin, but the area was also known to contain gold-bearing quartz veins.

During the early 1980s, Noranda Exploration Company Limited carried out exploration for gold and base-metal mineralization on the Mings Bight Peninsula in the area mainly to the west of the Bishop and Harvey Fee Simple Grant (Dimmell, 1981). One outcome of this work was a B.Sc. thesis study of the Goldenville Horizon by Fitzpatrick (1981). This study focussed on the stratigraphy of the horizon to the southwest of the former Goldenville Mine and postulated on the origin of the gold mineralization hosted by the horizon. Fitzpatrick (1981) indicated that the gold mineralization was strata bound and related to the deposition of the iron formation with the gold being either liberated from the volcanic rocks by circulating hydrothermal fluids, or scavenged from seawater during deposition of the sediments.

In 1980, Falconbridge Nickel Mines Limited conducted a brief examination of the Goldenville property (Hinchey, 1980). The U.S. Borax and Chemical Corporation conducted geochemical and geophysical surveys and diamond drilling in the area surrounding the old Goldenville Mine in 1984.

In 1983, Golden Hind Ventures Limited staked the western extension of the Goldenville Horizon, which was previously held by Noranda Exploration Company Limited, and in 1985 Maritec Limited was contracted to conduct ground magnetic and electromagnetic surveys of the property (Sheppard, 1984). In 1984, Maritec Limited staked the former Barry and Cunningham property and subsequently optioned the ground to Golden Hind Ventures Limited. Geological mapping, prospecting, geochemical and geophysical surveys were undertaken by Golden Hind in 1985 on both properties (Pickett, 1985a, b). In 1986, Cuvier acquired the Mings Bight west property and initiated exploration activity that resulted in the discovery of the Corkscrew and Green Cove Brook gold occurrences (McBride, 1987; Ovens and McBride, 1988).

In 1986, Noranda Exploration Company Limited acquired the Maritec property located to the east of the Bishop and Harvey Fee Simple Mining Grant (Gower, 1987). Between 1986 and 1989, Noranda conducted prospecting, geological mapping, soil geochemistry and geophysical surveys (Gower, 1987; Wells, 1989), which resulted in the discovery and trenching of five gold occurrences referred to as the Maritec #1 to #5.

In 1987, Granges Exploration Limited optioned the Bishop and Harvey Fee Simple Mining Grant and an adjoining property owned by Lewis Murphy and conducted geochemical and prospecting surveys and diamond drilling

(O'Donnell, 1987, 1988a, b). A total of six holes were drilled on the Murphy property and eleven holes were drilled on the Bishop and Harvey Fee Simple Mining Grant and significant gold values were intersected in the vicinity of the Goldenville Mine. In 1989, J. Tuach Geological Consultants Incorporated summarized the exploration history of the Bishop and Harvey Fee Simple Mining Grant and made a number of recommendations including geochemical surveys, detailed geological mapping, prospecting, an IP survey to cover the entire property, re-logging of all diamond-drill core, and that any geochemical anomalies be trenched (Tuach, 1989).

The Cuvier Mines Incorporated Mings Bight west property reverted to the Crown in 1982 and was subsequently staked by Seaside Realty Limited (Pollard, 1994). In 1993 and 1994, Seaside Realty carried out prospecting surveys, trenching and diamond drilling and eleven holes totalling 198.0 m were drilled. This work resulted in the discovery of the Big Bear gold occurrence.

Regional Geology

The Point Rousse Complex forms a complete but dismembered ophiolite suite and its conformable volcanic and volcaniclastic cover (Hibbard, 1983) that outcrops in a broad but structurally modified, east-trending synclinorium. Ophiolitic plutonic components occupy the northern and southern limbs whereas the central portion of the peninsula is underlain by the cover sequence rocks. The cover sequence contains a distinctive, regionally extensive but discontinuous unit of ferruginous chert and iron formation referred to as the Goldenville Horizon.

The complex is tectonically bounded. The complex exhibits a generally weakly developed, moderately northwest-dipping, penetrative cleavage. The cleavage is more intense within thrusts and shear zones. The south-verging thrust faults are interpreted to be cogenetic or later than the cleavage and predate high-angle faults (Hibbard, 1983). The complex has undergone greenschist-facies metamorphism.

Gold Mineralization

50. Penny Cove Showing

Location and Access

The Penny Cove showing (NTS 12H/16 Au029 UTM 562900E 5537200N) is a small auriferous quartz–pyrite vein system located on the eastern shore of Baie Verte (Figure 31). It is accessible either by foot from the Pine Cove area or by boat from Baie Verte.

Local Geology and Mineralization

The area is underlain by mafic volcanic rocks, pillow lava and pillow breccia of the cover sequence of the Point Rousse Complex. The mineralization was discovered by personnel from Cuvier Mines Incorporated (Ovens and McBride, 1988). The mafic volcanic wall rock is variably iron carbonate-altered over a width of approximately 5 m (Plate 42) and up to 2 percent, fine-grained, disseminated pyrite occurs throughout the wall rock. The mineralization comprises quartz–carbonate veins, up to 10 cm wide, and the largest vein, which trends about 95° and dip 75° to the south, contains clots of coarse pyrite, minor chalcopyrite and patches of blue-grey tetrahedrite (Plate 43). Grab samples collected by Cuvier Mines Incorporated assayed up to 5979 ppb Au (Ovens and McBride, 1988) and grab samples of the vein and altered wall rock (Evans, 1999) assayed 3000 ppb Au, 150 ppm Ag and 7 ppb Au and less than 2 ppm Ag, respectively.

Exposed along the coast approximately 200 m southwest of the showing is a 200-m-long zone of iron-carbonate alteration. This alteration zone, which is about 10 m thick, is developed within an undeformed sequence of pillow lava and pillow breccia. The sequence dips steeply to the northwest, but the alteration, which crosscuts the sequence, trends 080° and dips 55° to the southeast. The alteration is most intense in the central portions of the zone where the carbonate is pervasive and there is weak shearing. However, pillow selvages and breccia fragments are still preserved within the most intensely altered sections. Narrow quartz–carbonate veins occupy the central portions of the zone and rare disseminated pyrite occurs marginal to the veins. The alteration is gradational into unaltered wall rock over narrow widths, generally less than a metre. The alteration zone is offset by a number of east–west, vertical, brittle faults.

Exposed just to the south of the carbonate zone is a large milky-white, laminated quartz vein, up to 2 m thick, which trends 125 to 130° and dips 45° to the south. The vein contains wisps and patches of chlorite, minor coarse-grained pyrite and is locally vuggy. The vein can be traced in outcrop inland for least 50 m beyond which it is exposed in trenches. The vegetation covering the material removed from the trenches indicates that these workings are old. Grab samples collected from the vein and the altered wall rock assayed up to 110 ppb Au (Evans, 1999). This vein was also reported by Watson (1947) to contain a small amount of chalcopyrite, but no gold. Snelgrove and Howse (1934) reported a small lenticular "replacement deposit" of pyrite and minor sphalerite and chalcopyrite developed within chloritized greenstone from the same locality. They reported that a grab sample of this mineralization yielded a trace of gold.

51-52. Corkscrew Prospect/Big Bear Showing

Location and Access

The Corkscrew prospect (NTS 12H/16 Au030 UTM 563650E 5536850N) and Big Bear showing (NTS 12H/16 Au031 UTM 564550E 5537050N) are silica–sulphide replacement styles of gold mineralization located on the Mings Bight Peninsula about 4.5 km west of the community of Mings Bight. The area can be reached by a muskeg trail that leaves the Green Cove Brook forest-access road approximately 1.8 km north of its junction with the Pine Cove access road.

Local Geology and Mineralization

The Corkscrew prospect is hosted by mafic volcanic and intrusive rocks of the cover sequence of the Point Rousse Complex (Figure 31). The area was part of the Mings Bight West Property that was held by Cuvier Mines Incorporated. The firm of James Wade Engineering Limited was contracted to conduct prospecting, geological mapping, soil and rock geochemistry, magnetometer and VLF-EM surveys on the property (Ovens and McBride, 1988). The magnetometer survey outlined the trace of the Goldenville Horizon along the northern portion of the property. The survey indicated that the horizon appears to be folded or bent to the south along the western half of the property. The iron formation is composed of "...ferruginous chert or jasper layers or nodules with associated magnetite within a fine chloritic groundmass" (Ovens and McBride, 1988).

A number of gold in soil geochemical anomalies were identified and follow-up on one such zone resulted in the discovery of the Corkscrew prospect. Cuvier trenched the prospect and tested the zone with 2600 m of diamond drilling in 17 holes (Ovens and McBride, 1988). The Mings Bight West Property reverted to Crown Land and was staked by Seaside Realty in 1993. In 1993 and 1994, Seaside Realty drilled 11 diamond-drillholes totalling 1980 m on the Corkscrew prospect (Pollard, 1994).

Ovens and McBride (1988) reported that the Corkscrew was hosted by a "quartzite". However, they indicated that the "...term quartzite is used here in a compositional sense...and does not reflect original genesis". They reported that the "quartzite" contains 70 to 85 percent quartz, 10 to 20 percent feldspar, 5 to 10 percent chlorite, variable accessory hematite and sericite and locally up to 3 percent pyrite. The "quartzite" is located just to the southeast of the magnetic anomaly marking the folded trace of the Goldenville Horizon and isoclinally folded tuffaceous layers occur locally within the "quartzite". Ovens and McBride (1988) indicated that the trend of the "quartzite" parallels the magnetic anomaly and may be folded as well. The "quartzite" is bounded by tuffaceous units and based on diamond drilling varies between 40 and 100 m in thickness.

Plate 42. *Fe-carbonate-altered mafic volcanic rocks cut by milky-white quartz veining, Penny Cove showing.*

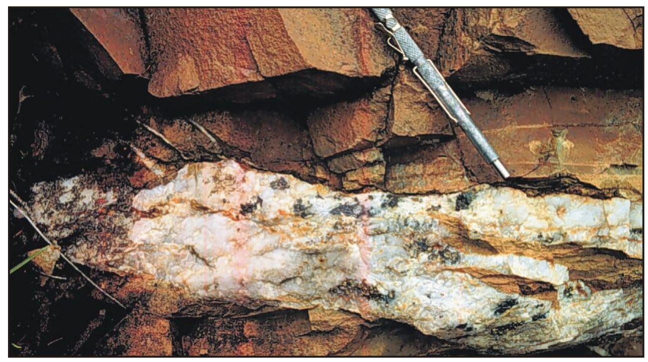


Plate 43. *Pyrite–chalcopyrite–tetrahedrite-bearing quartz vein, Penny Cove showing. Grab samples collected form this vein have assayed up to 5.979 g/t Au.*

The outcrop hosting the Corkscrew prospect comprises a white-weathering, fine-grained, mottled rock, which is greenish-grey on fresh surfaces (Plate 44). The outcrop is fairly massive but cut by quartz–pyrite-healed fractures. An angular block or xenolith of volcaniclastic sediments was observed within the massive white unit indicating a possible intrusive origin. Pollard (1994) described the host rock as a quartz–K-feldspar-rich gabbroic unit. Bailey (1999) conducted a petrographic examination of samples from the Corkscrew prospect and described the white-weathering host rock as a tonalite. The rock is composed primarily of quartz and plagioclase, which locally exhibits granophyric textures. Chlorite has replaced the mafic minerals (amphibole?) and commonly occurs along fractures.

The mineralization consists of small fracture-controlled quartz veins, locally up to 1 cm thick, which trend 045 to 050° and dip 75 to 80° to the north (Plate 45) and contain

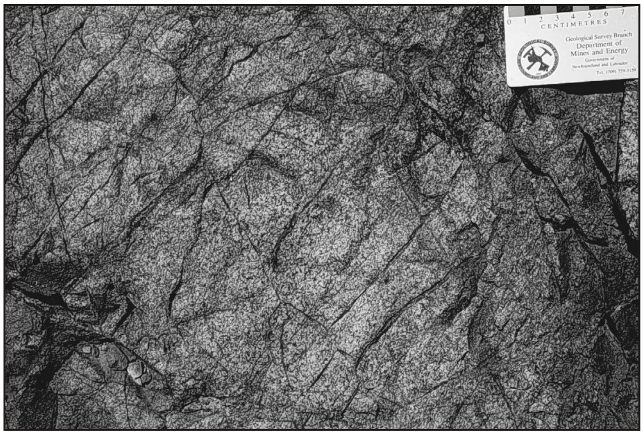


Plate 44. *Fractured, white-weathering tonalite, Corkscrew prospect.*

Plate 45. *Pyrite-bearing fractures developed within tonalite, Corkscrew prospect. A grab sample collected by the author assayed 5.83 g/t Au.*

rare euhedral pyrite. The veins locally form anastomosing zones up to 1 m wide, composed of strongly fractured and altered wall rock containing abundant disseminated euhedral pyrite. Both the massive unmineralized wall rock and the mineralized zones are cut by late quartz veins, which locally contain epidote. Bailey (1999) described a mineralized hand sample from the prospect as buff-white to green, highly fractured with hematization along fractures. The sample exhibited vuggy quartz and contained 1 to 2 percent disseminated magnetite. The alteration is not pervasive, but is mainly restricted to fractures. Chlorite within the tonalite has not been replaced by carbonate.

Trenching undertaken by Seaside Realty exposed a zone referred to as the Corkscrew extension or the Big Bear, located approximately 600 m to the east-northeast (Pollard, 1994). The mineralization is hosted by silicified gabbro and is reported to be similar in style to that at the Corkscrew prospect.

Initial grab samples collected from the Corkscrew prospect assayed up to 8956 ppb Au and mineralized boulders assayed up to 3478 ppb Au (Oven and McBride, 1988). Subsequent grab samples assayed in excess of 1 oz/t Au. Grab samples containing altered wall rock and pyrite-bearing quartz veinlets assayed 2530, 8860 and 5830 ppb Au (Evans, 1999). Tables 10 and 11 list assay results from diamond drilling. Chip sampling of the Big Bear showing returned values of 1.6 g/t Au over 4 m or 2.2 g/t Au over 2.2 m (Pollard, 1994). Grab samples from the area assayed up to 8235 ppb Au and grab samples collected from a trench located 100 m to the west assayed up to 2736 ppb Au. Diamond-drillhole M-94-27 near the Corkscrew prospect intersected 6.7 m of pyritic massive sulphide that assayed 430 ppb Au, 5200 ppm Cu, 5 ppm Pb, 3400 ppm Zn and 9.6 g/t Ag over a 1.0 m interval (Pollard, 1994).

54-55. Goldenville Mine and North Shaft

Location and Access

The Goldenville Mine (NTS 12H/16 Au033 UTM 567570E 5537940N) and North Shaft (NTS 12H/16 Au034 UTM 567500E 5538000N) are carbonate–quartz–sulphide replacement styles of gold mineralization that are located on the Mings Bight Peninsula approximately 1.7 km northwest of the community of Mings Bight. The old workings are easily accessed via a trail from the Deer Cove access road.

Local Geology

The Goldenville Mine is located within a regionally extensive, but locally discontinuous unit of ferruginous chert and iron formation known informally as the Goldenville Horizon (Figure 31). The North Shaft is located to the northwest of the Goldenville Mine (Main Shaft) and is hosted by a shear zone developed within mafic breccia. The Goldenville Horizon lies within the core of a major east-trending syncline, which folds the Point Rousse Complex (Norman, 1973; Hibbard, 1983). The horizon outcrops sporadically from Big Head in the east to Green Cove in the west. Coastal exposures at Big Head consist of structurally disrupted magnetite and purple chert beds, up to 1 m thick, developed within a sequence of mafic breccia (Plate 46). Previous workers (Watson, 1947; Hibbard, 1983) indicated that this section may be stratigraphically equivalent to the section exposed at the Goldenville Mine. However, lack of outcrop precludes definitively stating that the section exposed at Big Head is the Goldenville Horizon. Exposed immediately south of the iron formation at Big Head, but separated from it by a narrow mylonite zone, is a sequence of volcaniclastic sedimentary rocks, sandstone, siltstone and conglomerate, that extends southward for about 500 m along the shore (Plate 47; Norman, 1973). These rocks are inter-

Plate 46. *Oxide-facies iron formation and ferruginous chert (Goldenville Horizon?) within a sequence of mafic volcaniclastic rocks exposed at Big Head, Mings Bight.*

Plate 47. *Interbedded, green sandstone, siltstone and greywacke outcropping in coastal section south of Big Head, Mings Bight.*

Table 10. Diamond-drill assay results from the Corkscrew prospect (Ovens and McBride, 1988)

Hole	Dip	Bearing	Depth	Intersection	Width	oz./t Au
M87-1	-45.5°	195°	101.8 m	43.0-43.3 46.0-46.7	0.3 m 0.4 m	0.2280 0.1341
M87-2	-43°	100°	134.1 m	64.3-65.3 92.2-92.7	1.0 m 0.5 m	0.0825 0.3062
M87-3	-75°	100°	152.7 m	70.3-71.2	0.9 m	0.6155
M87-5	-75°	100°	1137.2 m	100.9-102.0	1.1 m	0.1444
M87-6	-45°	100°	122.2 m	51.4-52.3	0.9 m	0.1534
M87-7	-75°	100°	143.9 m	52.0-53.1 59.4-60.4	1.1 m 1.0 m	0.0899 0.0878
M87-12	-45°	100°	170.1 m	65.7-66.2	0.5 m	0.1657
M87-13	-75°	100°	224.9 m	70.5-71.7 94.0-94.5 181.2-182.2 182.2-182.6	1.2 m 0.5 m 1.0 m 0.4 m	0.0965 0.0834 0.1528 0.0735
M87-14	-45°	100°	202.4 m	111.7-112.7	1.0 m	0.1703
M87-15	-75°	100°	255.1 m	148.4-149.4 217.3-218.3 229.4-230.4	1.0 m 1.0 m 1.0 m	0.0779 0.0895 0.9529
M87-16	-56°	100°	181.4 m	139.8-140.8	1.0 m	0.1262

preted to conformably overlie the iron formation. Pillow breccia and pillow lava are exposed to the south of this sequence of sedimentary rocks.

At the Goldenville Mine, the volcaniclastic rocks appear to be less extensive. Mafic volcanic breccia and chloritic tuff form both the structural footwall and hanging wall to the iron formation. However, volcanic rocks in the footwall appear to be more epidotized, indicating that they may lie stratigraphically beneath the iron formation (Plate 48).

Table 11. Diamond-drill assay results from the Corkscrew prospect (Pollard, 1994)

Hole	Width	ppb Au
M-93-18	1.0 m 0.6 m 0.4 m	1 270 1 290 1 130
M-93-19	1.0 m 0.7 m	1 830 1 560
M-93-20	1.0 m 0.8 m 0.5 m	1 030 1 610 2 090
M-93-21	1.2 m 1.0 m	4 380 1 820
M-93-23	0.5 m	2 850
M-93-24	1.0 m 1.0 m 1.0 m 1.0 m 1.0 m 1.0 m 1.0 m 1.0 m	1 490 1 139 1 060 1 630 2 250 1 360 1 610 11 310
M-94-25	0.3 m 0.3 m	10 670 1 120

At Green Cove, a narrow unit of magnetite-rich breccia, which occurs within a sequence of mafic volcanic breccia and pillow lava, may represent the western most exposure of the Goldenville Horizon. Just inland and north of Green Cove Brook, ferruginous chert and argillite of the Goldenville Horizon are exposed in a series of exploration trenches. To the south of the horizon, near Green Cove Brook, logging roads have exposed a rhythmically bedded, east-trending, north-dipping unit of siltstone and sandstone. Graded bedding within the coarser sandstone beds indicate that the unit is overturned to the south. These sediments occupy a similar stratigraphic setting to the sediments exposed south of Big Head and are interpreted to stratigraphically overlie the Goldenville Horizon. A magnetic survey done for Cuvier Mines Inc. (Ovens and McBride, 1988) suggests that the horizon may be folded between the Corkscrew and Penny Cove prospects (Figure 31).

The Goldenville Horizon varies in thickness from about 3.7 m near the Main Shaft to about 4.6 m approximately 1 km to the southwest of the Main Shaft (Watson, 1947). The horizon thickens to the southwest where Fitzpatrick (1981) reported the horizon to be 7.0 m thick. There the horizon is composed of 1.5 m of chert nodules and sedimentary detritus in a chlorite–magnetite matrix, which is overlain by 5.0 m of massive ferruginous chert containing lenses of quartz and magnetite. This is in turn capped by 0.5 m of massive magnetite. Diamond drilling (O'Donnell, 1988b; drillhole MH-11-88) near the Main Shaft intersected approximately 34 m of chloritic mafic volcanic rocks containing numerous purple and reddish chert blocks and lenses. These are interpreted to be the thickened equivalent of the base of the section described by Fitzpatrick (1981). The increased thickness of the section may be the result of folding in the vicinity of the Main Shaft. The following section describing the character of the Goldenville Horizon in the vicinity of the Main Shaft is taken from Snelgrove (1935).

Plate 48. *Typical inland exposure of the Goldenville Horizon. Exposed from the base to the middle of the photograph are typical mafic volcanic rocks of the structural footwall to the horizon. The buff to slightly purple section above the volcanic rocks is a sedimentary horizon that locally contains chert nodules. This is overlain by a purple chert–magnetite horizon containing abundant chert blocks/boudins and milky-white quartz veins.*

"Beginning at the southeast side of Mings Pond and exposed intermittently as far as the East Trial Shaft a half mile to the east, is the main mineralized zone consisting chiefly of magnetite-hematite schist and interbanded ferruginous chert; and chloritic tuff and andesite in varying small proportions, in places transected by sulphide, quartz-sulphide, and quartz-carbonate-sulphide veins. In the vicinity of the collar of the main shaft this mineralized zone is 9 feet in width, about a third of which is quartz. At the surface of the shaft next adjacent, iron oxides are absent; in the East Trial Shaft, quartz is rare but magnetite-hematite schist is exposed over a thickness of about five feet, with magnetite relatively abundant. Not all of the ferruginous chert lenses...contain magnetite and specularite.

This mineralized zone dips 50° to 75° north westward (true bearing), and lies approximately parallel to the contact of the "greenstone" with the meta-gabbro one-half mile to the northwest."

History of Production

The Goldenville Horizon is host to 5 gold occurrences (Figure 31), which include the old Goldenville Mine, the Maritec/Noranda trenches (Wells, 1989), and Green Cove Brook/North Shaft (Ovens and McBride, 1988). In 1897, D.J Henderson and A.J. Harvey acquired mineral claims to the area that subsequently became the Goldenville Mine. They optioned the property to J.R. Stewart, who in 1902 discovered auriferous gravels, which by 1903, had been traced to their source. The Goldenville Mining Company was formed in 1903 and the property was leased from the owners for a period of ten years commencing on April 26, 1904 (Stewart *et al*., 1906). The following description of the mining activity is taken from a Directors report by Stewart *et al.* (1906).

"DEVELOPMENT. After the Goldenville Mining Company began operations in 1903, considerable surface prospecting was carried out with the result that it was proved that the auriferous lode extends through the property for a distance of at least one mile.

The lode, which is of the bedded type, is composed of Magnetite, Slate, Quartz and Pyrite, dipping North at an angle of about 60 degrees, and has a width of 15 to 20 feet.

The first opening made on the vein was by means of a trial shaft 50 feet deep, which was sunk on the eastern part of the deposit; later the sinking of a working shaft was commenced at a point on the lode, half a mile west from the trial shaft. When the working shaft attained a depth of 17 feet, a shipment of 23 tons were taken therefrom and made to Brookfield Mine, Nova Scotia, for the purpose of having a milling test made, the ore upon being treated by the amalgamation and cyanide processes, yielded 10.1/5 oz of melted Gold, valued at $192.78, as per U.S. assay Office, New York certificate equal to a recovery of $8.98 per ton and in addition to this 5 tons slime, carried a total value of $55.00 which was not saved, no facilities being at hand in the Brookfield Mill, for treating the slimes.

The results of the mill run having proved satisfactory, the sinking of the working shaft was continued, until it reached a depth of 100 feet.

At a point in the shaft 80 feet below surface, levels were begun and have been driven East and West on the lode, for 80 feet and 51 feet respectively, the width of the veins being from five to thirteen feet.

During sinking and driving operations, the ore yield from the lode was continuously sampled, and average samples were submitted to Messrs. Ledoux & Co. of New York for assay, which gave the following results:

1. Quartz, output from shaft 50 to 69 ft. Jan. 1905	$12.60
2. Pyrite, concentrated from above sample	50.80
3. Quartz out from shaft 69 to 84 ft. Feb. 1905	14.26
4. Pyrite concentrated from above sample	46.09
5. Magnetite output from shaft in Feb. to waste heap	11.03
6. Slime separated from sample 3	3.20
7. Quartz from which Pyrite and Slime largely removed	11.20
8. Quartz output from shaft 84 to 100 ft. Mar. 1905	12.80
9. Special sample of Pyrite clear of Quartz	26.05
10. Magnetite from shaft 84 to 100 ft. Mar. 1905	.62
11. Quartz output E.W. Drives April 1903	5.34
12. Magnetite and Slate Drives April 1903 to heap	1.43
13. Special Sample Magnetite	1.20
14. Special Sample Pyrite from various parts of ore heap	45.23
15. Pyrite concentrated from sample 11	31.45
16. Quartz and pyrite from lode half mile E. of shaft	1.84

17. Quartz and pyrite from lode half mile E. of shaft	1.43
18. Quartz from vein North of Iron Lode	9.25
19. Quartz output from East Drive May 1905	16.43
20. Quartz and Magnetite output from W. Drive May 1905	4.74
21. Slate output from East Drive May 1905	4.12
22. Quartz output from East Drive June 1905	4.73
23. Slate output from East Drive June 1905	1.44
24. Quartz output from West Drive June 1905	2.67
25. Magnetite output from West Drive May 1905	1.16
26. Magnetite output from West Drive June 1905	2.67
27. Quartz from side drive	4.73
28. Pyrite concentrated from sample 19	27.75
29. Pyrite concentrated from sample 19	$17.48

PLANT. In November 1905 the erection of a modern ten stamp Gold Mill with Wilfley Concentrator was taken in hand, and completed in May 1906.

The Battery is fitted with stamps of 1000 lbs. weight each which are run at a speed of 100 drops per minute, the ore being fed into the mortars of "Challenge Automatic Ore Feeders", after it has been reduced to a suitable size by passing through a stone breaker, and thence to the ore bins in the rear of batteries.

This mill has been running the past four months, one shift of ten hours per day, which is less than half time, it being usual to work mills of this kind continuously day and night.

These results have proved somewhat disappointing, the cause of which is difficult to explain.

The limited amount of capital of the present company having been exhausted in the erection of mill and in mine development, it is now proposed to re-construct the Company so that further capital will be available to prove the property and for working it.

A small Cyanide Plant is necessary to treat the concentrates on the ground and the working shaft requires to be sunk, a further depth of 200 feet in order to open up the Ore reserved for extraction this being accomplished and the mill working 24 hours per diem, the property would no doubt be capable of yielding gold with profit."

From an undated Directors report by Robert J. Foot, Robert B. Job and R.G. Rendell (Foot *et al.*, undated), for the year ending 30th of June 1907, the following is taken.

"Directors Report

To the Shareholders,

The Goldenville Mining Company, Limited.

Gentlemen:

We beg to report as follows regarding operations at Mings, for the year ending 30th, June 1907.

Mining

Work was carried on in the mine from 1st. July to 31st. October 1906 and 877 tons of Ore was extracted, being obtained by stoping above the level, east and west of the shaft, and below the level east of the shaft.

No development by way of sinking and driving on the lode was performed and this work is now necessary in order to open up fresh ore reserves for stoping.

Milling. The stamp mill was worked on ten hour day shifts as follows:- July 25 days August 26 days, September 16 days and October 18 days, stoppages occurred in Sept. of 5 days and Oct. of 3 days due to the breaking down of Mill engine.

The battery crushed 910 tons of Ore, through 25 mesh screens, 877 tons of which was hoisted from the Mine during the present season and 33 tons came from the output of the previous year.

The ore yielded 66 ozs. of gold bullion by plate amalgamation, which realized $1097.40.

The sand from plates was treated by a Wilfley concentrator which produced 57 tons of concentrates (Iron Pyrite) having an average assay value of $16.62 per ton and 36 tons of No. 2 concentrates carrying $1.50 per ton. The tailings from concentrators 817 tons, passed to waste dump, contained an average assay value of 64 cents per ton.

Suspension of Work. Owing to the lack of working capital, work was suspended at the end of October 1906 and the property was then placed in charge of a caretaker.

Accounts. We present herewith a statement of the Revenue Account and Balance Sheet also the Auditors report upon the same,

We have the honour to be,
Gentlemen,
Your obedient servant,

(Sgd) Robert J. Foote Director
Robert B. Job Director
R.G. Rendell Director"

The property remained dormant until 1935 when the N.A. Timmins Corporation of Canada, dewatered and sampled the main shaft. In 1937, the Newfoundland Prospecting Syndicate conducted trenching on the drift-covered area to the southwest of the Main Shaft. Since then a number of companies have briefly examined the property (*see* Exploration History section).

Mineralization

At the Goldenville Mine, a number of north-trending high-angle faults cut the horizon in the vicinity of the Main Shaft (Plate 49). Away from the iron formation, these faults, which host weakly pyritiferous quartz veins, were found to contain anomalous gold concentrations with values up to about 3 g/t Au. One such fault outcrops at the North Shaft (Plate 50; Figure 32). The shaft exposes mafic breccia that has been weakly mylonitized resulting in a millimetre-scale banding composed of quartz–carbonate and chlorite. Milky-white quartz shear veins containing minor pyrite occupy the central portion of the fault zone and similar zones have been intersected by diamond drilling near the Main Shaft. Grab samples collected from the North Shaft dump have assayed up to 2.07 g/t Au (Table 12).

Plate 49. *The Main Shaft and hoist, Goldenville Mine.*

Where the faults cut the oxide-facies iron formation (bedded magnetite), quartz veins contain and are mantled by coarse-grained pyrite. The magnetite acted as a ready source of iron, promoting the growth of the pyrite. Pyrite also occurs as disseminations, small veinlets and as semi-massive bedding-parallel bands. Drillhole MH-11-88 intersected 4.5 m of variably cleaved, sericitized and carbonitized chlorite schist (Plate 51). The schist contains blocks or lenses of purple and red chert up to 30 cm thick, and bands of magnetite and chert up to 80 cm thick. Quartz veinlets cut the chert–magnetite bands and pyrite occurs marginal to the veins as coarse patches, disseminations and bands. These veins crosscut both the bedding and the cleavage. A 1.8-m-

Plate 50. *North Shaft, Goldenville Mine area. Mylonitized volcanic breccia is exposed in the old shaft. The shear zone contain weakly pyritic quartz veins; grab samples of these veins assay up to 3 g/t Au.*

wide section of this zone assayed 12.89 g/t Au (O'Donnell, 1988b). Alteration extends well beyond the mineralized section as is indicated by the weakly oxidized nature of the drill core. Assay results from the Goldenville Mine are presented in Table 13. The following descriptions of the mineralization are taken from Snelgrove (1935) and Watson (1947).

> "In the main mineralized zone the commonest minerals are fine-grained magnetite and hematite, interbanded with red chert. Replacing the iron oxides, pyrite of cubic habit occurs as veins and disseminations usually of fine texture, but occasionally up to half an inch in diameter. Replacement is commonly incomplete, and numerous small residuals of magnetite are found within the pyrite crystals. Pyrite is also found in and bordering veins of coarse, milky quartz which transect the magnetite–hematite schist. In part associated with the pyrite, in tuff beds within the ore zone, and

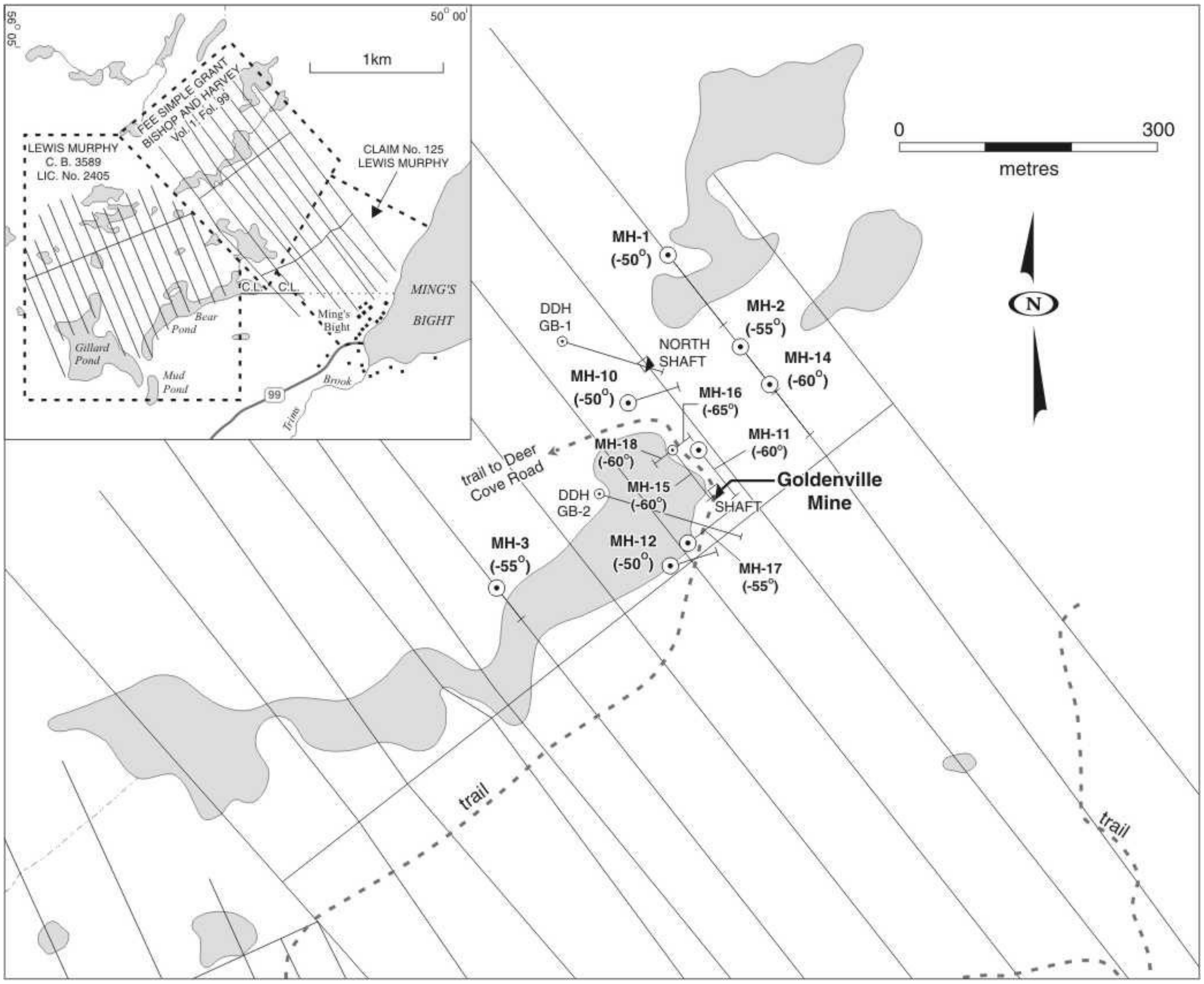


Figure 32. *Geological map of the Goldenville Mine area showing the diamond-drillhole locations (*modified after *O'Donnell, 1988b).*

likewise evidently of hydrothermal origin, is a chlorite of the variety daphnite (Ng 1.656).

Within the pyrite also, along fractures, are minute quantities of chalcopyrite. Chalcopyrite also occurs in veinlets of coarse specularite plates which cut the other minerals of the ore zone. Very rarely fine grains of native gold are observed in polished sections of the ore, in a silicate matrix which forms veinlets in pyrite.

Small amounts of brown and pink dolomite occur in the quartz veins; barren veinlets of similar carbonate also traverse the country rock of the mineralized zone." (Snelgrove, 1935)

"Mineralization

White quartz and minor amounts of carbonate, pyrite, chalcopyrite, specularite, chlorite, and gold have been deposited in the zone of chert and iron oxides from hydrothermal solutions. The quartz occurs principally as lenticular veins parallel to the foliation, but is also present as irregular veins of smaller size which are definitely cross-cutting. The individual veins are generally less than 6 inches thick, but commonly occur in groups. For example, at the No. 1 Shaft, there is a zone at least 4 feet wide consisting almost entirely of lenticular quartz veins which range from 4 inches to 0.25 inch in thickness.

A little rusty-weathering yellowish brown carbonate and also pink and white carbonates occur in the quartz veins and as small veinlets in the mineralized zone.

Pyrite is present in the magnetite–hematite–quartz rock and less commonly in the associated

Table 12. Assay results from the Goldenville Mine area. Samples designated by the letter G are from Snelgrove (1935) and samples designated by DE are from Evans (1999)

Sample	Location	Type	Description	Gold/long ton	Gold g/t
G7	10 ft. west of Main Shaft	Channel 3.0 feet	Quartz and pyrite	1 oz., 4 dwt, 19.84 gr	34.6
G8	(Continuous section)	Channel 4.5 feet	6 inches of pyritized greenstone 4 feet magnetite-hematite-quartz	Trace	
G9		Channel 1.5 feet	Magnetite-hematite-quartz rocks with pyrite	1 dwt, 7.36 gr	1.4
G11	Main Shaft	Selected 8.0 feet	Pyrite in chlorite schist and quartz	Nil	
G12	Concentrate Dump	Grab	2/3 iron oxides, 1/3 pyrite	1 oz., 19 dwt, 4.8 gr	54.7
G14	Dump, North Shaft	Selected	Pyrite in chlorite schist and quartz	1 dwt	1.4
DE-97-1b	Ore Dump, Main Shaft	Grab	Red chert		0.085
DE-97-1c	Ore Dump Main Shaft	Grab	Red chert with specularite		0.037
DE-97-1d	Ore Dump Main Shaft	Grab	Magnetite with quartz and pyrite		11.5
DE-97-5a	Dump, North Shaft	Grab	Sheared and altered mafic breccia		2.07
DE-97-5b	Dump, North Shaft	Grab	Sheared and altered mafic breccia		0.173
DE-97-5c	Dump, North Shaft	Grab	Quartz vein		0.586
DE-98-28b	Ore Dump	Grab	Pyrite in magnetite		20
DE-98-28c	Ore Dump	Grab	Semi-massive pyrite in magnetite		37.5
DE-98-28d	Ore Dump	Grab	Magnetite with minor pyrite		200
DE-98-28e	Ore Dump	Grab	Magnetite with trace of pyrite		0.067

chlorite schist as disseminations and distinct veinlets. It also occurs along the margins of, and locally within, the quartz veins. The pyrite forms euhedral to subhedral cubic crystals averaging 1 to 2 mm in diameter. The crystals commonly contain numerous small relict grains of magnetite which owe their preservation to incomplete replacement.

