



**THE McLYMONT NORTHWEST ZONE, NORTHWEST BRITISH COLUMBIA:
A GOLD-RICH RETROGRADE SKARN? (104B)**

**By G.E. Ray, Geological Survey Branch
V.A. Jaramillo, Gulf International Minerals Limited
and A.D. Ettlinger, Mineral Deposit Research Unit, U.B.C.**

KEYWORDS: Economic geology, skarn, gold, Iskut River, manto, retrograde skarn, garnet microprobe analyses, silicification, galena-lead isotopes.

INTRODUCTION

The McLymont property is located close to the headwaters of McLymont Creek, a tributary of the Iskut River; it lies at an elevation of approximately 1170 metres (3800 feet), about 2 kilometres southwest of Newmont Lake (Figure 2-11-1). The property is currently being explored by Gulf International Minerals Ltd. It contains two styles of mineralization whose relationship to each other is uncertain. One of these, the "Camp zone", consists of auriferous quartz-ankerite-pyrite-chalcopyrite veins hosted by a quartz-rich granite close to its contact with Triassic and Jurassic rocks. The second style, the "Northwest zone", comprises steeply dipping and subhorizontal zones of magnetite-sulphide-gold mineralization hosted in Mississippian rocks. This paper describes the geology and mineralization of the Northwest zone, and is based on preliminary work that includes core logging, polished thin-section studies, microprobe analyses of garnets, galena-lead isotope analyses, and some trace element analyses (Table 2-11-1).

REGIONAL GEOLOGY

The first major geological study of the region was presented by Kerr (1948). Recent work includes 1:50 000-scale geological mapping by Logan *et al.* (1990a) as well as other work by Read *et al.* (1989), Anderson (1989), Britton *et al.*

(1989, 1990), Webster and McMillan (1990), Anderson and Bevier (1990) and Logan *et al.* (1990b). A descriptive report of the skarn occurrences in the district is given by Webster and Ray (1991, this volume).

The area lies within the Stikine lithostructural terrane which represents a mid-Paleozoic to Mesozoic island-arc sequence of volcanic and sedimentary rocks. The Paleozoic rocks range from Devonian to Permian in age and form part of the Stikine assemblage, while the Mesozoic includes both the Upper Triassic Stuhini Group and the Jurassic Hazelton Group. These supracrustal rocks are intruded by Early Jurassic to Cretaceous and Tertiary plutons (Logan *et al.*, 1990b).

The region is cut by two sets of major faults. The most abundant are narrow, north-striking linear faults; one of these, the Forrest Kerr fault (Logan *et al.*, 1990a), has influenced the lower course of the Forrest Kerr Creek (Figure 2-11-1). The other set forms complex, north-northeast to northeast-trending fault zones. The faults bounding the Newmont graben belong to this set; the graben is 1 to 2 kilometres wide and contains downdropped Jurassic and Triassic sediments, tuffs and some intrusions that are juxtaposed against Paleozoic rocks to the east and west (Figure 2-11-1).

PROPERTY GEOLOGY

Previous studies on the property have been by Grove (1986, 1989), who first identified the McLymont Northwest zone as a skarn, and by Koyanagi (1990). The Camp zone

**TABLE 2-11-1
ASSAY RESULTS OF SELECTED UNMINERALIZED AND MINERALIZED SAMPLES: McLYMONT NORTHWEST ZONE**

Lab No.	Au	Ag	Cu	Pb	Zn	Co	Ni	Mo	As	Sb	Bi	Te	Se
041347	239	5	0.36%	38	81	21	4	8	110	8	<5	1.4	0.1
041348	176	5	0.49%	7	48	51	112	8	80	3	<5	4.0	18.0
041349	444	20	0.16%	125	28	38	10	8	424	10	<5	1.6	0.1
041350	1670	23	2.10%	255	52	129	42	8	835	16	11	4.0	0.1
041374	11938	30	1.18%	313	51	75	4	8	690	21	8	1.4	0.1
041375	2848	8	0.34%	13	73	6	6	52	115	4	<5	0.3	0.1

Units and Methods:

Au, in ppb; all other values in ppm except where noted in per cent (%).
Au, FA/ICP; Te and Se AH/ICP; all other elements are by AAS.

Sample description:

- 041347: magnetite-pyrite-ankerite alteration adjacent to ore zone, Drillhole 89-19.
- 041348: pyrite-quartz veining adjacent to ore zone, Drillhole 89-19.
- 041349: chlorite-pyrite-carbonate alteration adjacent to ore zone, Drillhole 89-19.
- 041350: coarse pyrite-magnetite-chlorite alteration, Drillhole 89-19.
- 041374: pyrite-chalcopyrite-carbonate mineralization from ore in mushroom zone, Drillhole 89-20.
- 041375: magnetite-pyrite-carbonate mineralization from ore in mushroom zone, Drillhole 89-18.

