

GOLD IN SKARNS OF THE WHITEHORSE COPPER BELT SOUTHERN YUKON

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INTRODUCTION

Skarns in the Whitehorse Copper Belt have produced 121,600 tonnes of copper, 97,000 kg of silver, and 7,700 kg of gold from 10 million tonnes of ore between 1967 and 1982 (Tenny, 1981; Watson, 1984). By the end of mining activities in 1982, gold and silver contributed a significant proportion of the ore value, thus sparking a renewed interest in the occurrence of gold in the Whitehorse skarns. A calculated gold grade (assuming 100% recovery) of 0.7 g/t Au for the Whitehorse deposits is probably too low, but neither exploration nor production drill holes were routinely assayed for gold. Hureau (1985) estimated that the 9 million tonnes of tailings from the Whitehorse deposits contain about 1,500 kg of gold and Tenny (1981) reported that tailings assays ranged up to 250 g/t Au near the tailings decant. It appears likely that not all the gold was recovered from Whitehorse skarn ore, that the calculated average gold grade for the deposit is too low, and that further gold-silver potential in the district may exist.

Worldwide, about 1.5×10^9 grams of gold have been produced from skarn deposits. The majority of this production has come as a by-product of large scale mining of skarns associated with porphyry copper deposits (Meinert, 1986). Most skarns in porphyry copper districts contain less than 0.5 g/t Au, although some deposits (e.g. Bingham, Utah, Cameron and Garmoe, 1983) contain local zones with grades up to 70 g/t Au. Little is known about the distribution of gold within these skarns or about possible correlations of skarn mineralogy or alteration stage with gold grade. In terms of gold grade, the Whitehorse skarns appear to contain more gold than most porphyry copper skarns and thus represent a unique opportunity to study the distribution of gold within a large copper skarn system. The present paper reports the results of a reconnaissance study of alteration, gold distribution, and mineralogy of skarns in the Whitehorse Copper Belt.

Scope of Study

More than 32 mines and prospects occur within the Whitehorse Copper Belt (Kindle, 1964; Tenney, 1981). Similar skarns occur in the surrounding area (e.g. the Jackson Lake prospect 16 km northwest of Whitehorse at $60^{\circ}41'N$, $135^{\circ}22'W$). Nine skarn deposits (Fig. 1) within the Whitehorse Copper Belt were chosen for a comparative study to address the following three questions: 1) What is the skarn mineralogy and how does it compare to other types of skarn deposits (e.g. Einaudi *et al.*, 1982)? 2) What is the distribution of gold in the various deposits? and 3) Can the gold content be correlated with the skarn mineralogy or alteration type?

In an attempt to answer these questions, selected drill core from each deposit was relogged and available mine workings were inspected. For each of the nine studied deposits, samples were collected for Cu, Ag, and Au assay from diamond drill core and where available, from mine workings or surface outcrops. Each sample was also studied petrographically and, where appropriate, individual skarn mineral grains were analyzed with an electron microprobe.

GEOLOGIC SETTING

The Whitehorse Copper Belt is a northwest trending zone of Cu-Fe-Mo-Au-Ag skarns about 30 km long located 5 km west of Whitehorse, Yukon (Fig. 1). Skarn is localized along the irregular west margin of the mid-Cretaceous Whitehorse Batholith (Table 1), a composite biotite-hornblende granodiorite pluton with a horn-

blende diorite margin (Morrison, 1981). The Whitehorse Batholith is one of a suite of calc-alkaline intrusions (Coast Plutonic Complex) which were emplaced during formation and probable accretion of a Permian to Jurassic island arc terrane (the Intermontane Belt). Although the main mass of the Whitehorse Batholith is relatively unaltered, Morrison (1981) describes quartz-kspars-bornite-chalcocopyrite veins which locally cut the diorite margin of the batholith.

Skarn has formed dominantly in the Upper Triassic Lewes River Group which consists of both clastic and carbonate rocks. The clastic rocks are largely arkose and graywacke (70% plagioclase, 15% augite, 10% oxides, and minor quartz; Grabher, 1974), which in hand specimen have a salt and pepper texture very similar to the diorite. Carbonate rocks include limestone, carbonaceous limestone, dolomitic limestone, and dolostone (based upon staining tests reported in Grabher, 1974). Detailed descriptions and chemical compositions of the sedimentary units are given in Grabher (1974) and Morrison (1981). The dominant skarn protoliths (as deduced from the skarn mineralogy) for each of the deposits studied are listed in Table 2.

SKARN MINERALOGY

The skarn mineralogy of the Whitehorse skarns is fairly typical of the copper skarns summarized by Einaudi *et al.* (1981), Einaudi (1982), and Einaudi and Burt (1982). As noted by Morrison (1981), the silicate mineralogy of individual skarn deposits in the Whitehorse Copper Belt is largely a function of the skarn protolith.

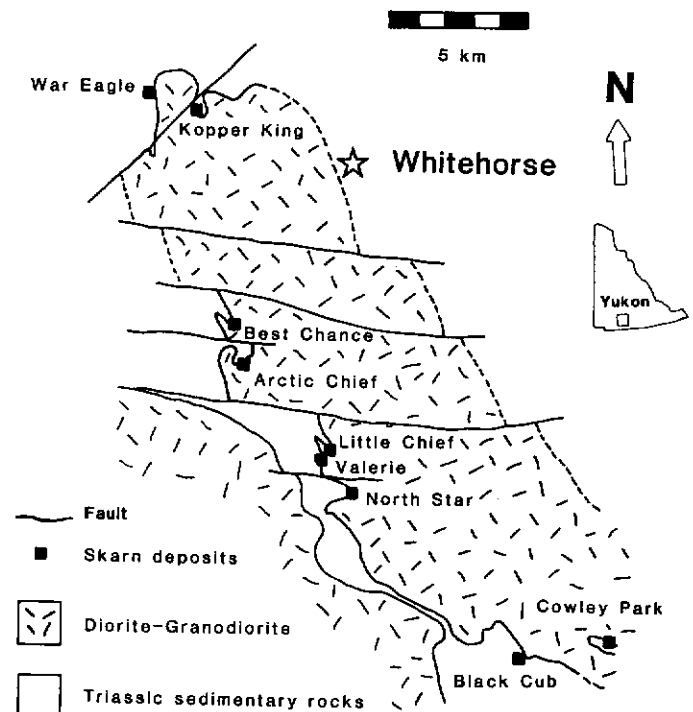


Figure 1. Simplified regional geology map of Whitehorse Copper Belt showing principle skarn deposits (after Tenney, 1981).