Chalcopyrite occurs as minute blebs and veinlets in the pyrite. It was also observed in small amounts within well-defined veinlets of specularite and chlorite which cut the other minerals of the ore zone.

The specularite–chlorite veinlets are most commonly about 0.1 inch thick. They consists of large plates of hematite arranged normal to the walls, which are separated by fine-grained chlorite.

Gold is present as minute grains in narrow silicate veinlets which cut the pyrite." (Watson, 1947).

Table 13. Selected diamond-drillhole assay results from the Goldenville Mine area (O'Donnell, 1988b)

Hole	Intersection	Assay ppb Au	Rock Type
MH-10-88	26.2-26.9 m	3 290	Quartz-carbonate veins in sheared mafic volcanic rock
MH-11-88	35.7-36.6 m 36.6-37.5 m	12 370 12 370	Quartz-pyrite veins and coarse pyrite in ferruginous chert and magnetite
MH-15-88	18.68-18.99 m 18.99-19.39 m 19.39-20.42 m 54.86-55.81 m	2 830 340 1 080 286	Quartz-carbonate veins in sheared mafic volcanic rock Quartz-carbonate veins in sheared mafic volcanic rock Quartz-carbonate veins in sheared mafic volcanic rock Ferruginous chert and magnetite

In 1988, Granges Exploration Limited tested the immediate Goldenville Mine area with eight diamond-drillholes (O'Donnell, 1988b). Figure 32 shows the location of the drill collars; four holes were oriented to test the 155°-trending fault and one hole was drilled 180° to this trend. Drillhole MH-10-88, which tested the 155°-trending fault, intersected a section of strongly cleaved mafic volcanic rocks that are cut by milky quartz–carbonate veins containing minor pyrite assaying 3290 ppb Au over 0.8 m. Three holes were collared to intersect the Goldenville Horizon and only one of these, MH-11-88, intersected significant iron formation and gold mineralization giving 12.37 g/t Au over 1.8 m. Diamond-drillholes MH-14-88 and MH-15-88, failed to intersect significant mineralization. Both holes intersected magnetite–jasper horizons, which assayed up to 286 ppb Au. MH-15-88 also intersected the 155°-trending fault; the fault zone assayed 1222 ppb Au over 1.74 m, which included 2830 ppb over 0.31 m. The spacing of the holes indicates that the Goldenville mineralization is structurally complex and not understood.

The following description of the mineralization associated with the Goldenville Mine is based on diamond-drillhole MH-11-88 that was drilled to a vertical depth of about 124 m. This hole was collared in epidotized, cleaved and tectonically brecciated mafic volcanic rocks approximately 35 m northwest of the Goldenville Horizon outcrops. A narrow fault breccia separates these rocks from a sequence of more massive mafic volcanic rocks that contain isolated blocks and lenses of ferruginous chert. The blocks are angular, broken and contain flecks of pyrite and wispy bands of magnetite. The mafic rocks are bleached looking and grades down-hole into a wide zone of carbonatization with associated quartz–carbonate tension-gash style veining. Epidote was not observed within these altered rocks. The alteration extends from about 10 m to 48 m in the hole and forms a halo surrounding the mineralized zone.

The Goldenville Horizon was intersected at 33 m and extends to 37.5 m, with the best mineralization intersected between 35.7 and 37.5 m. This section is composed of narrow intervals of brecciated purple chert and massive magnetite beds interleaved with strongly cleaved, buff-coloured mafic volcanic rocks (Plate 51). The mafic sections locally exhibit a mylonitic, ribbon-like fabric with narrow quartz–carbonate veinlets developed parallel to the fabric. This is very similar to the section at the North Shaft, which exposes the auriferous 155°-trending fault zone. The chert and magnetite sections are cut by milky quartz veins containing coarse euhedral pyrite (Plate 52). Locally, heavy concentrations of coarse pyrite are developed in the magnetite, marginal to the veins, as clots within the magnetite and as narrow semi-massive bands. Quartz–chlorite veinlets are present throughout the mineralization zone. The chert–magnetite interval ends at 37.5 m where it is in contact with sericitic mafic volcanic rocks. The alteration dies out gradationally down-hole and at about 48 m the mafic rocks are fairly massive and locally porphyritic.

Mineralization at the Goldenville Mine is an example of a non-stratiform banded iron formation-hosted gold occurrence. In this type of mineralization, the gold is restricted to late structures and veins that crosscut oxide-facies iron formation (Kerswill, 1993). Ore-body-scale mesothermal-style alteration is common. Pyrite replacing magnetite is the dominant sulphide species. These deposits are generally composed of small discrete ore shoots that tend to be small and difficult to mine. The Goldenville Horizon occupies a stratigraphic setting similar to the Nugget Pond Horizon within the Snooks Arm Group (A. Sangster, personal communication, 1998).

THE BRADLEY NORTH PROPERTY, BAIE VERTE MAP AREA (NTS 12H/16)

Exploration History

The Bradley North property area was originally staked in 1986 by local geologist Pearce Bradley and optioned to

Plate 51. *Mineralized section, diamond-drillhole MH-11-88, Goldenville Mine. The mineralization, which is confined to a unit of oxide-facies iron formation and ferruginous chert, comprises quartz veins mantled by coarse-grained euhedral pyrite. The mafic volcanic rocks are strongly sheared and variably carbonitized. Small chert blocks and nodules are preserved throughout the volcanic rocks.*

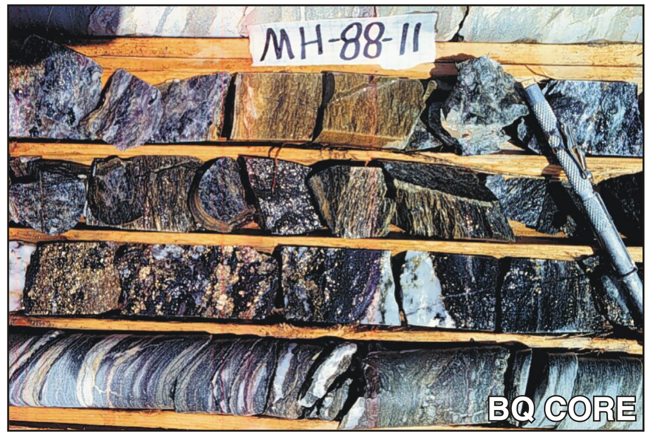


Plate 52. *Closeup of mineralized core, diamond-drillhole MH-11-88, Goldenville Mine. Section exhibits quartz veining cutting deformed oxide-facies iron formation. Pyrite replacing magnetite mantles the quartz veining. This particular section assayed 12.89 g/t Au over 1.8 m.*

International Impala. Prior to 1986, there were no known mineral occurrences within the area covered by the claims. Exploration on the property was carried out as part of a 50/50 joint venture arrangement between Impala and Noranda Exploration and Mining Company Limited. In 1987, Noranda Ltd. initiated an extensive soil geochemistry survey that outlined a number of gold anomalies (Huard, 1988a). A total of 1425 m of trenching resulted in the discovery of three new gold occurrences referred to as the Main Zone, Gabbro Zone and Massive Sulphide Zone (Figure 33), which were collectively known as the Stog'er Tight showing (Huard, 1988a). In 1988, Noranda tested the mineralized zones with a 1410.0 m, 17 hole diamond-drill program (Huard, 1988b). Between May, 1988 and March, 1989, an extensive exploration program on the Bradley North Property consisting of line cutting, soil geochemical, geological and geophysical surveys, trenching and diamond drilling resulted in the discovery of three auriferous zones, referred to as the Stog'er Tight, Gabbro West and Gabbro East zones (Figure 33; Huard, 1989b). In 1989, further exploration work resulted in the discovery of the Cliff Zone (Huard, 1990a). In total, Noranda conducted in excess of 8000 m of diamond drilling in 80 holes on the Bradley North Property.

In 1996, Ming Minerals Incorporated purchased the Bradley North Property from Noranda Exploration Company Limited and attempted to open-pit mine the Stog'er Tight Zone (Plate 53). However, problems with ore continuity resulted in cessation of mining in early 1997 (Bradley, 1997).

Regional Geology

The Bradley North Property is located on the Mings Bight Peninsula approximately 2 km southwest of the community of Mings Bight. The area is underlain by mafic volcanic and volcaniclastic rocks of the Point Rousse Complex cover sequence (Figure 33; Huard, 1989b; Kirkwood and Dubé, 1992), which is intruded by differentiated gabbroic sills. The volcaniclastic rocks range from fine ash tuff to pyroclastic breccia containing fragments up to 10 cm (Kirkwood and Dubé, 1992). The volcaniclastic rocks are overlain to the north by massive mafic flows, pillow lava and iron formation. Three distinct gabbroic sills are present within the pyroclastic sequence and the following description of the sills is taken from Kirkwood and Dubé (1992).

> "The gabbroic rocks which host the gold mineralization, have been mapped as three distinct sills within the pyroclastic rocks.... The upper (northern) contact between the gabbro sills and tuffaceous rocks usually displays a chilled margin whereas the lower (southern) contact is usually slightly to moderately sheared. In places, the sills show a distinct magmatic layering. The gabbro sills contain four megascopically distinct units: a basal melagabbro, a leucogabbro, a ferro-leucogabbro, and a quartz-ferrogabbro. These units have been distinguished in the eastern part of the study area where the gabbroic rocks are least altered. Field criteria used in identifying the gabbro units are: more than 50% ferro-magnesian minerals (melagabbro), less than 50% ferro-magnesian min-

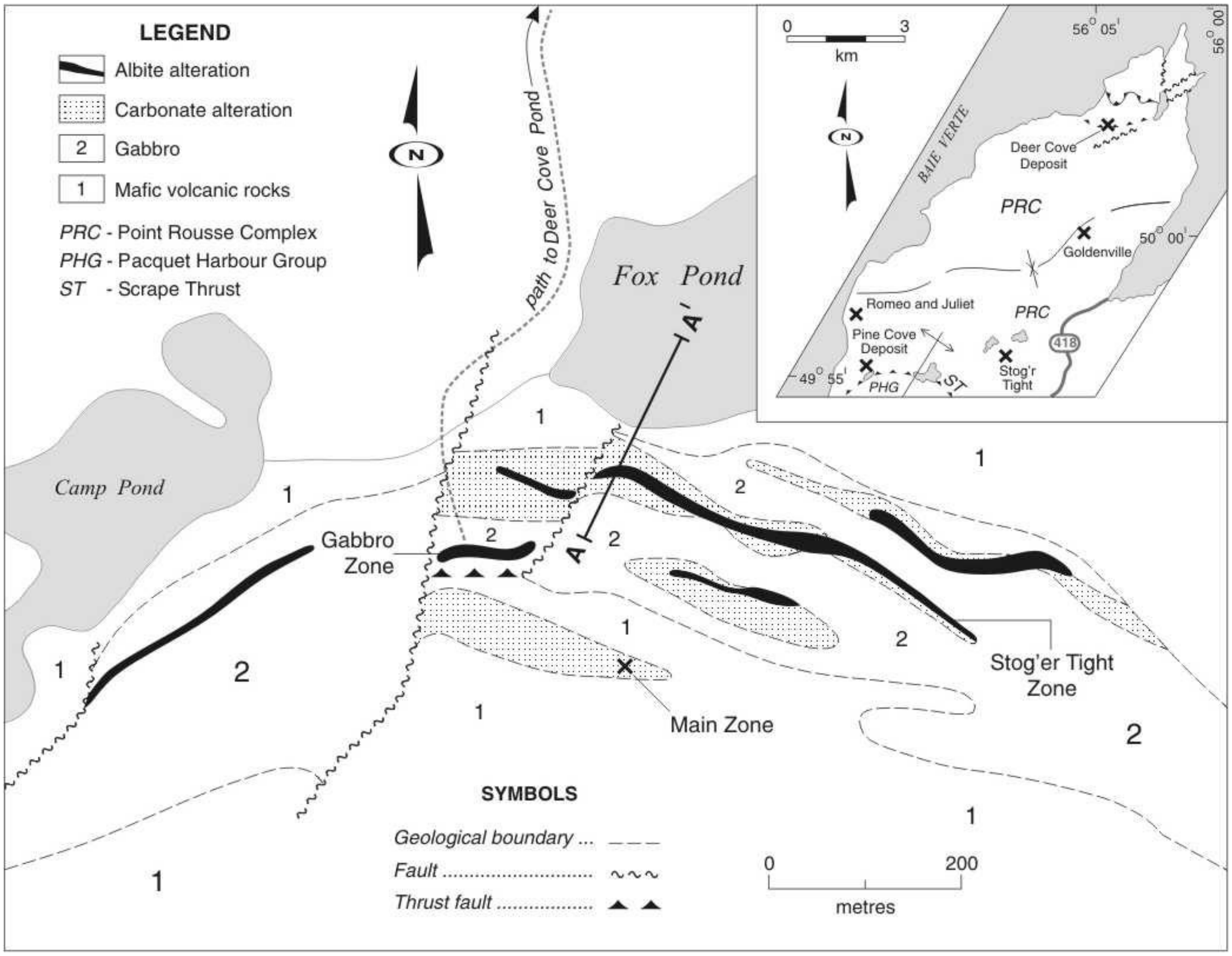


Figure 33. *Simplified geological map of the Stog'er Tight area showing the location of the Stog'er Tight, Main and Gabbro zones and the location of the geological section A-A' illustrated in Figure 36 (*modified after *Huard, 1990b).*

erals and between 3-8% leucoxene (leucogabbro), very coarse grained plagioclase crystals and abundant titano-magnetite in the leucogabbro (ferro-leucogabbro), and more than 1% of visible quartz (quartz ferrogabbro).

In the southern sill, the basal gabbro is strongly magnetic and contains two distinct units, a fine grained melagabbro and an overlying medium grained leucogabbro with 3-5% leucoxene as an alteration product of primary titano-magnetite. The minimum thickness of the southernmost sill is approximately 25 to 30 m, the lower contact being either unexposed or sheared. Two units have also been recognized within the middle gabbro, a basal fine to medium grained melagabbro overlain by a medium to coarse grained leucogabbro containing 3-7% leucoxene. The thickness of the middle gabbro is approximately 40 m. The northernmost or upper gabbro seems to thicken eastward where it is separated from the middle gabbro by two very narrow (less than 7 m thick) pyroclastic units. These tuffaceous units do not extend very far to the northwest. This fact, coupled with the presence of many sheared contacts, suggest that the upper gabbro is probably repeated by faulting in the eastern part of the study area. Nonetheless, two distinct units are recognized within the upper gabbro. A fine to coarse grained leucogabbro containing 3-8% leucoxene, and a coarse grained ferro-gabbro containing up to 10% titan-magnetite. The ferro-leucogabbro unit is contained within the leucogabbro unit which becomes progressively finer grained near the upper contact with the pyroclastic rocks. A fourth unit has been recognized in the central part of the study area on the Gabbro Zone outcrop, a 3 m thick, coarse-grained quartz-ferrogabbro which

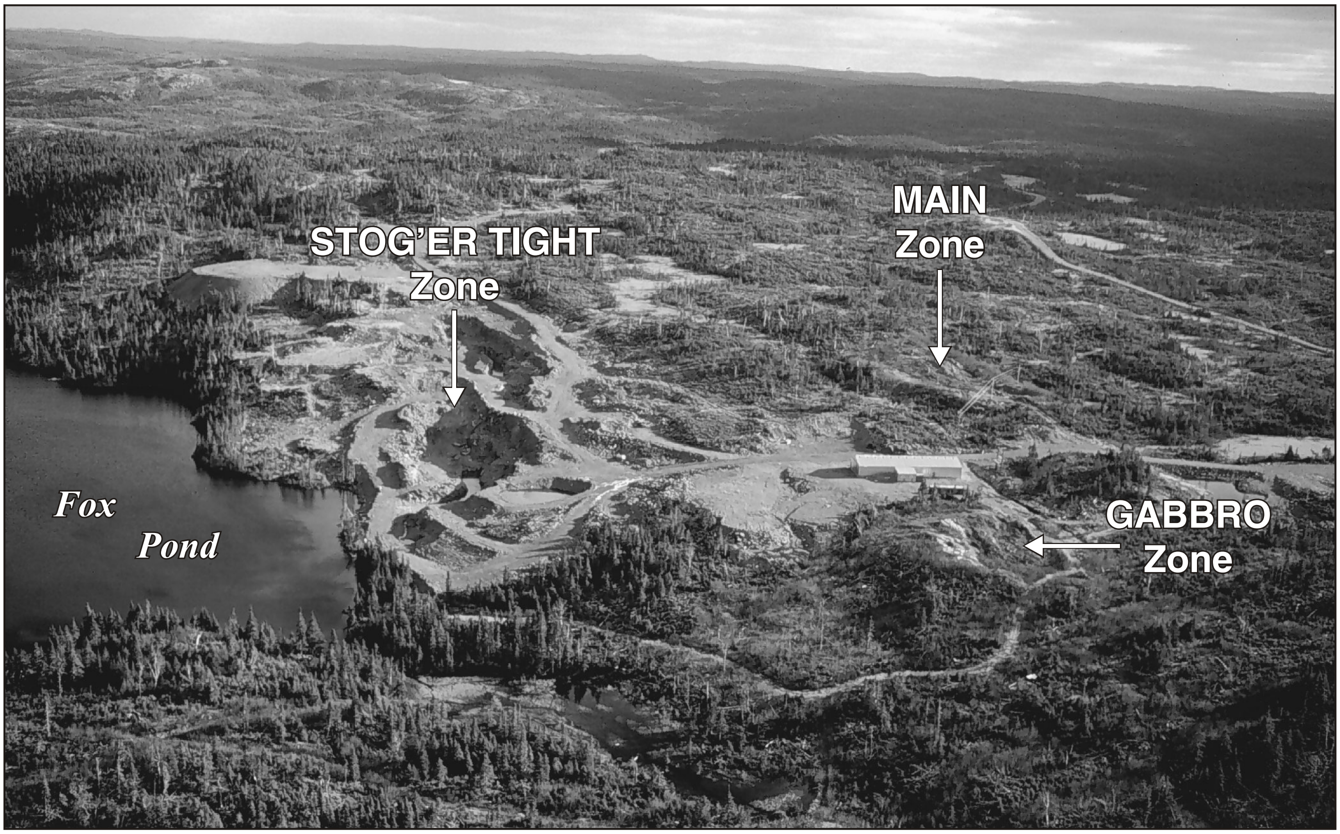


Plate 53. *Aerial view of the Stog'er Tight open-pit mine looking east.*

> is in fault contact with a leucogabbroic unit of the middle gabbro. This quartz-rich unit is probably part of the upper gabbro, thrust upon the middle gabbro. The thickness of the upper gabbro, which is increased by faulting in the east, varies from 45 to 100 m."

Plagioclase–porphyritic mafic dykes, up to 2 m wide, intrude both the pyroclastic and gabbroic units (Kirkwood and Dubé, 1992) and angular xenoliths of gabbro occur within the dykes where they intrude the sills.

Kirkwood and Dubé (1992) completed a detailed structural analyses of the Stog'er Tight area and concluded that the area had been subjected to three phases of deformation as outlined below.

> "The Stog'er Tight gold deposit is located on the south limb of the regional easterly-trending syncline of the Point Rousse Complex.... Rocks of the study area define a series of NNE-trending anticlines and synclines that post-date the major regional syncline. The structures within the study area are dominated by a well developed regional foliation (S_1) that contains a down dip stretching lineation. The lithologic contacts and main tectonic foliation are subparallel and generally dip to the north.
>
> Overprinting relationships at the outcrop scale indicate that two distinct generations of fold and cleavage followed the development of the regional foliation.... The regional foliation and earlier structures have been assigned to three deformational generations termed D_1, D_2, and D_3.
>
> D_1 Event
>
> The major D_1 deformation was responsible for the presently northerly dip of the succession due to large-scale regional folding. The study area is situated on the right way up limb of an east-trending, close to tight, F_1 syncline slightly overturned to the south-east (Hibbard and Gagon, 1980).... The regional S_1 fabric is a well developed foliation that dips to north between 25° and 40° and contains a typical downdip stretching lineation. The foliation is generally bedding-parallel, but is locally slightly oblique to bedding. Small-scale, isoclinal folds with an axial planar S_1 cleavage have been locally observed, although no large-scale F_1 folds have been recognized in the study area.

Throughout the area, the S_1 foliation is best developed in the volcaniclastic rocks. Near major ductile shear zones, the S_1 fabric intensifies and within a few metres, grades into a mylonitic foliation. Between the shear zones, strain is usually low in the more competent gabbro sills and the S_1 foliation is only weakly developed. Near these shear zones, the usually undeformed gabbroic sills become intensely foliated and develop a strong downdip stretching lineation, producing a fabric characterized by grain-shape lineations or L-tectonites. Within most of the high strain zones, the rocks are generally fine grained, laminated and contain small fragments of undeformed gabbro displaying primary textures, indicating a gabbroic protolith. D_1 shear zones are generally metre scale in width (1 to 3 m), and trend subparallel to the S_1 foliation with a moderate dip (40° to 60°). In thin section, the sheared gabbro varies from a protomylonite to an ultramylonite. In places, narrow shear zones less than 0.5 m wide developed at the contact between the gabbro and the pyroclastic rocks. These shear zones are parallel to the major D_1 shear zones and are characterized by a protomylonitic fabric. The downdip stretching lineation as well as megascopic and microscopic fabrics strongly suggest that north over south thrusting was responsible for the development of the first generation of structures. The noncoaxiality of the strain is indicated by shear bands and asymmetrical tails on rotated plagioclase porphyroclasts.

D_2 Event

The D_2 deformation is characterized by mesoscopic asymmetric folds with 15 to 70 cm amplitudes which fold the S_1-L_1 fabric, D_1 shear zones and related alteration zones. These southward-verging F_2 folds plunge between 5° and 40° to the W-WNW, and trend E- to ESE. The S_2 axial planar cleavage dips steeply towards the north and cuts the S_1 foliation. Numerous, steeply dipping, E- to ESE-trending kink bands, subparallel to the F_2 axial planes, occur and record north-over-south movement. A less common set of near-horizontal, south-dipping kink bands also occur in the strongly foliated rocks. Small-scale chevron folds are developed where both sets of kink bands are present. Within the strongly foliated rocks, a crenulation cleavage subparallel to S_2 folds the S_1 surface and is affected by F_2 folds and kink bands.

Shear zones developed during D_2 record evidence of brittle ductile behaviour. They are defined by narrow, subvertical chloritic zones between 10 and 40 cm wide, characterized by a mm-spaced schistosity which drags and displaces the S_1 foliation and cuts across the alteration zones. Their orientation is generally consistent, striking ESE and dipping 70° to 80° to the north. The major D_2-related faults were recognized from unpublished magnetic anomaly company maps as well as in drill core sections where displacements up to 20 m of the sills and alteration zones have been noted.

D_3 Event

The D_3 deformation consists of the development of broad open folds and a related S_3 fracture cleavage trending NNE to NE. These F_3 folds affect D_1 and D_2-related structures and are expressed as a series of broad, regional NNE-trending anticlines and synclines."

Gold Mineralization

62. The Stog'er Tight Gold Property

Location and Access

The Stog'er Tight Zone (NTS 12H/16 Au041 UTM 566150E 5535050N) is a red albite–ankerite–pyrite replacement style of gold mineralization that occurs as a cluster of gold occurrences located approximately 2 km southwest of the community of Mings Bight. A gravel road leads to the deposit from the Pine Cove access road.

Local Geology and Mineralization

The Stog'er Tight property is host to six similar zones of gold mineralization. These are known as the Cliff, Gabbro West, Gabbro, Gabbro East, Stog'er Tight and Magnetic zones (Figure 34). These will be discussed collectively with the Stog'er Tight Zone and will only be referred to separately in the discussion on gold grades. Two other gold occurrences, the Main Zone and the Massive Sulphide Zone, will be discussed separately.

The gold mineralization within the Stog'er Tight Zone is hosted by one of three gabbroic sills (Figures 33 and 34), informally termed the Stog'er Tight or middle gabbro. The gabbro sills intrude a sequence of pyroclastic, volcaniclastic and effusive volcanic rocks, which generally strike west-northwest and dip to the north. Geochemical studies indicate that both the volcanic and gabbroic rocks record a transition from island-arc to mid-ocean ridge and oceanic-island basalt-dominated magmatism that is analogous to a modern oceanic back-arc setting (Ramezani, 1992). He determined the crystallization age of the gabbro, based upon U–Pb zircon geochronology, to be 483 +3/−2 Ma.

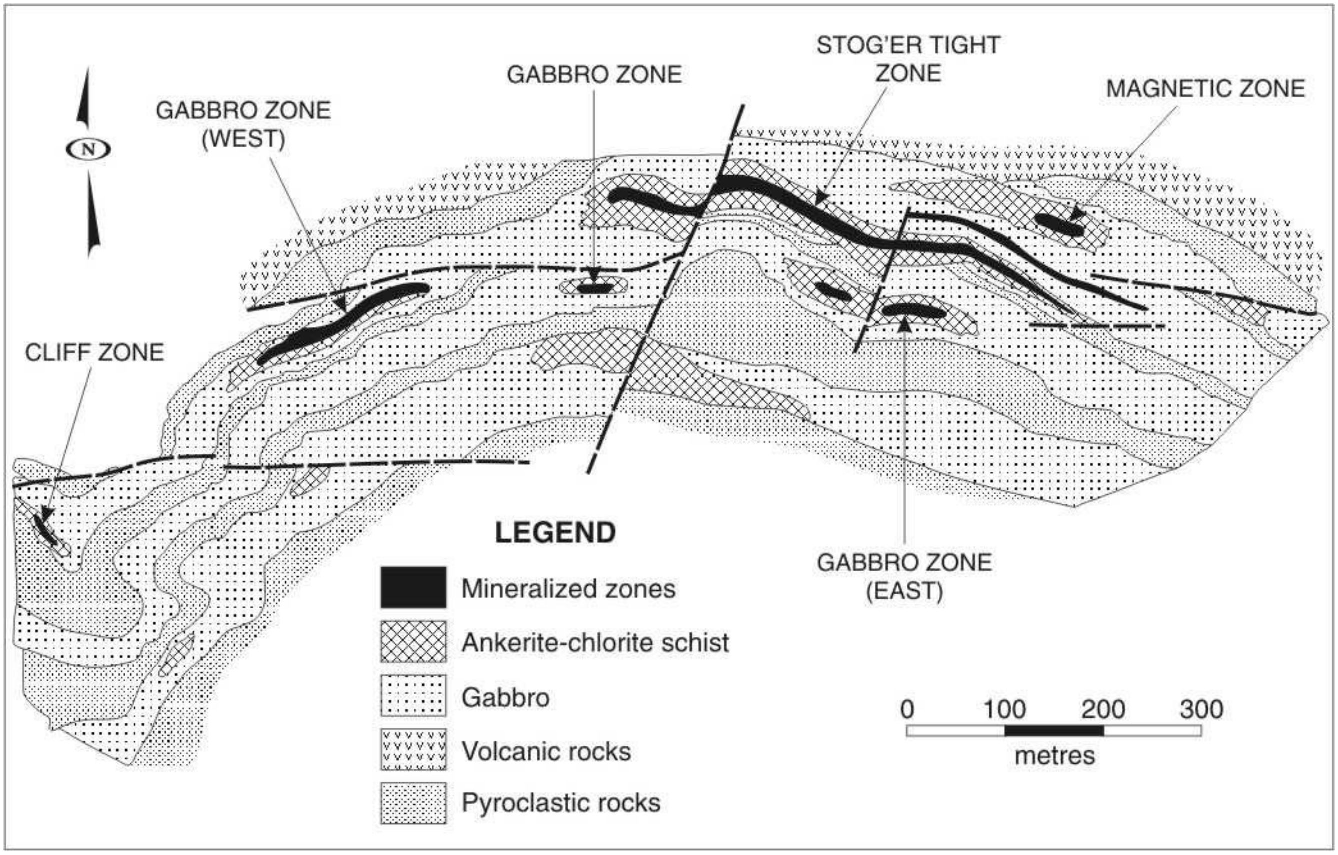


Figure 34. *Simplified geological map of the Stog'er Tight area, illustrating alteration and mineralized zones (*modified after *Ramezani, 1992).*

The gold mineralization within the Stog'er Tight Zone is bounded by a broad and consistent alteration envelope averaging 13 m in width. Ramezani (1992) defined four alteration zones (Figure 35) based on distinct mineral assemblages that occur at varying distances from the ore-grade zones. These include; i) a chlorite–calcite zone, ii) an ankerite–sericite zone, iii) a chlorite–magnetite zone, and iv) a red albite–pyrite (+gold) zone. The red albite–pyrite zone is termed a replacement vein by Ramezani (1992). The chlorite–calcite assemblage is the most distal, least intense, and extends well beyond the shear zone that controls the distribution of the alteration. This facies is marked by the replacement of actinolite and epidote by chlorite and calcite. Leucoxene is mostly unaffected by the alteration and locally leucoxene is coated by fine-grained acicular rutile. Ramezani (1992) attributed the rutile to "...a transition from a titanite-dominated type of leucoxene to a rutile-rich (acicular) variety characteristic of hydrothermally altered gabbro."

The chlorite–calcite zone is gradational into the ankerite–sericite zone, which is readily identified by a colour change from greyish-green to a bleached cream-yellow. The zone contains pervasive ankerite and sericite and is marked by a paucity of epidote and a significant decrease in the abundance of chlorite. Skeletal leucoxenes are composed of fine, acicular rutile aggregates and there is only local preservation of massive titanite-rich cores. Ramezani (1992) reported that most samples collected from this facies contain a recrystallized, fine-grained quartz–albite matrix with locally preserved relict albite. With increasing intensity of alteration, carbonate decreases and coarse albite becomes common. The grains are greyish-white, subhedral, coarse, locally up to 7 mm and may comprise up to 70 percent of the rock. Ramezani (1992) refers to this "...as a marginal or transitional facies of the ankerite–sericite zone, towards the red albite–pyrite alteration."

The red albite–pyrite (+gold) zone marks the most intense alteration facies, distinguished by hydrothermal red albite and auriferous pyrite (Plate 54). Ramezani (1992) reported that the red albite–pyrite facies "...occurs as a series of discontinuous, anastomosing, lens-shaped intervals (veins?), in close association and interleaved with the albite-dominated facies of ..." the ankerite–sericite zone. The albite occurs as yellow-red to red-orange grains, up to 7 mm long, which locally constitute up to 70 percent of the rock. Pyrite within this alteration facies occurs as small disseminated

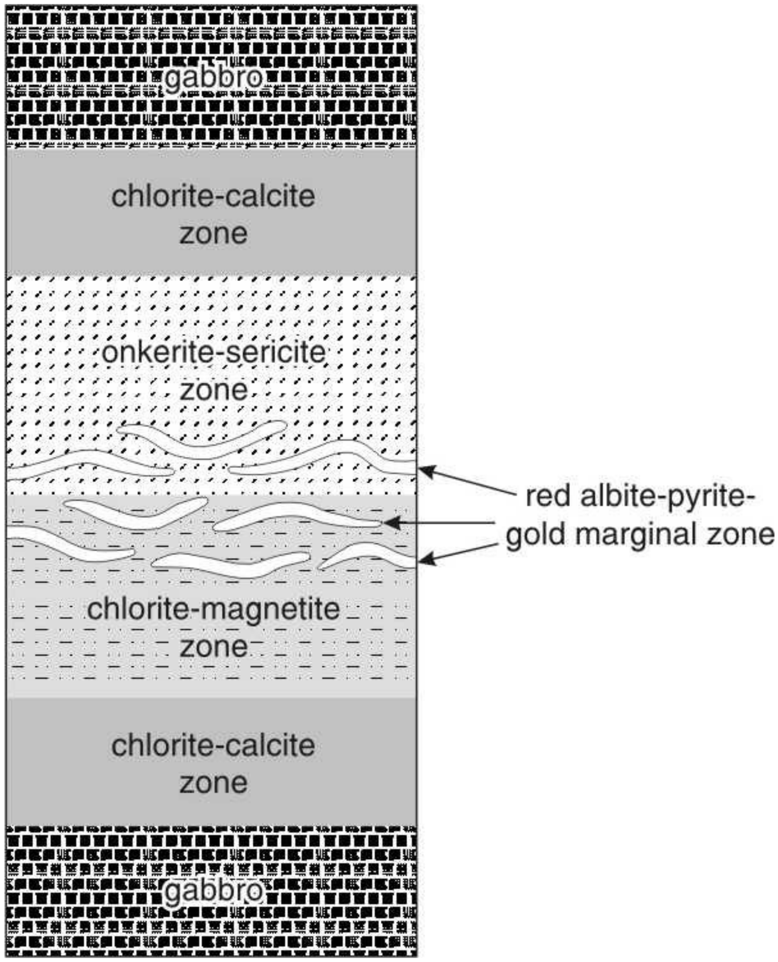


Figure 35. *Alteration zonation developed within gabbro at the Stog'er Tight gold deposit (*modified after *Ramezani, 1992).*

Plate 54. *Typical Stog'er Tight ore composed of red albite-pyrite cut by milky-white quartz–albite–ankerite veins. Note the coarse disseminated euhedral pyrite within the altered gabbro.*

cubes and locally as coarse polygrain aggregates. Lesser amounts of sericite, chlorite and apatite occur throughout the zone. Rutile pseudomorphs after leucoxene are common in the mineralized zones and are often overgrown or enclosed by the auriferous pyrite.

The red albite–pyrite (+gold) facies is interleaved in the footwall with the chlorite–magnetite facies alteration. This zone is marked by intensive chlorite alteration, up to 5 percent magnetite, and is cataclastically deformed (Ramezani, 1992). The chlorite–magnetite zone is gradational outwards into the chlorite–calcite facies. This zone was interpreted to record a late episode of brittle–ductile deformation and retrograde alteration that postdated the peak of hydrothermal alteration and mineralization.

The altered gabbroic rocks at Stog'er Tight contain hydrothermal zircon and these angular, opaque, pink- to dark-red zircons are distinct from the clear, euhedral prisms of the igneous zircons present in the unaltered portions of the gabbro. Ramezani (1992) dated the hydrothermal zircon and determined a U–Pb zircon age of 420 ± 5 Ma for the hydrothermal alteration

Ramezani (1992) reported that the hydrothermal alteration associated with the Stog'er Tight Zone was marked by enrichments in the LILE, HFSE, REE and Th from "...mineralizing fluids that were in equilibrium with (or derived from) enriched continental crustal sources, as opposed to the commonly depleted oceanic rocks."

Quartz veins occur within the mineralized zones both as barren tension-gash veins, which are interpreted to postdate the mineralization, and as shear-parallel, quartz–albite–ankerite veins (Ramezani, 1992). The gabbroic wall rock, up to 15 cm from the shear veins, is characterized by intense red-albite alteration and by coarse auriferous pyrite. The intensity of the alteration diminishes within 5 to 15 cm of the shear-parallel veins. Kirkwood and Dubé (1992) identified four main types of veins in the Stog'er Tight area, which they referred to as Va, Vb, Vc and Vd. Only the Va and Vb veins are associated with gold mineralization. A description of the veining is taken from Kirkwood and Dubé (1992).

> "Va veins consist of quartz-ankerite+chlorite+pyrite. They strike 120° and dip 65° to 85° to the south. These are extensional veins perpendicular to the L_1 stretching lineation.... Vb veins are slightly discordant with S_1, strike east-west and dip between 30° and 60°. They consist of quartz and ankerite+pyrite. Type Vc quartz-carbonate veins are emplaced along the F_2 axial fracture cleavage. Type Vd quartz veins trending SE-SSE are not associated with alteration and are generally barren.
>
> The mineralized veins (Va and Vb) show no signs of stretching, boudinage or isoclinal folding typical of D_1 ductile shearing although they are affected by asymmetric F_2 folds...."

The distribution of gold mineralization within the Stog'er Tight area is interpreted to be controlled by the D_1 ductile shear zones (Kirkwood and Dubé, 1992).

> "The development of quartz-carbonate veins and associated alteration and mineralization is ascribed to a late (post-ductile) increment of the D_1 event. Although D_1 shear zones do not show clear signs of hydrothermal alteration, subvertical extensional quartz-carbonate veins within the mineralized zones are perpendicular to the L_1 lineation.... Moreover, alteration zones with intense veining are spatially associated with (adjacent to) D_1 ductile shear zones. Microscopically, carbonate minerals occur as idioblastic grains aligned more or less subparallel to L_1, and are seen to have been partially dissolved within S_2 cleavage planes. Locally, carbonate porphyroclasts show an internal schistosity which is continuous with the matrix schistosity (S_1) implying growth of carbonate after the formation of S_1 and confirming their post-kinematic nature. These relationships suggest that precipitation of hydrothermal carbonates associated to mineralization is late-D_1 and pre-D_2."