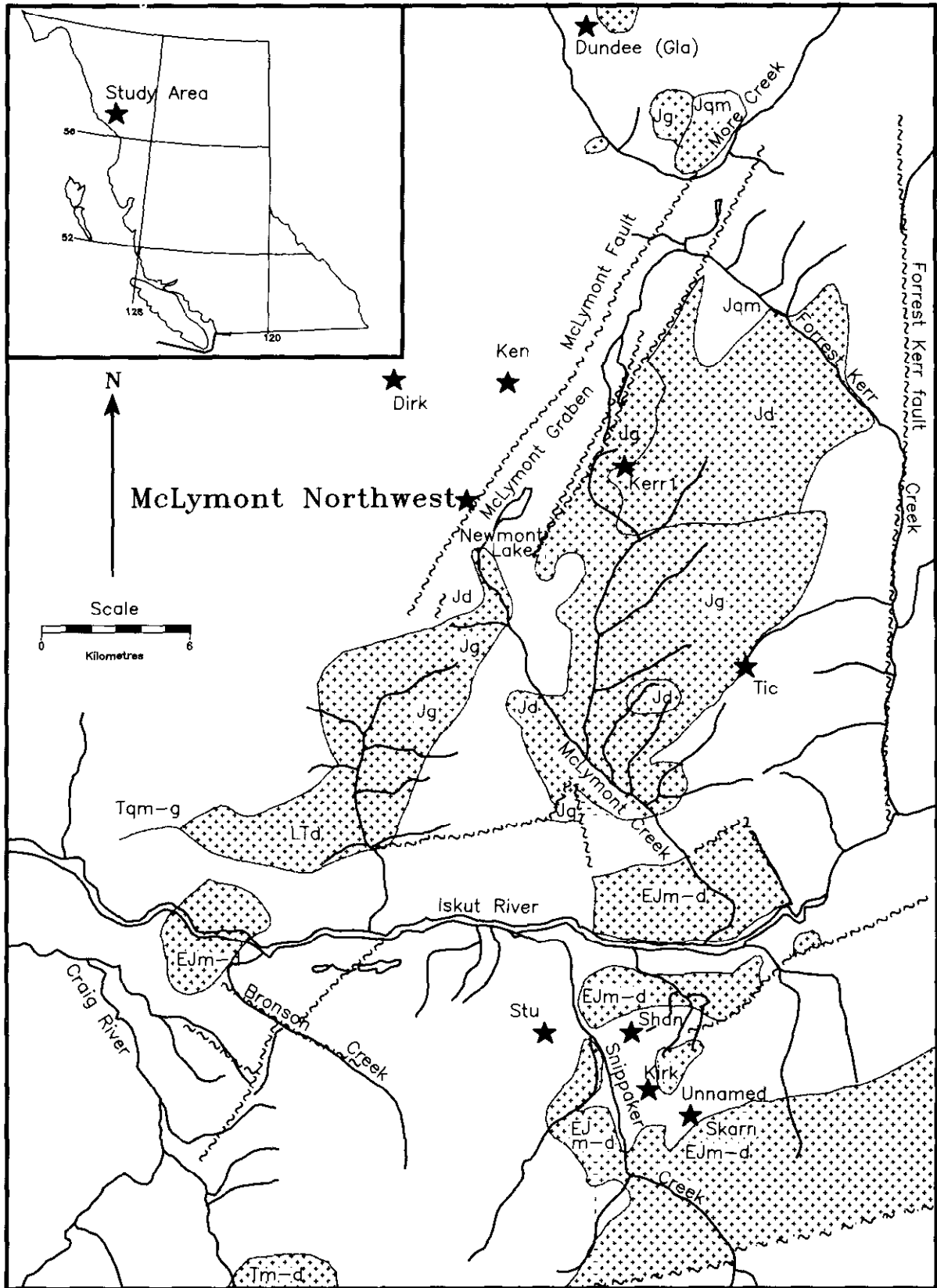


Figure 2-11-1. Location of the McLymont Northwest zone in relation to the McLymont graben and other skarn occurrences in the district. (see Webster and Ray, 1991, this volume). Geology after Logan *et al.* (1990b) and Britton *et al.* (1990).

Legend

- J, EJ = Jurassic, Early Jurassic
- T, LT = Tertiary, Late Tertiary
- d = diorite
- g = granite
- m = monzonite

- = undifferentiated supracrustals
- ★ = skarn location
- = regional fault
- = approximate geological contact

vein mineralization is exposed in the McLymont graben, east of the bounding McLymont fault (Logan *et al.*, 1990a). By contrast, the McLymont Northwest zone lies immediately west of the McLymont fault (Figure 2-11-1). The dip direction of the fault is unknown; consequently it is uncertain whether it represents a normal or high-angle reverse fault. Airphoto interpretation indicates that the rocks on both sides of the McLymont fault are cut by northerly trending fractures that probably represent second-order splay structures off the main fault. Several sets of faults are recognized on surface above the Northwest zone. An early, north-striking, steeply east-dipping set is probably related to these second-order structures; slickensides on this set plunge steeply east. This set is cut by younger, east-trending faults with slickensides indicating subhorizontal dextral movement.