Skarns with a limestone protolith (e.g. Best Chance, Cowley Park, and Kopper King, Table 2) contain abundant garnet, pyroxene, and wollastonite with variable actinolite, epidote, and chlorite. Skarns with a more dolomitic protolith (e.g. Arctic Chief and Little Chief, Table 2) contain abundant magnesian minerals such as diopside, olivine, phlogopite, and serpentine.

Pyroxene, the most abundant calc-silicate mineral in the Whitehorse Copper Belt, occurs in skarn formed from both dolomitic and non-dolomitic carbonate rocks and from siltstone. Pyroxene formed from a dolomitic protolith is very magnesium-rich, (usually pure diopside, Table 3) and ranges from fine-grained hornfels to coarse-grained (up to 2 cm) euhedral crystals. Pyroxene formed from limestone is more iron-rich (up to 37 mole % hedenbergite, Table 3) and typically is coarse-grained. Skarn formed in siltstone has more aluminous pyroxene than skarn formed in carbonate rock. All the pyroxenes analyzed in this study fall within the field defined by typical copper skarn pyroxenes (Fig. 2).

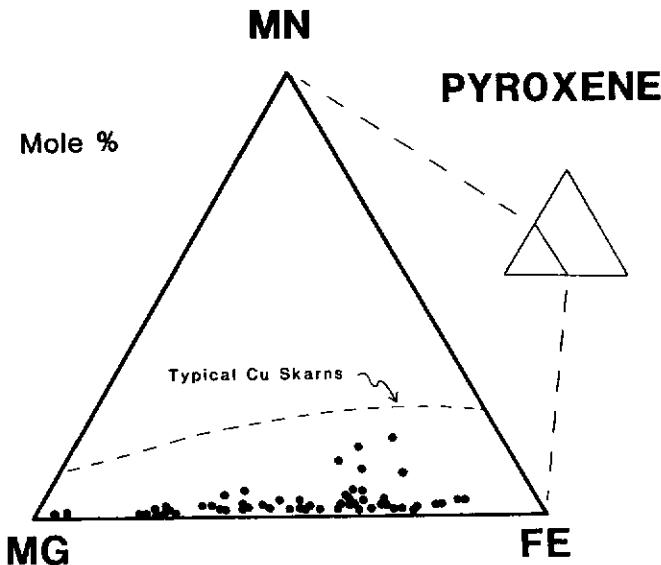


Figure 2. Triangular plot of pyroxene electron microprobe compositions.

Garnet also occurs in both calcic and magnesian skarn, but is far more abundant in the former. In skarn formed from limestone, garnet is typically yellowish-tan to dark brown in hand specimen, whereas in skarn formed from dolostone, garnet is reddish brown. In both types of skarn, garnet varies from fine-grained hornfels to large (up to 4 cm) euhedral crystals, although garnet in calcic skarn tends to be coarser-grained. All the garnets analyzed in this study are andraditic (Table 4) and fall well within the field of typical copper skarn garnets (Fig. 3).

Olivine only occurs in skarn formed from dolostone. It is typically a distinctive yellow-green colour and ranges from massive skarn to isolated 0.1 to 1 cm euhedral crystals in dolostone. Most olivine is magnesium-rich (nearly pure forsterite, e.g. AC-53-1496, Table 5) and has altered to hydrous magnesium-silicate minerals such as brucite, phlogopite, serpentine, and/or talc. Although most serpentine in the Whitehorse skarns is an alteration product of olivine, some serpentine (with magnetite) occurs as veins and patches directly replacing dolostone. Massive magnetite and phlogopite may also directly replace dolostone, although Grabher (1974) describes local olivine pseudomorphs within the massive magnetite.

In contrast to olivine, the minerals idocrase and wollastonite apparently occur only in skarn formed from a non-dolomitic protolith. In most cases, the occurrence of olivine, idocrase, or wollastonite along with the colour and composition of garnet and pyroxene can be used to identify the nature of the carbonate protolith. This relationship can be useful where poor exposures (or closed mines!) prevent detailed stratigraphic investigations.

All other minerals in the Whitehorse skarns are interpreted to have replaced, at least in part, previously formed silicate minerals. In some cases, these minerals have compositions similar to the replaced mineral(s), and thus can be used to help decipher the original stratigraphy. Additionally, relative to the prograde

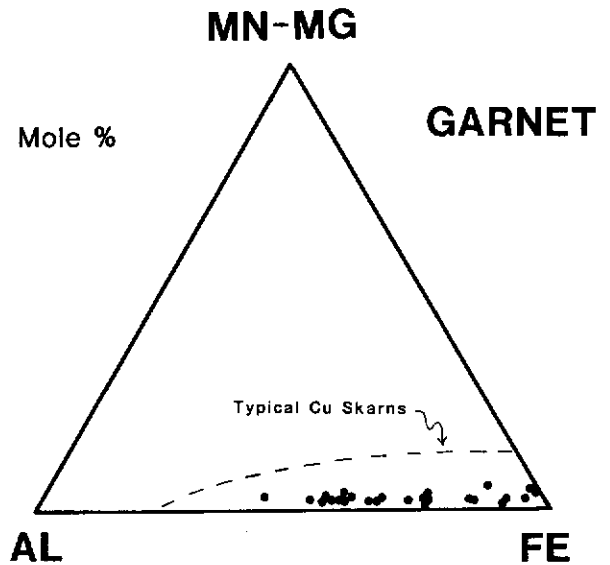


Figure 3. Triangular plot of garnet electron microprobe compositions.

minerals, some of the later minerals are stable under lower temperature or more hydrous conditions and thus can be considered to result from retrograde alteration.

Amphibole is the main alteration product of pyroxene and also occurs with massive sulphide replacement (mainly chalcocite and pyrite) of skarn (Fig. 4a). Most of the amphibole is actinolitic (Table 6), but locally (in more aluminous rocks?) hornblende is abundant. Amphibole in the Whitehorse skarns falls within the typical field of copper skarn amphiboles (Fig. 5). Other minerals associated with amphibole alteration of pyroxene include chlorite (Table 7), muscovite, apatite, and locally serpentine. Where amphibole has replaced garnet-pyroxene skarn, ksparr (Table 5) is locally present in the alteration assemblage.