The gold within the Stog'er Tight Zone occurs as fine-grained (<.05 mm) microveinlets and disseminated blebs within the coarse ""...polygrain aggregates of pyrite" (Ramezani, 1992). Visible gold was observed as rare delicate flakes localized within weathered-out pyrite cubes. Channel sampling across the Stog'er Tight Zone returned maximum values of 23.0 g/t Au over 7.0 m and grab samples with 115.3 g/t Au (Table 14; Huard, 1990b). Diamond drilling by Noranda Exploration Company Limited traced the zone approximately 150 m down-dip (Figure 36) and indicated a plunge to the east, which increased its strike length to 650 m. Based on this diamond drilling a probable geological reserve of 650 000 tonnes at 6.7 g/t Au was outlined within a continuous sheet-like body (Bradley, 1997). Table 15 summarizes diamond-drill assay results, between the years 1988 and 1990, for the Stog'er Tight Zone. The diamond-drillhole locations are shown on Figure 37.

Table 14. Channel sample assay results from the Stog'er Tight Zone (Huard, 1989b). NSA = no significant assay

Trench	Width (m)	Assay g/t Au
6+50W	1	5.2
7+00W	7	23
7+50W	4	1.7
8+25W	2.0 3.0	15.0 2.3
8+75W	3	3.2
9+25W	6	5.7
10+00W	8	5.1
10+50W		NSA
11+00W	2.5 2.0	2.1 2.5
11+50W	7	2.2

Ming Minerals purchased the property from Noranda in 1996 with the view to mining approximately 350 000 tonnes at 6.7 g/t Au, which was believed to be amenable to open-pit mining. However, diamond drilling and open-pit mining,

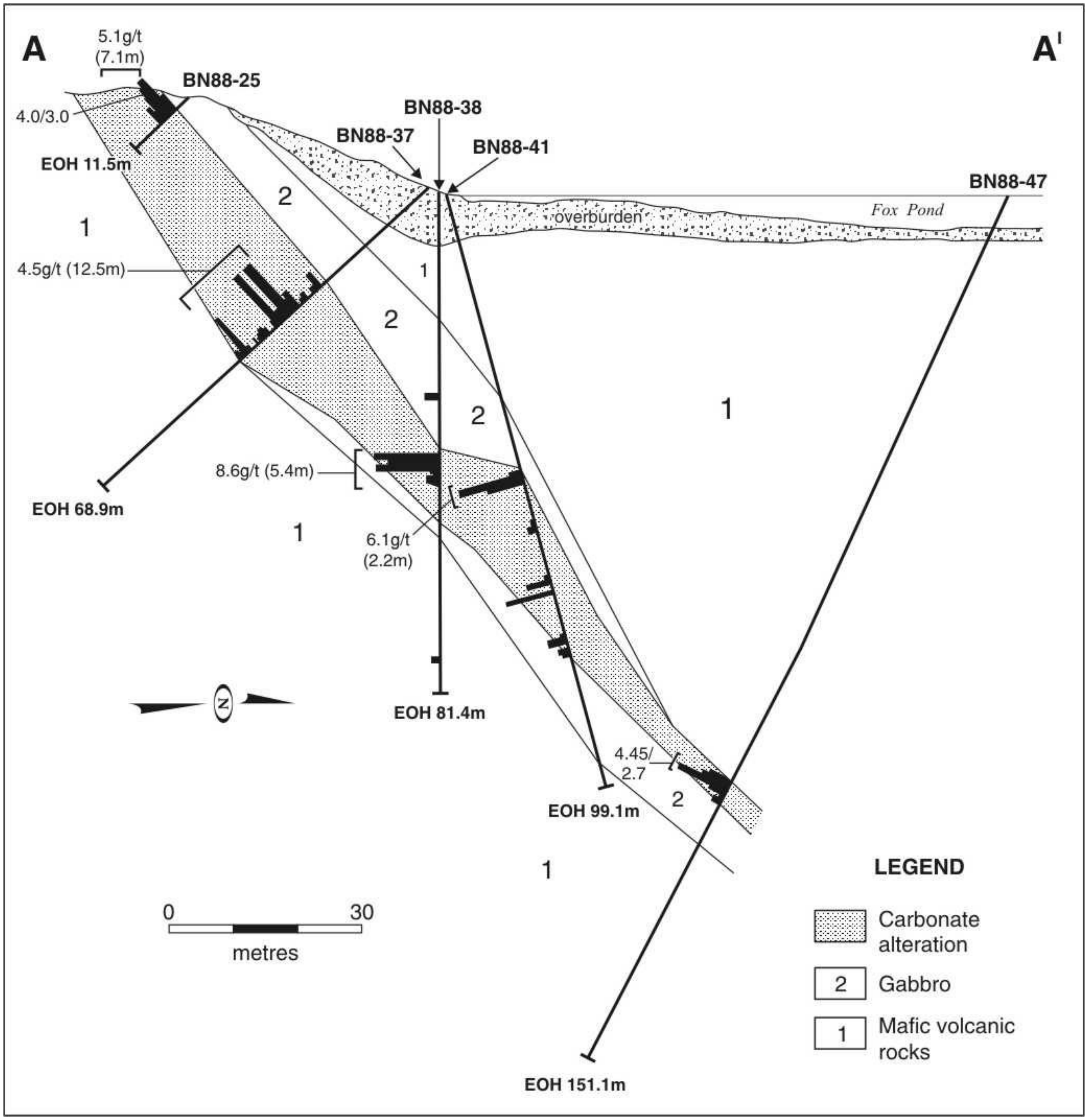


Figure 36. *Cross-section of the Stog'er Tight Zone from drillhole data (*modified after *Huard, 1990b). The section location is shown on Figure 33*

during October 1996 to January 1997, revealed that the ore zone is not a continuous body, but occurs as series of discontinuous lenses or pods separated by barren wall rock. It has not been determined if these lenses were formed through faulting and displacement of a once continuous zone.

The Cliff Zone, which is located roughly 800 m to the southwest of the Stog'er Tight Zone, was described as exhibiting Stog'er Tight-style alteration and mineralization (Huard, 1990a). The area was trenched and a channel sample returned an assay value of 7.11 g/t Au over a true width

Table 15. Diamond-drill assay results, Stog'er Tight Zone (Huard, 1989b; 1990a). NSA = no significant assay

Diamond Drillhole #	Interval (m)	Width (m)	Assay g/t Au	Diamond Drillhole #	Interval (m)	Width (m)	Assay g/t Au
18			NSA	44	263.7-265.2 290.5-291.6	1.5 1.1	1.4 3.24
19			NSA	45	72.6-76.6	4.4	4.82
20	18.97-21.37	2.4	4.09	46	22.3-23.6	1.3	0.22
21	9.87-12.67	2.8	5.1	47	103.8-106.5	2.7	4.45
22			NSA	48	66.2-70.2	4	1.5
24	11.4-15.0	3.6	11.3	50			NSA
25	3.3-6.3	3	4.05	51	61.6-65.3	3.7	5.63
26	4.0-9.5 4.5-7.6	5.5 3.1	5.86 8.68	52 53	 57.9-60.8	 2.9	NSA 2.71
27			NSA	54	136.9-139.6	2.7	0.093
29	27.4-47.3	19.9	4.97	55	129.8-131.7	1.9	3.02
30	24.1-27.1	3	8.71	56	98.9-100.7	1.8	3.32
31	46.2-46.7	0.5	9.65	57	91.7-98.0	6.3	5.14
32			NSA	58	111.9-112.4	0.5	1.72
33	40.9-43.8	2.9	8.59	59	93.5-93.8	0.3	2.15
34	64.1-65.7	1.6	4.51		155.7-156.7	1.0	6.81
35	45.8-46.6	0.8	0.29	60	88.6-95.0	6.4	4.11
36	50.0-50.6	0.6	0.44		90.8-93.9	3.1	6.27
37	28.2-33.0	4.8	9.78	61	83.4-88.5	5.1	9.58
38	42.9-48.3	5.4	8.65	66	96.0-96.6-	0.6	2.96
39			NSA		115.4-116.4	1.0	1.44
40	78.5-79.1	0.6	0.17	67	194.2-194.8 198.5-199.0	0.6 0.5	1.86 2.27
41	47.5-49.7	2.2	6.12				
42	182.9-184.0	1.1	3.17				
43			NSA				

of 3.5 m. Huard (1990a) reported that the zone trended 135° and dipped 45° to the northeast. Trenches located 60 m and 100 m along strike to the east and west failed to intersect the zone. However, the western trench exposed a 15-m-thick unit of talc–carbonate schist that contained lenses of massive talc–carbonate-altered gabbro containing minor pyrite. Grab samples from this trench assayed up to 1.21 g/t Au (Huard, 1990a). The Cliff Zone was tested with two diamond-drillholes, BN-90-74 and 75, both of which intersected weakly albitized and pyritized gabbro. The altered gabbro intersected in BN-90-74 assayed 1.03 g/t Au over 0.5 m and hole BN-90-75 returned no significant assays (Huard, 1990a). Noranda identified and trenched a number of altered and mineralized gabbro outcrops in this area (Table 16).

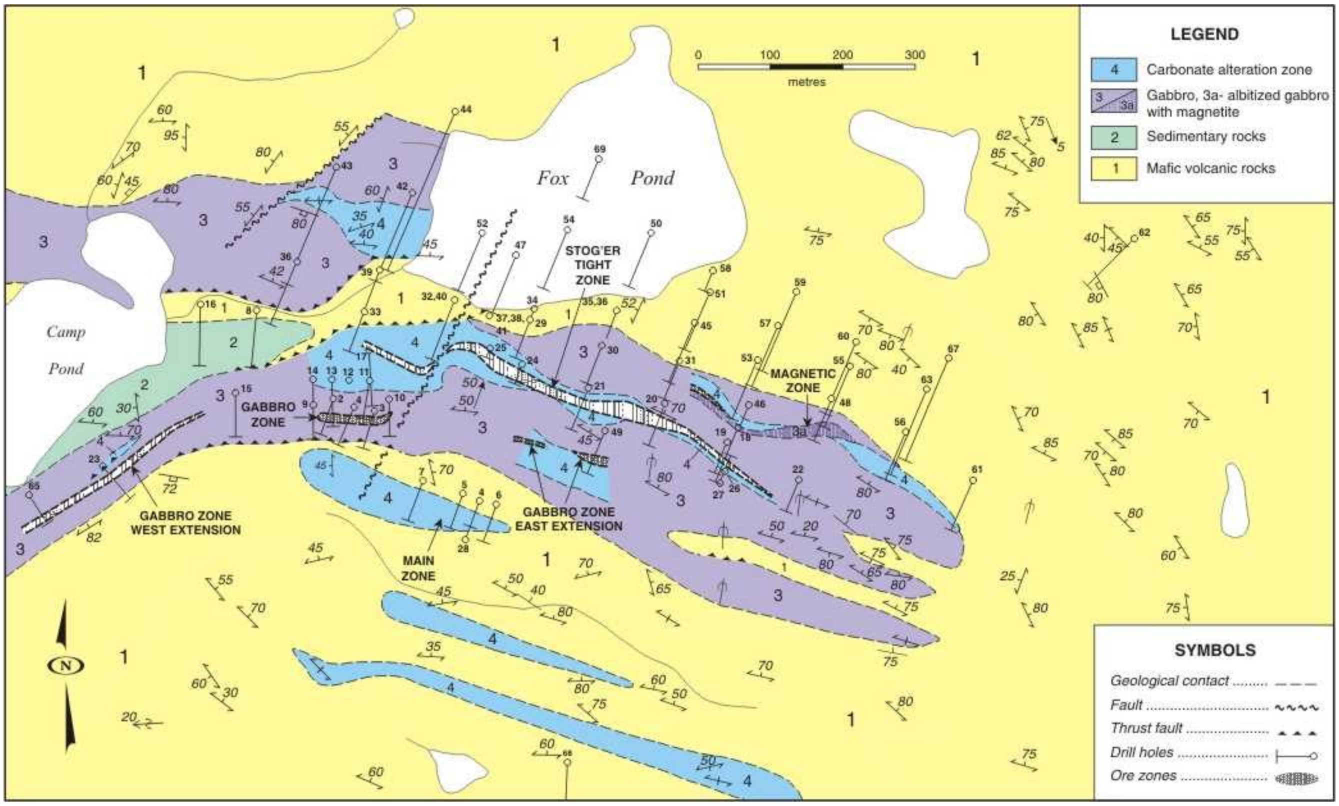


Figure 37. *Geological map of the Stog'er Tight area showing the distribution of diamond-drillholes, ca. 1988–1990 (Huard, 1990a).*

Table 16. Assay values from Noranda trenches located near the Cliff Zone (Huard, 1990a)

Location	Description	Assay
15+25W, 0+15S	Float	12.0 and 12.6 g/t Au
14+75	Trench exposed sheared and carbonatized gabbro	Grab samples up to 1.55 g/t Au Channel samples up to 100 ppb Au
16+25W, 2+44S to 3+90S	Trench exposed zone of carbonate altered basalt. The mineralization lies within the hinge of a gently west-plunging synformal fold	Grab samples up to 28.4 g/t Au. Channel samples across the hinge averaged 0.30 g/t Au over 13.0 m.
17+45W, 1+44S to 2+44S	Trench exposed a narrow zone of albitized and pyritized gabbro within a magnetite-rich gabbro	Grab samples up to 1.65 g/t Au. Channel sample assayed 0.96 g/t Au over 3.0 m.
Southwest corner of Pump Pond	Angular float of albitized and pyritic gabbro	12.0 g/t Au
8+50N, 1+25W	Float, ferruginous chert with 5% pyrite and 50% quartz veins	14.3 g/t Au

The Gabbro Zone is located approximately 100 m southwest of the Stog'er Tight Zone. Huard (1988a) described the altered gabbroic host rock as containing up to 60 percent coarse, pink feldspar and 15 percent coarse-grained disseminated pyrite. The zone was stripped and two 110°-trending, altered and mineralized zones were exposed.

Table 17. Diamond-drillhole assay results from the Gabbro Zone (Huard, 1988b)

Hole	Interval	Assay	Discussion
BN-88-1	18.7-22.8 m	6.6 g/t Au	Zone of disseminated pyrite in albitized gabbro
BN-88-2	20.7-23.9 m	5.9 g/t Au	
BN-88-3	11.0-14.25 m	6.7 g/t Au	
BN-88-9 to 14	No significant assays		
BN-88-15	68.7-68.95 m	23.24 g/t Au	Failed to intersect the albitized gabbro. Gold hosted by sheared sediments.

Table 18. Assay result from trenching and diamond drilling on the Gabbro West Zone (Huard, 1989b)

Sample	Interval	Assay
Trench 14+00W	2.0 m channel	1.8 g/t Au
Trench 15+00W	1.0 m channel 1.0 m channel 1.0 m channel	1.5 g/t Au 2.0 g/t Au 5.6 g/t Au
Drill Hole	Interval	Assay
BN-88-23	7.2 - 7.6 m	0.44 g/t Au
BN-89-65	29.2-29.8 m	3.61 g/t Au

The westernmost zone was reported to thicken and improve in grade to the west where it disappears beneath the deep overburden. The two zones pinch out toward the east. Diamond drilling on the zone revealed that the mineralized zone is overlain by sheared and distinctly magnetic gabbro and underlain by 2 to 4 m of strongly sheared gabbro, which was interpreted to mark the fault contact with underlying mafic volcanic rocks (Huard, 1988b). Initial grab samples collected from the zone assayed up to 16.5 g/t Au, whereas grab samples from the stripped area assayed up to 55.6 g/t Au. Combined channel-sample assay results included 4.7 g/t Au over 10 m (Huard, 1988a). Diamond-drill assay results are presented in Table 17.

The Gabbro West Zone, which is located approximately 100 m along strike to the west of the Gabbro Zone, was discovered during follow-up trenching of gold in soil anomalies and carbonate alteration. Huard (1989b) described the mineralization as similar in style to the Stog'er Tight Zone, although the zone is narrower and lower in grade. Diamond drilling confirmed that the mineralized zone has a strike length in excess of 200 m. Assay results are listed in Table 18.

Table 19. Diamond-drillhole assay data for the Magnetic Zone (Huard, 1990a)

Hole	Width	Assay	Host Rock
BN-89-69	6.4 m	7.68 g/t Au	Albitized and sheared basalt
BN-90-76	1.4 m 0.71 m	4.46 g/t Au 3.13 g/t Au	Albitized and sheared basalt Albitized gabbro

The Gabbro East Zone is located approximately 150 m along strike to the east of the Gabbro Zone. It comprises a zone of carbonatized and weakly albitized gabbro that has a strike length in excess of 75 m (Huard, 1989b). The zone was trenched and tested by a diamond-drillhole (BN-49), but the results were not encouraging. A channel sample across the zone of albitization assayed 0.22 g/t Au over 3 m.

The Magnetic Zone, which is located about 40 m to the north of the Stog'er Tight Zone, is composed of albitized and pyritized gabbro. The zone was tested by diamond drilling and the results are listed in Table 19.

63. The Main Zone

Location and Access

The Main Zone (NTS 12H/16 Au042 UTM 566050E 5534900N) is an auriferous carbonate–quartz–sulphide replacement-style of mineralization located approximately 200 m south of the Stog'er Tight Zone.

Table 20. Diamond-drillhole assay data from the Main Zone (Huard, 1988b, 1989b)

Diamond-Drillhole	Interval	Assay	Description
BN-88-4 BN-88-5 BN-88-6	No Significant Assays		These holes did not intersect significant alteration or quartz–carbonate veining.
BN-88-7	20.8-21.2 m	1.91 g/t Au	Intense carbonatization and quartz–carbonate veining, 1 % coarse pyrite
BN-88-28	No Significant Assays		Tested for south dip of zone, but failed to intersect it.

Local Geology and Mineralization

The Main Zone is hosted by mafic volcanic rocks that outcrop to the south of the gabbroic sills that host the Stog'er Tight and associated zones. These mafic volcanic rocks are in gradational contact to the south with mafic tuffaceous rocks that contain minor interlaminated magnetite chert (Huard, 1988a). Trenching in the vicinity of a gold in soil geochemical anomaly led to the discovery of this zone. The trench and subsequent stripping exposed a zone or zones of intensely recrystallized quartz and carbonate-altered mafic volcanic rocks, which contained up to 5 percent disseminated pyrite and abundant quartz and pyrite veins. Huard (1988a) reported that the mineralized zones trend 115° and appear to follow a fracture cleavage that crosscuts the east-trending, shallowly north-dipping regional cleavage. These zones are up to 3 m thick and 15 m long and exhibit gradational contacts over a few tens of centimetres with the wall rock, but locally these contacts are sharp. Wall rock comprises chloritic, schistose mafic volcanic rocks that exhibit minor carbonate alteration and disseminated pyrite. Quartz–chlorite veins occur locally within the altered wall rock and are developed parallel to the trend of the mineralized zones. Locally, the regional cleavage is folded into open folds that plunge shallowly to the northwest. Huard (1988a) reported that the hinge of one such fold was truncated by the fracture cleavage.

Initial grab samples collected from the Main Zone prior to trenching and stripping assayed up to 29 g/t Au. Grab samples collected from the trenches assayed up to 213 g/t Au and combined channel sample assays returned values of up to 4.6 g/t Au over 14 m (Huard, 1988a). An area measuring approximately 80 by 20 m was subsequently stripped. The zone was tested with 5 diamond-drillholes (Table 20), all of which failed to intersect mineralization similar to that exposed on surface.

64. Massive Sulphide Zone

Location and Access

The Massive Sulphide Zone (NTS 12H/16 Au043 UTM 565700E 5535075N) is an auriferous carbonate–quartz–sulphide replacement-style of mineralization located approximately 125 m west of the Stog'er Tight Zone. The area can be reached from the Stog'er Tight access road, which leads from the Pine Cove road.

Local Geology and Mineralization

The Massive Sulphide Zone was discovered as a result of follow-up trenching on a gold in soil geochemical anomaly (Huard, 1988a). This trenching exposed an east-trending zone of pyritic massive sulphide with an apparent thickness of 2.4 m. However, the zone is folded and the true thickness was reported to be about 1.0 m (Huard, 1988a). Immediately north of the massive sulphide is a unit of magnetite iron formation, which is interlaminated with the massive sulphide over a thickness of 10 cm, and is in turn overlain by a gossan.

Grab samples collected from the massive sulphide assayed up to 2.4 g/t Au and a 1-m channel sample assayed 6.2 g/t Au (Huard, 1988a). The zone was tested with two diamond-drillholes (Huard, 1988b). The first hole, BN-88-8, intersected a 1.0-m-thick unit of magnetite iron formation that assayed 3.2 g/t Au. This 1.0 m interval also included a 0.45-m-thick section of massive pyrite. Hole BN-88-16 was drilled 75 m to the west and intersected 0.2 m of magnetite iron formation that assayed 0.3 g/t Au. Both holes intersected intensely sheared gabbro underlying the iron formation. Silicification and fracture-controlled pyrite associated with the sheared gabbro, intersected in hole BN-88-8, assayed 4.81 g/t Au over 0.85 m (Huard, 1988b).

THE RAMBLER PROPERTY, BAIE VERTE MAP AREA (NTS 12H/16)

Exploration History

The area is the site of the former Consolidated Rambler Mines (Plate 55), which produced 88 916 388 kg copper, 4 896 268 grams of gold and 36 001 897 grams of silver between 1964 and 1982 (Government of Newfoundland and Labrador, 1987; Table 21 for a listing of deposits and production). For a historical review of the exploration and mine development of the area prior to 1983 the reader is referred to Hibbard (1983). In 1987, the Newfoundland Department of Mines evaluated the potential for economic concentrations of gold and base metals in the Rambler tailings area (Collins, 1987). A total of 1005 tailings samples were collected and analyzed and as a result, three zones containing a total of 881 468 tonnes grading 2.057 g/t Au were outlined (Table 22). In 1987, the Rambler Property, which comprised four Fee Simple Mining Grants and two Mining Leases totalling 1 107.54 hectares, reverted to the Crown and were designated Exempt Mineral Lands under the Minerals Act, 1976. Surface facilities, including the mill, were excluded having been purchased privately. In December, 1987, the Newfoundland Government issued a call for proposals to explore and develop the property and on June 24, 1988, the mineral rights were awarded to Petromet Resources Limited on behalf of the Rambler Joint Venture, a consortium formed between Petromet Resources Limited, Newfoundland Exploration Company Limited and Teck Corporation. The joint venture group staked the property and were issued two Extended Ground Staked Licences 3513 and 3514 on November 8, 1988.

Under the terms of the joint venture, the initial phase of exploration was to be jointly funded, on a 50/50 basis, by Petromet Resources Limited and the Newfoundland Exploration Company Limited. Teck Corporation could earn a 50% interest in the property by funding all subsequent expenditures including feasibility studies and production financing. MPH Consulting Company Limited was contracted to undertake the exploration program, which consisted of a compilation of existing data, an investigation of the Quaternary geology of the property and a soil geochemical orientation survey. This was followed by a soil geochemistry survey in the area east of the Ming Mine Boundary Shaft. Geophysical surveys conducted by MPH included, total field magnetometer and VLF-EM and horizontal loop electromagnetic (HLEM) surveys. Subsequent geophysical surveys included bi-directional and detailed magnetometer, VLF-EM and HLEM, target specific IP/resistivity, mise-a-la-masse, gravity and time domain electromagnetic surface profiling and borehole logging surveys. In total, $3.8 million was expended on the property over an 18 month period and the results of this work are outlined in Coates (1990a, b) and Duncan *et al.* (1990).

In late 1988, follow-up of Max-Min ground EM and soil geochemistry orientation surveys led to the discovery of the Ming West deposit (Duncan *et al*., 1990). The exploration work also identified a number of other high priority target areas, which included the Uncles', Main Mine, Ming Footwall, East Zone Footwall and the Boundary Shaft East, which were tested by detailed geological and geophysical surveys, channel sampling, trenching and diamond drilling (Duncan *et al*., 1990; Coates, 1990b). In the Uncles area, work concentrated on the Hill Bog where silicified and sericitized volcanic rocks contained elevated copper and gold values. This zone was tested by 13 diamond-drillholes totalling 1644.7 m. The nearby Uncle Theo showing was also tested by detailed geophysics and a single 96.6-m-long diamond-drillhole.

MPH Consulting Limited also explored the Ming Footwall Zone, which lies 50 to 150 m beneath the Ming deposit, and is estimated to contain 3 million tonnes grading 1.6% Cu (Government of Newfoundland and Labrador, 1994). MPH conducted detailed geophysical surveys, trenching and drilled two diamond-drillholes in an attempt to find the surface expression of the zone, but no significant base-metal mineralization was discovered. The altered footwall to the East Mine, which is exposed over a large area to the west of the shaft, was also channel sampled in detail, but this work failed to delineate any gold-enriched zones.

Detailed exploration and extensive diamond-drill programs were also undertaken to delineate the Ming West deposit and the gold-rich Footwall Zone to the Main Mine (Coates, 1990b). Work on the Ming West deposit outlined an estimated 110 000 tons grading 5.6 percent Cu, 0.37 percent Zn, 0.069 oz/t Au and 0.536 oz/t Ag. A detailed investigation of the tailings area, including bulk sampling, metallurgical studies and a water-quality baseline study, was also undertaken. The tailings study outlined three auriferous zones (Table 23).

The Rambler Joint Venture produced a number of positive results including the discovery of the Ming West deposit and a detailed examination of the auriferous Footwall Zone. However, the Ming West deposit was viewed to be subeconomic and the regional exploration program had failed to outline economically significant concentrations of base-metal mineralization in the near surface and as a result no further work was undertaken on the Rambler property. In 1993, the Rambler Property was optioned to NovaGold Resources Incorporated and the company conducted a limited amount of work on the Rambler tailings. NovaGold

Plate 55. *Aerial view (looking east) of the Rambler Mill complex. The small, water-filled pit to the right of the mill is the Footwall Zone open pit. The East Mine headframe is visible in the background.*

Table 21. Production statistics for volcanogenic massive sulphide deposits, Rambler area (after Evans *et al.,* 1992; Bradley, 1997)

Deposit	Years Mined	Grade and Tonnage
Main Mine	1961-1967	1.3 % Cu, 2.16 % Zn, 29 g/t Ag, 5.1 g/t Au, 399 000 tonnes
East Mine	1967-1974	1.04 % Cu, 1 933 079 tonnes
Big Rambler Pond	1969	1.2 % Cu, 45 000 tonnes (reserves 15 000 tonnes at 1.5 % Cu)
Ming Mine	1971-1982	3.66 % Cu, 22 g/t Ag, 2.4 g/t Au, 1 991 592 tonnes (15 240 tonnes of low-grade Cu mined from Crown Pillar, 1996)
Ming West	1995-1996	3.2% Cu, 1.7 g/t Au, 26 g/t Ag, 150 000 tonnes
Main Zone Crown Pillar and Footwall	1996	10 000 tonnes of massive sulphide ore 25 000 tonnes of silicified footwall ore

applied for a Mining Lease and attempted, unsuccessfully, to recover the tailings gold by means of a vat leach process. The remainder of the Rambler Property reverted to the Crown and the area south of the La Scie Highway was opened for staking on January 25, 1994. The northern portion of the property, which covered the Ming Mine and Ming West deposit, became Exempt Mineral Land under the Minerals Act and a call for proposals to explore and develop the property was issued in March, 1994 (Government of Newfoundland and Labrador, 1994).

Ming Minerals Incorporated staked all of the southern portion of the Rambler Property, which covered the Main, East and Big Rambler Pond mines. Ming Minerals had also acquired, by staking, most of the land encompassing the Exempt Mineral Land. A proposal from Ming Minerals to develop the Exempt Mineral Land (Dimmell and Blagdon, 1994) was accepted and by 1995 the company had refurbished the Rambler Mill. Mining of the Ming West deposit began in October, 1995, with the first shipment of concentrate taking place in December, 1995 (Dimmell *et al.*,

Table 22. Gold grades and tonnages, Rambler tailings area, as outlined by the Department of Mines (Government of Newfoundland and Labrador, 1987)

Zone	Tonnage	Grade
Total Tailings	3 787 700	1.0 g/t Au
Zone 1	768 358	2.106 g/t Au
Zones 2 and 3	113 110	1.723 g/t Au
Zones 1, 2 and 3	881 468	2.057 g/t Au

Table 23. Rambler tailings calculated reserves (Coates, 1990b)

Zone	Grade	Tonnage
1	0.041 oz/t Au, 0.14% Cu, 0.34% Zn	591 195 tons
2	0.062 oz/t Au, 0.48% Cu, 0.38% Zn	520 497 tons
3	0.041 oz/t Au, 0.35% Cu, 0.48% Zn	172 838 tons

1999). Approximately 150 000 tonnes grading 3.2 percent Cu, 1.7 g/t Au and 26 g/t Ag were mined from the deposit before weak copper prices and an exhaustion of easily accessible near-surface ore curtailed mining in July, 1996.

Ming Minerals Incorporated also conducted detailed exploration of Footwall Zone to the Main Mine. A decision was made to open pit the near-surface portion of the zone and to recover the Main Mine crown pillar. A gold circuit was installed at the Rambler Mill and mining was undertaken in 1996 (Bradley, 1997). Ore from Ming Minerals Incorporated's Stog'er Tight open-pit operation was also treated at the Rambler Mill until January, 1996 when mining ceased and as of December, 1999 the mill has not resumed operation.

The Wellsdale Fee Simple Mining Grant (Volume 1, Folio 82) is located immediately to the east of the old Consolidated Rambler Property. It was optioned by Noranda Exploration Company Limited in 1987 (Walker, 1988). This property covered the down-plunge extension of the East Mine. Noranda Ltd. carried out geophysical and geochemical surveys, identified several targets, but relinquished its option in 1989 without doing further work. In 1990, Corona Corporation optioned the property and carried out a compilation of previous work, re-logged and sampled 18 diamond-drillholes dating from 1979, and conducted geological mapping and prospecting (Dimmell and MacGillivray, 1991a). This work identified a number of sulphide occurrences associated with quartz–carbonate–chlorite-altered volcanic rocks. The company also reported a 15-m-wide auriferous quartz vein containing pyrite and chalcopyrite mineralization (*see* Appendix 1, Wellsdale gold showing). However, no economic concentrations of gold or base-metal mineralization were reported and the option was relinquished.

Immediately west of the Rambler Property was Noranda Exploration Company Limited's Rocky Pond South Property. Noranda Ltd. conducted geological, geochemical and geophysical surveys and trenching mainly in the area of the Uncle Angus showing (Beer and MacDougall, 1989) and this work led to the discovery of number of minor mineral occurrences, including the Spillway gold showing (*see* Appendix 1). This area was subsequently included in the ground staked by Ming Minerals Incorporated.

Regional Geology and Mineralization

The Rambler Mines area is underlain by Ordovician volcanic rocks of the Pacquet Harbour Group (Figure 38). Hibbard (1983) described the group as a

> "... moderately to steeply northerly dipping sequence of variably deformed and metamorphosed mafic volcanic and volcaniclastic rocks, felsic volcaniclastic rocks and mafic dykes that outcrop in the north-central portion of the Baie Verte Peninsula".

The Pacquet Harbour Group outcrops in an arcuate pattern that extends from Pacquet Harbour westward to the Rambler Mine area and then southeastward to the Brass Buckle area (Figure 38). To the north, the group is in fault contact with the Point Rousse Complex and the Mings Bight Group and is intruded by the Dunamagon Granite. To the west of the Rambler area, the Pacquet Harbour Group is intruded by the Burlington granodiorite, which also bisects the group south of the Rambler area, separating the Rambler area from the southern lobe of the Pacquet Harbour Group. To the east and south, the group is intruded by and unconformably overlain by, the Cape Brule Porphyry and the Cape St. John Group, respectively. Structural complexities, abrupt facies changes and a paucity of bedrock exposure has precluded defining the internal stratigraphy of the Pacquet Harbour Group.

Pillow lava, which comprise a significant proportion of the mafic volcanic rocks within the Pacquet Harbour Group form two distinct geochemical groups (Hibbard, 1983). In the north, a sequence of tholeiitic basalts outcrop in the vicinity of the La Scie Highway and to the south of the Ram-

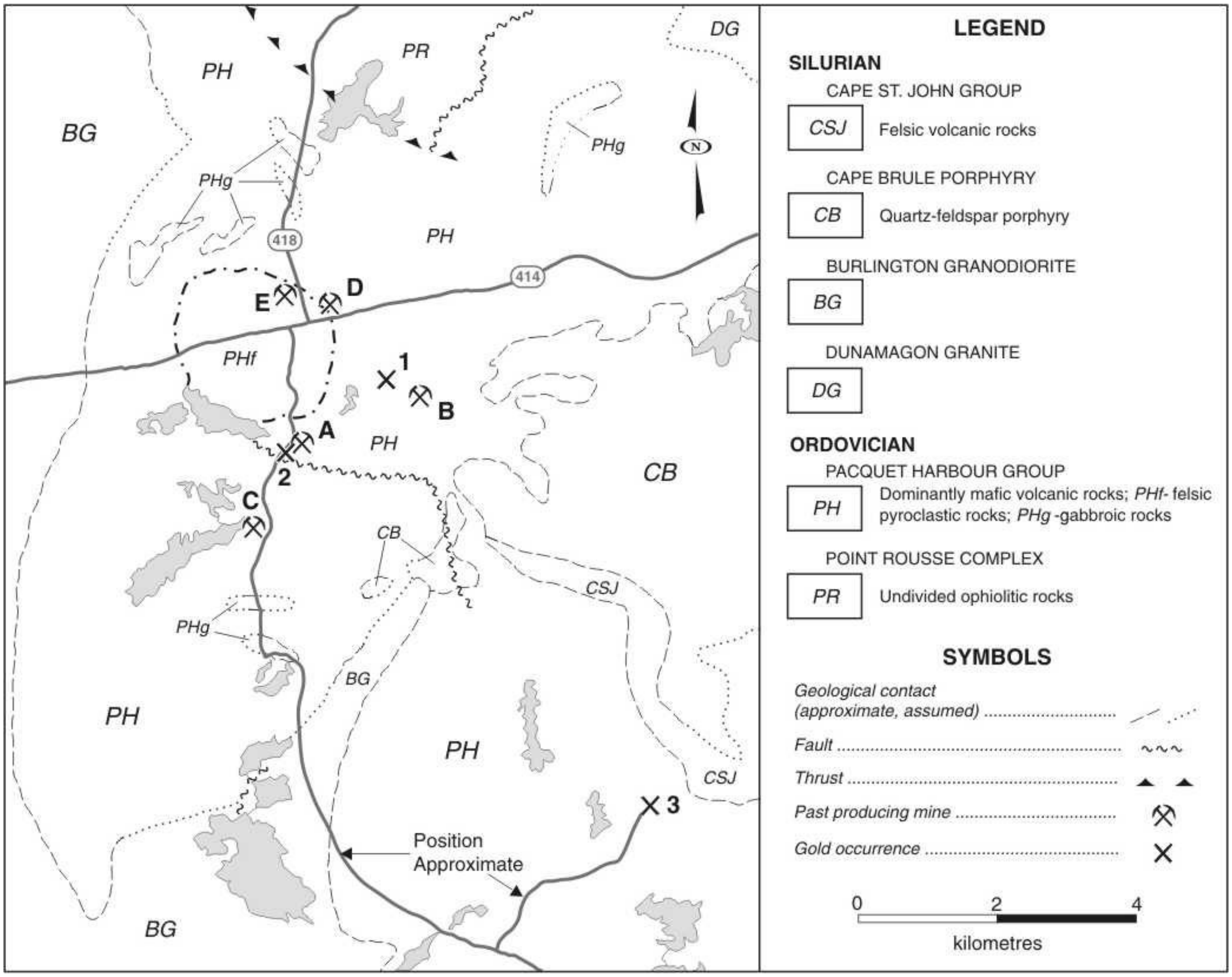


Figure 38. *Simplified geological map (*modified after *Hibbard, 1982) of the Rambler and Brass Buckle areas showing the significant gold occurrences and past producing mines. 1) Stuckey Vein, 2) Footwall Zone, and 3) Brass Buckle; A) Main Mine, B) East Mine, C) Big Rambler Pond, D) Ming Mine, and E) Ming West.*

bler Mine area the pillow lavas are basaltic komatiites or boninites. Hibbard (1983) interpreted the pillow lavas to be geochemically comparable with the ophiolitic Betts Cove Complex with the boninites and tholeiites representing the lower and upper levels respectively of an ophiolitic lava member.

In the Rambler area, 5 mappable units have been identified (Tuach, 1976): 1) mafic flows, dominantly boninitic in composition based on the geochemistry of Gale (1973) and Hibbard (1983); 2) mafic volcanic (mostly tholeiitic flows) and volcaniclastic rocks composed of agglomerate, tuff, pillow breccia and reworked fragmental rocks and minor chert, silicic rocks and quartz–sericite schist; 3) mixed felsic and mafic volcaniclastic rocks and pillow lava occurring marginal to the felsic volcanic sequence; 4) felsic volcaniclastic rocks composed mainly of keratophyritic fragmental rocks that are commonly quartz porphyroblastic and outcrop in a domal pattern; and 5) mafic sedimentary rocks consisting of bedded, laminated volcanogenic sedimentary rocks, reworked crystal tuff, minor flows and grey chert. Gabbro and diabase underlie approximately 20 percent of the Rambler area.

Tuach and Kennedy (1978) reported that, in the Rambler area, the Pacquet Harbour Group was subjected to four deformational events of which the second and third phases were the most significant. The second deformational event, also referred to as the main deformation, produced the strong, generally northeast- to north-plunging particle, mineral and pillow lineation. The lack of outcrop hampers the recognition of major folds or faults within the Rambler area. However, minor faults and folds were widely observed in the mine workings.

Metamorphism accompanying the main deformational event was the most intense (lower amphibolite), with retrograde (upper greenschist) metamorphism superimposed during later events. Metamorphic grade generally decreases from north to south throughout the Pacquet Harbour Group (Hibbard, 1983).