The deposit is hosted by a Mississippian clastic marine succession that is several hundred metres thick. The upper part comprises fresh, green, massive andesitic ash and lapilli tuffs with thin units of marble. Lower down, where the mineralization occurs, is a sequence of bedded tuffs, thin-bedded tuffaceous siltstones, occasional units of massive ash and crystal tuff, and some horizons of white to grey marble, some of which contain remnant crinoids. The lowest part of the sequence, which is seen in drill-core, includes lapilli and ash tuff, with minor tuff breccia and tuffaceous siltstone. Excellent grading in the tuffaceous siltstones indicates the Mississippian package hosting the mineralization is upright. Poorly defined bedding attitudes measured on surface suggest that the area of drilling lies close to a northerly striking and plunging fold; the western limb of this fold dips 35 to 75° northwest while the eastern limb apparently dips steeply southeast. This structure is not well understood but it has possibly controlled some of the ore zones.

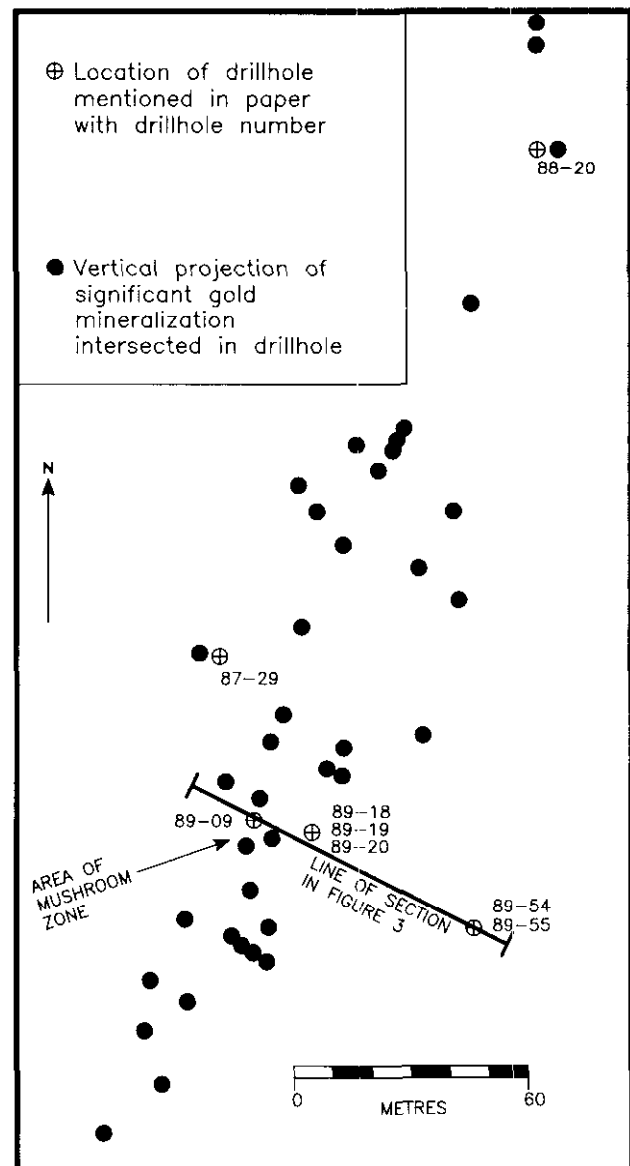


Figure 2-11-2. Location of mineralized drillholes – McLymont Northwest zone. Note line of section for Figure 2-11-3. Data courtesy of Gulf International Minerals Ltd.

MINERALIZATION IN THE NORTHWEST ZONE

The deposit plunges north and has been traced by drilling for over 300 metres in a north-northeast direction (Figure 2-11-2), although it remains unexplored to the north and south. It occurs both in steep, generally narrow, possibly fracture-controlled zones, and in gently dipping, thicker zones that appear to have replaced units of coarse, crinoidal marble and lesser amounts of calcareous siltstone and tuff. In one southern section, several steeply dipping mineralized zones pass upwards into an extensive, sulphide-rich “mushroom zone” (Figure 2-11-3); it is uncertain whether this represents a mineralized fold structure or is the result of