Epidote (Table 8) is the main alteration product of garnet and typically is intergrown with amphibole and chlorite where the replaced skarn contained both garnet and pyroxene. Epidote is commonly associated with the introduction of sulphides (especially bornite-chalcocite, Fig. 4b). The systematic association of epidote with bornite-chalcocite and amphibole with chalcocite may reflect the more oxidized environment of the former and a more reduced environment for the latter. A similar oxidation control on sulphide mineralogy was proposed by Morrison (1981).

Several unusual minerals occur in minor to trace amounts in the Whitehorse skarn deposits. Valleriite ($\text{Cu}_{1.20}\text{Fe}_{0.80}\text{S}_{2.00}1.67$ ($\text{Mg}_{0.73}\text{Al}_{0.06}\text{Fe}_{0.21}(\text{OH})_2$), Petruk *et al.*, 1971; Harada *et al.*, 1973) is a rare micaceous mineral with alternating sheets of Cu-Fe-S and brucite which occurs in magnesium-rich rocks. In the Whitehorse skarns, valleriite occurs in magnetite and sulphide-rich skarn replacing dolomite. Locally, valleriite is coarse-grained and constitutes 20-30% of the rock. Associated with the valleriite in some occurrences is a zinc-bearing spinel similar to gahnite. Other minor minerals described by Grabher (1974) and Morrison (1981) but not observed in the present study include: scapolite, digentite, djurleite, tennantite-tetrahedrite, carrollite (CuCo_2S_4), wittichenite (Cu_3BiS_3), tellurobismuthite (Bi_2Te_3), and stutzite (Ag_5Te_3).

DISTRIBUTION OF PRECIOUS METALS IN WHITEHORSE SKARNS

To assess the distribution of precious metals in the Whitehorse skarns, 144 spot samples were collected from diamond drill core, sawn in half with a diamond saw, and cleaned vigorously with soapy water and a nylon brush. One half of each sample was assayed for Cu, Ag, and Au, (Table 9) while the other half was saved for petrographic examination. The assayed samples typically were about 50 grams in size and were chosen to illustrate specific rock, skarn mineralogy, mineralization, and alteration types; they should not be construed as bulk samples indicative of average deposit grades. All samples were analyzed by fire assay and atomic absorption methods by Bondar-Clegg & Company Ltd. (Vancouver

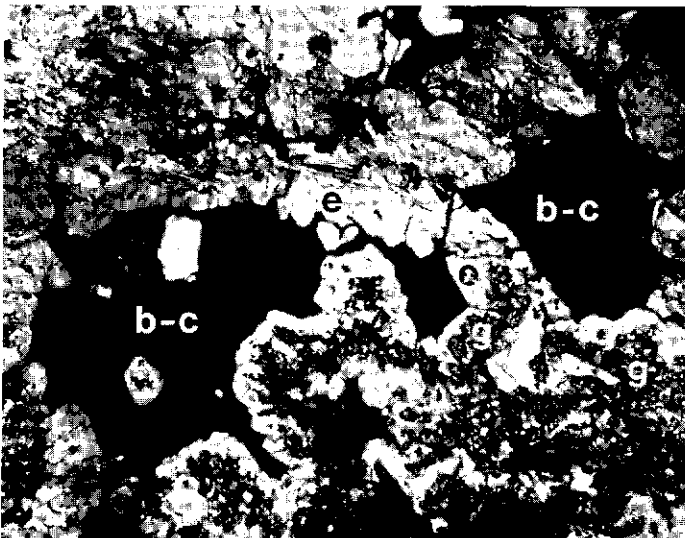


Figure 4. Photomicrographs of associated retrograde alteration of sulphide mineralization: a) actinolite-chalcopyrite replacement of pyroxene, Sample AC-53-352 b) epidote-chalcocite, replacement of garnet, Sample AC-51-269. a = actinolite, b-c = bornite-chalcocite, cp = chalcopyrite, e = epidote, g = garnet, p = pyroxene.

office). Minimum detection limits were: Cu = 1 ppm, Ag = 50 ppb, and Au = 1 ppb. Additionally, 23 ore grade samples were assayed for platinum and palladium to check the reported occurrence of these elements by Kindle (1964); all Pt assays were less than or equal to 50 ppb and all Pd were less than or equal to 70 ppb.

When all 144 samples are plotted as a group (Fig. 6 a-c), there is a moderate correlation between Cu and Au, a moderately strong correlation between Cu and Ag, and a strong correlation between Ag and Au. Similar correlations were noted by Tenney (1981) for composite drill core samples from the Little Chief Mine. The plot of Cu versus Au (Fig. 6a) shows significant scatter, but several generalizations can be made: 1) all samples with high gold contain significant copper (e.g. all samples with more than 1 ppm Au contain more than 5,000 ppm Cu), 2) samples with high copper do not necessarily contain significant gold (e.g. samples with greater than or equal to 5000 ppm Cu range from 1 to 80,000 ppb Au). These generalizations suggest that gold is only deposited in a restricted zone or time of copper mineralization and that gold does not occur in solid solution or as systematic inclusions within copper sulphide minerals. In contrast, the stronger correlation of Cu and Ag values (Fig. 6b), suggests that silver may occur in solid solution or as mineral intergrowths with copper sulphide minerals and that silver is probably deposited throughout the period of copper mineralization. The plot of Ag versus Au (Fig. 6c) further disting-

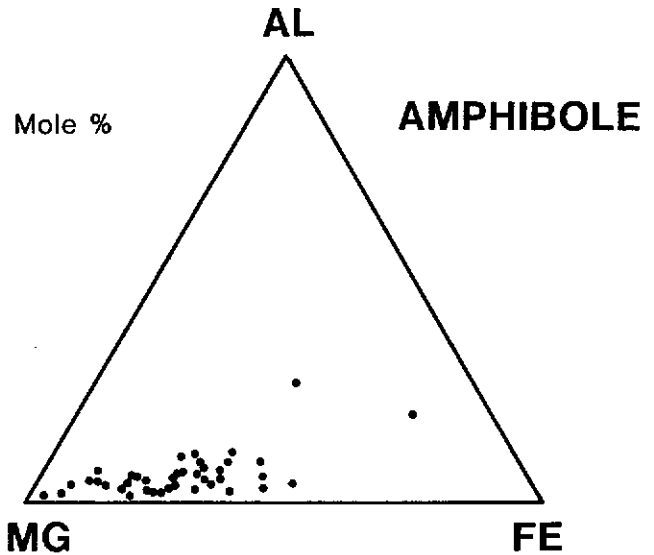


Figure 5. Triangular plot of amphibole electron microprobe compositions.

uishes the occurrence of gold and silver. All of the analyses in Figure 6c are more silver-rich than the average fineness (890, Table 10) of electrum which occurs in Whitehorse skarns and the trend of these analyses is subparallel to the average electrum fineness. Thus, silver must occur in other mineral phases in addition to electrum, whereas electrum could be the only gold mineral present in the Whitehorse skarns.