The Rambler area is host to both volcanogenic massive sulphide and epigenetic gold mineralization. The sulphide mineralization occurs as massive, tabular lenses (Main, Ming and Ming West deposits), which are spatially associated with the contact of the felsic domal feature and the overlying intermediate to mafic volcanic rocks, and as stringer zones (Big Rambler Pond, East Mine and Ming Footwall). All the mineralized zones and ore bodies have been rotated and elongated parallel to the northeasterly, 030° plunging lineation. The massive sulphide bodies are composed primarily of pyrite with lesser concentrations of chalcopyrite, bornite, sphalerite, pyrrhotite, arsenopyrite, tetrahedrite, tennanite, cubanite and locally appreciable concentrations of gold and silver. In the Main Mine, pyritic portions of the ore body contained enough gold to be considered ore and coarse wire gold associated with bornite in chert was discovered on the 1700 foot level of the Ming Mine. About 500 tons of this ore was stoped and stockpiled underground where it still remains (Dimmell and Blagdon, 1994). Gold concentrations in the massive sulphide deposits are listed in Table 21.

The stringer sulphide deposits comprised both disseminated and stringer sulphide mineralization consisting of equal proportions of chalcopyrite–pyrite–pyrrhotite in a quartz–chlorite schist. These stringer zones do not contain appreciable concentrations of precious metals.

Within the Rambler area, gold mineralization occurs associated with: 1) structurally controlled base-metal-rich quartz veins (Stuckey and Uncle Hank), and 2) units of sulphide-bearing quartz–sericite schist (Footwall Zone, Uncle Theo and Hill Bog). The Stuckey and Footwall gold occurrences are discussed in detail in the following section.

Gold Mineralization

67. The Stuckey Vein Prospect

Location and Access

The Stuckey Vein (NTS 12H/16 Au046 UTM 566950E 5528500N) is an auriferous base-metal-rich quartz vein located approximately 1.6 km northeast of the Rambler Mill and 500 m south of the La Scie Highway. A muskeg trail leads to a trench that exposes the mineralization.

Local Geology and Mineralization

The Stuckey Vein (Plate 56) was discovered in the mid-1970s during regional mineral exploration of the Consolidated Rambler property and was first reported in a Department of Mines and Energy internal report by Tuach (1978). In 1997, Ming Minerals Incorporated exposed the vein with a single trench.

Plate 56. *View of the Stuckey Vein looking toward the East Mine headframe.*

The Stuckey Vein is localized within strongly deformed gabbro of the Pacquet Harbour Group (Plate 57). The gabbro displays the strong, northeast-trending, 35°-dipping, particle lineation and rodding common to the group in the Rambler area. The vein, which is developed subparallel to a north-south, steeply east-dipping shear zone, is up to 0.5 m wide and has been exposed by trenching over a strike length of approximately 8 m. The vein trends 015° and dips 80 to 85° to the east. Small east- and northwest-trending brittle faults cut the vein. Locally, the vein exhibits tight Z-shaped folds (Plate 57), which appear to plunge parallel to the particle lineation.

Deformed gabbro adjacent to the vein is overprinted by iron-carbonate alteration and locally disseminated pyrite is developed in the wall rock marginal to the vein. Large bull quartz veins are common in the area and abundant angular

Plate 57. *The Stuckey Vein, view to the north. The laminated nature of the vein and the Z-shaped folding or kinking is evident in the photograph.*

Plate 58. *Closeup of the Stuckey Vein illustrating the grey, sugary-textured quartz. Gold is visible in the small quartz fragment at the centre of the photograph just below and to the right of the scale. A small clot of chalcopyrite is present at the bottom of the photograph.*

Plate 59. *Section through the Rambler Main Zone as exposed in the Footwall Zone open pit. The grey rocks in the foreground are the silicified footwall. The massive sulphide outcrops next to the hammer. The sulphide body is intruded here by a massive diorite dyke (centre of photograph).*

quartz float is common, making it difficult to trace mineralized veins.

The vein material consists of glassy recrystallized quartz containing disseminations and patches of coarse galena and lesser chalcopyrite. The gold occurs as small clots within quartz and locally spatially associated with the sulphides (Plate 58). Assay results from the Stuckey Vein include channel samples collected over intervals of 1.8 feet (0.54 m) and 2 feet (0.60 m) that assayed 0.13 oz/ton Au and 0.43 oz/ton Ag and 0.18 oz/ton Au and 3.19 oz/ton Ag, respectively (Tuach, 1978). Grab samples of the altered gabbro adjacent to the vein collected by the author assayed 83 and 227 ppb Au.

69. Footwall Zone, Main Mine

Location and Access

The Footwall Zone (NTS 12H/16 Au048 UTM 566400E 5527100N) of the Main Mine is a silica–sulphide replacement-style of gold mineralization that outcrops approximately 200 m south-southwest of the Rambler Mill (Plate 59). A gravel road leads to the open pit from the Rambler Mill/Main Mine.

Local Geology and Mineralization

The earliest description of the Footwall Zone is taken from Baragar (1954) who described footwall rocks to the massive sulphide of the Rambler Vein as comprising both quartz–sericite and chloritic schists. He described the quartz–sericite schist as forming a vaguely layered sequence of varying thickness adjacent to the massive sulphide body, which interfingers laterally with, and is also underlain by, the chlorite schist. The contact with the chlorite schist is often gradational and is marked by zones of quartz–sericite–chlorite schist. Both the Footwall Zone and the massive sulphide body are intruded by diorite and other mafic dykes.

The Main Mine massive sulphides and the Footwall Zone occur within the crest of a northeast-trending, symmetrical anticline that plunges about 30° to the northeast. Both the quartz–sericite and chlorite schists and the massive sulphides exhibit the well-developed particle-mineral lineation prevalent in the Rambler area.

Disseminated pyrite and minor sphalerite is pervasive throughout the quartz–sericite schist (Plate 60). Immediately beneath the massive sulphide body, bands of fine- to medium-grained pyrite with chalcopyrite and sphalerite are common. In deeper portions of the Footwall Zone stringer sulphides, composed of fine- to medium-grained pyrite, fine- to medium-grained pyrite with chalcopyrite and sphalerite, and chalcopyrite and pyrrhotite, crosscut the foliation. Quartz veins with coarse clots of chalcopyrite are locally developed.

Plate 60. *Typical banded silicified and sericitic, sulphide-bearing schist from the Footwall Zone, Rambler Main Mine.*

The silicified portion of the Footwall Zone lying directly beneath the massive sulphide body contains significant gold concentrations (Bradley, 1997). Gold concentrations decrease with distance from the massive sulphide body. Higher gold values appear to correlate with: 1) increased concentrations of sphalerite and chalcopyrite, and 2) an increase in silicification and a decrease in sericite and chlorite. Fuchsite-rich zones, which occur locally within the quartz–sericite schist, typically contain lower gold concentrations. The gold is interpreted to be very fine grained, but coarse visible gold associated with quartz veining was intersected in the Rambler Joint Venture drilling. Visible gold was also reported from the discovery outcrop (Peter Dimmell, personal communication, 1997). Weick (1993) identified both electrum and gold telluride from auriferous Footwall Zone samples using a SEM. Both minerals were described as forming irregular to rounded and flattened grains that were interstitial to silicate and sulphide minerals.

In 1988, the Rambler Joint Venture carried out a detailed exploration program aimed at testing: 1) the extension of the Ming deposit at depth, 2) a high-grade gold zone within the hanging-wall rocks as reported in historical diamond drilling, and 3) the gold potential of the Footwall Zone (Coates, 1990b). Channel sampling and mapping of the original discovery outcrop of the Footwall Zone indicated an average gold content of 0.2 oz/t Au. The zone was tested with 34 diamond-drillholes and 5 hole deflections totalling 7834.9 m. Twenty holes were drilled to test the upper levels of the mine where historical drilling had reported high-grade gold in the hanging wall. The drilling failed to confirm the hanging-wall gold, but gold was identified in the Footwall Zone. The down-dip workings, between the 650 foot level and a depth of 1000 feet was tested with 10 holes totalling 3650.3 m. Gold and base-metal mineralization was intersected in most holes. The down-dip extension of the massive sulphide and Footwall Zone was tested at vertical depths of 1200 and 1700 feet with 4 diamond-drillholes and five deflections totalling 2734 m. These holes also encountered gold and base-metal mineralization (Coates, 1990b). Figure 39 is a location plan showing the distribution of diamond drilling conducted on the Main Zone/Footwall Zone by the Rambler Joint Venture. Assay results are presented in Table 24. A surface and borehole TDEM survey (10 holes) was conducted in the area of the Main Mine. Coates (1990b) reported that 7 of the holes returned intersection-type responses, two holes had off-hole type responses and one hole returned no response.

As a result of this work, the dimensions of both the massive sulphide body and the Footwall Zone were established (Coates, 1990b). The massive sulphide body has a maximum strike length of less than 100 m, an average thickness of approximately 4.57 m and plunges at between 30 to 35° from surface to a vertical depth of 1200 feet. The Footwall Zone, which lies up to 6.1 m beneath the massive sulphide body, has a maximum strike length of 30.5 m, an average thickness of 4.57 m and has been traced to a vertical depth of about 1800 feet. As a result of their exploration program, the Rambler Joint Venture felt that insufficient reserves and technical difficulties in mining beneath the old workings made the Footwall Zone uneconomic.

In 1994, Ming Minerals Incorporated completed a detailed diamond-drill program to define the near-surface reserves in the auriferous Footwall Zone and geological reserves of 32 000 tons grading 6.2 g/t Au were outlined (Dimmell *et al*., 1999). A minimum of 136 000 tonnes grad-

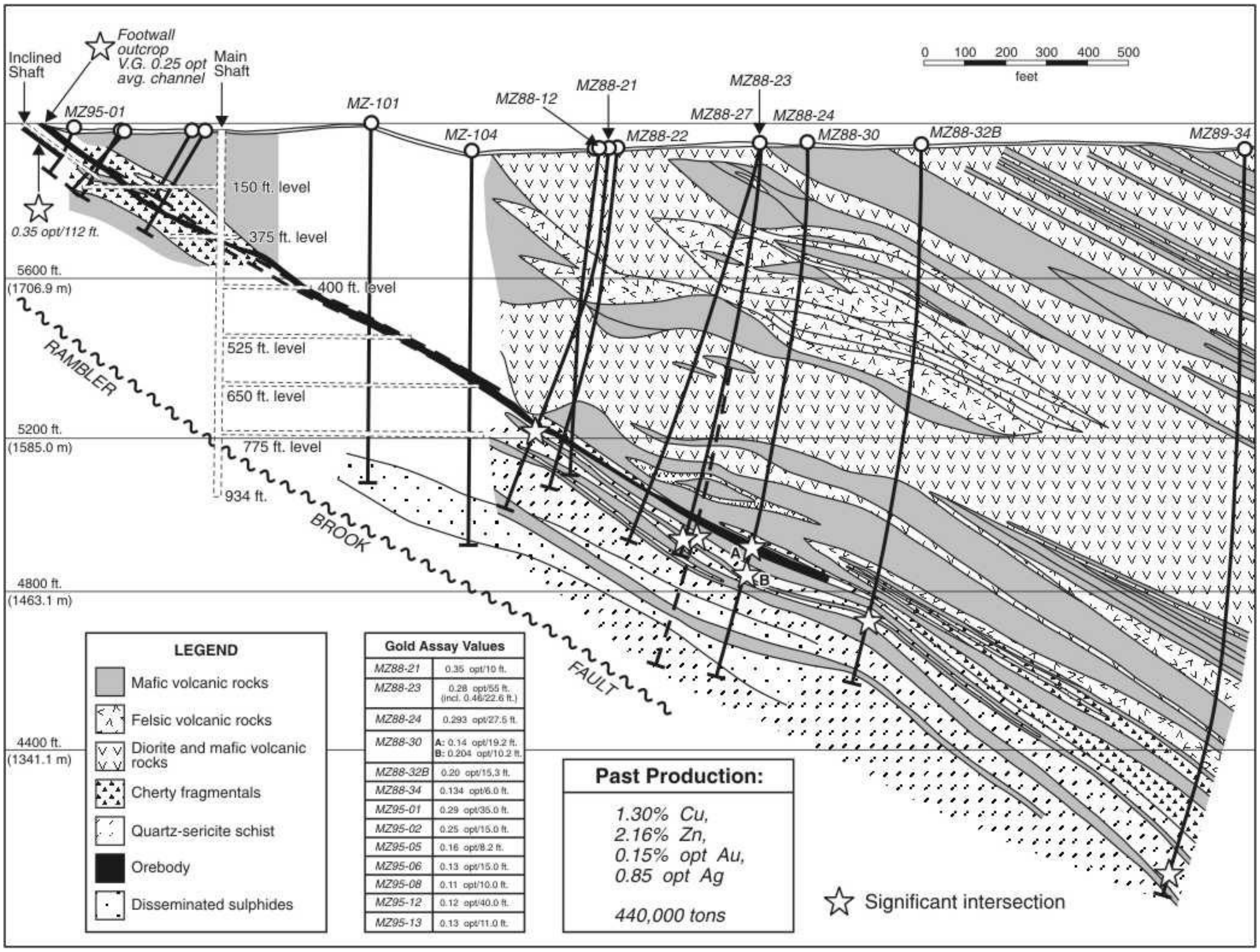


Figure 39. *Geological cross-section through the Footwall Zone/Rambler Main Mine; view to the north (*modified after *Dimmell* et al., *1999).*

ing 4.5 g/t Au and 1.5 percent Cu was inferred to the 800 foot level, with the potential for a total of 275 000 to 360 000 tonnes to the 1200 foot level (MacGillivray, 1995). A gold circuit was installed in the Rambler Mill and open pit mining of the Footwall Zone commenced in August, 1996 and continued until October, 1996 (Bradley, 1997). To recover the massive sulphide ore remaining in the crown pillar and to mine the Footwall Zone, the open stope beneath the crown pillar was backfilled and this was accomplished via a 300-m-long decline that was driven into the open stope. Low gold prices and lower than anticipated gold recoveries forced cessation of mining activities. Some of the ore recovered from both the Footwall Zone and the crown pillar is stockpiled near the Rambler Mill and provides excellent examples of both ore types.

RAMBLER SOUTH AREA, BAIE VERTE MAP AREA (NTS 12H/16)

Exploration History

The earliest mineral exploration within the southern lobe of the Pacquet Harbour Group appears to have been undertaken by Advocate Mines Limited during the 1960s and Kerr-Addison Mines Limited in the early 1970s. During the 1960s and 1970s, Consolidated Rambler Mines Limited conducted a regional base-metal exploration program within the southern portion of the Pacquet Harbour Group. This work, which included prospecting and geological and geophysical surveys, failed to identify any significant mineral-

Table 24. Diamond-drillhole assay results, Main Zone, Rambler (Coates, 1990b)

Hole Number	Intersection (m)	Au (oz/ton)	Cu (%)	Zn (%)
MZ88-5A	2.71 0.76	0.125 0.148	0.21 7.44	0.34 0.14
MZ88-6	3.32 8.84	0.151 0.06	0.42 1.52	1.09 0.33
MZ88-10	1.58	0.12	1.7	1.11
MZ88-16	0.46 1.31	3.23 0.45	0.82 1.45	0.14 0.50
MZ88-18	4.88	0.19	0.08	0.8
MZ88-19	3.38	0.12	0.6	1.85
MZ88-21	2.37	0.09	1.85	4.4
MZ88-22	4.72	0.08	1.46	0.3
MZ88-23	4.24 5.97 6.89	0.07 0.26 0.46	0.35 0.74 0.36	1.14 0.02 0.02
MZ88-24	8.38 7.32	0.29 0.07	0.61 0.33	0.02 0.02
MZ88-25	5.67	0.1	0.91	2.15
MZ88-26	6.07	0.06	0.59	7.39
MZ88-27	1.71 4.54	0.10 0.09	0.69 1.57	5.73 0.10
MZ88-28	5.43	0.14	0.36	1.2
MZ88-30	4.33 3.11	0.17 0.20	 0.06	 0.01
MZ89-32B	5.09 4.66	0.07 0.20	0.15 0.15	1.26 0.58
MZ89-32C	3.81 6.95	0.08 0.11	0.03 0.09	1.50 1.26
MZ89-32D	4.12 2.01	0.02 0.02	0.04 0.14	1.71 1.09
MZ89-33B	4.48 3.17 2.13	0.04 0.01 0.09	0.17 0.92 0.06	1.02 0.07 0.01
MZ89-33E	2.53 2.23	0.03 0.14	0.21 0.96	2.37 0.61
MZ89-34	2.32	0.13	0.05	0.38

ization. However, during the 1970s, prospecting along the new woods roads south of Rambler Mines, by geologists Tom Lever and John Tuach, revealed 4 copper occurrences referred to as the Lever-Tuach showings. Noranda Exploration Company Limited optioned the Lever-Tuach property and completed geological, geophysical and geochemical surveys over the area (Nash, 1977). No further mineralization was discovered and mineralized float found in the area was interpreted to have originated from the Rambler Mine area. The Lever-Tuach property was subsequently acquired by Ionex Limited and a detailed exploration program consisting of trenching and four diamond-drillholes was undertaken (Lever, 1978).

In the late 1970s, the southern Pacquet Harbour Group was included in regional base-metal mineral exploration surveys conducted by Amoco Canada Limited. The company carried out soil and stream geochemical surveys and prospecting, but failed to identify any new occurrences (Kacira *et al*., 1977; Donovan, 1978). In 1982, the Iron Ore Company of Canada carried out detailed geological mapping and prospecting of the Gull Pond area and a number of base-metal showings were discovered as a result of this work. Two diamond-drillholes tested the showings, but only disseminated pyrite was intersected and the claims were later dropped (Kerr and Collins, 1983).

During the early 1980s, the focus of exploration shifted to include gold mineralization. West Coast Ventures Limited carried out soil geochemical, geophysical and geological surveys in the area south of Big Rambler Pond (Hinchey, 1987, 1988). This work identified a number of gold and copper soil anomalies but there is no record of these being followed up.

In 1986 and 1987, Canaustra Gold Exploration (later known as Cliff Resources and then Canadian Giant Exploration Limited) staked the old IOC property and conducted an extensive exploration program consisting of geophysics, soil geochemistry, geological mapping, prospecting, trenching and diamond drilling, which resulted in the discovery of the Twin Pond (Tie Line) gold and base-metal property (Bradley, 1987, 1988b; Al, 1989b). Much of the property was subsequently staked by Allan Cramm and Pearce Bradley (Cramm, 1993) and in 1993 it was optioned to Phelps Dodge Corporation of Canada (Jagodits, 1994; Stewart, 1995).

In 1987, Lacana Exploration (1981) Incorporated staked five contiguous claim blocks to the north of the Gull Pond area and conducted reconnaissance geological mapping, prospecting and a soil, silt and stream-sediment sample geochemical survey program (Chance, 1988) and prospecting resulted in the discovery of the FDR showing by prospector Fred Denis. In 1988, an Aerodat EM and Magnetic survey covering the entire property was flown and Corona Corporation (formerly Lacana) conducted detailed geophysical, geochemical and geological surveys in the area of the FDR showing (Dimmell, 1989). This work resulted in the discovery of the WJ-660 and the Brass Buckle gold occurrences. The Brass Buckle was trenched and tested by 7 diamond-drillholes. In 1989 and 1990, Corona Corporation undertook further geochemical and geological surveys of the Rambler South Property and carried out a remote sensing study aimed at identifying major structural features (Dimmell and MacGillivray, 1991b). The remote sensing study involved combining digitized airborne geophysical data with Synthetic Aparture Radar Data (SAR) Imagery. A number of small copper and gold–copper occurrences were discovered during this phase of exploration. Also in 1990, Corona Corporation conducted reconnaissance geochemical surveys over the western portion of the property that outlined a gold anomaly associated with the hornfelsed contact zone in the Pacquet Harbour Group adjacent to its contact with the Burlington granodiorite (Dimmell, 1992)

Corona Corporation relinquished the mineral rights to the property and the Brass Buckle area was subsequently staked by Sam Blagdon. Krinor Resources Incorporated acquired the mineral rights to the area immediately west of the Brass Buckle property and by 1993, Krinor had entered into a joint venture arrangement with Blagdon. In 1993, Krinor conducted minor follow up biogeochemical and geophysical surveys over the western portion of the property (Dimmell, 1993). In 1994, the property was optioned by Major General Resources Limited and the company completed geophysical surveys and a limited diamond-drill program. By 1996, Major General Resources Limited had dropped its option and the area was held by Maple Mark International Incorporated.

Regional Geology

The Rambler South Property is underlain by volcanic and volcaniclastic rocks of the southern lobe of the Pacquet Harbour Group (Figure 40; DeGrace *et al*., 1976; Hibbard, 1983). To the south and east, the southern lobe is intruded by the Burlington granodiorite. In the northwest, a narrow tongue of the granodiorite almost severs the southern lobe from the remainder of the Pacquet Harbour Group. Along its northeastern margin, the southern lobe is intruded by the Cape Brule Porphyry and is unconformably overlain by the Cape St. John Group.

The internal stratigraphy of the southern lobe of the Pacquet Harbour Group has not been established. Hibbard (1983) indicated that much of the area was underlain by mafic rocks, dominantly pillow lava (commonly variolitic) and pillow breccia. Thin units of felsic pyroclastic rocks

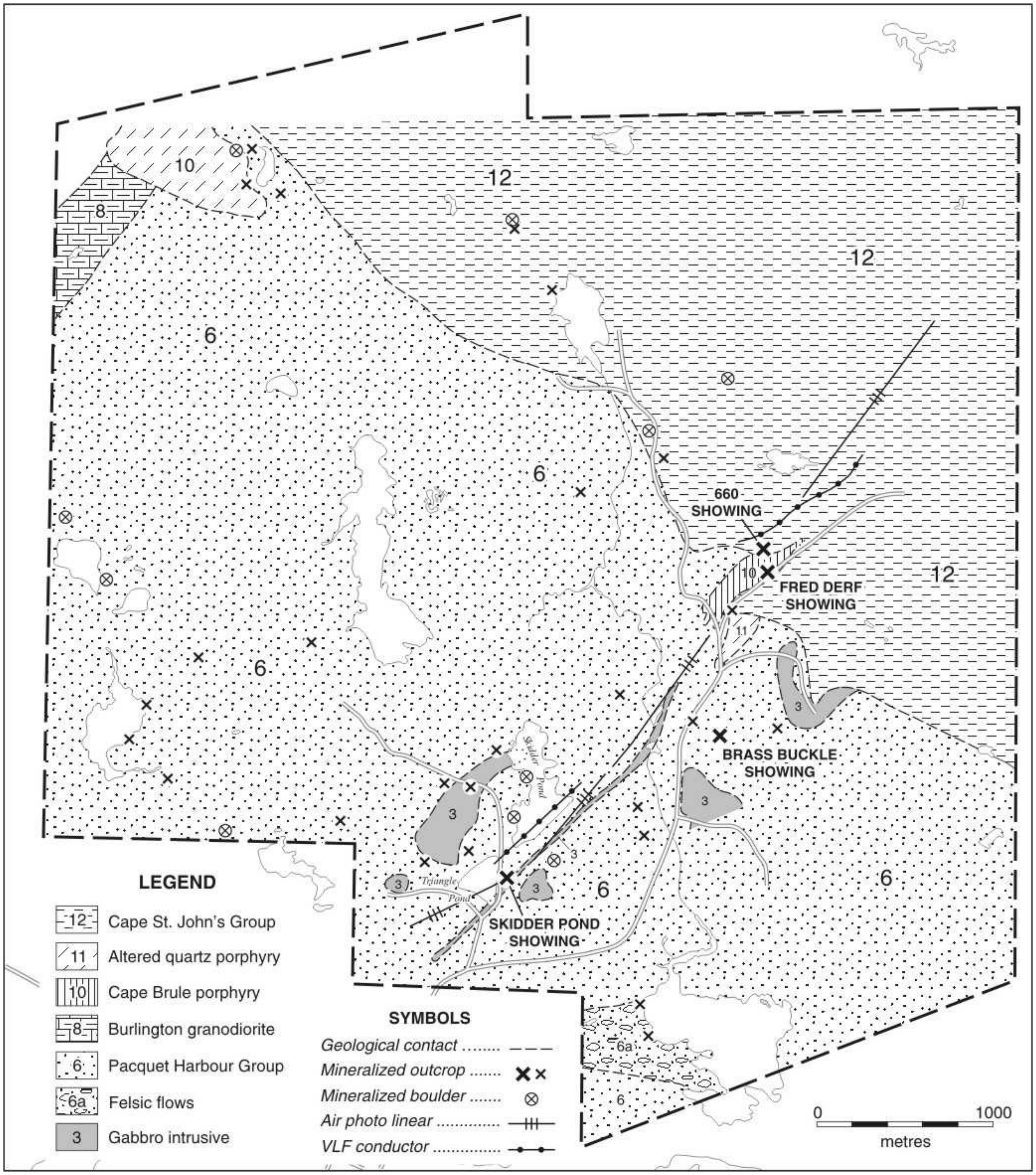


Figure 40. *Geological map of the Rambler south area showing distribution of gold occurrences (*modified after *Dimmell and MacGillivray, 1991b).*

outcrop in the area west of South Yak Lake and massive layers up to 3 m thick, possibly representing felsic flows, outcrop in both the South Yak Lake and Gull Pond areas. DeGrace *et al*. (1976) reported that units of thick-bedded, reworked green tuff with minor chert also occur in the South Yak Lake area.

Kerr and Collins (1983), who carried out detailed geological mapping of the Gull Pond area for the Iron Ore Company of Canada, indicated that the pillow basalts and breccias are dominantly tholeiitic in composition, whereas high Mg-lavas appeared to be more common to the south. Hibbard (1983, page 93), reported that A. Kerr, in a personal communication, noted that "...the high magnesian lavas weather bright emerald green in contrast to the pale green weathering tholeiites". Kerr and Collins (1983) also reported that the felsic rocks, which typically contain abundant quartz phenocrysts and locally exhibit fragmental textures, occur as small lenses associated with the high Mg-basalts and mafic volcaniclastic rocks. Small lenses of mafic epiclastic rock and chert and magnetite–epidote-rich layers occur locally and are interpreted to represent metamorphosed iron-formation.

Intrusive rocks in the southern Pacquet Harbour Group consist of fine- to medium-grained diabase and medium- to coarse-grained gabbroic dykes, which are interpreted to be part of the volcanic sequence. Locally, the group is intruded by dykes of Burlington granodiorite and Cape Brule Porphyry and also by felsic dykes related to the Cape St. John Group.

Rocks within the southern lobe appear to strike northeast and dip to the southeast. The southern lobe typically exhibits a northerly dipping, east-trending penetrative fabric. Rare facing directions (Hibbard, 1983), indicate that the sequences are northeast facing and all units have been metamorphosed in the lower greenschist facies. The volcanic rocks adjacent to the large plutons, particularly the Burlington granodiorite, are typically hornfelsed over a distance of several hundred metres.

Gold Mineralization

85. The Brass Buckle Trend

Location and Access

The Brass Buckle Trend is located within the southern lobe of the Pacquet Harbour Group approximately 5.5 km east of Gull Pond. The area is accessed by abandoned forestry roads that originate from both the La Scie (Route 414) and Burlington (Route 413) highways. The most significant gold occurrence within the Brass Buckle Trend is the Brass Buckle prospect (NTS 12H/16 Au064, UTM 571200E 5522050N), which is an auriferous quartz–pyrite vein.

Local Geology and Mineralization

The Brass Buckle Trend (Figure 41) is defined by a regionally extensive northeast-trending linear observed from aerial photography and the Synthetic Aparture Radar Data (SAR) Imagery (Dimmell and MacGillivray, 1991b). The trend extends from south of Triangle Pond northeastward for approximately 6 km and has coincident VLF-EM conductors and apparent resistivity anomalies. Six gold occurrences, the WJ-660, the FDR, the Brass Buckle, the BBS, the BBT and Skidder Pond, and a number of alteration zones are spatially associated with the linear.

The Brass Buckle Trend is underlain mainly by mafic volcanic rocks (fine-grained massive flows, pyroclastic rocks, chlorite and quartz–chlorite schists) of the Pacquet Harbour Group (Figure 41). Quartz–feldspar porphyritic felsic breccia outcrops at the Brass Buckle prospect and both mafic and felsic units are intruded by both diabase dykes and gabbroic dykes and plugs.

To the north, in the area of the WJ-660 (Figure 40) gold occurrence, the trend is underlain by felsic to intermediate volcanic rocks of the Cape St. John Group, which unconformably overlie the Pacquet Harbour Group. South of this contact, elongate, northeast-trending units of aphanitic felsic porphyry and quartz–feldspar porphyry intrude the Pacquet Harbour Group and are host to the FDR showing. These rocks are interpreted to be dykes related to the Cape St. John Group (Dimmell, 1989). Farther south, the Pacquet Harbour Group is intruded by a sill of equigranular Burlington granodiorite, which is up to 90 m thick, and extends from south of Skidder Pond northeastward parallel to the Brass Buckle Trend and is host to the Skidder Pond showing (Figure 40).

Dimmell and MacGillivray (1991b) reported that the volcanic rocks generally lacked any distinctive measurable structural features. The locally prominent schistosity in the mafic volcanic rocks is northeast trending and vertical to steeply northwest dipping. Locally, northwest-trending vertical schistosities were observed.

Of interest to explorationists is a zone of alteration developed within felsic volcanic rocks of the Cape St. John Group approximately 700 m north of the Brass Buckle prospect. The alteration, which is exposed in a trench on the east side of the forest access road, comprises pervasive green-yellow silicification and sericitization. The rock is aphanitic, but locally contains small patches of bright green fuchsite. The rock is visually similar to the massive pyro-

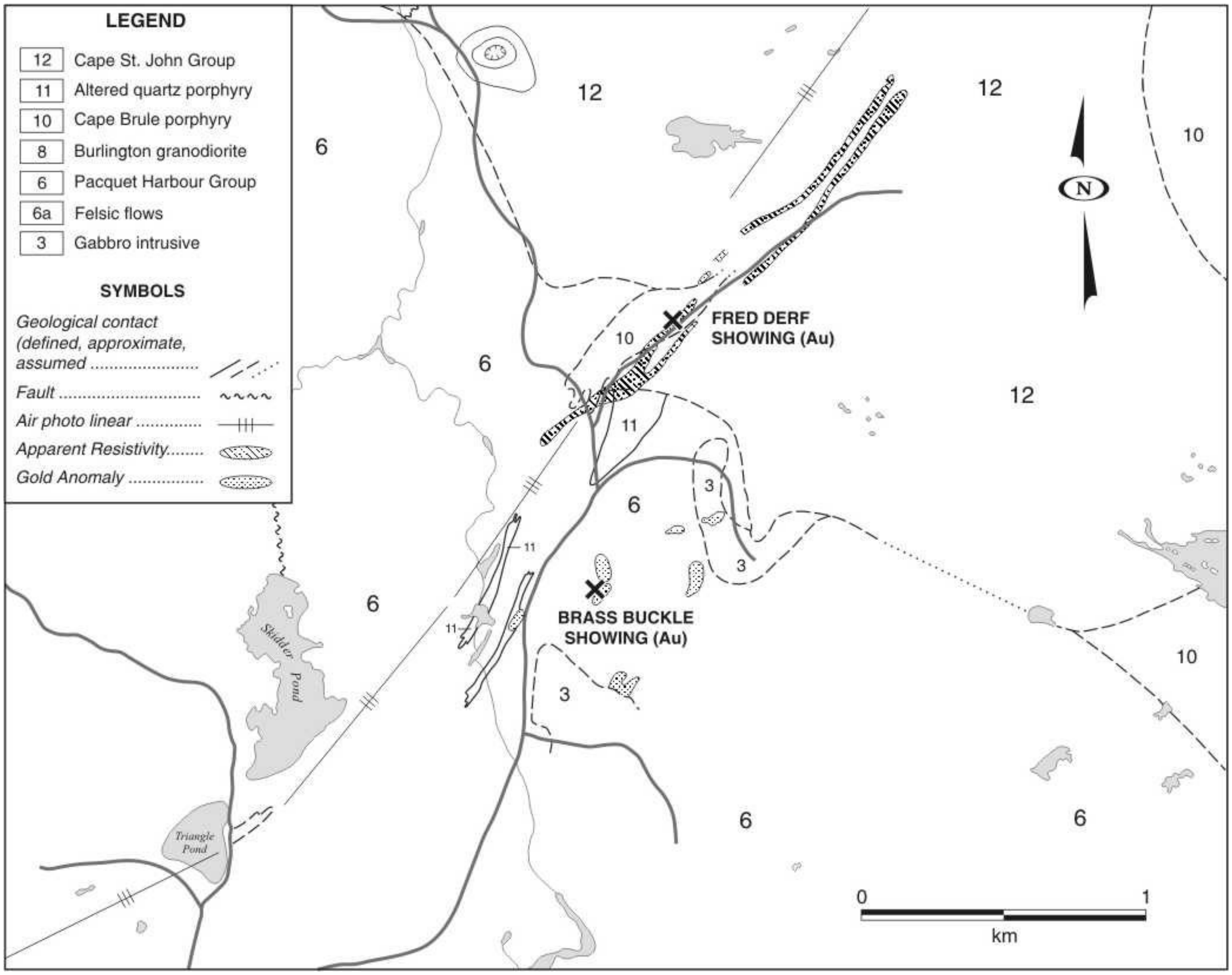


Figure 41. *Geological map of the Brass Buckle Trend area showing the gold occurrences, geophysical anomalies and air photo linears (*modified after *Dimmell and MacGillivray, 1991b).*

phyllite from the Fox Trap Mine within the Avalon High Alumina Belt on the Avalon Peninsula.

The most significant mineralization exposed along the Brass Buckle Trend is the Brass Buckle prospect. The mineralization was discovered during geological mapping to the south of the WJ-660 and FDR showings by geologists Wilson Jacobs and Gilbert Wong. The showing derived its name from a brass belt buckle given to Wilson Jacobs by prospector Alex Turpin. In return, Jacobs said he would name the next showing in honour of the buckle that had originated from an American sailor who had been involved in the USS Pollux and Truxton disaster near St. Lawrence on the Burin Peninsula during the Second World War.

Initial grab samples collected from a pyritic gossan zone (Plate 61) developed along the contact between mafic volcanic rocks and a quartz–feldspar porphyry assayed up to 54.9 g/t Au (Dimmell, 1989). A subsequent investigation revealed visible gold within the gossanous weathered portion of a quartz–carbonate–pyrite vein. The gold is only visible where the pyrite cubes are oxidized leaving only the outline of the cube preserved and coarse gold flakes, up to 5 mm across, were found in the soil covering the gossan. The initial survey identified visible gold at three locations over a 20 m strike length and samples collected from the zone assayed up to 272.1 g/t (7.9 oz/t). The gold-enriched samples were also found to have elevated concentrations of Te (up to 21 ppm), Bi (up to 284 ppm), Ag (up to 10.5 ppm), Cu and Ba. The area was trenched and further sampling identified gold mineralization for up to 60 m along strike to the northeast (Table 25; Figures 42 and 43). On surface, the mineralized quartz vein is milky-white, sugary-textured and trends about 030° and dips 55° to the west. It contains abun-

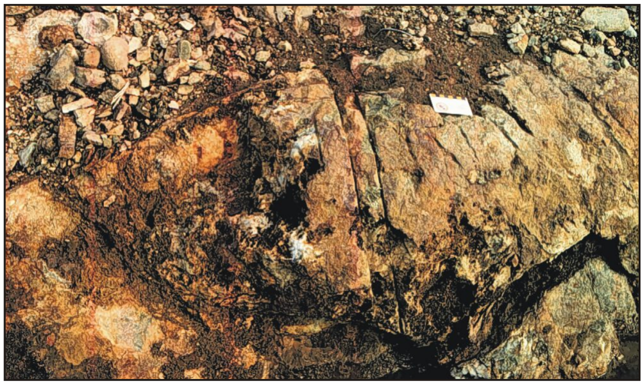


Plate 61. *Oblique view of the Brass Buckle vein illustrating the weathered pyrite. Visible gold is restricted to the oxidized pyrite exposed on surface.*

dant coarse-grained pyrite occurring as disseminations and coarse clots (Plate 62), which gives the vein a weakly laminated appearance. In outcrop, the vein appears to be hosted by silicified, white-weathering, quartz–feldspar porphyry.

Geological mapping revealed that the mineralized quartz vein was emplaced along the sheared contact between mafic volcanic rocks of the Pacquet Harbour Group and a quartz–feldspar porphyry dyke. A subsequent investigation of the felsic unit by the author identified numerous angular fragments indicating that the unit was possibly a felsic breccia. The quartz–feldspar porphyry outcrops in a horseshoe shaped pattern, which suggests a fold open to the northeast (Figure 42).

In February, 1989, the Brass Buckle prospect was tested with 7 diamond-drillholes totalling 648 m. The drilling confirmed the presence of high-grade gold mineralization associated with narrow quartz veins containing semi-massive and disseminated pyrite (Plate 63). Assay results from the drill program are presented in Table 26.

The diamond drilling, which has tested the mineralization over a 90 m strike length, revealed that the gold-bearing veins are associated with a gabbroic dyke rather than to the mafic volcanic rocks (Figure 44a). The dyke is fine to medium grained and drill thicknesses vary from less than 5 m in BB-89-01 to greater than 20 m in hole BB-89-03, indicating that the gabbroic unit widens to the north. The gabbro crosscuts both the quartz–feldspar porphyry and the mafic volcanic units. The mineralized quartz veining, which is developed along the sheared contacts between the dyke and both the quartz–feldspar porphyry and the mafic volcanic rocks, appears to dip up to about 65° to the west. Both hangingwall and footwall contacts are mineralized over widths up to 3 m. Gold concentrations within the contact zones range from less than a 100 ppb up to 242.5 g/t in hole BB-05-89, with the best values corresponding with the heaviest concentrations of pyrite. The anomalous gold outside of the pyritic quartz veins is related to small quartz–calcite–pyrite veinlets that range from 3 to 6 mm in width. The higher grade veins vary from 10 to 30 cm in width and contain between 40 to 80 percent semi-massive and coarse aggregate pyrite and minor chalcopyrite. The immediate wall rock adjacent to the veining contains up to 10 percent disseminated and fracture-filled pyrite.