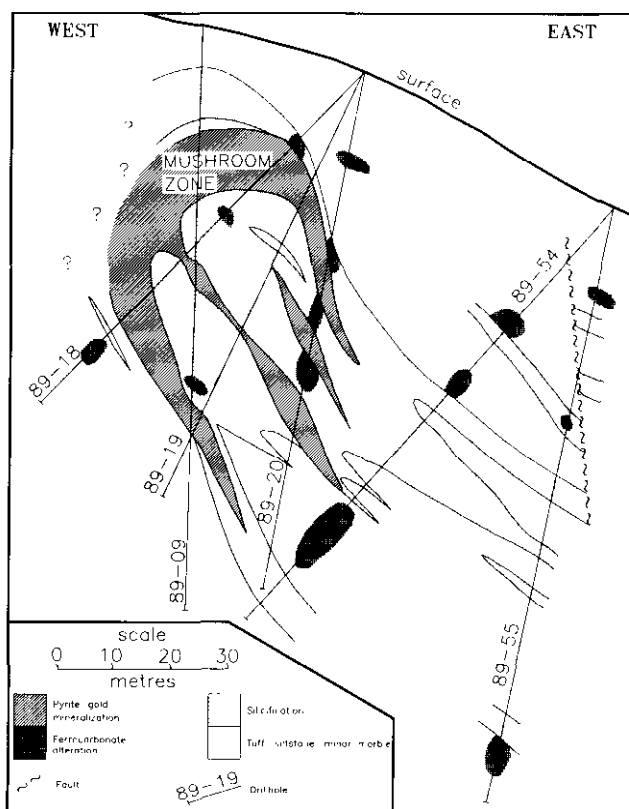


Figure 2-11-3. Generalized geological cross-section across the southern part of the McLymont Northwest zone, (for location see Figure 2-11-3). Interpretation based on core logging by G.E. Ray.

mineralization controlled by the intersection of steep fractures and a subhorizontal carbonate unit. At the northern end of the deposit, the ore zones are shallow dipping. Gold grades are sometimes very high. For example, the MINFILE database records that Drillhole 87-29, located north of the mushroom zone (Figure 2-11-2), cut an 11.2-metre intercept that assayed 55.02 grams gold and 1362 grams silver per tonne, and 0.97 per cent copper. Trace element analytical results on unmineralized and mineralized drill-core samples are shown in Table 2-11-1. Besides gold and copper enrichment, weakly anomalous antimony, arsenic, bismuth and tellurium values are recorded in some samples.

Mineralization consists principally of pyrite and magnetite, with subordinate chalcopyrite and trace galena, sphalerite and gold, in a carbonate-quartz-chlorite gangue. Other minerals present include hematite, sericite, jasper, garnet, rutile, sphene, covellite, tetrahedrite, barite and gypsum; graphite is sporadically present, particularly along fault zones. Trace amounts of a minute bladed mineral, tentatively identified as arsenopyrite, were noted in one thin section.

The magnetite is irregularly distributed; it displays two habits: a rounded to nodular form which apparently replaces carbonate, and an acicular to bladed form that results in crystals up to 2 centimetres long (Plate 2-11-1). Similar elongate magnetite crystals are observed in other skarns such as those at the Merry Widow mine and Nanaimo Lakes

on Vancouver Island, and the Texada Island iron mines (Ettlinger and Ray, 1989). At McLymont, this magnetite appears to replace an early, pale green mineral, which is tentatively identified as tremolite-actinolite.

Small isolated remnants of garnet, as well as pseudomorphs after garnet (Plate 2-11-2), are observed throughout the deposit. Garnet is commonly fractured (Plate 2-11-3) and retrograde-altered to jasper, carbonate or chlorite; generally, only millimetre-sized glassy fragments of unaltered garnet remain. Most garnet replaces marble, where it originally formed either isolated, euhedral crystals or small masses. Garnet pseudomorphs occur as concentric zones of deep red jasper alternating with brown jasper and carbonate. Thin-section studies show the unaltered garnets commonly have isotropic, yellowish brown cores and clear, birefringent, zoned overgrowths. Microprobe analyses indicate they are iron-rich and contain less than 5 per cent manganese. The isotropic cores are generally Ad_{95} to Ad_{100} mole per cent while the overgrowths range from Ad_{59} to Ad_{64} mole per cent (Figure 2-11-4).

Pyrite also occurs in two habits, both of which carry gold. The commonest forms coarse, rounded subhedral crystals up to 1 centimetre in diameter; these may occur as single, isolated crystals within carbonate, or as large clusters and irregular masses that, in thin section, are seen to contain cataclastic textures (Plate 2-11-4) and abundant inclusions. Some of this pyrite replaces either large carbonate crystals, remnant crinoid ossicles or garnet. The other pyrite is fine grained and massive, and locally carries very high gold values. It occurs as veins and masses that postdate the coarse crystalline pyrite. In polished section it is seen to comprise densely packed clusters of small, euhedral, subhedral and anhedral crystals in a carbonate, quartz or chloritic matrix (Plate 2-11-5).

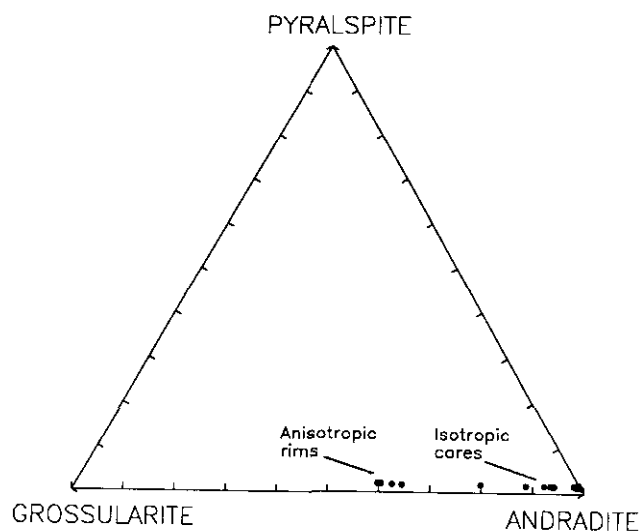


Figure 2-11-4. Composition of garnets from the McLymont Northwest zone (25 analyses). Note andraditic cores and more grossularitic rims. Microprobe analyses by A.D.Ettlinger at The University of British Columbia.