Individual mineral phases were analysed for the presence of gold, silver, and tellurium (Table 10). Pyrite and all the silicate minerals tested (garnet, pyroxene, olivine, amphibole, phlogopite, epidote, chlorite, and serpentine) were at or below the limit of detection (about 100 ppm) for all three elements on the electron microprobe. Additionally, there does not appear to be any correlation between major element composition of these minerals and the precious metal assays of the enclosing rock (Tables 3-8).

Silver was detectable in chalcocite, bornite and valleriite and was highest (2.44 wt. %) in chalcocite surrounded by electrum. It is not known whether this silver is present in solid solution or as a separate mineral phase smaller than the 1µm microprobe beam diameter. Chalcocite and bornite commonly contain significant silver (Elsing, 1930) and they are probably the main silver hosts in the Whitehorse skarn deposits. Gold was detected in some chalcopyrite, bornite, and valleriite, although many samples of each contained no detectable gold. The highest gold values occur in chalcopyrite (up to 0.20 wt. %). Significant tellurium was only detected in one sulphide sample (AC-51-269, chalcocite, this sample also contained electrum). In general, the amount of tellurium does not correlate with the amount of gold or silver in a given mineral, suggesting that the gold and silver are probably not present as telluride minerals.

In summary, gold in the Whitehorse skarns occurs mainly as electrum, but the minor and erratic occurrence of gold in chalcopyrite and valleriite may have been an important contribution to the historic district gold production. In contrast, although silver also occurs in electrum, the bulk of silver was probably recovered from chalcocite and to a lesser extent, bornite.

The distribution of copper, gold, and silver among the various Whitehorse skarn deposits is difficult to assess without bulk assay or production data. The samples assayed for the present study represent a variety of rock and alteration types, so direct correlation of metal grades by deposit is not appropriate. However, a limited comparison can be made based upon metal ratios of Cu, Ag, and Au (Fig. 7). This is supported by the fact that the production average for the entire Whitehorse district plots close to the spot assay average for the Little Chief and War Eagle deposits, which together constitute more than 90% of district production. Three deposits (Cowley Park, Best Chance, and Kopper King) have low precious metal ratios. These deposits occur mainly in limestone protoliths (Table 2). Two deposits (Arctic Chief and North Star) have relatively copper-poor, silver-rich ratios and were formed largely from dolostone. The remaining four deposits (Little Chief,

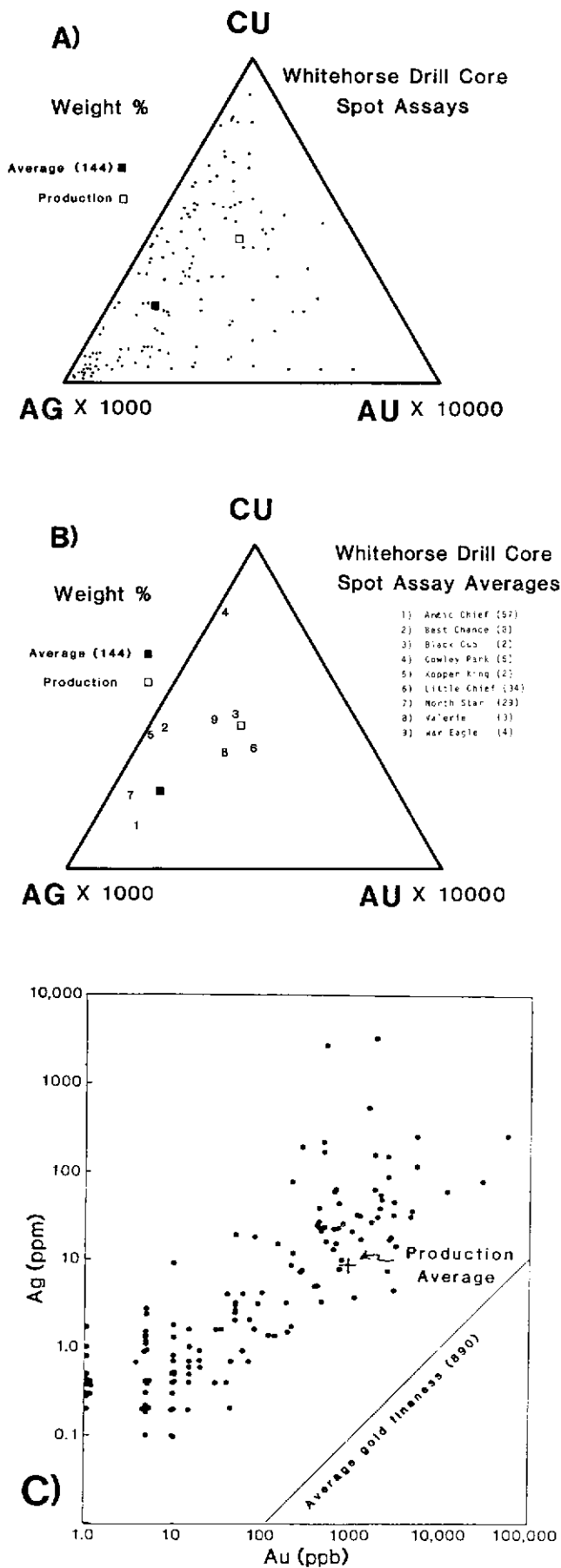


Figure 6. Spot drill core assays of samples from Whitehorse Copper Belt.

Valerie, Black Cub, and War Eagle) have relatively high gold ratios and formed from mixed limestone-dolostone protoliths.