The gabbro adjacent to the veining is generally cleaved and weakly chloritized and epidotized. Alteration in the mafic volcanic rocks comprises silicification and moderate epidotization. Quartz and calcite occurs as fine veinlets and fracture filling within the volcanic rocks. The quartz–feldspar porphyry, which is typically pink-grey, varies form pink-orange to pink-brown and pale grey-green due to sericitization adjacent to the mineralization. In altered sections, the porphyry is cut by sericitic and chloritic fractures and locally contains minor disseminated and stringer pyrite.

Major General Resources Limited optioned the Brass Buckle Property in 1994 (Table 27), relogged the 1989 drillcore and completed a 2 km IP survey. In late 1995, a five-hole, 554-m diamond-drill program was completed to test the Brass Buckle prospect and its extensions (Hartley, 1996). This program was designed to follow up the 1989 drill program completed by Corona Corporation and to test gold in soil and IP anomalies. Magnetic and VLF-EM surveys were also completed over the Brass Buckle prospect prior to drilling. The drill program confirmed the gold–mafic dyke association and indicated that the gold mineralization was continuous down-dip, but not along strike to the northeast. Gold concentrations were generally low (Table 27).

THE DEER COVE AREA, FLEUR DE LYS MAP AREA (NTS 12I/01)

Exploration History

Noranda Exploration Company Limited focused on the Deer Cove area as a result of favourable geology and a high Au value obtained during the regional lake-bottom geochemical sampling project conducted by the Newfoundland and Labrador Department of Mines and Energy. The area was staked in July, 1984 and by 1985, exploration was focusing on the Deer Cove valley, an area underlain by talc–carbonate-altered ultramafic rocks. Tills in this area contained abundant, delicate gold grains (Graves, 1986). Trenching failed to explain the gold grains and the focus of exploration shifted to the sequence of volcanic rocks lying above the Deer Cove Thrust. In June, 1986, Noranda prospectors discovered spectacular visible gold associated

Table 25. Grab and channel sample assay results from the Brass Buckle prospect (Dimmell, 1989)

Sample	Width	Au ppb	Sample	Width	Au ppb
WJ-684	Grab	226 500	BB-006B	1.0 m	1090
BB-001A	0.5 m	269 200	BB-006C	1.0 m	1930
BB-001B	0.5 m	630	BB-006D	1.0 m	1640
BB-003A	1.0 m	9 230	BB-006E	1.0 m	1330
BB-003b	1.0 m	4 320	BB-008A	1.0 m	320
BB-004A	1.0 m	26 500	BB-008B	1.0 m	7480
BB-004b	1.0 m	47	BB-008C	1.0 m	9300
BB-006A	1.0 m	41			

Plate 62. *Closeup of the Brass Buckle vein showing abundant coarse pyrite within milky-white recrystallized quartz.*

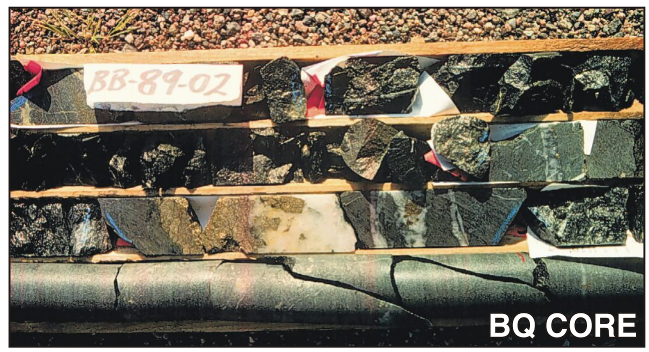


Plate 63. *Coarse pyrite-bearing quartz vein developed at the contact between a gabbroic dyke and mafic volcanic rocks, diamond-drillhole BB-89-02 Brass Buckle prospect. The 30 cm interval assayed 17.25 g/t Au.*

with brecciated quartz veins. On August 31, 1987 Noranda signed an option and joint venture agreement with Galveston Resources Limited. Between 1986 and 1989, Noranda conducted an extensive exploration program on the Deer Cove area that included prospecting, geological mapping, geochemical and geophysical surveys, trenching, diamond drilling (138 holes on the Deer Cove grid), construction of a 7.2 km access road and underground exploration (Gower *et al*., 1990).

As part of an attempt to determine the source of the abundant gold grains within the Deer Cove Valley tills, Noranda commissioned Mike Milner to undertake a study to: 1) determine the source area of this gold, 2) describe the geomorphology, 3) test the placer potential of the area, and 4) to confirm the direction of ice movement during the last period of glaciation (Gower, 1987). The results of this survey revealed that the Deer Cove area had a complex history of glaciation and marine transgression. The valley is host to two tills. A locally preserved, lower gravelly till of variable thickness. The lower till is overlain by a 0.5- to 1.0-m-thick unit of marine clay, which contains abundant well-preserved marine seashells. This clay is overlain by a second till, up to 3.5 m thick, which is dominated by angular ultramafic blocks, lesser granitic boulders and abundant broken shell fragments. The presence of the shell fragments and abundant ultramafic boulders indicated that the tills, and hence the gold, were locally derived. The ice-flow direction, was determined from pebble orientations and striations, at between 035° and 055°. Trenching was carried out to the southwest in the vicinity of Normans Pond, but the source of the gold was not determined. The study also reported that the placer gold potential of the valley was limited by the rugged topography and potential difficulties in separating the marine clay from the tills.

In 1987, Noranda Exploration Company Limited initiated an extensive exploration program in the Normans Pond area (Gower, 1988) that included, the establishment of the Normans Pond grid, soil sampling and prospecting surveys and a trenching program. In 1988, the grid was extended and

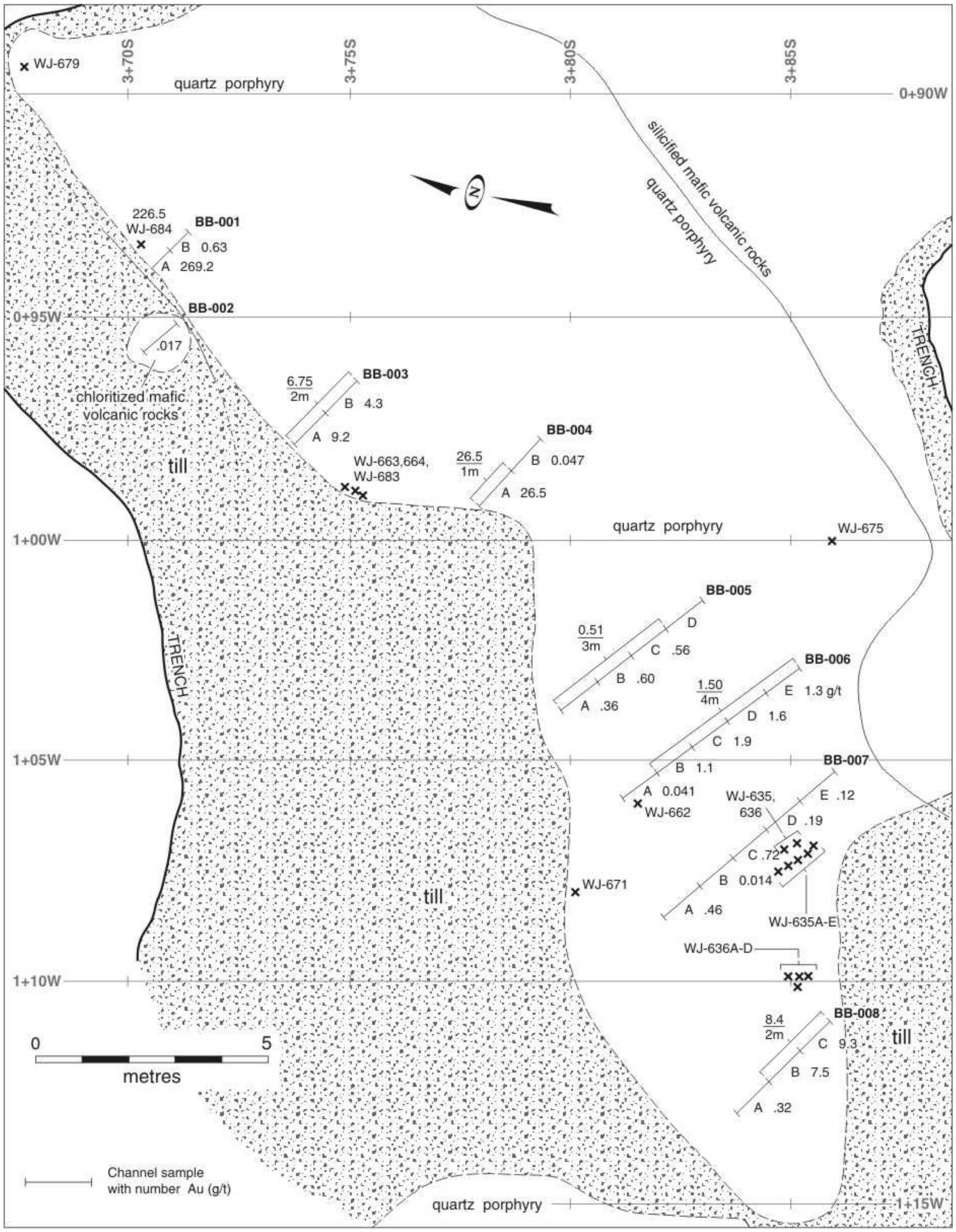


Figure 42. *Trench map of the Brass Buckle prospect showing channel-sample locations and assay results (*modified after *Dimmell, 1989).*

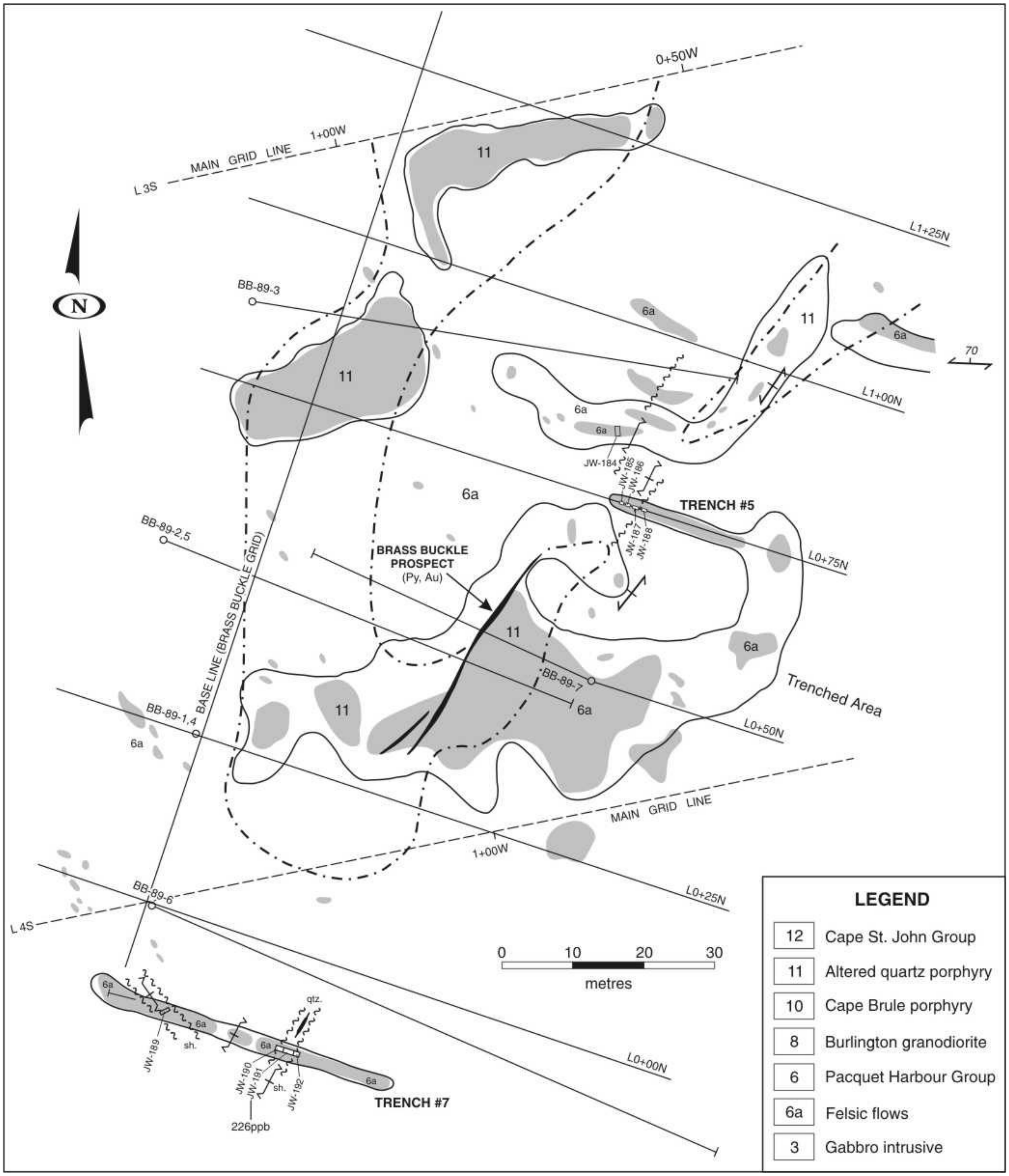


Figure 43. *Geological map of the Brass Buckle prospect showing diamond-drillhole locations (*modified after *Dimmell and MacGillivray, 1991).*

Table 26. Assay results from diamond drilling at the Brass Buckle prospect (Dimmell, 1989)

Hole	Interval (m)	Width (m)	Au (g/t)
BB-01-89	27.3-27.8 57.6-58.9	0.5 1.3	5.39 0.51
BB-02-89	29.6-29.9	0.3	17.25
BB-03-89	19.0-20.3 21.5-21.6 43.4-44.55 44.3-44.55 48.0-50.0	1.3 0.1 1.15 0.25 2.0	3.72 42.00 24.7 109.0 1.00
BB-04-89	32.5-33.2 41.85-42.0	0.7 1.15	2.34 202.3
BB-05-89	33.6-33.85	0.25	242.5
BB-06-89	35.8-35.9 110-115 115.5-116	0.1 5.0 0.5	4.1 1.7 1.4
BB-07-89	No significant assays		

Table 27. Diamond-drill assay results, Major General Resources Limited, Brass Buckle Property (Hartley, 1996)

Hole	Interval	Assay Results
Brass Buckle Prospect		
BBO-95-08 BBO-95-09	58.4-58.8 m 77.2-77.5 m 81.8-82 m	1778 ppb 1227 ppb 5198 ppb
Brass Buckle Northeast Strike Extension		
BBO-95-10	No significant assays	
Regional Gold Soil Anomalies		
BBO-95-11 BBO-95-12	No significant assays	

soil geochemical, gold-grain analysis, mapping, prospecting and magnetometer and VLF-EM surveys were conducted. Soil and bedrock gold anomalies were trenched resulting in the discovery of the Fox Pond prospects.

On February 6, 1995, Noranda transferred the minerals rights for the Deer Cove property to Hemlo Gold Mines Incorporated and subsequently on September 13, 1996 to Battle Mountain Canada Limited. The mineral rights reverted to Noranda on January 28, 1998. No exploration work resulted from these transfers and the property reverted to the Crown on November 11, 1998. The area surrounding the Main Zone and the Deer Cove talc resource was made an Exempt Mineral Land when the remaining ground was staked by Canaco Resources Incorporated. A call for proposals to develop the property was issued (Government of Newfoundland and Labrador, Call for Proposals, 1999) and on May 25, 1999 it was announced that the mineral rights to the Exempt Mineral Land had been awarded to WMC International Limited (Ministerial Statement, May 25, 1999). The area subsequently reverted to Crown Land and the Deer Cove area was staked in 2001 by South Cove Ventures Inc.

Regional Geology

The Deer Cove area is underlain by rocks of the Point Rousse Complex, which comprises a complete, but dismembered ophiolite suite and its conformable volcanic and volcaniclastic cover rocks (Hibbard, 1983). The structure, stratigraphy and geochemistry of the ophiolitic rocks on the Mings Bight Peninsula were examined as part of an M.Sc. thesis by Norman (1973) and a detailed study of the ophiolitic rocks was undertaken by Kidd *et al.* (1978). The Point Rousse Complex outcrops in a broad but structurally modified, east-trending synclinorium, with ophiolitic plutonic components occupying the northern and southern limbs and cover sequence rocks underlie the central portion of the peninsula.

The complex is tectonically bounded and internally can be subdivided into five discrete fault-bound blocks (termed the Western, Eastern, Ming's, Point Rousse, and Deer Cove blocks), which are bounded by major sole thrusts (Figure 45; Norman and Strong, 1975). The sole thrusts typically strike east-northeast and dip 50 to 60° north-northwest. Generally, the complex exhibits a weakly developed, moderately northwesterly dipping, penetrative cleavage that locally intensifies within thrusts and shear zones. The south-verging thrust faults are interpreted to be either cogenetic or later than the cleavage, to predate the high angle faults, and are related to Siluro-Devonian emplacement of the Point Rousse Complex southward over the Pacquet Harbour Group (Hibbard, 1983). Minor faults, which both predate and postdate the sole thrusts, are common with orientations typically trending 060°, 140° and 170°. Rocks within the complex have been metamorphosed within the greenschist facies.

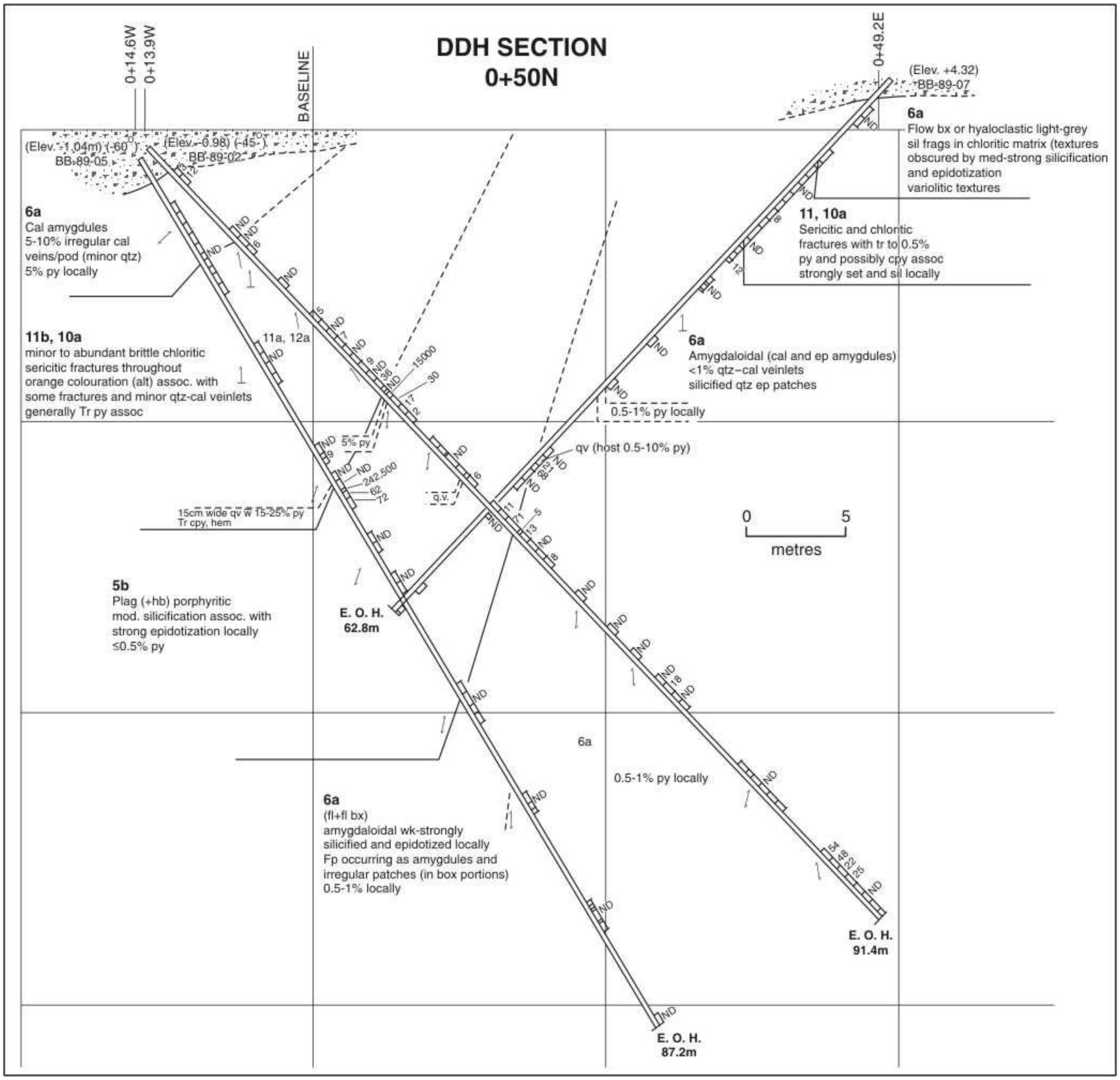


Figure 44a. *Diamond-drill section 0+50N, Brass Buckle prospect, drillhole location is shown on Figure 42 (*modified after *Dimmell, 1989). Au values are in ppm.*

Gold Occurrences

90-91. Deer Cove Block

Location and Access

Approximately two dozen gold occurrences have been located within the Deer Cove block to the north of the Deer Cove Sole Thrust and most of these occur within the mafic volcanic cover sequence (Figure 46; Plate 64). Two of these occurrences, the Main Zone (NTS 12I/01 Au001 UTM 568450E 5540900N) and the AK-2 Zone (NTS 12I/01 Au002 UTM 568475E 5541200N) are auriferous quartz–pyrite veins and are discussed below; the remainder are listed in Appendix 1.

Local Geology and Mineralization

The Deer Cove (structural) block consists of an overturned, south-facing ophiolite, capped by mafic volcanic

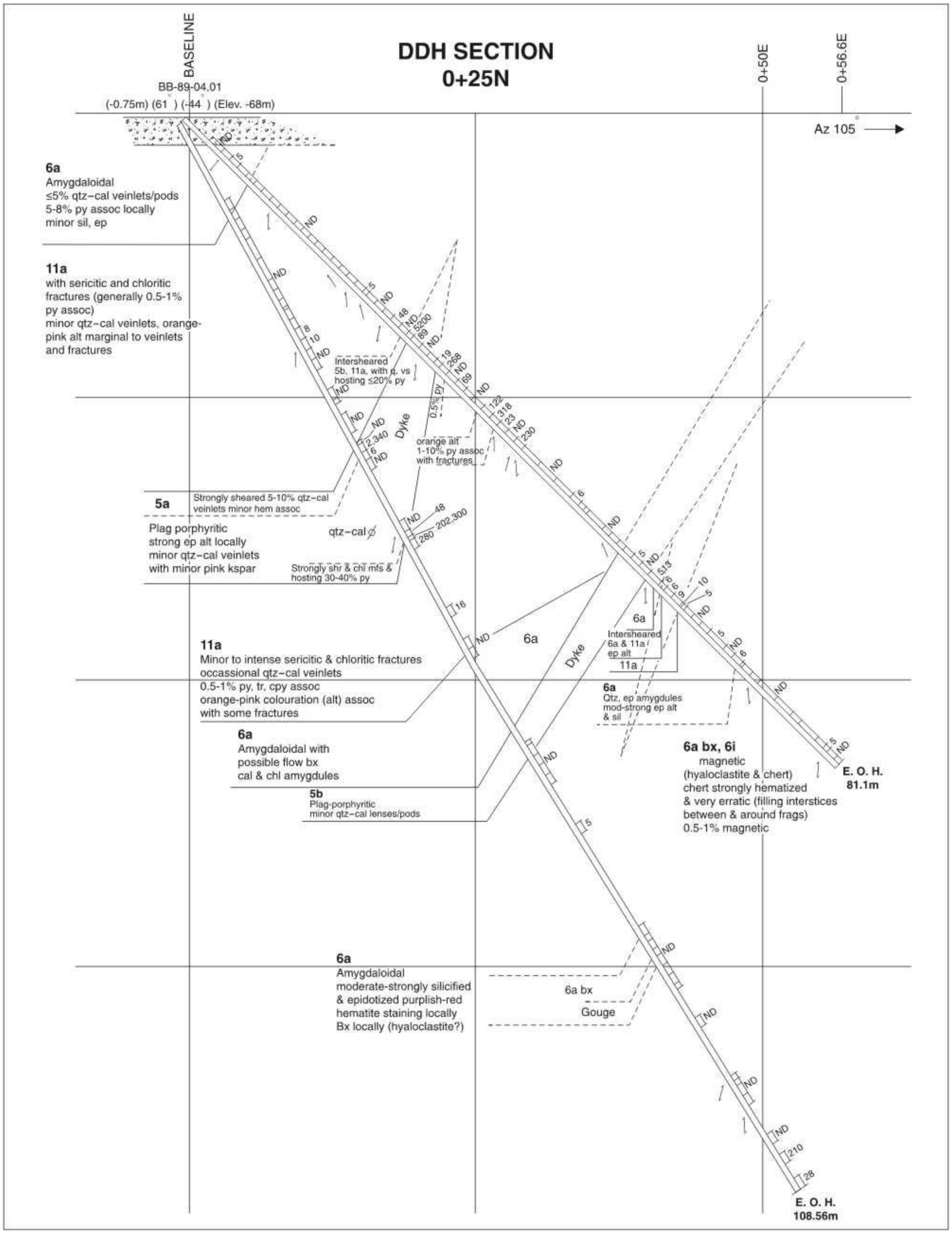


Figure 44b. *Diamond-drill section 0+25N, Brass Buckle prospect, drillhole location is shown on Figure 42 (*modified after *Dimmell, 1989). Au values are in ppm.*

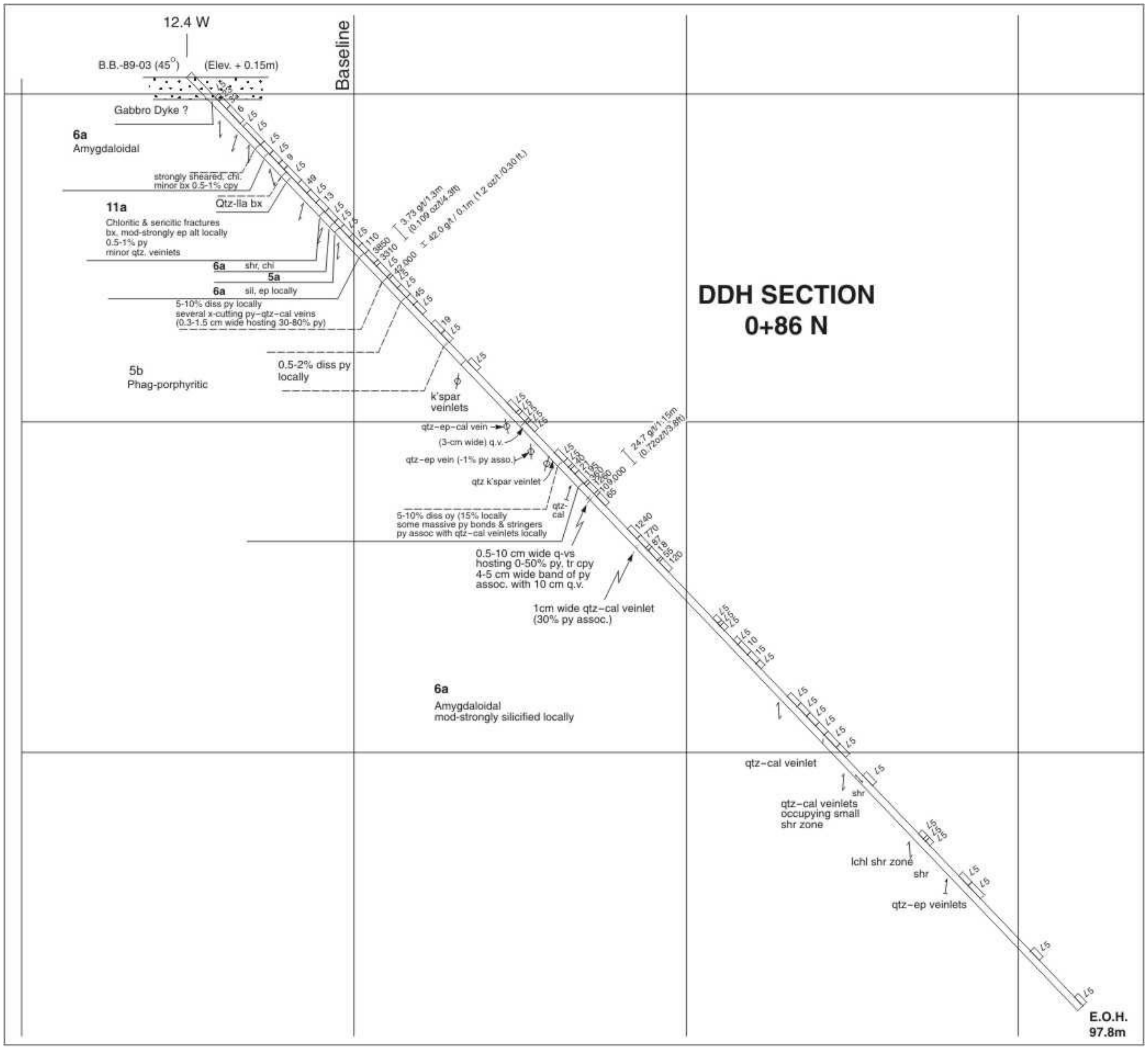


Figure 44c. *Diamond-drill section 0+80N, Brass Buckle prospect, drillhole location is shown on Figure 42 (*modified after *Dimmell, 1989). Au values are in ppm.*

rocks, which is faulted to the south against ophiolitic rocks of another structural block (Figure 45). The zone of juxtaposition is marked by tectonic melange and a significant fault zone termed the Deer Cove Sole Thrust (Plate 65; Gower *et al*., 1990). The mélange contains blocks of ultramafic and mafic volcanic rocks. The Deer Cove Sole Thrust is a brittle–ductile zone marked by millimetre-wide gouge developed between strongly deformed mafic volcanic rock in the hangingwall and serpentinized ultramafic rocks in the footwall (Dubé *et al*., 1993).The general trend of the zone is east-northeast, dipping 50° to 60° north-northwest and has a south-directed vergence with associated down-dip stretching lineations.

The footwall ultramafic sequence is composed of talc–carbonate and serpentinized ultramafic rocks. Locally, fuchsitic (virginite) zones are present within the altered ultramafic rocks (Hibbard, 1983). Interlayered flows, pillow lava, hyaloclastite, volcaniclastic rocks and minor jasper form the hangingwall volcanic sequence. The mafic volcanic rocks are interpreted to exhibit a calc-alkaline affinity (Patey, 1990; Patey and Wilton, 1993) that implies forma-

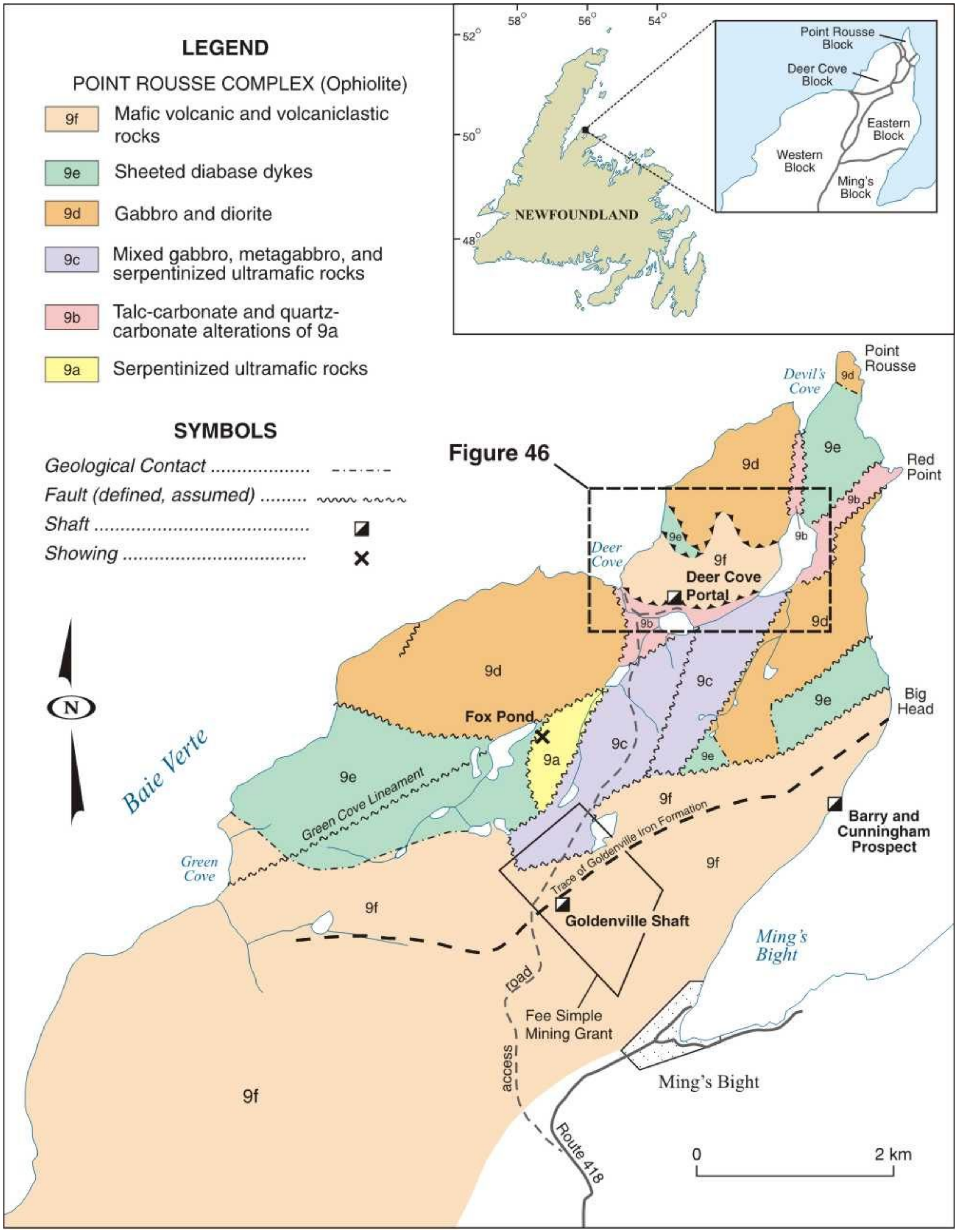


Figure 45. *Geology of the northern section of the Ming's Bight Peninsula showing the location of the adit portal at the Deer Cove deposit and the Fox Pond occurrences (*modified from *Gower* et al.*, 1990).*

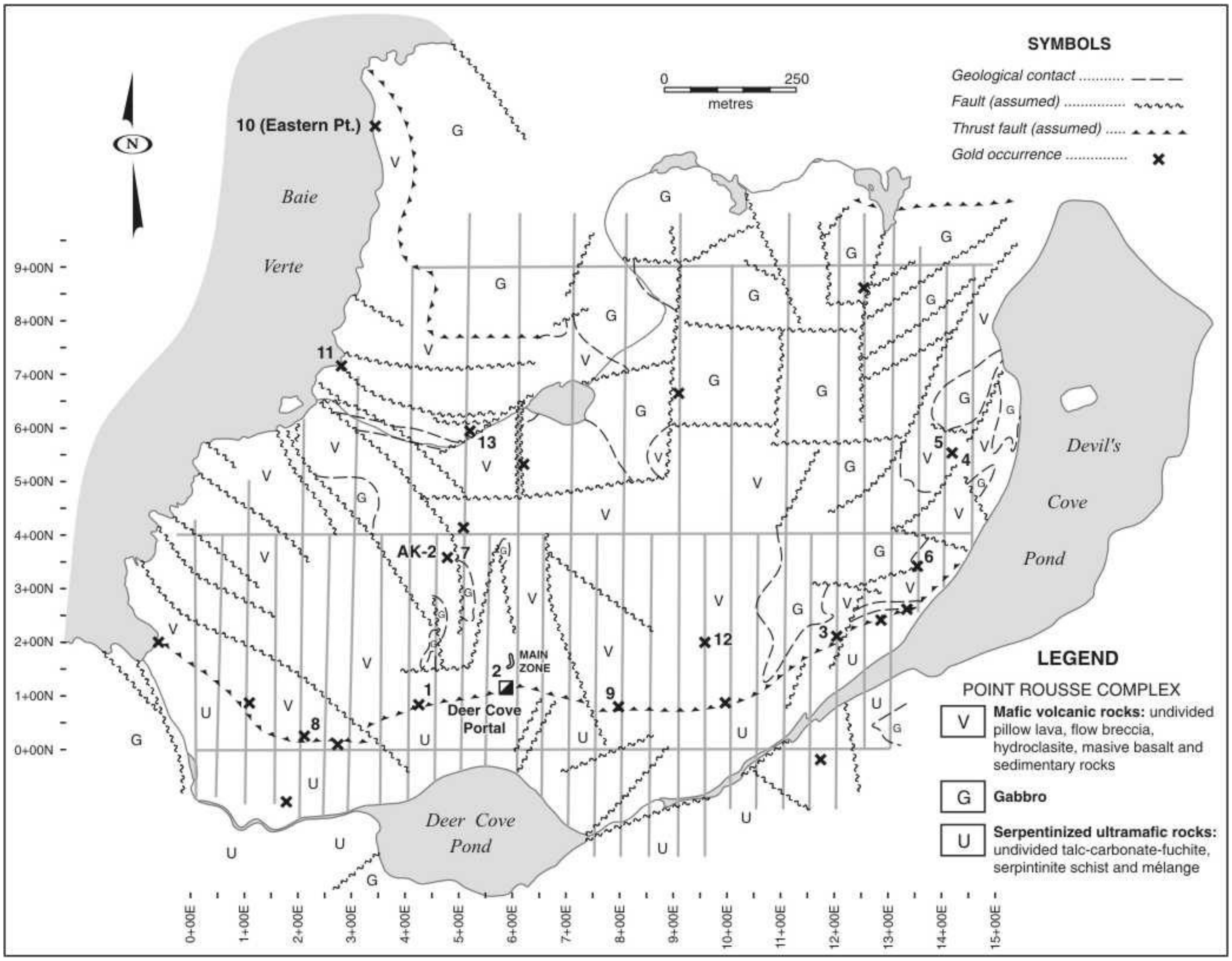


Figure 46. *Simplified geological and grid map of the Deer Cove block illustrating gold occurrences (*modified after *Graves, 1986). For a description of showings not discussed in the text the reader is referred to Appendix 1.*

tion in an island-arc or back-arc tectonic setting. Gabbroic rocks, within the mafic volcanic sequence, are geochemically dissimilar to ophiolitic gabbroic rocks of the Deer Cove block but are similar to the gabbroic rocks that host the Stog'er Tight Zone. Based on their geochemical data, Patey and Wilton (1993) indicate that gold mineralization within the Deer Cove block is hosted by a volcanic cover sequence and not by the ophiolitic rocks.