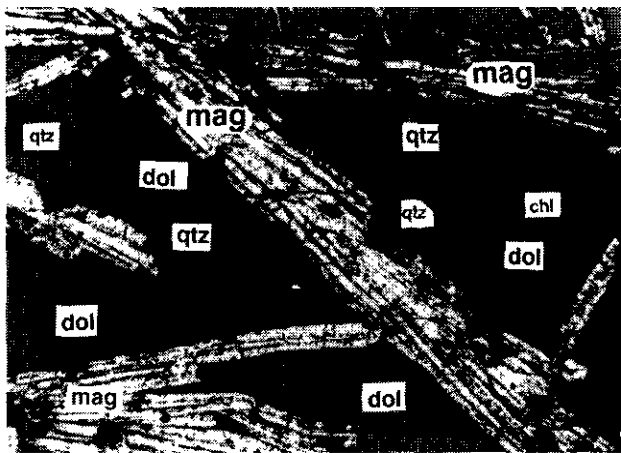


Plate 2-11-1. Photomicrograph of elongate magnetite (mag) in a matrix of dolomite (dol), chlorite (chl) and euhedral quartz crystals (qtz), Drillhole 89-18. Reflected PPL, x 100 magnification.



Plate 2-11-4. Brecciated, coarse, first generation pyrite in a carbonate matrix, Drillhole 89-18. Reflected PPL, x 150 magnification.



Plate 2-11-2. Jasper-chlorite pseudomorphs after euhedral garnet in marble, Drillhole 88-36.

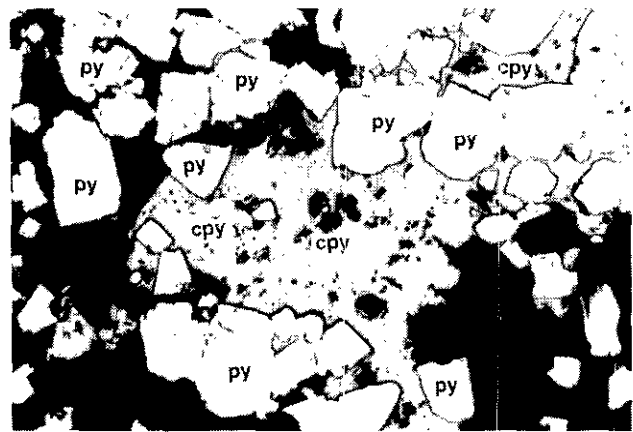


Plate 2-11-5. Anhedral to subhedral, second generation pyrite (py) overgrown by chalcopyrite (cpy), Drillhole 89-29. Reflected PPL, x 150 magnification.

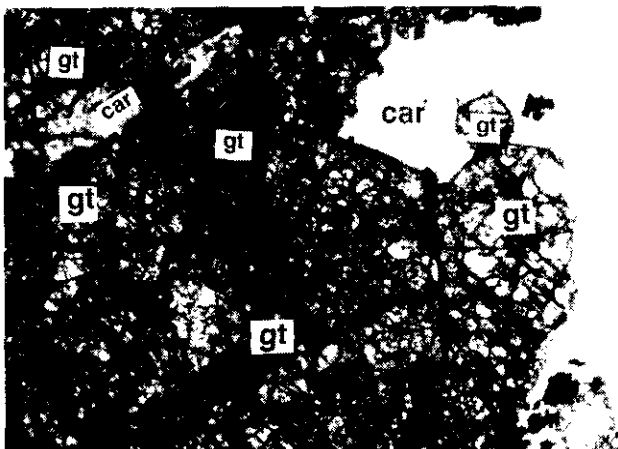


Plate 2-11-3. Photomicrograph of fractured euhedral garnet crystals (gt) intergrown with carbonate (car), Drillhole 89-09. Transmitted PPL, x 100 magnification.

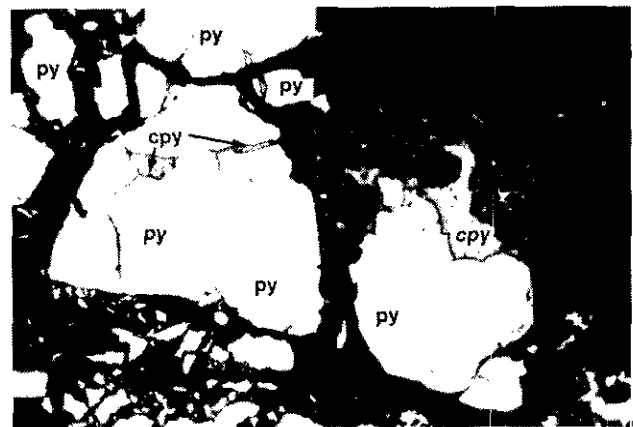


Plate 2-11-6. Brecciated, first generation pyrite (py), with overgrowths and veins of chalcopyrite (cpy), Drillhole 89-18. Reflected PPL, x 100 magnification.