To assess the distribution of Cu, Ag, and Au in various protoliths and alteration types, the spot samples were subdivided into six groups: 1) relatively unaltered diorite, 2) relatively unaltered limestone and dolostone, 3) skarn with little retrograde alteration or sulphide mineralization, 4) skarn with abundant retrograde alteration, 5) skarn with abundant sulphide mineralization, and 6) skarn with both abundant retrograde alteration and sulphide mineralization. The unaltered carbonate protolith is very low in Cu, Ag, and Au and would not be a good source rock for any of these elements (Fig. 8). Other sedimentary rocks in the local stratigraphic section do not contain significantly more of these elements, although Morrison (1981) concluded that the pyritic siltstone unit might be an important source for copper.

The Cu, Ag, and Au in the diorite (Fig. 8) are about average for typical mafic igneous rocks (Krauskopf, 1967) and are slightly higher than the values reported by Morrison (1981). If the Whitehorse pluton (approximately 500 km³) was the source of the ore elements in skarn the total production from the Whitehorse district would require an average depletion in the pluton of about 100 ppb Cu, 0.1 ppb Ag, and 0.01 ppb Au. This level of depletion would be undetectable in the present study. However, it is unknown how much, if any, of the Whitehorse pluton generated or interacted with the skarn-forming liquids.

Relative to the diorite pluton and carbonate protolith, skarn that has not been affected by significant retrograde alteration or sulphide mineralization is slightly enriched in Cu and Au, but not Ag (Fig. 8). This type of skarn is not ore grade and, importantly, is distinguishable in thin section and hand specimen from higher grade skarn material. As would be expected, sulphide-rich skarn has high average Cu, Ag, and Au grades (Fig. 8). Skarn that has strong retrograde alteration also is typically ore grade (Fig. 8). Some of the skarn samples with strong retrograde alteration have high Au-Ag assays even though sulphides are minor or not visible in hand specimen. The highest average Ag and Au grades occur in skarn that is both sulphide-rich and has abundant retrograde alteration.

SUMMARY AND CONCLUSIONS

Skarns in the Whitehorse Copper Belt occur in both dolomitic and calcareous carbonate rocks near contacts with the diorite contact phase of the Whitehorse Batholith. The skarns are mineralogically and compositionally similar to typical copper skarns (Einaudi et al., 1981). The main prograde skarn minerals are andraditic garnet and diopsidic pyroxene, with significant forsteritic olivine in dolomitic host rocks. Locally, intense retrograde alteration has converted garnet to epidote ± chlorite ± hematite, pyroxene to actinolite ± chlorite, and olivine to serpentine ± chlorite ± magnetite. The colour, composition, and mineralogy of prograde and retrograde skarn minerals reflect the protolith composition.

The bulk of sulphide mineralization is associated with retrograde alteration. Chalcopyrite and pyrite are preferentially associated with actinolite and chlorite, whereas bornite and chalcocite are preferentially associated with epidote and locally serpentine. The other important copper mineral, valleriite, is restricted to magnesian rocks and is commonly associated with phlogopite, serpentine, and chlorite. Overall, the Whitehorse system is copper-rich and sulphur-poor; iron sulphide minerals are not abundant.

Significant amounts of gold and silver have been recovered from the Whitehorse skarns. Gold occurs as electrum with an average fineness of 890. Coarse-grained visible gold was observed in drill core in the present study but is not common. Gold also occurs in minor, but economically important, amounts in some chalcopyrite and valleriite. The association of chalcopyrite with actinolitic retrograde alteration of pyroxene may be a useful guide to this latter occurrence of gold. Silver also occurs in electrum, but probably is more abundant as a minor constituent of chalcocite and bornite. The association of chalcocite and bornite with epidote after garnet and serpentine after olivine and diopside, may be a useful guide to this occurrence of silver. It may be possible to locate zones with significant precious metals by mapping prograde and retrograde skarn mineralogy.

Cu, Ag, and Au metal ratios of spot sample assays can be used to discriminate among the different Whitehorse skarns. Deposits formed from relatively pure limestone appear to have low precious metal ratios. Deposits formed from more magnesian protoliths appear to be silver-rich. Deposits with the highest gold ratios appear to have formed from mixed limestone-dolostone lithology. The metal ratio for total district production is similar to the average for the Little Chief and War Eagle deposits, the two largest producers in the district. Furthermore, the Little Chief deposit has the highest average gold metal ratio of the deposits studied.

The general correlation between copper and precious metal grades suggests that past exploration programs probably located the skarn deposits in the district with the most potential for precious metal production. The correlations between precious metal content and skarn mineralogy outlined in the present study can be used to guide exploration for new deposits and reevaluation of known deposits. The fact that the Little Chief skarn, the largest deposit with the highest gold metal ratio in the Whitehorse Copper Belt, has been extensively mined, suggests that future exploration should focus on similar skarns in peripheral districts such as Jackson Lake. Particular attention should be paid to skarn mineralogy and protolith composition.