The gold mineralization is associated with quartz breccia veins (e.g., the Main Zone; Figure 47; Plates 66 and 67), and shear-parallel, quartz breccia veins (e.g., AK-2 Zone; Figure 48). Gold mineralization at the Main Zone is hosted by discontinuous lenses of brecciated quartz developed within an approximately north-striking, 45 to 55° west-dipping structure that cuts the mafic volcanic and volcaniclastic rocks. The breccia lenses average less than 1 m in width but locally they may reach up to 3 m. Pyrite with lesser chalcopyrite and arsenopyrite are disseminated in the wallrock, breccia fragments and quartz veins. The zone has been traced by trenching and diamond drilling (87 holes drilled from surface; Figure 49) over a 500 m strike length, but is still open along strike to the north and down-dip (Figure 50; Gower *et al.*, 1990). Encouraging diamond-drill results led to approximately 515 m of underground development (Figure 51) and a bulk sampling program. Table 28 presents ore reserves as calculated by Noranda Exploration Company Limited based on their diamond drilling and underground exploration programs.

Within the Main Zone the gold occurs both as: 1) free gold within the quartz veins and the altered wallrock, and 2) disseminations within the sulphide minerals. There is a direct correlation between gold grades and pyrite concentrations. The best grades were reported from the most deformed sections of the zone, closest to the sole thrust

Plate 64. *Aerial view of the Deer Cove Block (view to the northwest), showing the Main Zone adit to the right, and the Deer Cove Talc Zone, bulldozed area to the far left.*

Plate 65. *The Deer Cove Sole Thrust as exposed near the shore of Deer Cove.*

where the zone abuts a jasper-rich volcaniclastic unit. Gower *et al*. (1990) reported that the southernmost 32 m of the zone contained abundant visible gold and averaged 14.25 g/t Au over a width of 2.9 m. Here the ore zone is crumpled into a series of sharp folds that plunge to the northwest (Gower, 1988). The axial-planar cleavage associated with these folds parallels the trend of the sole thrust and the ore zone is thought to have a north to northwest plunge approximately parallel to the sole thrust (Gower, 1988).

The AK-2 Zone (using the notation of Dubé *et al*., 1993) is localized within a N318°/50°-striking, 2-m-wide shear zone, developed within gabbroic rocks approximately 100 m west of the Main Zone. They reported that the shear zone exhibited a planer fabric, trending about N298°/47° that contains an "... oblique, shallow- to moderately-plunging, stretching lineation" that was interpreted to indicate a dextral sense of movement along the shear zone. The mineralized vein, which trends N335°/30°, is discordant to the planer fabric, but is approximately parallel to a N320°/40°-trending fracture cleavage. This fracture cleavage has produced shear band-like structures that cut and dextrally offset the main planer fabric (Dubé *et al.*, 1993). Toward the north, the orientation of the shear zone and vein changes to approximately east–west (N254°/31°) with a down-dip stretching lineation. Dubé *et al.* (1993) reported that the shearing was most likely induced by layer anisotrophy contrasts between the gabbro and nearby mafic volcanic rocks.

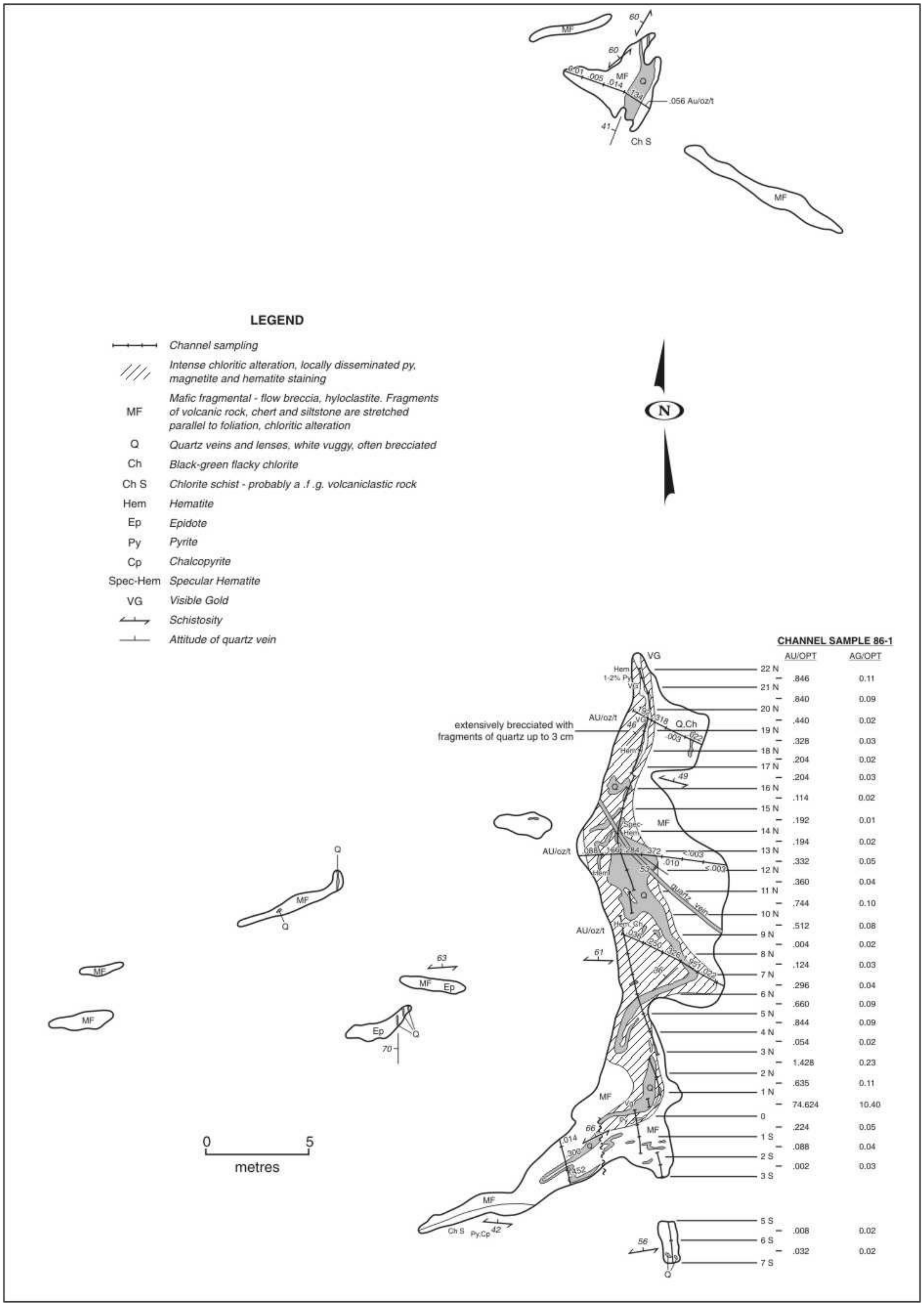


Figure 47. *Trench map, Main Zone, showing channel-sample locations and assay results (*modified after *Graves, 1986).*

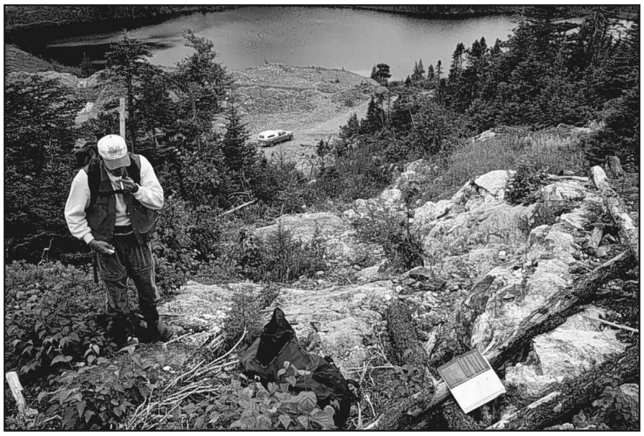


Plate 66. *The Deer Cove Main Zone (view to the southeast; Jeff Meade ponders the complexity of the vein).*

Plate 67 *The quartz breccia vein, Deer Cove Main Zone, developed within mafic hyaloclastite.*

The AK-2 Zone is developed at the sheared contact between fine-grained gabbro in the hanging wall and fine- to medium-grained plagioclase porphyritic gabbro in the footwall (Patey, 1990). The following description is taken from Patey and Wilton (1993).

> "The hanging wall of the AK-2 Zone is fine-grained gabbro (microgabbro). It has been chloritized and contains actinolite (a regional metamorphic product) with epidote and quartz-carbonate veinlets and stringers. The unit is moderately sheared and contains trace pyrite and 1-2% leucoxene. The unmineralized footwall is a fine- to medium-grained porphyritic gabbro containing 5-15% leucoxene. There is weak chlorite alteration with numerous local epidote veinlets. The unit contains minor quartz and calcite fracture fillings. Up to 5% pyrite occurs as disseminations and as millimetre cubes.
>
> Where the wall rocks have anomalous, but low-grade gold values, they are strongly sheared and chloritized with 3-5% leucoxene and 1-3% pyrite developed locally in stringers of brecciated quartz and carbonate. The chlorite is closely associated with the pyrite, forming pressure shadows and outlining schistosity in the host rocks. The mineralized high-grade ore is composed of brecciated quartz-carbonate veins which contain 1-5% disseminated and stringer pyrite."

Dubé *et al*. (1993) described the AK-2 vein as a relatively undeformed breccia-type vein containing up to 40 percent chloritic fragments and minor pyrite. The vein has an exposed strike length of less than 28 m.

Patey (1990) reported that a well-developed alteration halo is associated with the mineralized quartz veins at Deer Cove. The brecciated quartz vein zones exhibit a chlorite and carbonate alteration assemblage. Vein selvages are characterized by a zone of sericitic alteration in the mafic volcanic wall rock that grades outward into a wide zone of propylitic alteration characterized by chlorite, epidote, carbonate and accessory leucoxene. Quartz and carbonate concentrations decrease, and chlorite and epidote become finer grained, with increasing distance from the veins. Patey (1990) indicated that high-grade gold mineralization is typically associated with zones of abundant and coarse-grained pyrite. Also in zones that exhibit carbonate flooding and a paucity of potassium alteration minerals (e.g., sericite), gold grades tend to be lower particularly at deeper levels.

Previous workers (Gower *et al.*, 1990; Dubé *et al*., 1993; Patey and Wilton, 1993) reported that the gold mineralization within the Deer Cove block was genetically related to the Deer Cove Sole Thrust with mineralization deposited during the late stages of the regional, south-directed thrusting. Near the Deer Cove Sole Thrust, the Main Zone breccia vein is folded and the strong cleavage associated with the thrust is also axial planar to the folds observed in the veining (Gower *et al*., 1990). However, to the north, the Main Zone crosscuts the thrust contacts between the mafic volcanic cover sequence and the sheeted dykes and gabbroic rocks. These observations indicate that the gold mineralization was deposited after the Deer Cove block had been imbricately stacked, but before movement on the sole thrust had ceased (Gower *et al*., 1990; Dubé *et al.*, 1993).

Dubé *et al*. (1993) reported that the Main and AK-2 zones are discordant to the regional foliation and the Deer Cove Sole Thrust, which strikes east–west and has a south-directed vergence with associated down-dip stretching lineation. Adjacent to the Main Zone, the thrust fault is an east-trending, high-angle, reverse fault. To the northeast and northwest, the thrust is an oblique ramp exhibiting strike-

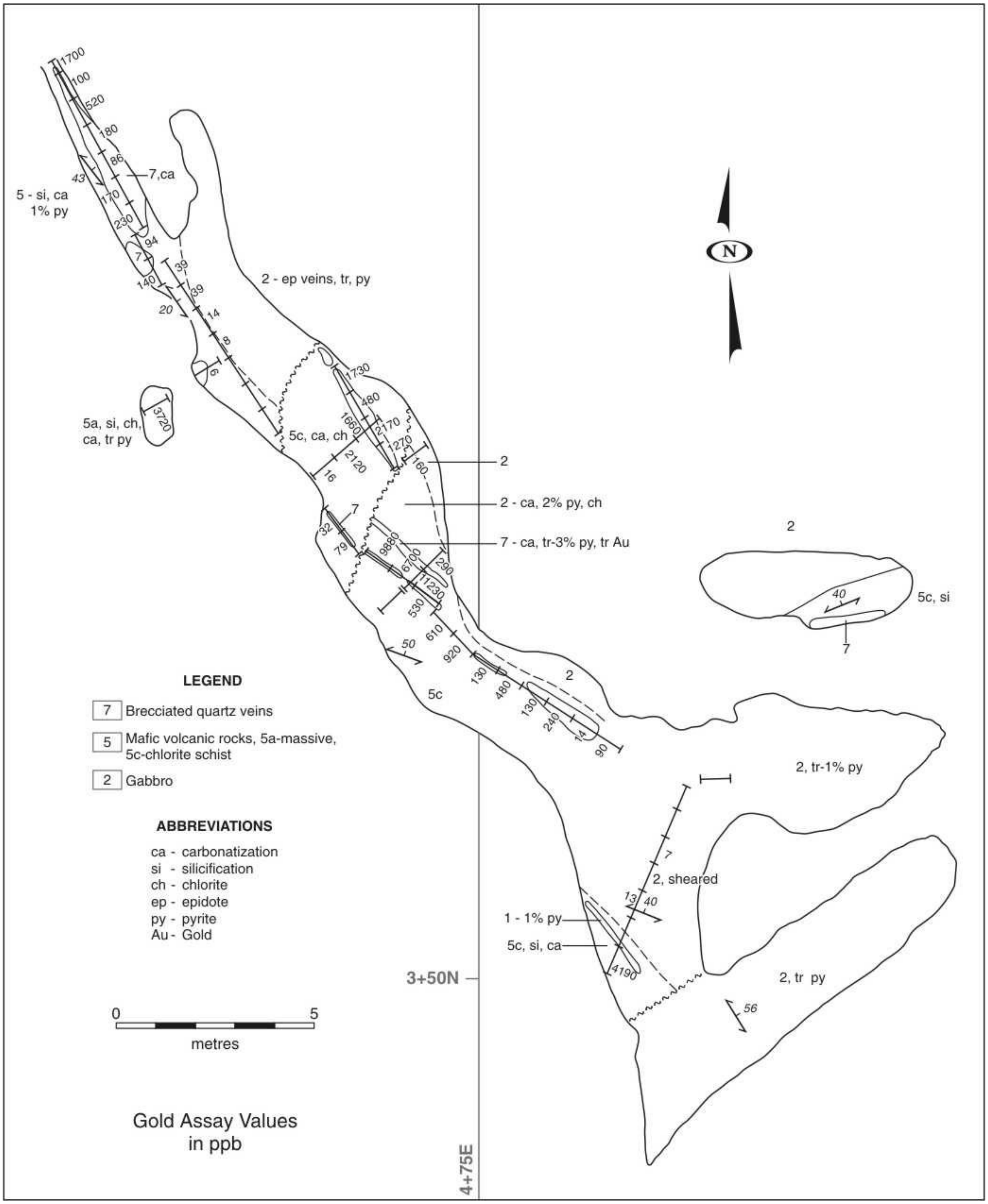


Figure 48. *Trench map of the AK-2 Zone showing channel-sample locations and assay results (*modified after *Gower, 1988).*

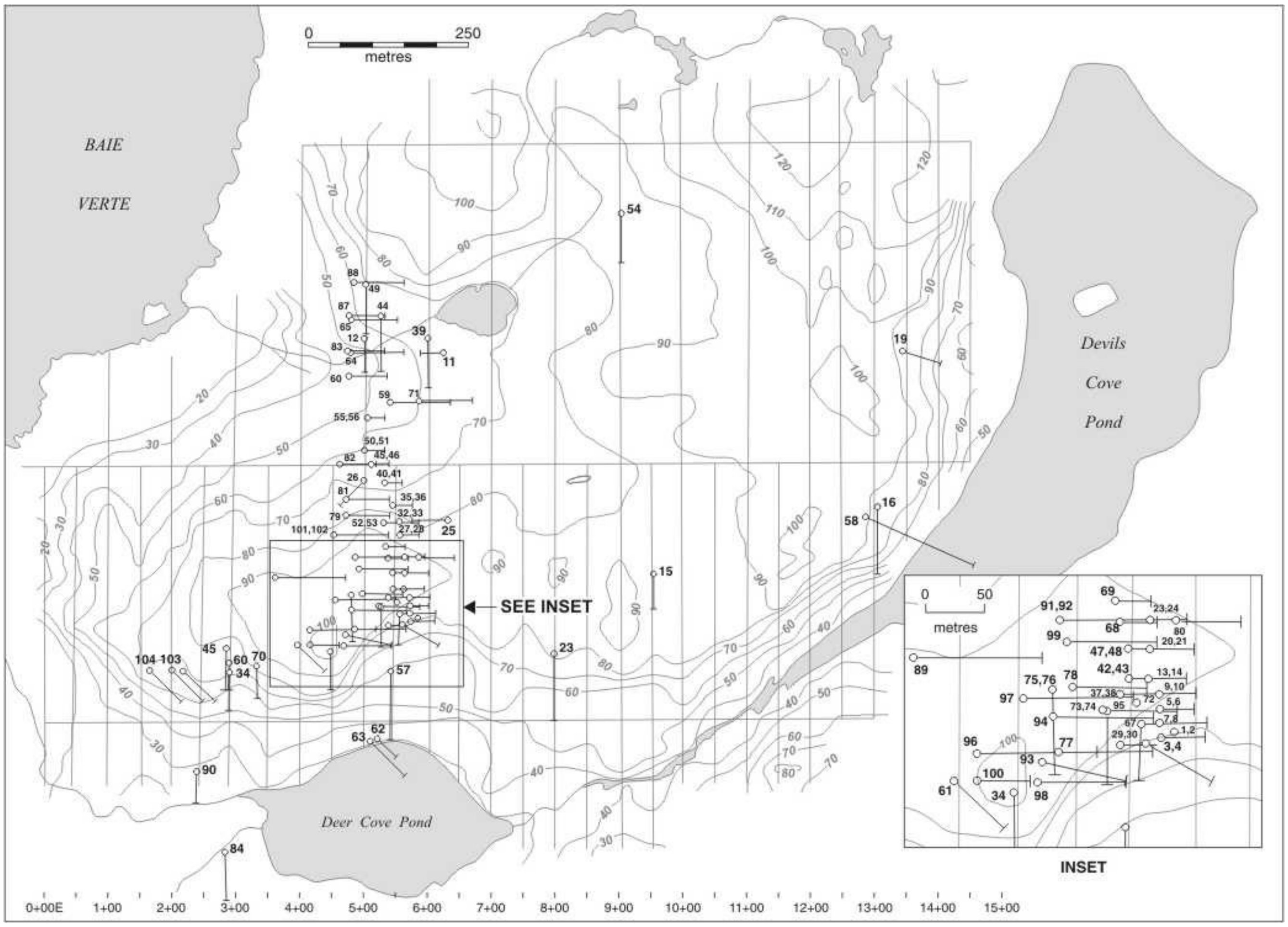


Figure 49. *Diamond-drillhole plan, Deer Cove block (*modified after *Graves, 1986).*

slip movement. The mineralized structures are interpreted to have formed in response to variation in strain rate and orientation of movement along the length of the Deer Cove Sole Thrust. At the Main Zone, which is centrally located within the Deer Cove block, this strain rate variation resulted in extension subparallel to the strike of the thrust, producing a breccia-vein, oriented approximately perpendicular to the east-strike of the sole thrust (Figure 52). Dubé *et al.* (1993) interpreted the subhorizontal to oblique stretching lineations present at the AK-2 Zone as indicating strike-slip movement. The AK-2 Zone developed in response to dextral movement along the northwest strike-slip segment of the Deer Cove Sole Thrust. The development of these strike-slip shears appears to have in part been driven by layer anisotropy. Exploration activity has identified numerous gold-bearing shear veins developed within the Deer Cove block to the east and west of the Main Zone. These shears occur along both the northwest and northeast segments of the Deer Cove Sole Thrust within the hanging-wall mafic volcanic rocks. The shears exhibit dextral oblique strike-slip movement parallel to the northwest segment and sinistral oblique strike-slip movement parallel to the northeast segment.

Gower *et al.* (1990) favoured the Listwaenite model (Buisson and Leblanc, 1985, 1986) to explain the origin of the Deer Cove gold mineralization. They suggested that the gold mineralizing processes started with the initial Ordovician obduction and serpentinization of the ophiolitic rocks. Compressional tectonics during the Siluro-Devonian produced the south-directed thrusting and liberated the gold from the serpentinized ultramafic rocks. The gold-bearing fluids were focused along the thrusts and into permeable structures in the hanging-wall sequences. However, Patey (1990) and Patey and Wilton (1993) argued, based upon stable isotope data and trace-element geochemistry, that the mineralizing fluids formed during Siluro-Devonian metamorphism of subcreted rocks (i.e., various ophiolitic rocks, arc-related rocks and sedimentary rocks) and were unrelated to the earlier Taconic ophiolitic emplacement. These metamorphogenic fluids were then focused into brittle-fracture systems and deposited within the Ordovician volcanic cover

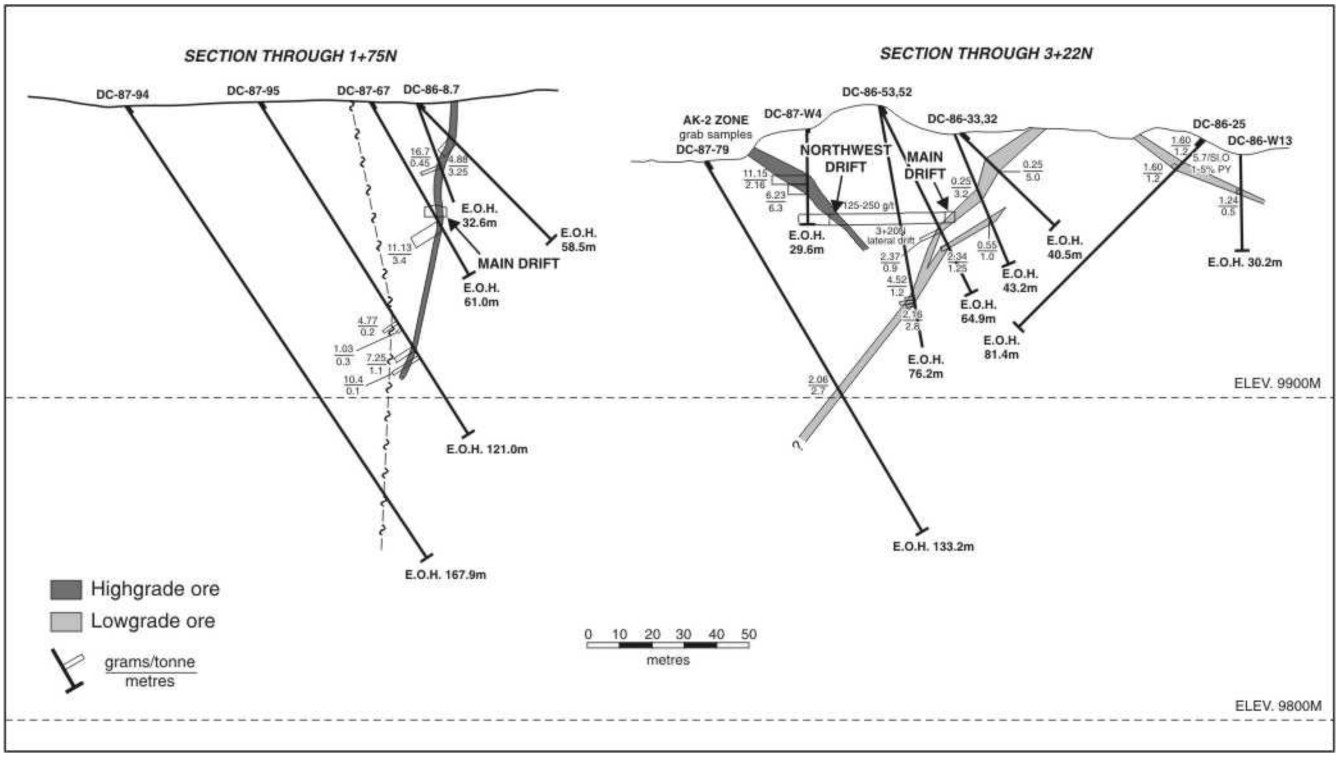


Figure 50. *Cross-sections through the Main Zone - looking north (*after *Gower, 1988).*

sequences. To explain the hydrobrecciation so characteristic of the mineralized zones, Dubé *et al*. (1993) favoured sudden decompression of gold-bearing fluids within zones of extension.

97. Normans Pond Area

Location and Access

The Normans Pond area contains two ultramafic-hosted gold occurrences, the Fox Pond #1 (NTS 12I/01 Au008 UTM 567050E 5539450N) and Fox Pond #2 (Appendix 1, Number 98) that are both talc–carbonate replacement-styles of gold mineralization. There are also a number of low-grade, gabbro-hosted gold occurrences (Appendix 1). The Normans Pond area is located immediately south of the Deer Cove block and is accessible via muskeg trails from Deer Cove road.

Local Geology and Mineralization

The Normans Pond area is underlain by rocks of the Point Rousse Complex, which consists of ophiolitic ultramafic rocks and gabbro. To the south of Normans Pond (Figure 53), the ultramafic rocks have a lensoidal outcrop pattern and are composed dominantly of medium-grained layered cumulate harzburgite, undivided gabbro and lherzolite (Hibbard, 1983). Gower (1988), described the rocks as "...massive, fine to coarse grained, black to greenish serpentinites, with rare coarse relict pyroxenes." The ultramafic unit is tectonically bounded and internal shearing has locally resulted in narrow talc–magnesite schist zones, asbestiform serpentine, and fibrous talc. Locally these zones exhibit weak silicification accompanied by 1 to 2 percent coarse cubic pyrite and quartz veining in excess of 1.5 m in width.

To the west, the ultramafic rocks are in fault contact with an extensive unit of serpentinized gabbro. This fault coincides with the Green Cove Linear (Gower, 1987), a major topographic linear that extends from Green Cove to Red Point. The structure is interpreted to be a late, steeply dipping thrust that juxtaposed the gabbroic unit southeastward over the ultramafic unit. Gower (1988) reported that mineral lineations and slickensides associated with the thrust plunge 40 to 50° to the northwest. The gabbroic rocks to the west of the fault are typically medium grained, equigranular and locally exhibit layering. Diabase dykes are common. Shear zones within the gabbro typically exhibit chlorite or chlorite–sericite alteration assemblages locally accompanied by brecciated quartz veining (Gower, 1988). To the east, the ultramafic rocks are in fault contact with a layered sequence of gabbro and pyroxenite (Gower, 1988).

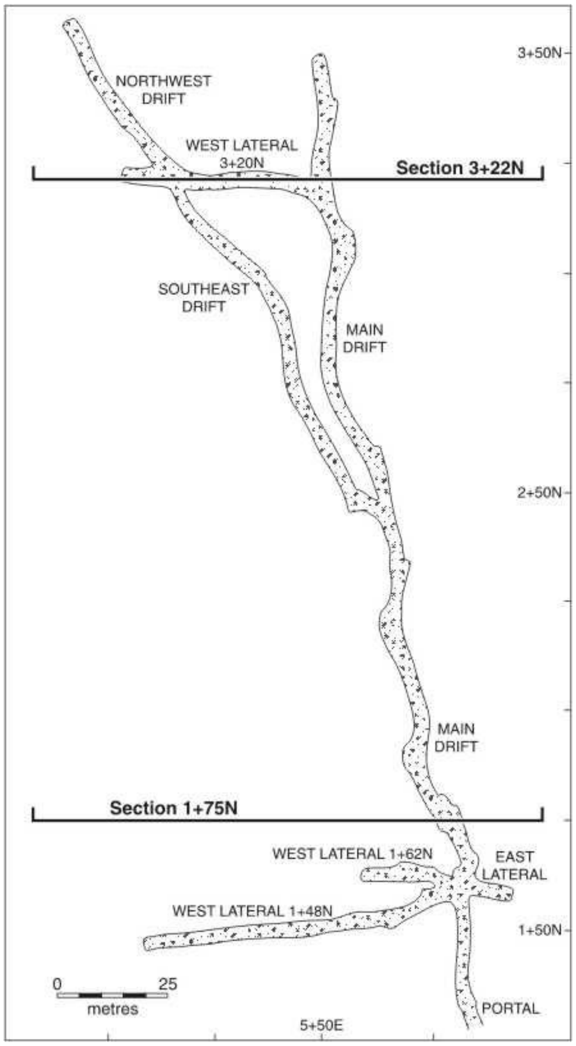


Figure 51. *Plan of underground workings, Deer Cove deposit (*after *Gower, 1988).*

The gabbro is medium grained and pervasively serpentinized, and the pyroxenite varies from medium to coarse grained. The primary layering strikes northeast and dips approximately 50° to the northwest. Shear zones cutting the sequence typically exhibit locally intense carbonate alteration associated with coarse cubic pyrite (Gower, 1988). This alteration is well developed along the northeast-trending fault zone, which separates the layered gabbroic rocks from the ultramafic rocks to the west.

The most significant gold mineralization within the Normans Pond area is hosted by shear zones developed within the ultramafic rocks at the Fox Pond #1 (Plate 68; Figure 53). The showing was discovered as a result of a trenching program to determine a source for delicate gold grains recovered from till samples collected along the Green Cove Lineament (Gower, 1988). The mineralization and alteration are localized within narrow, approximately north-

Table 28. Ore reserves calculated for the Deer Cove deposit; parameters used include: i) all high assays were cut to 34.28 g/t Au before averaging, ii) a cut-off grade of 3.0 g/t Au over a true thickness of 1.5 m, iii) for low grade ore, cut-off grade was lowered to 2.0 g/t Au over a true thickness of 1.5 m, and iv) the longitudinal section of the ore body was used to calculate ore reserves by the polygon method, using a specific gravity of 2.75 (Government of Newfoundland and Labrador, Call For Proposals, 1999)

Category	Tonnes	Gold Grade Uncut g/t	Gold Grade Cut to 34.28 g/t
High Grade Ore (undiluted)			
Proven	13 893	8.58	7.04
Probable	38 355	6.76	6.47
Possible	41 845	4.48	4.48
Sub Total	94 093	6.01	4.6
Low Grade Ore (undiluted)			
Proven	3 917	2.59	2.59
Probable	27 044	2.52	2.45
Possible	17 945	2.32	2.32
Sub Total	48 906	2.45	2.41
Stockpile Ore			
Proven	1 275	6.67	2.59
Total	144 274	4.8	3.86

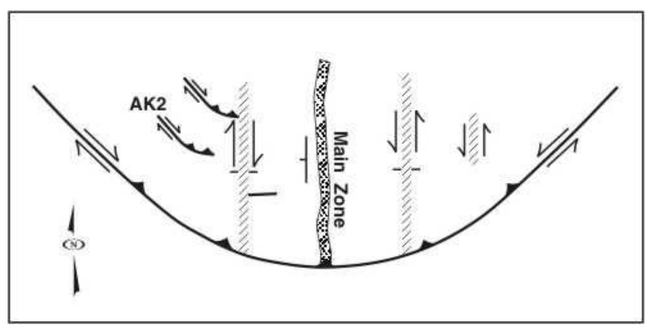


Figure 52. *Schematic structural model showing the lateral variation of orientation and related movement of the Deer Cove Sole Thrust from east–west with reverse movement to the northwest and northeast oblique ramp with strike-slip movement. This variation induced differences in the strain rate along the length of the Deer Cove Sole Thrust, which resulted in extension subparallel to the strike of the Deer Cove Sole Thrust and formation of the breccia-vein almost perpendicular to the orientation of the east–west segment of the Deer Cove Sole Thrust. Teeth on thrust plane point to the overthrusted block (*modified after *Dubé* et al., *1992).*

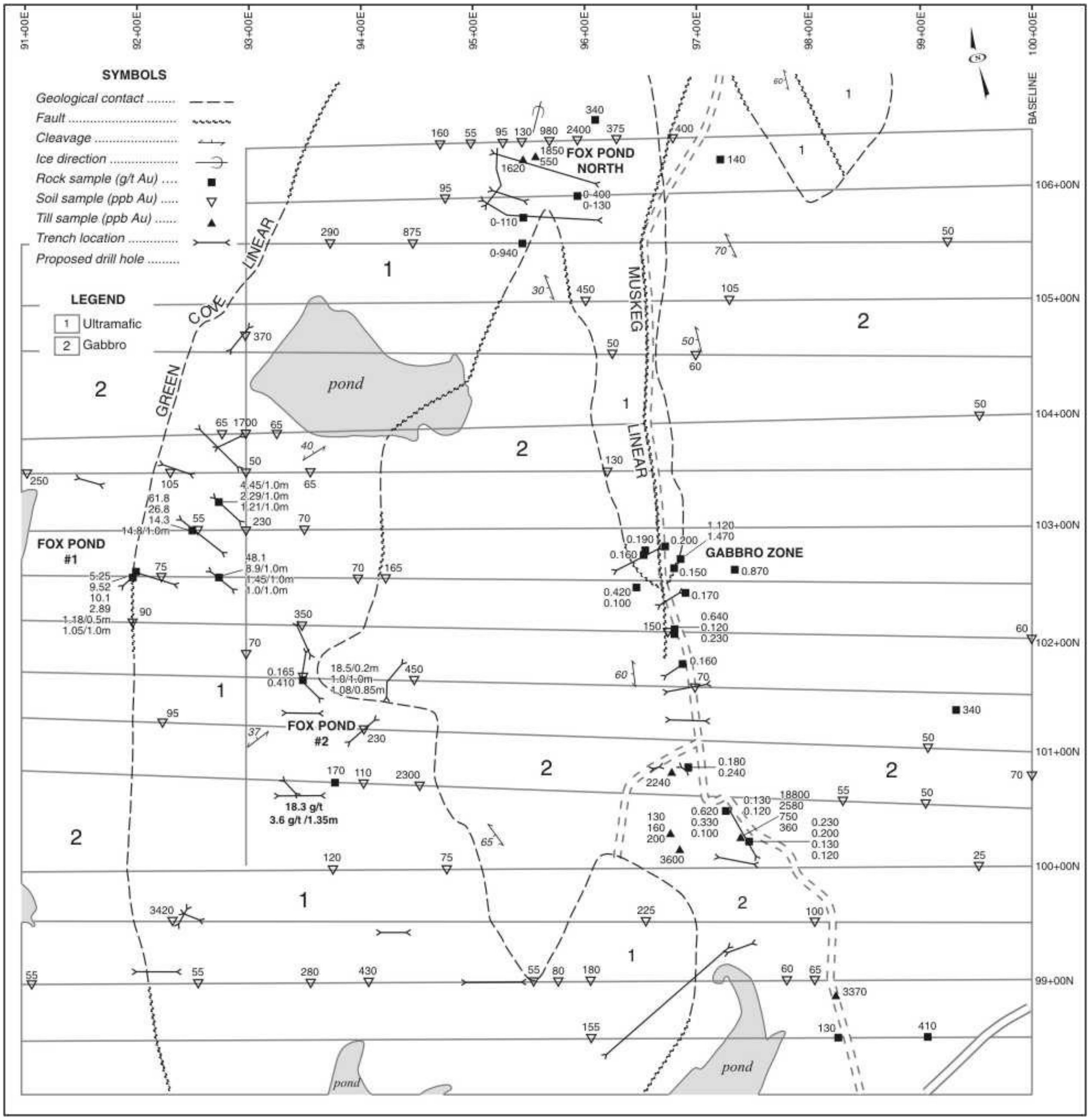


Figure 53. *Grid map, Normans Pond area showing trench locations and assay results (*modified after *Gower, 1988).*

trending high-strain zones (Plate 69) that cut weakly serpentinized ultramafic rocks (Figure 54). Gower (1988) reported two fault orientations: 1) a 150°-striking, 50 to 60° west-dipping fault set, which exhibit a well-developed cleavage and intense talc–carbonate alteration; and 2) minor, 050°-striking shear zones. The following description of the mineralization is taken from Gower (1988, page 23).