Chalcopyrite is widespread throughout the mineralized zones. It occurs as overgrowths or veinlets that cut both the coarse and fine pyrite (Plates 2-11-5 and 6), as small inclusions within sphalerite, or as late veinlets with barite, carbonate and quartz. Galena, sphalerite, tetrahedrite and covellite are rare and tend to occur in small veins. Galena forms anhedral skeletal masses that are spatially associated with pyrite and chalcopyrite. Sphalerite forms coarse to fine clots, while covellite is fine grained and occurs with chalcopyrite and tetrahedrite. Hematite forms isolated crystals and veinlets that cut both the magnetite and the coarse and fine pyrite.

Chlorite is sporadically distributed, but tends to show a spatial correlation with the magnetite-sulphide zones and can carry visible gold. It forms large, black to dark green, irregular and deformed masses as well as fine-grained clots. It appears to replace and pseudomorph quartz, carbonate, garnet and possibly pyroxene.

Quartz occurs in veins and as isolated, euhedral crystals. The irregular, thin white veins cut the coarse and fine pyrite; they contain vugs lined with elongate, euhedral quartz crystals. These crystals reach 2 centimetres in length and commonly grow within carbonate (Plate 2-11-1).

Disseminations and small masses of sericite can make up to 20 per cent of the rock in some thin sections; it appears to be a relatively late alteration mineral and largely replaces original feldspar. Trace amounts of sphene and rutile are present; the latter as disseminated, small (<20 micrometres) subhedral crystals.

The mineralized zones are also characterized by abundant white to cream to pale brown carbonate that includes calcite, dolomite, ankerite and siderite. Carbonate occurs both as a groundmass to the magnetite and sulphides (Plate 2-11-1) and as late crosscutting veins. Some of the late dolomitic and ankeritic veins contain stringers of chalcopyrite and small masses of white barite.

Although some coarse visible gold is seen in chlorite, polished-section studies suggest that most of the gold is very fine grained (<15 micrometres). These minute grains of gold are seen in chlorite and as inclusions in both the coarse pyrite crystals and the younger, fine-grained pyrite.

The mineralized zones and the adjacent white marble can contain small amounts of red, podiform jasper that have replaced garnet. Isolated jasper pseudomorphs of large euhedral garnet crystals are occasionally seen in the marble (Plate 2-11-2). Locally, jasper is partially replaced by pyrite, and some jasper pseudomorphs are rimmed with magnetite and chlorite.

The mineralized zones are surrounded by irregular envelopes of early silicification and later ankeritic-dolomitic alteration up to 25 metres wide (Figure 2-11-3). The silicified rocks vary from grey to pale green to pale brown in colour. Silica can crosscut bedding or may selectively replace certain beds in the tuffaceous siltstones, resulting in alternating layers of unaltered and silicified rock. Where complete silicification has occurred, extensive zones of

massive chert-like rock are formed. Silicification was followed by the introduction of brown-coloured carbonate that includes siderite, ankerite and dolomite; this occurs either as a massive overprinting or as fracture-related ferroc carbonate veins and breccias. Some of the carbonate veins contain small euhedral quartz crystals, stringers of chalcopyrite, and clots of white barite.

Mineral textures suggest the following broad paragenesis: 1. garnet, 2. jasper and chlorite, (the chlorite possibly replaced early pyroxene), 3. magnetite, 4. coarse pyrite, 5. fine-grained pyrite, 6. quartz veining and silicification, 7. pervasive and vein-carbonate alteration.

There are at least two generations of chalcopyrite: the first is associated with, but postdates pyrite, while the second is found in late quartz-carbonate-barite veins. Sphalerite may postdate the early chalcopyrite. Specular hematite postdates both the magnetite and pyrite. The relative age of the gold is uncertain although it appears to be associated with pyrite and chlorite, but not with chalcopyrite.

GALENA-LEAD ISOTOPES

Sphalerite-galena veins tend to be more common on the outer margins of the Northwest zone and are interpreted to represent a distal part of the hydrothermal system. A galena sample from a sphalerite-galena vein in Drillhole 88-20, at the north end of the deposit (Figure 2-11-2), was analysed at The University of British Columbia for its lead isotope ratios; $^{208}\text{Pb}/^{206}\text{Pb}$ and $^{207}\text{Pb}/^{206}\text{Pb}$ ratios of 2.0429 and 0.83223 respectively (± 0.01 per cent error for each) were measured (A.D.R. Pickering, personal communication, 1990).