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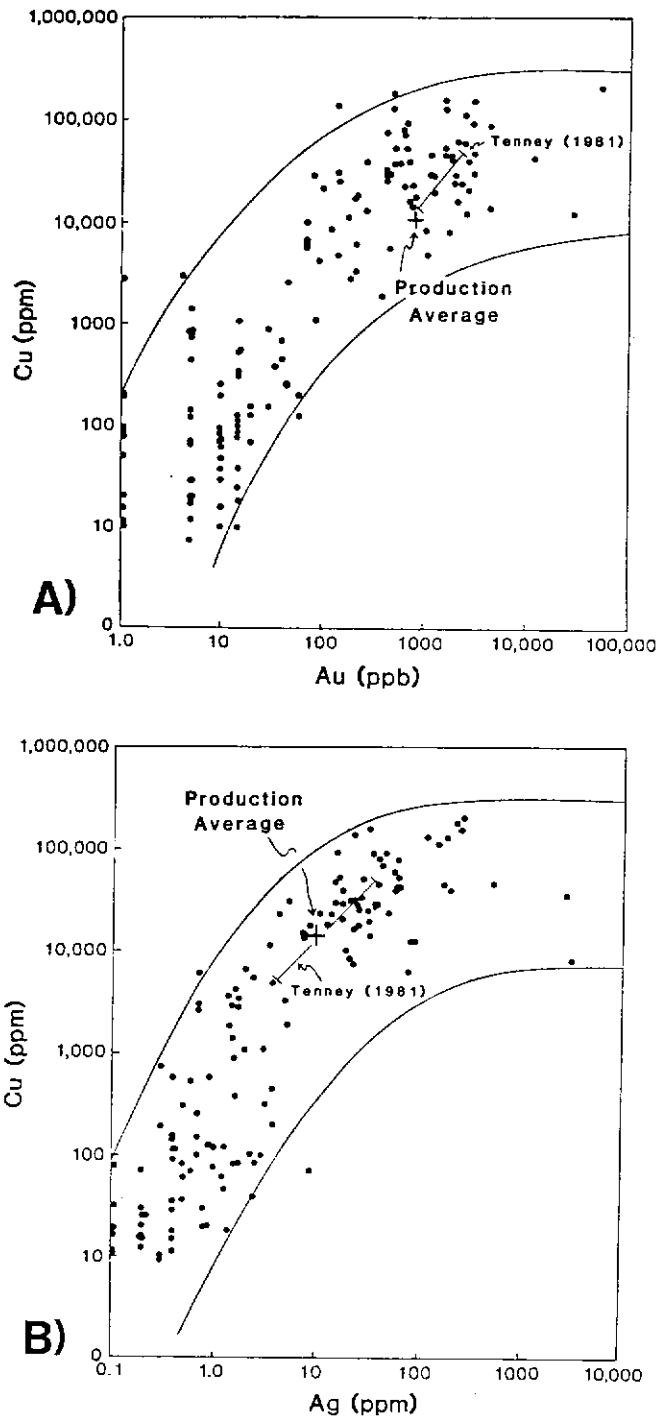


Figure 7. Cu, Ag, and Au metal ratios for spot samples from Whitehorse Copper Belt.

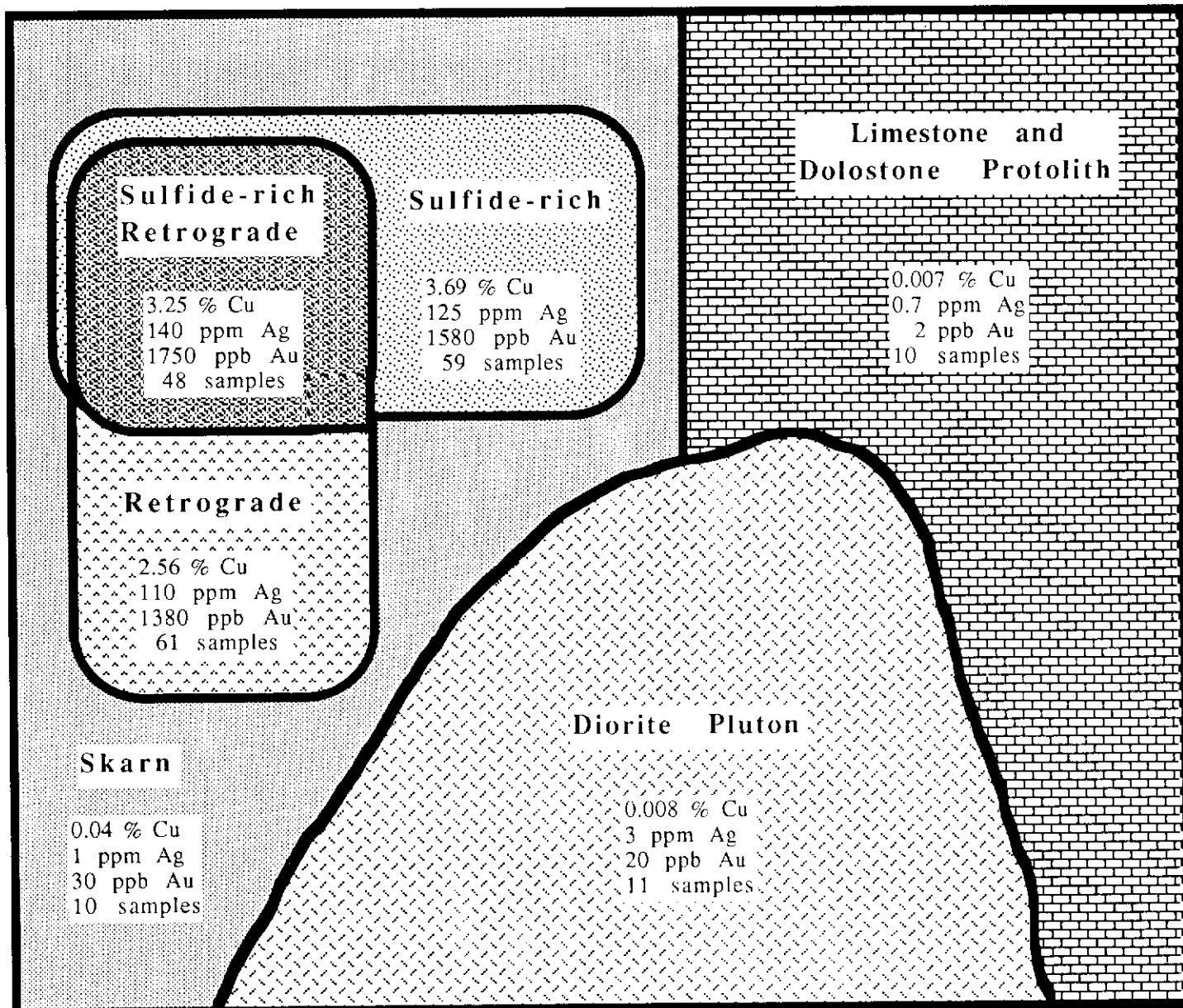


Figure 8. Cartoon illustrating distribution of Cu, Ag, and Au in rock and alteration types in the Whitehorse Copper Belt.