"Irregular 0.5-15 cm coarse grained magnesite-dolomite-talc veins follow two prominent directions sub-parallel to the fault planes. These veins contain clots of magnetite and have a magnetite stockwork in the selvage. Massive porcelain-white dolomite veins, with magnetite and minor pyrite, chalcopyrite, malachite and bornite fill planar fractures. These veins are sometimes associated with pure greenish talc margins. Fibrous talc and serpentine veins generally strike E–W and dip southward. Visible gold has been recovered from intensely talc magnesite altered ultramafics from

Plate 68. *The Fox Pond #1 showing looking west across the Green Cove Linear.*

Plate 69. *The Fox Pond #1 showing. Exposed in the trench are massive, serpentinized ultramafic rocks that are bisected by a series of highly schistose talc–carbonate shear zones.*

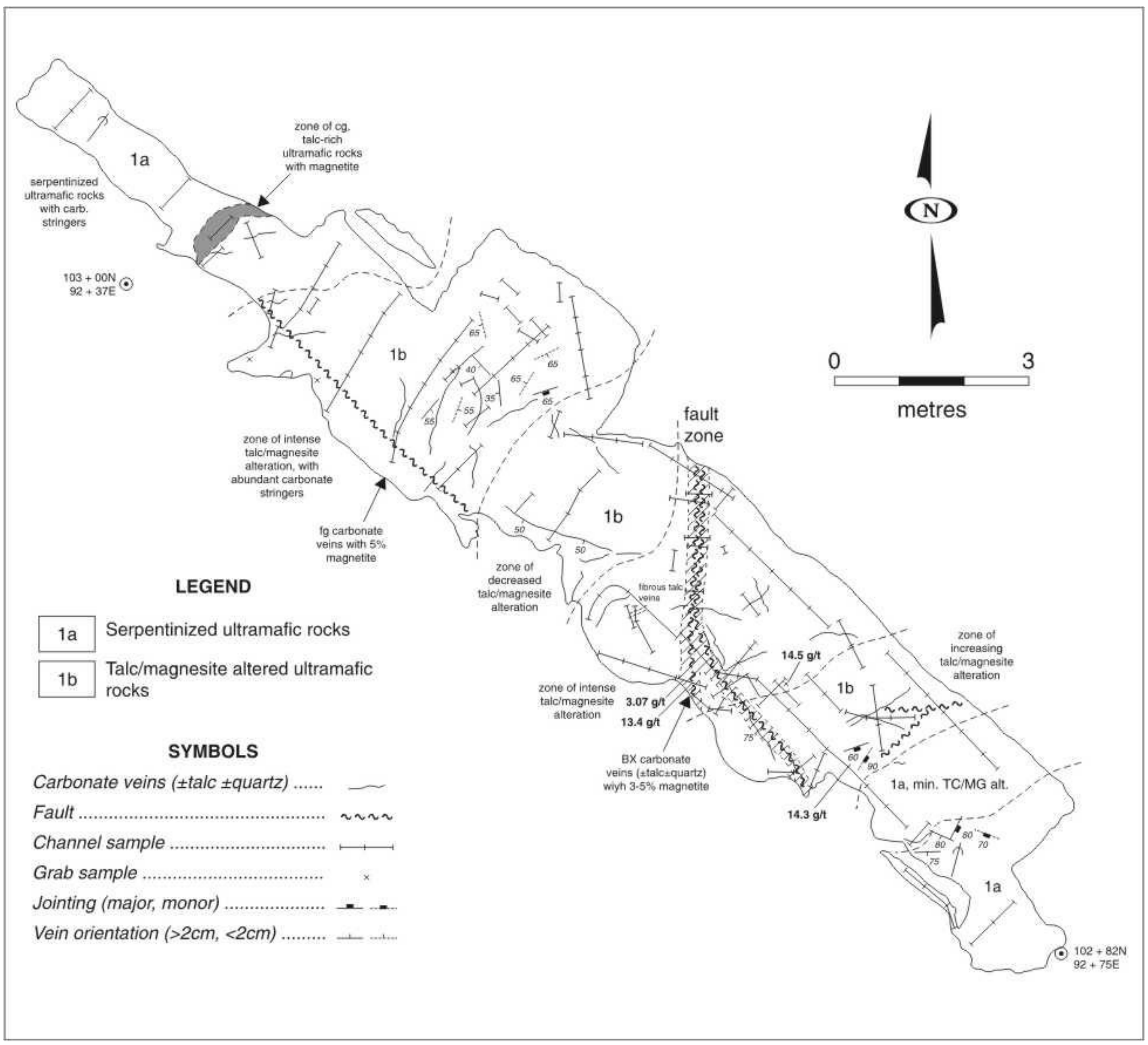


Figure 54. *Trench map, Fox Pond #1 showing (*modified after *Gower, 1988).*

Plate 70. *Porcelain white, coarse-grained magnesite–dolomite–talc vein, containing small clots of magnetite, cutting talc–carbonate altered ultramafic rocks, Fox Pond #1 showing.*

two localities: 1) wall rock near a magnesite-dolomite-magnetite vein and 2) within an E–W trending shear zone. Values have been recovered from magnesite-dolomite-talc veins, porcelaineous dolomite veins (without sulphides), wall rock in shear zones, vein selvages and intensely altered, magnetite-rich blocks in shear zones."

Plate 70 illustrates an example of a porcelain white magnesite–dolomite–talc vein containing small clots of magnetite. Grab samples collected from prospect assayed 26.8 g/t Au and 14.3 g/t Au whereas channel samples assayed up to 61.8 g/t Au over 1.0 m. Assay results are presented in Table 29.

Table 29. Channel- and grab-assay results, Fox Pond #1 showing (after Gower, 1988)

Trench	Interval/Grab	Grade g/t Au
TR-11.5, 103+00N, 92+30E	1.0 m	61.8, 26.8, 14.3, 14.8
103+50N, 92+75E	1.0 m	4.45, 2.29, 1.21
102+50N, 92+75E	1.0 m Grab	8.9, 1.45, 1.0 48.1
102+50N, 92+00E	0.5 m 1.0 m Grab	1.18 1.05 5.25, 9.52, 10.1, 2.89

SULPHUR ISOTOPIC ANALYSES

INTRODUCTION

Sulphur isotope data can be used to discriminate between organic (sedimentary) and crustal sources of sulphur that may have contributed metals to the auriferous mineralizing fluids. Isotopic homogeneity may represent a homogeneous fluid source area and/or a single mineralizing event. A large degree of isotopic variability can be interpreted as inhomogeneity of the source area or multiple pulses of mineralization.

Sulphur can occur in three oxidation states: 1) oxidized, as in sulphate mineral species and sulphur dioxide; 2) neutral, as in native sulphur, and 3) reduced, as in sulphide minerals and hydrogen sulphide. Analyses of sulphur isotopes are stated as $\delta^{34}S$ per mil (‰) values that represent the ratio of $^{34}S/^{32}S$ in the sample analyzed compared to a standard sample. This standard, which is derived from troilite contained in the Canyon Diablo meteorite (CDT), is interpreted to represent the average composition of terrestrial sulphur, unaffected by crustal fractionation processes. The ratio is determined using the following formula:

$$\delta^{34}S=[(^{34}S/^{32}S)_{sample}-{}^{34}S/^{32}S_{standard}] \times 10^3 \; (^{34}S/^{32}S)standard$$

A sample enriched in ^{34}S relative to ^{32}S will produce a positive $\delta^{34}S$ ratio (isotopically heavy) whereas a sample depleted in ^{34}S relative to ^{32}S will produce a negative $\delta^{34}S$ ratio (isotopically light).

There are three isotopically distinct sulphur reservoirs, these are: 1) mantle-derived sulphur that has values near 0 ‰, 2) seawater sulphur, the composition of which has been quite variable since the Precambrian and is currently about +20 ‰, and 3) sedimentary sources, which due to biological activity, produce sulphur that is strongly negative.

GOLD OCCURRENCES

Two suites of samples were collected from the various gold occurrences within the Baie Verte gold study area. Sulphur isotopic determinations were made on sulphide minerals from these suites. One group was collected by Dr. A. Sangster and the author, and the analyses were carried out in the stable isotope laboratory of the Ottawa Carleton Geoscience Centre at Ottawa University. The second group was collected by the author, Dr. D. Wilton and S. Bailey of Memorial University of Newfoundland. This latter group was analyzed at the Department of Earth Sciences, Memorial University.

The epigenetic vein and altered wall-rock hosted gold occurrences within the study area typically exhibit $\delta^{34}S$ values that range from about +2 to +10 ‰ (Table 30). Occurrences within the ophiolitic sequences range from +2.06 to +9.53 ‰ (Figure 55). The Corkscrew prospect exhibits a weakly negative value of −1.25, but the data set is limited to two samples and the second sample has a $\delta^{34}S$ value of +4.21 ‰, which is more typical of the other Baie Verte gold occurrences.

Samples collected from the Goldenville Horizon and the Goldenville Mine form two distinct data sets. One set is composed of strongly negative (−19.5 ‰) to weakly negative (−2.9 ‰) $\delta^{34}S$ values that are interpreted to represent synsedimentary biogenic pyrite. The second set represents samples collected from the mine dump that contain significant concentrations of gold and exhibit $\delta^{34}S$ values ranging from +2.06 to +7.0 ‰. Background gold values for the Goldenville Horizon are typically 15 to 20 times the background of 3 to 4 ppb for the surrounding mafic rocks (Frew, 1971; Fitzpatrick, 1981). This is also evident from assay values reported from the Granges diamond-drill program; all of the intersected chert–magnetite zones contained anomalous concentrations of gold, with values up to a few hundred parts per billion. It is not known if the iron formation was the source of the gold. Previous workers interpreted these elevated concentrations to mean that the gold mineralization was strata bound and syngenetic. However, where the chert is fractured and veined it was reported to locally contain up to 4 times more gold than more massive non-fractured chert (Frew, 1971; Fitzpatrick, 1981). Hibbard (1983) also reported that at the main shaft, the gold-bearing quartz veins crosscut the regional foliation and therefore the gold was remobilized. The best mineralization is associated with a crosscutting fault zone and alteration surrounding this zone overprints both structural hanging-wall and footwall rocks indicating that the gold is syngenetic. The abundance of gold occurrences in the immediate area, many of which are hosted by gabbro, would suggest an epigenetic origin for the gold mineralization with a metal source external to the iron formation. The Fe-rich gabbros and oxide-facies iron formation would act as perfect physiochemical traps for the gold-bearing fluids. The isotopically heavy sulphur values derived from pyrite associated with the gold mineralization at the Goldenville Mine supports an external non-sedimentary sulphur source.

Strongly negative $\delta^{34}S$ values of −12.72 and −11.52 ‰ are also associated with the Penny Cove alteration zone,

Table 30. Sulphur isotope analyses performed on pyrite separates from selected epigenetic gold and volcanogenic massive sulphide occurrences, Baie Verte Peninsula. Sample data designated by SB and KP are taken from Bailey (1999) and Patey (1990) respectively and samples designated by BV and W were collected by A. Sangster and D. Wilton respectively (NA - Not Assayed)

Location	Sample	$\delta^{34}S$	Au ppb
Mic Mac Lake Group			
Crow Hill South	DE-97-41A	2.92	NA
	DE-98-18A	8.49	NA
	DE-98-31V	6.5	368
Crow Hill North	DE-97-43	2.8	NA
Burlington Granodiorite			
Kruger	DE-98-14A	9.89	23500
	DE-98-14C	12.52	NA
Bedford	DE-97-21	-15.16	320
Clydesdale	DE-97-31	6.62	5500
	DE-97-31H	6.84	NA
Flat Water Pond Group			
Gunshot	DE-97-17	14.99	33100
	W91-7	1.55	NA
Voodoo Float	SB9816A	618	22
	W91-9C	4.88	NA
El Strato	DE-97-24B	7.01	127
	W91-8A	7.04	NA
	SB9814A	6.57	7675
	SB9814A	7	7675
	SB9814A	7.47	7675
	SB9814A	6.73	7675
Tornado	DE-97-30B1	-8.71	NA
	DE-97-30B2	-14.31	NA
Tornado Float	SB9815A	3.93	5
	SB9815A	3.31	5
Mic Mac Lake NE	SB9818	5.52	9495
Flat Water Pond	W90-13C	4.6	NA
Dorset	W91-3A	7.54	NA
	W91-3D	6.39	NA
	SB9813B	5.12	NA
Dorset Extension	W91-4	7.3	NA
Braz	W91-5A	6.46	NA
Powderhouse Cove	PH	7.62	NA
Pacquet Harbour Group			
Brass Buckle	DE-97-37	6.32	NA
	BB	6.91	NA
	W90-21B	4.37	NA
	W90-21C	5.15	NA
Stuckey	W90-14	6.48	NA
Advocate Complex			
Baie Vista	DE-98-3C	7.25	150
Albatross	SB9807	5.17	5
Point Rousse Complex			
Goldenville	DE-97-1A	-8.2	85
	DE-97-9B	2.06	NA
	DE-98-28A	4.17	NA
	DE-98-28C	2.29	37500
	GV	6.97	NA
	SFB98-BV-001	-19.5	NA
	SFB98-BV-003	7	NA
	SFB98-BV-005	3.9	6450
	SFB98-BV-006	6.2	NA
	SFB98-BV-008	-2.9	NA
Deer Cove	KP-230	7.77	NA
	KP-260	9.53	NA
	KP-273	8.68	NA
	SFB98-BV-012	11.1	NA
	SFB98-BV-013	10	NA
Juliet	SFB98-BV-015	4.3	>10000
Stog'er Tight	SB9807	-1.25	10303
	SFB98-BV-017	2.4	1360
	SFB98-BV-019	4.5	>10000
	W89-79	5.14	NA
	W89-82	3.14	NA
Corkscrew	DE-97-4	4.21	8860
Pine Cove	W89-72	2.87	NA
Barry & Cunningham	SFB98-BV-051	7.6	960
	SFB98-BV-052	7.8	744
Pumbly Point	SB9802	-11.52	5
	SB9802	-12.72	5
Fleur de Lys Supergroup			
Castors Brook	DE-97-32	1.22	532
	DE-97-32B	-0.12	NA
Marble Cove Point	DE-98-1B.1	8.53	7110
	DE-98-1B.2	8.48	7110
	DE-98-1B.3	9.55	7110
	DE-98-2A	8.54	2260
	DE-98-2A	7.72	2260
Cabot	SFB98-BV-54	9.2	68
	SFB98-BV-56	7.9	NA
	SFB98-BV-58	8.2	NA
	SFB98-BV-60	7.2	50
	SFB98-BV-61	7.2	42

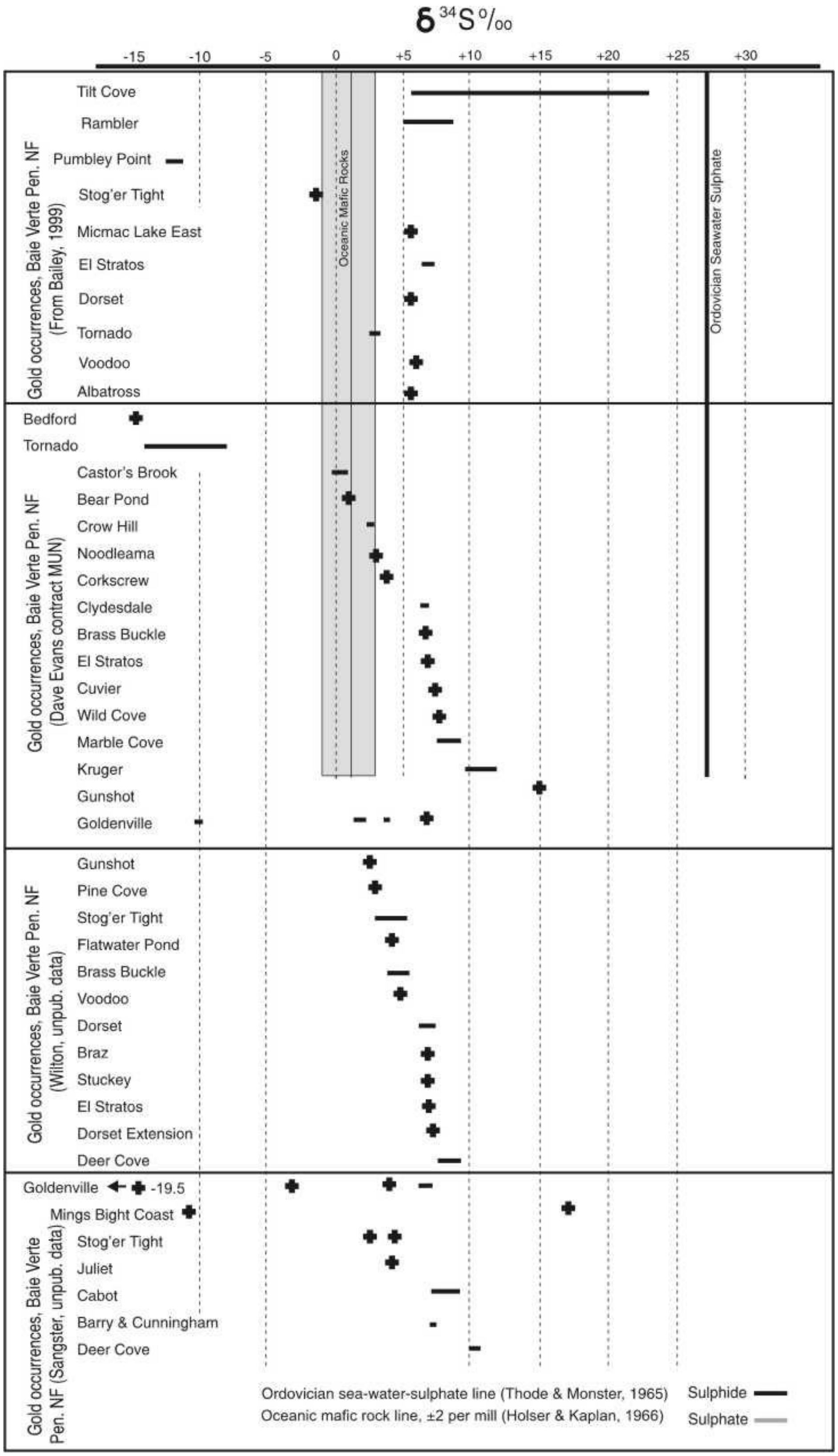


Figure 55. *Pyrite sulphur isotope compositions of Baie Verte gold occurrences in NTS map areas 12H/09, 12H/16 and 12I/01 (+ indicates single values;* **---** *indicates a range of values). Also shown are data for the Rambler, Barry and Cunningham and Cabot volcanogenic sulphide occurrences.*

Plate 71. *Pervasive iron-carbonate replacement of pillow lava, Penny Cove. Note the lack of deformation within the pillow lava.*

Plate 72. *The Penny Cove alteration zone illustrating the crosscutting orientation of the zone.*

which is exposed at Penny Cove on the eastern shore of Baie Verte. The zone comprises an approximately 10 m by 200 m zone of pervasive carbonate alteration developed within undeformed pillow basalt (Plate 71) and pillow breccia. The zone, which appears to be fault/fracture controlled, strikes about 080° and dips 55° to the east and crosscuts the dip of the pillow lava sequence at 90° (Plate 72). The alteration zone is bisected and offset approximately 20 m by a shear zone that trends 90° and dips 45° to the north. Within the central portion of the alteration zone that appears to be weakly sheared, numerous, euhedral pyrite-mantled, quartz–carbonate veins are developed. Grab samples collected from the veins and wall rock were assayed and found to contain no gold.

The Penny Cove alteration zone exhibits gradational contacts with the enclosing unaltered volcanic rocks. Bailey (1999) reported that these unaltered rocks exhibit a typical greenschist-facies metamorphic mineral assemblage dominated by chlorite. Within the outer portion of the alteration zone, thin section analyses indicate that the rock is composed of approximately 60 percent carbonate, 20 percent quartz and fine-grained albite, minor sericite, magnetite and 1 to 2 percent pyrite rimmed by chalcopyrite. In the central portion of the zone, which exhibits the most intense alteration, thin sections revealed the rock to be composed of less carbonate and more quartz–sericite–chlorite. Within the alteration zone, siderite is the dominant carbonate mineral (Bailey, 1999).

Hodgson (1993) reported that while carbonate alteration is typical of mesothermal gold occurrences in volcanic-dominated sequences, many carbonate zones are not auriferous. Carbonate zones that lack silicification, sulphidation and alkali metasomatism rarely contained gold. The carbonate alteration was interpreted to be a widespread phenomenon upon which gold mineralization was later locally superimposed. The fluids responsible for the early carbonate were thought to have evolved chemically between the time of widespread carbonate alteration and the more restricted silicification and sulphidation of gold. This may have been the case at Penny Cove where the strongly negative $\delta^{34}S$ values indicate a sedimentary sulphur source. Penny Cove may represent an early stage of carbonate alteration that was not overprinted by a later gold event. Penny Cove differs from other auriferous carbonate alteration zones on the Baie Verte Peninsula, such as the Albatross, in that it lacks a penetrative deformation, which maybe necessary for gold mineralization.

The Ordovician volcanic cover sequences of the Flat Water Pond Group host a number of base-metal-rich quartz vein occurrences. These gold occurrences exhibit $\delta^{34}S$ values, which range from +3.31 to +7.47 ‰, similar to the gold occurrences hosted by ophiolitic sequences. The Gunshot occurrence is an exception. Two pyrite analyses completed on vein samples had $\delta^{34}S$ values of +1.55 and +14.99 ‰ and the latter sample assayed approximately 1 oz./t Au. The Tornado prospect, which contains pyrite-bearing quartz veins cutting sheared and carbonitized gabbro, exhibits strongly negative (−14.3 to −8.71 ‰) values, indicating that the zone is probably analogous to the Penny Cove alteration zone.

The Crow Hill prospects within the Mic Mac Lake group exhibit $\delta^{34}S$ values (+2.8 to +8.49 ‰), which are consistent with other gold occurrences on the peninsula. Gold occurrences within the Burlington granodiorite also show a similar range of values with the exception of a single analysis from the Bedford showing, which has a $\delta^{34}S$ value of −15.6 ‰ indicating a sedimentary sulphur influence and an analysis from the Kruger showing, which has a $\delta^{34}S$ value of +12.52 ‰.

The $\delta^{34}S$ values for the epigenetic gold occurrences within the study area correspond with $\delta^{34}S$ values for volcanogenic massive sulphide mineralization from the Rambler deposits (Pacquet Harbour Group), the Barry and Cunningham prospect (Point Rousse Complex) and the Cabot prospect (Birchy Cove Schist, Fleur de Lys Belt). Both the Rambler and Barry and Cunningham occurrences are classified as gold-rich massive sulphides. The overlap in $\delta^{34}S$ values for the gold and VMS mineralization suggests sulphur sources comprising a mixed assemblage of ophiolitic, arc-volcanic and sedimentary rocks, were the same for both mineralizing events.

AGE OF THE GOLD MINERALIZATION

Gold mineralizing systems in the Newfoundland Appalachians range in age from the late Neoproterozoic to the Siluro-Devonian. In central Newfoundland, the syngenetic gold mineralization is associated with the Cambro-Ordovician volcanogenic massive sulphide deposits. The oldest deposits occur within the Tally Pond volcanics of the Victoria Lake Supergroup, which has been dated at 513 ± 2 Ma (Evans *et al*., 1990). The youngest deposits predate deposition of the Llandeilo–Caradoc shale, which, in central Newfoundland, signals the cessation of island-arc volcanism during the Taconic Orogeny.

Sequences that only show evidence of Taconic deformation do not contain significant epigenetic gold mineralization. For example, the Fleur de Lys Belt of the Baie Verte Peninsula, which has a paucity of mesothermal gold occurrences, only exhibits evidence of Taconic deformation. Similarly, in the eastern Dunnage Zone, ophiolitic rocks of the Gander River Ultrabasic Complex do not contain significant concentrations of gold mineralization. These ophiolitic rocks were emplaced during the Ordovician (Blackwood, 1982) and the structures that controlled their emplacement were not significantly reactivated by later orogenic events. It would appear that the Taconic Orogeny was not the climactic event responsible for producing significant mesothermal gold.

The structurally controlled, mesothermal or metamorphogenic style of mineralization, which is widely developed throughout central Newfoundland, clusters along major, regionally extensive fault systems that affect rocks of widely varying ages. Many of these structures affect Silurian and younger units and in a number of instances the Silurian sequences are known to host structurally controlled gold mineralization. However, the age of this gold mineralization is not well constrained by radiometric dating. It is more or less assumed that the mesothermal occurrences are Silurian or younger. Direct attempts to date this mesothermal event or events are confined to three occurrences located on the Springdale and Baie Verte peninsulas. Ritcey *et al*. (1995) reported that a zircon collected from a felsic dyke, which is cut by a gold-bearing quartz vein at the Hammer Down deposit, yielded an igneous age of 437 ± 4 Ma. The date is interpreted to represent a maximum age, but does not constrain the lower age for the gold mineralization. Ramezani (1992) dated hydrothermal zircon that was collected from the alteration zone at the structurally controlled Stog'er Tight gold deposit on the Baie Verte Peninsula, at 420 ± 5 Ma. At the Nugget Pond deposit, also located on the Baie Verte Peninsula, the gold mineralization is spatially associated with a quartz–carbonate–feldspar stockwork, and xenotime collected from the stockwork was dated at 374 Ma (Bédard *et al.*, 1997). Elsewhere on the Baie Verte Peninsula, Silurian sequences such as the Cape St. John and Mic Mac Lake groups are known to host fault-controlled gold mineralization. This implies that these occurrences are at least as young as Early Silurian, but how much younger is not known.

Hudson and Swinden (1990) reported that the Lake Bond volcanogenic massive sulphide deposit in central Newfoundland, was overprinted by a later epigenetic gold-bearing event. This gold-bearing event overprints the main regional fabric in the Roberts Arm Group that is also present within the fossiliferous Lower Silurian flyschoid sequences. The deformation fabric is overprinted by a syn- to post-tectonic metamorphic event related to the intrusion of the Twin Lakes granodiorite, which has a U/Pb zircon age of approximately 435 Ma. Hudson and Swinden (1990) considered the gold mineralization to be coeval with this metamorphic event and therefore constrained to the Early Silurian (circa 435 Ma).

The available evidence indicates that the structurally controlled gold mineralization in central Newfoundland ranges in age from the early Silurian to Devonian. As data is sparse, it cannot be said with certainty that the occurrences are related to a single Dunnage Zone-wide event or to several more localized events. From the available data it would appear that the oldest constrained age of epigenetic gold mineralization is the 437 Ma age derived from the Hammer Down deposit and the youngest age is the 374 Ma age from the Nugget Pond deposit. These dates coincide with both the Salinian and Acadian orogenies, which produced widespread regional deformation, metamorphism and plutonism. During the Salinic orogenic event (circa 430 to 415 Ma; Dunning *et al.*, 1990), there was extensive reactivation of the major fault systems throughout central Newfoundland

(Karlstrom *et al*., 1982; Tuach, 1987; Szybinski, 1988). The reactivation of major structures during transpressive orogenic pulses is a significant controlling factor in gold mineralizing systems (Eisenlohr *et al*., 1989; Kerrich, 1989). Swinden (1990) suggested that the Salinic orogeny, besides being a climactic peak of metamorphism and deformation, was also a climatic metallogenic event. Metamorphism and plutonism produced large volumes of CO_2-rich hydrothermal fluid, which leached gold and other metals from large volumes of rock before being focussed into major fault zones and depositing the mesothermal lodes.

The Salinic Orogeny appears to have been the most significant post-Taconic event to have affected the Dunnage Zone. However, Acadian orogenesis produced similar conditions, albeit on a more localized scale, for the generation of mesothermal style mineralization (i.e., reactivation of structures) and this may have been the case at Nugget Pond. On the Baie Verte Peninsula, Acadian deformation appears to have been focussed along the Baie Verte Line and in particular along the eastern limb of the Baie Verte Flexure (Hibbard, 1983). Elsewhere on the peninsula, deformation is either Taconic or Salinic in age. Acadian deformation may have also produced conditions that resulted in the remobilization of pre-existing gold but, subsequent Acadian and even Carboniferous deformation disrupted ore continuity in earlier formed deposits. The age of the gold mineralization on the Baie Verte Peninsula can therefore be broadly constrained to the late Silurian–Early Devonian, approximately 80 to 100 million years post-emplacement of the Taconic allochthons.

SUMMARY

GEOLOGICAL SETTING OF THE EPIGENETIC GOLD MINERALIZATION, BAIE VERTE PENINSULA

The rocks of the Baie Verte Peninsula and in particular those of the Baie Verte Belt are prolific hosts for gold mineralization. Most of the epigenetic occurrences associated with these structures were discovered during the exploration boom, which lasted from 1985 to 1990. Since then many of the high potential areas have received little exploration effort and the potential for further discoveries is excellent. Approximately 98 percent of the occurrences are located within the Baie Verte Belt to the east of the Baie Verte Line. The Baie Verte Line is a structurally complex zone that is composed of a braided network of faults, including the Baie Verte Road and the Micmac–Flat Water faults, which exhibit a tight spatial association with many of the gold occurrences. The complex deformational history of the Baie Verte Line resulted in: 1) the juxtaposition of a variety of lithological elements that could serve as a gold source, 2) the generation of large volumes of metamorphic fluid capable of leaching and transporting gold, 3) a series of deep-seated regionally extensive faults to serve as fluid conduits, and 4) the structural preparation of favourable host rocks. Brittle deformation associated with the numerous regionally extensive structural breaks, such as the Micmac–Flat Water Fault, provided sites for gold deposition. These sites do not appear to be lithogically controlled. However, mafic rocks, particularly gabbro, are the most prevalent gold-host due to their Fe-rich nature and their competency contrasts with surrounding rocks that enables them to deform more brittlely.

On the western limb of the Baie Verte Flexure, a major episode of south-directed thrusting produced a number of significant thrusts, including the Scrape Thrust, the Pasture Pond Thrust and the Deer Cove Sole Thrust, within the Point Rousse Complex and the Pacquet Harbour Group. These thrusts are spatially associated with gold mineralization and most of the occurrences are located in the hanging wall less than a hundred metres from the thrusts.

Similar structures exist within the Rambler area of the Pacquet Harbour Group where gold mineralization occurs associated with: 1) units of sulphide-bearing quartz–sericite schist (Footwall Zone, Uncle Theo and Hill Bog), and 2) structurally controlled base-metal-rich quartz veins (Stuckey and Uncle Hank). The origin of the gold within these schistose units is problematic. The gold may be primary and related to the volcanogenic sulphides, but was later remobilized, or it may be related to a later gold mineralizing event that was superimposed upon an older VMS system. Overprinting of volcanogenic sulphide mineralization and alteration by later gold mineralizing events have been described from the Dumagami Mine in the Abitibi area of Quebec (Marquis *et al*., 1990) and the Lake Bond area of central Newfoundland (Hudson and Swinden, 1990). A series of ultramafic lenses (talc–carbonate schist), up to 3 m thick, located about 250 m above the Ming ore body was interpreted by Hibbard (1983) to represent tectonic slices emplaced along layer parallel or schistosity parallel faults, similar to the Scrape Thrust. Located immediately to the south of the Main Mine is the Rambler Brook thrust, a northerly dipping thrust that is interpreted to separate boninitic and tholeiitic parts of the Pacquet Harbour Group (Duncan *et al*., 1990).

Based on the styles of epigenetic gold mineralization there would appear to have been at least two different gold-bearing fluids, or sources of fluids, responsible for the gold occurrences on the Baie Verte Peninsula. One fluid was CO_2-rich and produced pyritiferous gold occurrences with associated carbonate alteration zones, particularly in the ophiolitic sequences. The other mineralizing fluid produced the base-metal-rich vein systems that occur mainly in the Ordovician and younger cover sequences. These fluids were probably not significantly different in age, but their source areas contrasted significantly. The fluids responsible for the pyritiferous gold occurrences were probably derived from the ophiolitic sequences. On the other hand, the base-metal-bearing fluids would have had to been derived from either Grenvillian basement or felsic volcanic and sedimentary rocks of island-arc derivation. Sulphur isotopic data for many of these occurrences do not differentiate possible multiple fluid sources.

CAMBRO-ORDOVICIAN OPHIOLITIC AND COVER SEQUENCE ROCKS

The ophiolitic sequences (Advocate and Point Rousse complexes and Pacquet Harbour Group) and the Flat Water Pond Group of the Baie Verte Belt are among the most prolific hosts to epigenetic gold mineralization on the Baie Verte Peninsula. The mafic volcanic and gabbroic rocks of the Point Rousse and Advocate complexes contain the majority of gold occurrences. Economically significant deposits within the study area appear to be restricted to the Point Rousse Complex (i.e., Deer Cove, Stog’er Tight, Romeo and Juliet and Pine Cove). However, base-metal-rich quartz veins are restricted to the Pacquet Harbour Group, which is probably in part stratigraphically equivalent to the Flat Water Pond Group. Gold mineralization within the Pacquet Harbour Group is associated with both mafic felsic sequences. The Flat Water Pond Group gold mineralization is associated with quartz–pyrite veins, base-metal-rich quartz veins and carbonate–quartz–pyrite replacement style gold mineralization in mafic volcanic and intrusive rocks and silica–sulphide replacement in felsic rocks.

The quartz–pyrite–carbonate-altered wall-rock style of gold mineralization is the most widespread style of gold mineralization within the ophiolitic sequences. However, despite their abundance, these occurrences, which mostly contain less than 5 percent disseminated pyrite, consistently exhibit low gold concentrations. Despite the abundance of mafic minerals that would serve as a source of iron, low concentrations of sulphur in the mineralizing fluids would explain the low pyrite abundances. These fluids carried gold as is shown by the gold concentrations in pyrite-rich zones. If pyrite formation was restricted, then a nucleation site for gold was lacking and therefore much of the gold remained in solution.

Within the Point Rousse Complex, iron formations are common. The most extensive unit, which consists of interbanded ferruginous chert and iron formation, is referred to as the Goldenville Horizon. The horizon is host to 5 gold occurrences, including the Goldenville Mine. Within the Goldenville Horizon, gold is associated with pyritiferous quartz veins and as disseminated gold hosted by bedded magnetite and ferruginous cherts. Background gold values for the Goldenville Horizon are typically 15 to 20 times the background of 3 to 4 ppb for the surrounding mafic rocks (Frew, 1971; Fitzpatrick, 1981). This led previous workers to state that the gold mineralization is strata bound and syngenetic. However, where the chert is fractured and veined it was reported to locally contain up to 4 times more gold than more massive non-fractured chert (Frew, 1971; Fitzpatrick, 1981). Hibbard (1983) also reported that at the main shaft, the gold-bearing quartz veins crosscut the regional foliation and therefore the gold was remobilized. The abundance of gold occurrences in the Goldenville area, many of which are hosted by gabbro, the crosscutting nature of the mineralized veins within the iron formation, and the spatial association between these veins and crosscutting faults, suggest an external non-iron-formation gold source. The Fe-rich gabbros and iron formation would act as chemical traps for the gold-bearing fluids.

SILURIAN COVER SEQUENCES AND INTRUSIVE ROCKS

In the Mic Mac Lake and Cape St. John groups, gold is associated with silica–pyrite replacement zones within schist zones developed within felsic volcanic rocks. There are no known examples of extensive iron-carbonate alteration within the Silurian or younger cover sequences. Gold occurs in association with shear-hosted base-metal-rich and quartz–pyrite veins within the Burlington granodiorite and quartz–pyrite veins within the Cape Brule Porphyry.

FLEUR DE LYS BELT

The Castor Brook prospect and the Breezeway and Marble Cove Point showings are the only known significant gold occurrences within the Fleur de Lys Belt. At Castor Brook and Marble Cove Point, the gold is associated with quartz–pyrite, shear-related veins hosted by metamorphosed sedimentary rocks of the Rattling Brook Group. The Breezeway showing is composed of small base-metal-rich veinlets developed within muscovite schist and marble. The Castor

Brook and Breezeway occurrences are spatially associated with a major arcuate structure, which is a possibly a splay from the Baie Verte Line, extending northward toward the community of Fleur de Lys. Isolated pods or lenses of ultramafic rocks occur along this structural zone and it is believed that the gold was derived from Baie Verte Belt rocks. The Marble Cove Point showing is hosted by rocks of the Rattling Brook Group, which are structurally imbricated with Advocate Complex rocks.

DISCUSSION

The Baie Verte Peninsula is host to two broad classes of epigenetic mesothermal gold mineralization; 1) vein-hosted, and 2) altered wall-rock or replacement-hosted. This gold mineralization is analogous to mesothermal lode gold occurrences as described in a review by Hodgson (1993). There are also many parallels between the geological evolution and gold mineralization of the Baie Verte Peninsula and the Mother Lode Belt of California. Both areas formed through accretion of marine volcanic and sedimentary sequences along a destructive continental margin. Both areas were affected by subsequent orogenic events resulting in extensive deformation, metamorphism, plutonism, and gold mineralization. In both instances, the gold is associated with structurally complex zones, which juxtapose poly- and lesser deformed terranes. The Mother Lode Belt occurs within the lesser deformed sequences and likewise the majority of gold occurrences in the Baie Verte area are hosted by rocks of the Baie Verte Belt. The poly-deformed Fleur de Lys Belt is known to host few gold occurrences.

Unlike the Mother Lode Belt, in which the gold-bearing veins have remained relatively intact since their formation, the Baie Verte Line was subjected to continued deformation long after gold deposition. As a result many of the auriferous vein and altered wall-rock occurrences are deformed. Vein systems associated with the larger fault zones exhibit evidence of brittle (brecciation) and ductile (boudinaged) deformation. Alteration zones tend to be lensoidal and transposed parallel to the regional cleavage.

Regionally there is no significant variation in the style of gold mineralization along the trace of the Baie Verte Line. However, there is an obvious correlation between the style of gold mineralization and the host rock. The Cambro-Ordovician ophiolitic and cover sequences are the most prolific gold hosts on the Baie Verte Peninsula. The carbonate–quartz–pyrite subclass is the most widely developed style of gold mineralization on the peninsula and it occurs within mafic rocks of the both the ophiolitic and Ordovician cover sequences. This subclass most closely resembles the “grey ore” deposits of the southern Mother Lode Belt and offer potential for large tonnage, low grade deposits.