When these galena-lead isotope ratios are compared to similar data from other deposits in the Iskut-Stewart area (*see Godwin et al.*, 1991, this volume), an Early Jurassic, or older age for the mineralization is indicated. The measured ratios are consistent with a tight cluster of precious metal deposits that are cogenetic with the Jurassic Hazelton Group. These include Eskay Creek, Premier, Scotty Gold, Kerr, Johnny Mountain and Snip. All but Eskay Creek and Snip are closely associated with the Texas Creek plutonic suite which has been dated as Early Jurassic (Brown, 1987).

DISCUSSION

The silicate-sulphide mineral assemblages in the Northwest zone deposit indicate it may represent a retrograde skarn, while the abundant dolomitic alteration suggests it could have magnesian skarn affinities. The importance of retrograde activity in developing an ore-grade skarn deposit has previously been described by Meinert (1986). Remnant early andradite garnet is preserved in the deposit, particularly within the mushroom zone, although most of the garnet is now a retrograde assemblage of jasper, hematite, carbonate, chlorite and quartz. The mushroom zone is underlain and enveloped by a halo of intense silicification (Figure 2-11-3) in which the marble and clastic rocks are replaced largely by silica and chlorite with lesser magnetite

and pyrite. At the outer margins of this envelope, and distal to the deposit, are thin veins containing sphalerite and galena; one of these veins was sampled for galena-lead isotope analysis.

Development of garnet skarn close to a source of hydrothermal fluids, with more distal hydrous silicate alteration and silicification, and peripheral base metal mineralization is well documented (Zharikov, 1970; Einaudi *et al.*, 1981; Meinert, 1983). The alteration paragenesis observed in the Northwest zone suggests the mushroom zone was a garnet-bearing skarn that formed close to the source of the hydrothermal fluids. Outwards from this feeder zone, pyroxene may originally have crystallized and later been destroyed during the subsequent retrogression that accompanied sulphide deposition, as no pyroxene has been positively identified in the deposit.

The gold-rich Northwest zone is unusual in that it does not contain the reduced mineral assemblages that characterized other gold skarns in British Columbia (Ettlinger and Ray, 1989; Ray *et al.*, 1990). Iron-bearing phases in the deposit are hematite, jasper, magnetite and andradite which all contain abundant Fe³⁺. Pyrite is the most abundant sulphide, while pyrrhotite and arsenopyrite, which characterize other gold skarns, are generally absent. Although pyroxene has not been seen, the abundant chlorite suggests that if prograde pyroxene was originally present, it was probably diopsidic in composition. This contrasts with true gold skarns, such as those in the Hedley district, which are marked by iron-rich, hedenbergitic pyroxenes (Ray *et al.*, 1988; Ettlinger *et al.*, in press).

To summarize, the oxidized assemblage at the McLymont Northwest zone is atypical for Hedley-type gold skarns, but instead resembles those found in skarns associated with porphyry copper systems. Similar, oxidized skarn assemblages occur in the gold-rich McCoy and Surprise deposits in Nevada (Brooks *et al.*, 1990; J.W. Brooks, personal communication, 1990).

CONCLUSIONS

The McLymont Northwest zone is believed to represent a highly retrograde-altered, gold-rich skarn deposit, which, on the basis of galena-lead isotope analyses, is probably Early Jurassic or older in age. Although some coarse visible gold is present, much of the gold is fine grained (<15 micrometres) and commonly occurs as inclusions in pyrite. The pyrite-magnetite-hematite-andradite assemblages indicate the deposit formed under oxidized conditions which are atypical of other gold skarns in British Columbia. Alteration envelopes of silicification and distal base metal veining are present around the deposit; extensive dolomitic alteration may indicate the deposit has magnesian skarn affinities.

Precise controls of the ore zones are not yet fully understood. Mineralization is believed to be both lithologically and structurally controlled, and it is possible that the flat-lying and steeply dipping ore zones represent mantos and chimneys. It is uncertain, however, whether the richest part of the deposit, the mushroom zone, represents a mineralized fold hinge, a stockwork feeder or a pipe.

ACKNOWLEDGMENTS

We are grateful for the assistance and cooperation of the management and staff of Gulf International Minerals Ltd., particularly Reg Davis, Bob Gifford and Paul Carter. Thanks are also expressed to Gerry Carlson for his help, to Colin Godwin and Anne Pickering of The University of British Columbia, for the galena-lead isotope data, and to John Knight for help with the microprobe analyses. Geological discussions with Ian Webster, and the assistance of Bob Paul are also acknowledged.