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Table 1 Average* igneous whole rock composition

SiO ₂	58.27
TiO ₂	0.62
Al ₂ O ₃	15.65
Fe ₂ O ₃ (T)	5.39
MnO	0.08
MgO	3.43
CaO	6.97
Na ₂ O	4.12
K ₂ O	1.54
P ₂ O ₅	0.23
LOI	1.54
Cu (ppm)	61
Ag (ppm)	0.7
Au (ppb)	6
Norms	
Q	9.77
Or	9.3
Ab	37.79
An	39.27

* Average of specimens (G25H, Pb1, Pb11, 75-50, Pb13A, Pb13B, ACNOR1, G26, GR21, Pb4) from near skarn in the Whitehorse mining district (Morrison, 1981, Appendix 2)

Table 2 Skarn Protoliths

Deposit	Abv.	Protolith	Main Silicate Skarn Minerals
Arctic Chief	AC	dolostone >> limestone	pyx>sp>act=gar=phl>ep>ol
Best Chance	BC	limestone > dolostone	gar>pyx>wo
Black Cub	BLC	limestone > dolostone	gar=pyx=act=ep
Cowley Park	CP	limestone >> dolostone	gar=pyx>wo
Kopper King	KK	limestone	gar>act=pyx
Little Chief	LC	dolostone > limestone > siltstone	pyx>gar=phl=sp=ol>act
North Star	NS	dolostone = limestone	gar=pyx>ep
Valerie	V	limestone = dolostone	pyx=gar
War Eagle	WE	limestone > dolostone	gar>pyx>wo

TABLE 3 ELECTRON MICROPROBE ANALYSES OF PYROXENE

Sample #	AC-21-153	AC-21-180	AC-21-180	AC-21-185	AC-21-215	AC-21-215	AC-51-268	AC-51-268	AC-51-269	AC-51-290	AC-51-290	AC-51-320
SiO ₂	53.63	53.98	53.52	54.50	53.48	53.59	52.91	53.98	52.82	54.32	52.51	52.51
TiO ₂	0.11	0.11	0.02	0.01	0.05	0.05	0.16	0.06	0.07	0.06	0.09	0.09
Al ₂ O ₃	1.82	0.40	0.73	0.36	0.81	0.51	0.70	0.79	1.51	0.42	1.49	1.49
FeO	1.73	2.52	1.85	2.09	2.37	4.47	4.61	4.53	6.38	1.52	4.84	4.84
MgO	16.90	16.75	17.45	17.15	16.75	15.20	15.01	15.24	14.56	17.69	15.25	15.25
MnO	0.19	0.09	0.06	0.28	0.12	0.29	0.40	0.26	0.11	0.12	0.08	0.08
CaO	25.76	25.97	26.04	26.09	25.69	25.13	25.57	25.15	24.75	25.60	25.22	25.22
Na ₂ O	0.00	0.04	0.11	0.05	0.05	0.23	0.22	0.28	0.25	0.06	0.20	0.20
K ₂ O	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Total	100.14	99.87	99.78	100.53	99.32	99.47	99.58	100.29	100.45	99.80	99.68	99.68
Cations Based on 6 Oxygens												
Si	1.949	1.976	1.958	1.979	1.968	1.985	1.966	1.982	1.953	1.979	1.947	1.947
Ti	0.003	0.003	0.001	0.000	0.001	0.001	0.005	0.002	0.002	0.002	0.003	0.003
Al	0.078	0.017	0.032	0.016	0.035	0.022	0.031	0.034	0.066	0.018	0.065	0.065
Fe	0.053	0.077	0.057	0.063	0.073	0.138	0.143	0.139	0.197	0.046	0.150	0.150
Mg	0.916	0.914	0.952	0.928	0.919	0.839	0.831	0.834	0.802	0.961	0.843	0.843
Mn	0.006	0.003	0.002	0.009	0.004	0.009	0.013	0.008	0.003	0.004	0.002	0.002
Ca	1.003	1.019	1.021	1.015	1.013	0.997	1.018	0.990	0.980	0.999	1.002	1.002
Na	0.000	0.003	0.008	0.004	0.004	0.017	0.016	0.020	0.018	0.004	0.014	0.014
K	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sum	4.008	4.014	4.029	4.014	4.015	4.010	4.022	4.009	4.021	4.013	4.025	4.025
Mole %												
Di	94.0	91.9	94.2	92.8	92.3	85.0	84.2	85.0	80.0	95.0	84.7	84.7
Hd	5.4	7.8	5.6	6.3	7.3	14.0	14.5	14.2	19.7	4.6	15.1	15.1
Jo	0.6	0.3	0.2	0.9	0.4	0.9	1.3	0.8	0.3	0.4	0.2	0.2
Assay												
Cu (ppm)	200	72	72	18	70	10000	10000	12400	15	15	11	11
Ag (ppm)	3.9	9.0	9.0	0.4	0.6	18.8	18.8	80.2	0.2	0.2	0.4	0.4
Au (ppb)	60	10	10	15	20	70	70	28490	1	1	1	1