The base-metal-rich quartz vein subclass appears to be restricted to the Ordovician cover sequences and the presence of Pb in these veins precludes a totally ophiolitic fluid source. Obducted sedimentary or island-arc volcanic rocks would be the most obvious source for the Pb. Alternatively Pb may have been derived from rocks of the Fleur de Lys Belt over which the Baie Verte Belt had been thrust. Sulphur isotopic data does not help distinguish these potentially different metal sources.

The Silurian cover sequences, in particular the Mic Mac Lake group, contain silica–sulphide replacement-style gold mineralization that, at Crow Hill, exhibit features somewhat analogous to low-sulphidation epithermal-like alteration. This alteration comprises broad zones of silicification and sericitization, disseminated pyrite, and quartz–specularite and quartz–adularia (?) veins. However, these zones do not appear to show enrichment in the typical epithermal elements Hg, As, and Sb (MacDougall, 1988b). Gold values, while typically low, are enriched over broad areas. Some narrow higher grade zones and high-grade float have been reported. These occurrences offer excellent potential for large tonnage–low grade deposits.

Unlike the Mother Lode Belt, where mariposite locally forms the immediate host rock for some of the gold occurrences, no significant gold mineralization is associated with similar rocks (locally termed virginite) exposed along the Baie Verte Line. Williams *et al*. (1977) reported the presence of virginite blocks in the Kidney Pond conglomerate east of Trap Pond on the Baie Verte Highway. The Kidney Pond conglomerate is interpreted to form the base of the Flat Water Pond Group. Therefore, the genesis and exhumation of the virginite must predate deposition of the Flat Water Pond Group. However, this same conglomerate also contains blocks of granodiorite interpreted to have been derived from the Burlington granodiorite (Hibbard, 1983). Recent radiometric age dating has revealed that the Burlington granodiorite is Silurian (Cawood and Dunning *et al*., 1993) and if the conglomerate blocks are indeed Burlington granodiorite then the Kidney Pond Conglomerate must postdate the granodiorite and the Flat Water Pond Group would represent a Late Silurian volcanic arc. Further work needs to be completed on the granodiorite blocks within the conglomerate. It is also significant to note that fuchsite-bearing and hematized ultramafic clasts are abundant within the basal portions of the Cape St. John Group (DeGrace *et al*., 1976) indicating pre-Silurian alteration. If, as evidence would suggest, the gold mineralization is related to Siluro-Devonian deformation then the zones of virginite, that are exposed at numerous localities on the Baie Verte Peninsula, are unrelated to subsequent gold mineralizing events. However, it is important to note that Cr-micas are almost ubiquitous within mineral deposits within the Baie Verte Belt, traces of these micas are present in many of the gold occurrences and fuchsite occurs in the Footwall Zone of the Rambler Main Mine (Bradley, 1997). This suggests a Cr/ophiolitic component in the mineralizing fluids. Regional correlations and limited radiometric dating indicates that the gold mineralization in central Newfoundland postdates emplacement of the Taconic allochthons by 80 to 100 million years.

The Baie Verte Peninsula is host to the largest concentration of gold occurrences in Newfoundland and four of these deposits are former producers including Nugget Pond Deposit. Previous mineral exploration has largely concentrated on the Baie Verte Belt and in particular on the Cambro-Ordovician ophiolitic and cover sequences. The lack of significant gold mineralization within the Fleur de Lys Belt may only reflect the limited amount of gold exploration carried out within this area. A number of large sigmoidal topographic linears extend from the Baie Verte Line northwestward across the Fleur de Lys Belt and the gold potential of these features should be examined. Exploration work should concentrate along structures that are demonstrably Late Silurian or younger in age.

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[Note: Geological Survey file numbers are included in square brackets.]

APPENDIX 1

PARTIAL LISTING OF GOLD OCCURRENCES, NTS MAP AREAS 12H/09, 12H/16, 12I/01, BAIE VERTE PENINSULA

Kings Point NTS 12H/9								
Name	No	Style	UTM	Host Rocks	Mineralogy	Assay Results	Comments	Referrences
Pandora (Au021)	2	QV	541750 5495125	Flat Water Pond Group(?)	pyr (Au)	Up to 6.9 g/t Au, grab samples	Narrow quartz veins, 2 to 3 cm wide, developed within a 0.2-m-wide zone of sheared mafic volcanic rocks containing up to 15 to 20% disseminated pyrite.	MacDougall, 1987a
Tamsworth (Au025)	6	QV	541600 5495700	Flat Water Pond Group(?)	pyr (Au)	Up to 10.5 g/t Au over 10 cm, up to 3.7 g/t Au, grab samples from the southern vein	Two 20°-striking, 5- to 10-cm-wide milky-white quartz veins developed within sheared and silicified mafic volcanic rock. The veins are vuggy and contain 5 to 10 percent pyrite and have been traced for 20 m. Buckshot-like pyrite is weakly developed in the wall rock marginal to the veins and trenching 30 m to the south revealed a 10-cm-wide vein.	MacDougall, 1987a
Micmac Lake West (Au026)	7	AW	539010 5498800	Fleur de Lys Supergroup	asp (Au)	1.03 and 0.72 g/t Au, grab samples	A 10- to 15-cm-wide silicified zone containing 1 to 2 percent fine arsenopyrite within quartz-mica schist.	MacDougall, 1988a
Micmac NW (Au028)	9	QV	541820 5498800	Fleur de Lys Supergroup	pyr (Au)	33.4 g/t Au, grab sample (could not be duplicated)	An east-west-trending, 6-cm-wide quartz vein containing up to 1 percent disseminated pyrite, exposed strike length of several metres. The vein crosscuts the regional foliation in the schists.	MacDougall, 1988a
Wild Cove Pond East (Au029)	10	QV	541800 5599850	Birchy Complex, Fleur de Lys Supergroup	asp, pyr, cp, bo (Au)	1.9, 1.0, 0.29 and 0.16 g/t Au, grab samples	A 0.5- to 1.0-m-wide milky-white quartz vein that outcrops at two locations approximately 25 m apart. A total of 75 m of trenching failed to expose more of the vein. The vein was reported to contain 10% disseminated and stringer arsenopyrite, pyrite, and minor chalcopyrite and bornite, but very little mineralization was observed in situ. However, an angular block of rusty quartz containing patches and laminations of arsenopyrite and pyrite was found approximately 25 m downstream from the most westerly outcrop.	MacDougall, 1987a
Bedford (Au030)	11	AW	545650 5498880	Burlington granodiorite	pyr (Au)	Up to 0.75 ppb Au, grab samples	An east-west-trending, 3- to 5-m-wide gabbro dyke cutting Burlington granodiorite. The dyke is locally feldspar porphyritic, epidotized and contains up to 30% disseminated and patchy medium-grained pyrite.	MacDougall, 1989b
Kidney Pond South (Au034)	15	QV	543990 5504300	Kidney Pond granite	pyr (Au)	1.46 g/t Au, grab sample	A rusty quartz vein, which contains 5% disseminated pyrite, is located along the apparent fault contact between the Kidney Pond conglomerate and the greenschist of the Birchy Complex. Rubbly exposure along a westward-dipping slope, bedrock source not confirmed.	MacDougall, 1988b, c
Crow Hill NE (Au038)	19	QV	548400 5508100	Mic Mac Lake group	spec, pyr (Au)	Up to 3.8 g/t Au, grab samples	Single trench exposes strongly cleaved and fractured quartz and feldspar porphrytic felsic volcanic rocks. Narrow quartz veins up to 10 cm wide, containing specularite and minor pyrite are developed within the volcanic rocks.	MacDougall, 1987b, 1988b
Bear Paw (Au039)	20	AW	547450 5510600	Flat Water Pond Group and Fleur de Lys Belt	pyr (Au)	Up to 1.2 g/t Au and 5.9 g/t Ag, grab samples from a graphitic horizon	An extensive alteration zone up to 150 m wide developed along fault contact between the Flat Water Pond Group and the Fleur de Lys Belt is exposed in 4 trenches. Alteration comprises variable quartz carbonate± pyrite or fuchsite and/or talc carbonate with minor silicified zones and graphitic horizons.	MacDougall, 1988b

Strugglers Pond (Au042)	21	AW	546350 5599850	Mic Mac Lake group	pyr (Au)	A 4.0 m channel sample assayed 14.4 g/t Au.	Pyrite occurring as disseminations and lenses within quartz flooded mafic volcanic rocks.	Day, 1998

NTS 12H/16 Baie Verte								
Name	No	Style	UTM	Host Rocks	Mineralogy	Assay Results	Comments	Referrences
Flat Water Pond Park (Au001)	22	AW	549175 5512450	Flat Water Pond Group	pyr (Au)	Grab sample assays up to 2.0 g/t Au.	A small silicified lens containing disseminated pyrite within a zone of carbonate-altered mafic volcanic rocks. Part of an extensive zone of quartz carbonate chlorite alteration outlined by Noranda.	MacDougall and Churchill, 1989
Breezeway/ Baie Verte River (Au005)	26	QV	550900 5529320	Rattling Brook Group	bo (Au)	Grab sample assays include 25.5, 6.75, 1.7, 1.5 and 0.6 g/t Au.	A 2.0-cm-wide seam of bornite associated with quartz carbonate veins developed within amphibolite schists.	MacEDougall, 1987c
Casa Loma (Au008)	29	AW	554400 5527100	Advocate Complex	pyr (Au)	Grab sample assays up to 7.3 g/t Au, and a channel sample assayed 2.3 g/t Au over 2.0 m. Tested by a single, 129.8 m, diamond-drill-hole (A-88-11); no significant assays were reported.	The mineralization occurs within a 3- to-4 m-wide, 50/60° north-dipping shear zone approximately 0.3 m beneath it's structural hanging-wall contact. A 1.0-m-wide section of the zone is comprised of quartz chlorite pyrite breccia. Small tension-gash quartz-carbonate veins cut both the mineralized section and the remainder of the shear zone. Less than 1 percent disseminated pyrite occurs both in the veins and in the wall rock adjacent to the veins.	MacDougall, 1989c
Central Carbonate (Au010)	31	AW	555000 5526375	Flat Water Pond Group	pyr (Au)	Grab samples assayed up to 5.5, 4.6 and 2.8 g/t Au. Channel samples assays include 0.35 g/t Au over 5.0 m and 0.20 g/t Au over 2.0 m.	A 70-m-wide zone of pervasive Fe-carbonate (ankerite) alteration accompanied by patchy 1 to 2% disseminated pyrite. Traced by trenching for at least 700 m.	MacDougall, 1990c
Braz (Au011)	32	QV	555075 5526650	Flat Water Pond Group	hem, pyr (Au)	Grab sample assays up to 314.0 g/t Au. Channel sample assays include 9.5 g/t Au over 0.4 m, 5.7 g/t Au over 0.5 m and 1.2 g/t Au over 0.65 m. Combined averages (vein & mineralized wall rock) include 5.8 g/t Au over 1.9 m, 3.1 g/t over 2.0 m and 1.2 g/t Au over 0.65 m.	A number of boudinaged quartz vein lenses are preserved within a 1- to 3-m-wide shear zone developed within mafic volcanic rocks. Kinenmatic indicators suggest sinistral offset on the shear. The lenses, which are up to 1.0 m wide, are developed parallel to the shear, which trends 60° and dips 70° to the north. The veins are composed of milky-white quartz, locally hematized, with up to 10 percent vuggy pyrite and rare visible gold. The zone has a strike length of 30 m and pinches out at both ends.	MacDougall, 1990c
Dorset Extension (Au013)	34	QV	554100 5526550	Flat Water Pond Group	pyr, Au	Combined assay of 56.0 g/t Au over 2.5 m, detailed channel sample.	Trenching of a soil anomaly 350 m along strike to the southwest of the Dorset #2 vein exposed 3 small, 0.1- to 0.5-m-wide boudined quartz veins localized within a 2.0- to 2.5-m-wide shear zone. The veins contained disseminated pyrite and abundant coarse gold. Two diamond-drillholes (D-88-9 and 10) were collared in 1988 to test the Dorset Extension. Assay values up to 2.32 g/t Au over 0.5 m were from the drill core.	MacDougall, 1989c

Powerline (Au015)	36	AW	554850 5527500	Flat Water Pond Group	pyr (Au)	Grab sample assays include 13.3, 13.7, 8.3, 2.46 and 5.3 g/t Au. Detailed channel sample assays include 1.6 g/t Au over 1.6 m and 1.39 g/t Au over 1.15 m.	Numerous, sheeted tension-gash quartz veins, up to 15 cm wide are developed within a weakly sheared gabbro. Wall rock adjacent to the veins is silicified and weakly carbonitized. Coarse euhedral pyrite, up to 1 cm across, occurs in the wall rock adjacent to the veins. The zone has been exposed along a northeast-trending strike length for 20 m over a width of 1 to 3 m.	MacDougall, 1990c
TN-89-1 (Au016)	37	AW	554400 5528500	Advocate Complex	pyr, po (Au)	A 1.0 m diamond-drill intersection assayed 2.01 g/t Au.	A single 125.0-m-long diamond-drillhole tested an HLEM geophysical anomaly. The hole intersected a graphitic argillite containing disseminated pyrite and pyrrhotite.	MacDougall, 1990c
Biarritz (Au017)	38	AW	556125 5529150	Advocate Complex	pyr (Au)	Grab sample assays range from 1.3 to 16.02 g/t Au, combined chip assay results 3.9 g/t Au over 4.0 m. Trench located 300 m southwest exposed 5- to 10-m-wide shear zone from which grab sample assayed up to 9.2 g/t Au. Diamond-drillhole A-88-7 assayed 0.66 g/t Au over 1.5 m and A-88-9 assayed 3.11 g/t Au over 0.5 m.	Gabbroic rocks are cut by a 5 to 10 m wide carbonitized, shear zone, which contains 1 to 2% disseminated pyrite. The zone is cut by numerous quartz-carbonate veinlets and stringers. The prospect has been tested by trenching, three diamond-drillholes and a single Winke hole.	MacDougall, 1989c
Sisters Point (Au020)	41	AW	559350 5533950	Advocate Complex	pyr (Au)	Grab sample assays up to 1.4 g/t Au. Detailed channel sample assays up to 0.6 g/t Au over 2.8 m.	Zone consists of a 2.5-m-wide, 70-m-long unit of sheared to massive, intensely carbonitized, chloritized and quartz-veined basalt, locally silicified and containing up to 5% medium-grained euhedral pyrite.	Smith, 1989
Baie Vista (Au021)	42	QV	560700 5536100	Advocate Complex	pyr, asp (Au)	Grab samples assayed up to 5.7 g/t Au, and wall-rock grab samples assayed up to 1.0 g/t Au.	Quartz-carbonate veins containing minor pyrite and arsenopyrite, are hosted by pervasively carbonatized, chloritized and sheared mafic volcanic rocks/gabbro. The altered rock contains 1 to 2% disseminated pyrite. The veins and alteration form zones up to 5.0 m wide and up to 25.0 m long. Stringer veins containing 3 to 4% pyrite and arsenopyrite are also present.	Pollard, 1988
Iron Formation (Au025)	46	AW	562725 5535325	Point Rousse Complex	pyr (Au)	Grab samples up to 1.18 g/t Au, 1.13% Cu and 6.8 g/t Ag.	Massive pyrite bands and stringers within hematite magnetite jasper iron formation. Two outcrops approximately 150 m apart.	Dimmell and Hartley, 1991b
Corner Shore (Au026)	47	QV	561775 5535900	Point Rousse Complex	pyr (Au)	Grab samples up to 14.6 g/t Au. Grab sample of vein collected by author assayed 28.6 g/t Au.	Discovered during initial Noranda prospecting of the Pumbly Point area. Exposed by a single, hand-dug trench; no further work undertaken. The mineralization consists of a 1- to 2-cm-wide milky-white quartz vein containing coarse euhedral pyrite. The vein is hosted by carbonate altered mafic volcanic rocks which contain 5 to 10% coarse-grained euhedral pyrite.	Smith, 1989 Evans, 1999

Pumbly Point (Au027)	48	AW	562050 5536550	Point Rousse Complex	pyr (Au)	Grab samples have assayed up to 1.91 g/t Au.	A 2-m-wide shear zone, developed within mafic volcanic rocks. The shear zone is marked by intense Fe-carbonate alteration and milky-white quartz veins. The zone contains 3 to 5% euhedral pyrite. A second zone is developed within carbonitized flow breccia 200 m to the north. Channel sampling of this zone revealed anomalous gold concentrations over a 6 m width that included 0.65 g/t over 2.0 m.	Pollard, 1988
Pumbly Point Carbonate and Fuel Bog Zones (Au028)	49	AW	562500 5536400	Point Rousse Complex	pyr (Au)	Carbonate Zone: Grab samples assayed up to 2.7 g/t Au. Detailed channel sample assays up to 2.7 g/t Au over 1.4 m and grab samples from the unaltered wall rock assayed up to 3.7 g/t Au. Detailed channel samples collected across the unaltered rock assayed 1.3 g/t Au over 1 m. Fuel Bog Zone: Grab sample assays up to 1.9 g/t Au. Detailed channel sampling assayed 1.15 g/t Au over 4.0 m. A piece of rubble from one of the trenches assayed 4.9 g/t Au.	Carbonate Zone was discovered during follow-up prospecting of a ground VLF survey and a gold grain survey. The zone varies from 0.5 to 12 m in width and has a discontinuous strike length of 500 m and zone is composed of strongly sheared and intensely carbonate-altered microgabbro containing 1 to 2% medium-grained euhedral pyrite. The Fuel Bog Zone discovered during trenching of the Carbonate Zone comprises an east-west-trending zone, 30 m wide and consists of massive to weakly sheared, intensely carbonate-altered microgabbro containing up to 3% medium-grained euhedral pyrite. Both zones were tested by a single 149.6-m-long NQ diamond-drillhole.	Smith, 1989
Green Cove Brook (Au032)	53	AW	565550 5537350	Point Rousse Complex	pyr (Au)	Grab samples assays up to 6443 ppb Au.	Cherty silicate iron formation. Trench exposes about 30 to 40 m of purplish hematitic sediments and hematitic chert breccia. The breccia is cut by numerous specularite-bearing quartz veinlets. Specularite also occurs as fracture coatings and as small veinlets.	Ovens and McBride, 1988
East Shaft (Au035)	56	QV	568150 5538350 approxi-mate	Point Rousse Complex	pyr, mag (Au)	A 4.3 ft channel sample collected east of the East Shaft assayed 1 dwt, 7.36 gr Au (1.4 g/t)	Trial shaft sunk on a five foot thickness of magnetite-hematite schist containing minor quartz and pyrite.	Snelgrove, 1935
Maritec #1 (Au036)	57		568625 5538500	Point Rousse Complex	pyr (Au)	Grab sample assayed 1.38 g/t Au.	Strongly carbonatized mafic rock (gabbro?). Cut by small milky quartz and quartz chlorite veins. Wall rock adjacent to the veins locally contain minor cubic pyrite up to 2 mm across.	Wells, 1989
Maritec #2 (Au037)	58		568725 5538100	Point Rousse Complex	pyr (Au)	Grab sample assayed 22.2 g/t Au.	Brecciated carbonate vein containing 5 to 10% pyrite occurring marginal to a 50-m-wide zone of carbonate altered gabbro.	Wells, 1989

Maritec #3 and #4 (Au038)	59		569050 5538650	Point Rousse Complex	pyr, mag (Au)	Maritec #3 Grab sample assay values up to 14.36 g/t Au. Maritec #4 Grab sample assay values up to 9.87 g/t Au.	Maritec #3 and Maritec #4 refer to two trenches that expose the same mineralized horizon approximately 75 m apart. The mineralization comprise quartz veins up to 15 cm wide that are developed adjacent to and extend into a 1- to 1.5-m-wide magnetite bed. Abundant coarse pyrite is developed in the magnetite adjacent to the veining. The magnetite is underlain by about 4 m of ferruginous chert.	Wells, 1989
Maritec #5 (Au039)	60	QV	569500 5538600	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 4.68 g/t Au.	A 30-cm-wide shear zone developed within mafic volcanic rocks. The shear hosts thin quartz veinlets, which contain a trace of pyrite.	Wells, 1989
Barry and Cunningham Gold (Au040)	61	QV	569900 5538500	Point Rousse Complex	pyr, cp, Au	Grab samples assayed up to 10.06 oz/t on Au.	A 2.5-mm to 3.8-cm-thick quartz vein composed of coarse-grained, white and grey quartz and minor amounts of pyrite, chalcopyrite and visible gold. The vein strikes northeast, dips 15° southeast and can be traced for several metres. The showing is located approximately 6 m south of the Barry and Cunningham adit.	Tuach and Collins, 1974; Howse and Collins, 1977
Shear #1 (Au044)	65	AW	567950 5532550	Point Rousse Complex	(Au)	Grab sample assayed 1.63 g/t Au.	Quartz-fuchsite altered ultramafic rock containing minor pyrite. Tills in the area contain anomalous concentrations of gold.	Huard, 1987b; 1988c
Carol Option (Au045)	66	AW	566950 5531200	Pacquet Harbour Group	(Au)	Grab sample assayed 2.3 g/t Au.	Carbonatized gabbro.	
Hank's (Au047)	68	QV	565410 5526550	Pacquet Harbour Group	gn, sp, cp, pyr (Au, Ag)	Grab sample of quartz float collected by the author assayed 6.18 g/t Au and 49 g/t Ag.	Milky, recrystalized quartz containing coarse-grained galena, sphalerite and chalcopyrite. Showing described as an area 210 m^2 containing abundant disseminated and stringer sphalerite and galena within chlorite quartz schist. No vertical continuity was found.	Tuach, 1978; Evans, 1999
Uncle Enos (Au049)	70	AW	565450 5527250	Pacquet Harbour Group	cp, pyr (Au)	The zone is reported to have averaged .5 oz/ton Au.	A zone of quartz sericite schist exposed for approximately 120 m by 10 m along England's Brook. Drilled by Jawtam Key Gold Zones.	Quinn, 1945; Tuach, 1978; Hibbard, 1983
Hill Bog (Au050)	71	AW	565375 5526575	Pacquet Harbour Group	cp, pyr (Au)	Channel samples assayed up to 1.06 oz/t Au and 1.42% Cu over 0.76 m. Diamond drilling intersected zones that assayed up to 1.12% Cu, 0.036 oz/t Au and 0.23 oz/t Ag over 2.6 m.	Zones of chlorite and quartz sericite schist, locally with quartz fuchsite bands, containing up to 10% disseminated pyrite, chalcopyrite and sphalerite in bands up to 1.3 m thick.	Duncan et al., 1990; Coates, 1990b
Uncle Bill (Ramber No. 3 Prospect) (Au051)	72	AW	565450 5526300	Pacquet Harbour Group	cp, pyr (Au)	Average grade 0.49% Cu over 17.7 m. A channel sample assayed 2.43 g/t Au over an unknown width.	Disseminated and stringer sulphides within quartz-chlorite-sericite schist	Hibbard, 1983; Duncan et al., 1990

Uncle Theo (Rambler No. 1 Prospect) (Au052)	73	AW	565050 5525150	Pacquet Harbour Group	pyr (Au)	Channel sample assays of 0.12 oz/t Au over 0.37 m and 0.47 oz/t Au over 0.61 m.	A 0.5-m-wide quartz vein containing chalcopyrite, developed within sericitic schist.	Beer and MacDougall, 1989
Uncle Angus (Au053)	74	AW	564210 5526680	Pacquet Harbour Group	cp, pyr (Au)	Assays of up to 1.11 g/t Au.	Chloritized and carbonitized basalts containing pyrite seams and nodules.	Beer and MacDougall, 1989
Uncle Will (Rambler No. 2 Prospect) (Au054)	75	AW	565250 5526250	Pacquet Harbour Group	cp, pyr (Au)	Extensive channel sampling returned assayed values of 0.2 to 2.0% Cu, best sections included 1.97% Cu over 0.46 m and 2.1% over 0.46 m. Anomalous gold values were reported.	Pyritic quartz-sericite schist.	Duncan et al., 1990
Uncle Mike (Au055)	76	AW	564730 5525950	Pacquet Harbour Group	cp, pyr (Au)	Anomalous gold values were reported.	Silicified schistose zone (quartz sericite schist) at least 1 m wide containing fine-grained pyrite and minor chalcopyrite.	Tuach, 1978
Mink (Statuesque /Beaver) (Au056)	77	AW	564250 5526500	Pacquet Harbour Group	cp, pyr (Au)	Mink Showing: grab samples assayed up to 2.2g/t Au, 5.3 g/t Ag and 0.6% Cu. Beaver Showing: grab samples assayed up to 1.1 g/t Au, channel samples averaged 0.22 g/t Au over 4 m. Statuesque Showing: grab samples assayed up to 0.9 g/t Au, channels samples up to 0.26 g/t Au over 7 m.	Pyritic quartz-sericite schist.	Beer and MacDougall, 1989
Wellsdale (Au057)	78	QV	567850 5528950	Pacquet Harbour Group	cp, pyr (Au)	Grab samples assayed up to 4.1 g/t Au and 4.4% Cu.	Milky-white, 15-m-thick (?), quartz vein developed within chloritic and sericitic-altered volcanics and cherty sediments.	Dimmell and MacGillivray, 1991a
Spillway (Au058)	79	QV	564050 5527850	Pacquet Harbour Group	cp (Au)	A grab sample assayed 4.0 g/t Au.	Quartz vein, up to 0.5 m wide, containing minor chalcopyrite developed within sericitic schist	Beer and MacDougall, 1989
Mallard (Au059)	80	AW	562950 5527250	Pacquet Harbour Group	pyr (Au)	A grab sample assay 3.27 g/t Au, could not be duplicated	Pyrite seams and nodules developed within chloritized and partially carbonatized basalt	Beer and MacDougall, 1989
Rambler Brook (Au060)	81	QV	568600 5525200	Pacquet Harbour Group	cp, pyr (Au, Ag)	Grab samples assayed to 3% Cu, 6 g/t Au and 5 to 9 oz/t Ag.	Narrow, stringer chalcopyrite/pyrite veins hosted by a 2-m-wide, north-trending shear zone developed within intermediate to felsic feldspar-phyric porphyry.	Dimmell and MacGillivray, 1991b

Krissy Trend (Au061)	82	QV	565700 5524550	Pacquet Harbour Group	pyr, gn, ang (Au)	A chip sample assayed 1.34 g/t Au over 2.7 m. A composite grab sample of pyr-gn-ang-bearing quartz veining assayed 7.25 g/t Au. A grab sample from a 3- to 4-cm-wide quartz vein assayed 12 g/t Au.	Prospecting led to the discovery of a large quartz boulder (Krissy Showing) containing abundant visible gold. Further prospecting, and geological and geophysical surveys and trenching on the Krissy Trend exposed a 2.7-m-wide zone of sericite schist containing boudinaged sugary quartz veining. The veins contain banded and disseminated pyrite and minor galena, anglesite and chalcopyrite.	Dimmell, 1993
WJ-660 (Au062)	83	AW	571450 5523100	Pacquet Harbour Group	pyr (Au)	Grab samples assayed up to 3.14 g/t Au. Three 1 m channel samples assayed 1110, 930 and 1520 ppb Au.	Discovered by geologist Wilson Jacobs, the showing comprises trachytic crystal lithic tuff containing up to 5 percent disseminated and finely banded pyrite.	Dimmell, 1989
FDR-263 (Au063)	84	AW	571450 5522925	Pacquet Harbour Group	pyr, gn (Au)	Large pyrite cubes assayed up to 71 g/t Au and greater than 100 g/t Ag.	Discovered in 1987 by prospector Fred Dennis. Cubic pyrite megacrysts up to 8 cm on a side are associated with a flat-lying, discontinuous quartz vein that cuts coarse-grained Cape Brule Porphyry.	Chance, 1988; Dimmell, 1989
Brass Buckle South (BBS) (Au065)	86	QV	571200 5521950	Pacquet Harbour Group	Au	Visible gold.	A 2-cm-wide quartz vein with visible gold developed within intermediate breccia.	Peter Dimmell, personal communication, 1997
BBT (Au066)	87	AW	570900 5521450	Pacquet Harbour Group	pyr (Au)	A grab sample assayed 4.9 g/t Au.	A 30-cm-wide zone of quartz breccia containing fine-grained pyrite developed marginal to a quartz porphyry dyke that cuts epidotized mafic breccia.	Peter Dimmell, personal communication, 1997
Skidder Pond (Au067)	88	AW	570100 5521300	Pacquet Harbour Group	pyr, cp (Au, Ag)	A grab sample assayed 1.4 g/t Au.	A 60-cm-wide zone of disseminated, euhedral pyrite developed marginal to a dyke of Burlington granodiorite.	Peter Dimmell, personal communication, 1997
Tie Line (Au068)	89	QV	570100 5519850	Pacquet Harbour Group	cp, pyr, gn, mag, po (Au, Ag)	Grab sample assays include: Sulphide stringers 33.4 g/t Au, 250 g/t Ag, 2% Cu, 36.8% Pb, and 8% Zn; Quartz veins 2.8 g/t Au	Twin Pond East and West zones were discovered in 1988. Disseminated and stringer to massive sulphide and magnetite in silicified mafic rocks. Magnetite-bearing quartz veins 5 to 25 cm wide exposed over a 20-m-strike length.	Bradley, 1988; A1, 1989b

Fleur De Lys NTS 12I/1								
Name	No	Style	UTM	Host Rocks	Mineralogy	Assay Results	Comments	Referrences
Deer Cove Block (Au003)	92	QV						

#1	568250 5540850	Point Rousse Complex	pyr, Au	Visible gold	Narrow quartz veins	Graves, 1986
#3	569125 5540950	Point Rousse Complex	pyr (Au)	Grab sample sassayed up to 6.3 g/t Au	Vuggy quartz veins containing 5 to 15% pyrite developed within chloritic shear in mafic volcanic breccia. Trend of zone 35°, dip 50° north.	Graves, 1986; Evans, this study
#4,5	569350 5541225	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 4.8 g/t Au, channel samples up to 4.05 g/t Au over 1 m	Quartz veins, vuggy quartz and quartz breccia developed over a width of about 2 m within sheared, silicified and bleached, hematitic and epidotized, fine-grained gabbro/mafic volcanic breccia. Trend of zone 070°, dip 55° north.	Graves, 1986; Evans, this study
#6	569200 5540975	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 9.6 g/t u	Coarse milky-white, vuggy quartz chlorite veins and veinlets, with 1 to 2 mm pyrite cubes, developed over a width of about 3 m within sheared medium-grained gabbro/mafic volcanic breccia. Trend of zone 075°, dip 50° north.	Graves, 1986; Evans, this study
12+80E 2+40N	569175 5540875	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 2.5 g/t Au.	Narrow quartz veins within sheared mafic volcanic rocks.	Graves, 1986
13+30E 2+70N	569230 5540800	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 9.6 g/t Au.	Narrow quartz veins within sheared mafic volcanic rocks.	Graves, 1986
13+50E 3+50N	569250 5540975	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 1.65 g/t Au.	Narrow quartz veins within mafic volcanic rocks	Graves, 1986
Deer Cove Pond South	569175 5540750	Point Rousse Complex	pyr (Au)	Channel sample assayed 2.3 g/t Au over 1.0 m.	Quartz veins within quartz carbonate fuchsite-altered ultramafic rocks. Specular hematite common locally	Graves, 1986
#8	568100 5540800	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 2.05 g/t Au.	Qaurtz veins within mafic volcanic rocks	Graves, 1986
2+75E 0+00	568175 5540750	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 1.15 g/t Au.	Quartz veins within mafic volcanic rocks	Graves, 1986
1+50E 0+90N	568050 5540850	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 1.00 g/t Au.	Quartz veins within mafic volcanic rocks	Graves, 1986
1+75E 1+00S	567950 5540650	Point Rousse Complex	pyr (Au)	Channel sample assayed 1450 ppb Au over 1.0 m.	Talc carbonate altered ultramafic rocks	Graves, 1986
#9	568600 5540700	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 3.7 g/t Au.	Quartz veins within mafic volcanic rocks	Gower, 1988
#12	568800 5540900	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 7.6 g/t Au	Zone of anastomosing quartz veins and veinlet within mafic volcanic rocks The zone pinches and swells to a maximum exposed width of 4 to 5 m. Trend of zone 004°, dip 70° south.	Gower, 1988; Evans, this study
8+50E 1+50N	568200 5540850	Point Rousse Complex	pyr (Au)	Channel samples assayed up to 5.52 g/t Au over 1.0 m	Quartz veins and quartz breccia with minor pyrite within shear zones cutting massive mafic volcanic rocks. The veins are up to 30 cm wide, weakly laminated, vuggy, contain altered angular wall-rock fragments and small patches of chlorite. Wall rock adjacent to the veins is locally carbonitized, silicified and contains disseminated pyrite. Trend of vein 080°, dip 60° south.	Gower, 1988; Evans, this study

10+50E 2+50N			568800 5540975	Point Rousse Complex	pyr (Au)	Channel samples assayed up to 1.36 g/t Au over 1.0 m	Quartz veins containing pyrite and trace magnetite cutting silicified and fractured mafic volcanic rocks	Gower, 1988
8+50E 2+40N			568475 5540950	Point Rousse Complex	pyr (Au)	Channel sample asssays include 16.3 g/t Au and 32 g/t Au	Shear-hosted, narrow quartz veins with trace pyrite developed within mafic volcanic breccia. Trend of veins 100°, dip 25° north.	Gower, 1988; Evans, this study
Deer Cove			567850 5540925	Point Rousse Complex	pyr (Au)	Channel samples assayed up to 1.8 g/t Au.	Narrow quartz veins with trace pyrite within sheared mafic volcanic and ultramafic rocks.	Graves, 1986
Deer Cove North (Au004)	93	QV						
#13			568500 5541350	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 6.0 g Au.	A large, locally vuggy and coarsely crystalline, milky-white quartz vein up to 3 to 4 m wide developed within fine- to medium-grained gabbro and mafic volcanic rocks. Carbonate is developed along the vein margins. Trend of zone 110°, dip 70° south.	Graves, 1986; Evans, this study
6+10E 5+25N			568575 5541300	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 4.30 g/t Au.	Anastomosing, narrow rusty quartz veins and veinlets, locally vuggy developed over a width of 3 to 4 m within mafic volcanic rocks. Trend of zone 095°, dip 83° south.	Graves, 1986
6+00E 6+75N			568575 5541425	Point Rousse Complex	pyr (Au)	Channel samples assayed up to 13.5 g/t Au over 1.0 m.	Discontinuous quartz stringers, with up to 20% fine-grained disseminated pyrite and up to 5% pyrite along vein selvages, developed within shear zones cutting sheeted dykes.	Gower, 1988
#11 (Au005)	94	QV	568400 5541450	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 3.3 g/t Au.	Narrow quartz veins within sheared gabbro.	Graves, 1986
#10 Eastern Point (Au006)	95	QV	568300 5541900	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 2.35 g/t Au	Deformed, milky quartz vein, up to 1 m wide, within strongly sheared sheeted diabase dykes. Only minor sulphide was noted in the vein. The wall rock within the shear zones contains up to 5% pyrite occurring as disseminations, patches and wispy bands. Trend of vein 090°, dip 55° north.	Graves, 1986
Devils Cove (Au007)	96	QV	569650 5542575	Point Rousse Complex	pyr (Au)	Grab samples up to 4.44 g/t Au. Samples were collected from large boulders at the base of a steep cliff.	Quartz carbonate veins containing coarse clots of pyrite within talc carbonate altered and deformed ultramafic rocks.	Graves, 1986
Fox Pond #2 (Au009)	98	AW	567200 5539300	Point Rousse Complex	mag (Au)	Up to 18.5 g/t Au over 0.20 m from a diamond-drillhole	Quartz carbonate talc veins with minor magnetite developed along a shear zone cutting serpentinized ultramafic rocks. Trend of zone 175°, dip 55° west.	Gower, 1988; Evans, this study
Fox Pond North	99	AW	567575 5539900	Point Rousse Complex	pyr (Au)	Grab samples up to 2.7 g/t Au.	Quartz veins within sheared gabbro.	Gower, 1988

Muskeg Linear (Gabbro Zone) (Au011)	100	AW	567425 5539350	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 1.47 g/t Au.	Quartz carbonate pyrite veins within sheared gabbro.	Gower, 1988
Marble Cove Point (Au012)	101	QV	561800 5540350	Rattling Brook Group/Birchy Cove Schist	pyr (Au)	Grab samples: Main Vein assayed up to 8.3 g/t Au, North Vein 9.9 g/t Au. Altered wall rock adjacent to the North Vein assayed up to 6.5 g/t Au.	The Main Vein is up to 40 cm wide and is developed within a southeast-trending fault zone. The North Vein is up to 6 cm wide and is developed within a northeasterly striking shear zone. The veins are milky-white, vuggy, laminated, locally contain wall-rock fragments and patches of chlorite and exhibit pinch and swell textures. Pyrite occurs as disseminated euhedral crystals and bands up to 1 cm thick developed within the wall rock up to 15 cm from the veins, and as disseminations within and surrounding the wall rock fragments. Smaller tension-gash veins, which trend 185° and dip 72° west, crosscut the North Vein.	Huard, 1987a; Evans, this study
Fox Pond West (Au013)	102	AW	566325 5539500	Point Rousse Complex	pyr (Au)	Channel samples assayed up to 1.9 g/t Au over 1 m.	Quartz veins within sheared gabbro	Gower, 1988
Devils Cove Pond NW (Au014)	103	QV	569200 5541600	Point Rousse Complex	pyr (Au)	Grab samples assayed up to 2.6 g/t Au.	Quartz veins locally containing up to 2 to 3% pyrite within in talc carbonate-altered gabbro.	Gower, 1988

Note: abbreviations used in table include: Qv (quartz vein), AW (altered wallrock), pyr (pyrite), asp (arsenopyrite), cp (chalcopyrite), bo (bornite), sp (sphalerite), spec (specularite), hem (hematite), po (pyrrhotite), mag (magnetite), gn (galena), and ang (anglesite). () denotes presence determined through assay.