REFERENCES

- Anderson, R.G. (1989): A Stratigraphic, Plutonic, and Structural Framework for the Iskut River Map Area, Northwestern British Columbia; in Current Research, Part E; *Geological Survey of Canada*, Paper 89-1E, pages 145-154.
- Anderson, R.G. and Bevier, M.L. (1990): A Note on Mesozoic and Tertiary K-Ar Geochronometry of Plutonic Suites, Iskut River Map Area, Northwestern British Columbia; in Current Research, Part E, *Geological Survey of Canada*, Paper 90-1E, (in press).
- Britton, J.M., Webster, I.C.L. and Alldrick, D.J. (1989): Unuk Map Area (104B/7E, 8W, 9W, 10E); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1988, Paper 1989-1, pages 241-250.
- Britton, J.M., Fletcher, B.A. and Alldrick, D.J. (1990): Snip-paker Map Area (104B/6E, 7W, 10W, 11E); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1989, Paper 1990-1, pages 115-125.
- Brooks, J.W., Meinert, L.D., Kuyper, B.A. and Lane, M.L. (1990): Petrology and Geochemistry of the McCoy Gold Skarn, Lander County, Nevada; in *Geology and Ore Deposits of the Great Basin*, Symposium Proceedings, *Geological Society of Nevada*, April 1-5, 1990, Sparks, Nevada.
- Brown, D.A. (1987): Geological Setting of the Silbak-Premier Mine, Northwestern British Columbia (104A/4, B/1); unpublished M.Sc. thesis, *The University of British Columbia*, 216 pages.
- Ettlinger, A.D. and Ray, G.E. (1989): Precious Metal Enriched Skarns in British Columbia: an Overview and Geological Study; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1989-3, 128 pages.
- Ettlinger, A.D., Meinert, L.D. and Ray, G.E. (in press): Skarn Evolution and Hydrothermal Fluid Characteristics in the Nickel Plate Deposit, Hedley District, British Columbia; *Economic Geology*.
- Einaudi, M.T., Meinert, L.D. and Newberry, R.J. (1981): Skarn Deposits; in 75th Anniversary Volume, 1906-1980; *Economic Geology*, B.J. Skinner, Editor, *The Economic Geology Publishing Company*, pages 317-391.

- Godwin, C.I., Pickering, A.D.R. and Gabites, J.E. (1991): Interpretation of Galena-lead Isotopes from the Stewart – Iskut Area (1030, P, 104A, B, G); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1990, Paper 1991-1, this volume.
- Grove, E.W. (1986): Geology and Mineral Deposits of the Unuk River – Salmon River – Anyox Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 63, 152 pages.
- Grove, E.W. (1989): Geological Report and Development Proposal on the McLymont Creek Property in the Iskut River Area, N.W. British Columbia; *Gulf International Minerals Ltd.*, unpublished report.
- Logan, J.M., Koyanagi, V.M. and Drobe, J.R. (1990a): Geology, Geochemistry and Mineral Occurrences of the Forrest Kerr – Iskut River Area, Northwestern British Columbia, (104B/15 and part of 104B/10); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1990-2.
- Logan, J.M., Koyanagi, V.M. and Drobe, J.R. (1990b): Geology of the Forrest Kerr Creek Area, Northwestern British Columbia (104B/15); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1989, Paper 1990-1, pages 127-139.
- Kerr, F.A. (1948): Lower Stikine and Western Iskut River Areas, British Columbia; *Geological Survey of Canada*, Memoir 246, 94 pages.
- Koyanagi, V.M. (1990): Northwest Zone, McLymont Property, Northwestern British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Exploration in British Columbia 1989, pages 225-227.
- Meinert, L.D. (1983): Variability of Skarn Deposits; in *Guides to Exploration; in Revolution in the Earth Sciences – Advances in the Past Half-Century*, S.J. Boardman, Editor, *Kendall/Hunt Publishing Company*, pages 301-316.
- Meinert, L.D. (1986): Gold in Skarns of the Whitehorse Copper Belt, Southern Yukon; in *Yukon Geology*; J.A. Moran and D.S. Emond, Editors; *Indian and Northern Affairs Canada*, Exploration and Geological Services Division, Volume 1, pages 19-43.
- Ray, G.E., Dawson, G.L. and Simpson, R. (1988): Geology, Geochemistry and Metallogenic Zoning in the Hedley Gold-skarn Camp; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1987, Paper 1988-1, pages 59-80.
- Ray, G.E., Ettliger, A.D. and Meinert, L.D. (1990): Gold Skarns: Their Distribution, Characteristics and Problems in Classification; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1989, Paper 1990-1, pages 237-246.
- Read, P.B., Brown, R.L., Psutka, J.F., Moore, J.M., Journey, M., Lane, L.S. and Orchard, M.J. (1989): Geology of Parts of Snippaker Creek (104B/10), Forrest Kerr Creek (104B/15), Bob Quinn Lake (104B/16), Iskut River (104G/1), and More Creek (104G/2); *Geological Survey of Canada*, Open File 2094.
- Webster, I.C.L. and McMillan, W.J. (1990): Structural Interpretation of Airborne Synthetic Aperture Radar Imagery in the Sulphurets–Unuk–Iskut River Area, Northwest British Columbia (104B); *B.C. Ministry of Energy Mines and Petroleum Resources*, Open File 1990-7.
- Webster, I.C.L. and Ray, G.E. (1991): Skarns in the Iskut River – Scud River Region, Northwest British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork 1990, Paper 1991-1, this volume.
- Zharikov, V.A. (1970): Skarns; *International Geological Review*, Volume 12, pages 541-559, 619-647, 760-775.