TABLE 3 ELECTRON MICROPROBE ANALYSES OF PYROXENE

Sample #	AC-51-320	AC-51-339	AC-51-339	AC-51-351	AC-51-490	AC-51-490	AC-51-498	AC-51-498	AC-51-503	AC-51-503	AC-51-503	AC-53-349
SiO2	52.80	50.46	53.41	52.58	54.62	55.13	53.94	53.37	55.34	54.16	53.87	55.28
TiO2	0.06	0.36	0.07	0.00	0.15	0.05	0.00	0.00	0.07	0.00	0.04	0.01
Al2O3	1.36	3.65	1.15	1.49	1.10	0.24	0.73	0.43	0.12	0.48	0.91	0.00
FeO	4.63	6.65	4.39	4.73	1.19	0.97	6.01	9.47	1.11	2.08	2.08	0.90
MgO	15.16	13.95	15.64	15.58	17.95	17.84	15.19	13.06	17.93	17.04	17.12	18.06
MnO	0.20	0.18	0.15	0.17	0.01	0.00	0.25	0.29	0.00	0.07	0.14	0.02
CaO	25.05	25.06	25.23	25.40	25.88	26.04	25.12	23.56	25.57	25.89	25.95	26.22
Na2O	0.18	0.28	0.14	0.14	0.09	0.06	0.21	0.35	0.04	0.03	0.07	0.01
K2O	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
Total	99.44	100.61	100.18	100.10	100.99	100.33	101.45	100.53	100.18	99.76	100.18	100.51
Cations Based on 6 Oxygens												
Si	1.959	1.874	1.963	1.942	1.962	1.991	1.971	1.992	1.999	1.980	1.963	1.994
Ti	0.002	0.010	0.002	0.000	0.004	0.001	0.000	0.000	0.002	0.000	0.001	0.000
Al	0.060	0.160	0.050	0.065	0.047	0.010	0.032	0.019	0.005	0.021	0.039	0.000
Fe	0.144	0.207	0.135	0.146	0.036	0.029	0.184	0.296	0.033	0.064	0.064	0.027
Mg	0.838	0.772	0.857	0.857	0.961	0.960	0.827	0.727	0.966	0.928	0.930	0.971
Mn	0.006	0.006	0.005	0.005	0.000	0.000	0.008	0.009	0.000	0.002	0.004	0.001
Ca	0.995	0.997	0.994	1.005	0.996	1.008	0.984	0.942	0.990	1.014	1.013	1.013
Na	0.013	0.020	0.010	0.010	0.007	0.004	0.015	0.026	0.003	0.002	0.005	0.001
K	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sum	4.016	4.046	4.015	4.031	4.013	4.004	4.020	4.011	3.998	4.011	4.019	4.006
Mole %												
Di	84.8	78.4	86.0	85.0	96.4	97.0	81.2	70.4	96.7	93.4	93.2	97.2
Hl	14.5	21.0	13.5	14.5	3.6	3.0	18.0	28.7	3.3	6.4	6.4	2.7
Jo	0.6	0.6	0.5	0.5	0.0	0.0	0.7	0.9	0.0	0.2	0.4	0.1
Assay												
Cu (ppm)	11	29	29	20	14200	14200	29000	29000	29000	101	101	18000
Ag (ppm)	0.4	0.1	0.1	0.2	33.2	33.2	17.5	17.5	17.5	3.0	3.0	25.0
Au (ppb)	1	10	10	5	4380	4380	1230	1230	1230	15	15	800

TABLE 3 ELECTRON MICROPROBE ANALYSES OF PYROXENE

Sample #	AC-53-349	AC-53-420	AC-53-420	LC-111-847	LC-111-847	NS-15-1378	NS-15-1393	NS-15-1404	NS-15-1404	NS-15-1404	NS-15-1404	NS-15-1407
SiO ₂	53.54	52.31	52.69	54.87	54.69	54.80	54.62	53.08	54.28	54.66	54.33	53.97
TiO ₂	0.00	0.00	0.03	0.00	0.07	0.03	0.00	0.04	0.05	0.03	0.02	0.00
Al ₂ O ₃	1.06	0.35	0.24	0.10	0.40	0.26	0.14	0.90	0.20	0.21	0.30	0.60
FeO	2.47	11.64	11.10	2.20	1.06	1.32	2.76	4.15	2.95	0.98	4.99	3.29
MgO	16.62	10.57	11.11	17.70	17.98	17.86	16.76	15.68	16.47	18.21	14.43	16.27
MnO	0.06	0.47	0.50	0.10	0.09	0.00	0.22	0.13	0.08	0.07	0.85	0.10
CaO	25.79	24.51	24.40	25.52	25.95	26.35	26.02	25.71	25.66	26.29	25.57	25.55
Na ₂ O	0.06	0.20	0.12	0.06	0.02	0.06	0.02	0.19	0.18	0.02	0.22	0.13
K ₂ O	0.00	0.00	0.00	0.02	0.00	0.03	0.02	0.00	0.02	0.01	0.03	0.00
Total	99.60	100.05	100.19	100.57	100.26	100.71	100.56	99.88	99.89	100.48	100.74	99.91
Cations Based on 6 Oxygens												
Si	1.964	1.992	1.996	1.987	1.979	1.979	1.988	1.960	1.989	1.976	1.997	1.979
Ti	0.000	0.000	0.001	0.000	0.002	0.001	0.000	0.001	0.001	0.001	0.001	0.000
Al	0.046	0.016	0.011	0.004	0.017	0.011	0.006	0.039	0.008	0.009	0.013	0.026
Fe	0.076	0.371	0.352	0.067	0.032	0.040	0.084	0.128	0.090	0.030	0.154	0.101
Mg	0.909	0.600	0.628	0.956	0.970	0.962	0.909	0.863	0.899	0.981	0.790	0.890
Mn	0.002	0.015	0.016	0.003	0.003	0.000	0.007	0.004	0.003	0.002	0.026	0.003
Ca	1.014	1.000	0.990	0.991	1.006	1.020	1.015	1.017	1.007	1.018	1.007	1.004
Na	0.004	0.015	0.009	0.004	0.002	0.004	0.002	0.014	0.013	0.001	0.016	0.010
K	0.000	0.000	0.000	0.001	0.000	0.002	0.001	0.000	0.001	0.000	0.001	0.000
Sum	4.014	4.008	4.002	4.013	4.011	4.017	4.010	4.026	4.012	4.019	4.004	4.012
Mole %												
Di	92.1	60.9	63.1	93.2	96.5	96.0	90.9	86.7	90.6	96.9	81.5	89.5
Hd	7.7	37.6	35.3	6.5	3.2	4.0	8.4	12.9	9.1	2.9	15.8	10.1
Jo	0.2	1.6	1.6	0.3	0.3	0.0	0.7	0.4	0.3	0.2	2.7	0.3
Assay												
Cu (ppm)	18000	195	195	40000	40000	156000	184000	184000	29500	29500	29500	18700
Ag (ppm)	25.0	0.3	0.3	56.5	56.5	249.7	219.2	219.2	24.0	24.0	24.0	12.7
Au (ppb)	800	10	10	680	680	1510	480	480	410	410	410	210

TABLE 3 ELECTRON MICROPROBE ANALYSES OF PYROXENE

Sample #	NS-15-1407	NS-15-1415	NS-15-1415	NS-15-1415	NS-15-1415	NS-15-1422
SiO2	54.25	54.46	54.04	53.75	53.04	53.04
TiO2	0.05	0.21	0.00	0.02	0.03	0.03
Al2O3	0.21	1.04	0.15	0.16	0.68	0.68
FeO	1.79	0.13	7.12	5.12	6.05	6.05
MgO	17.68	18.78	13.23	14.49	14.58	14.58
MnO	0.09	0.00	1.02	1.43	0.29	0.29
CaO	25.88	25.88	25.02	25.07	25.25	25.25
Na2O	0.02	0.11	0.25	0.04	0.22	0.22
K2O	0.00	0.01	0.00	0.01	0.00	0.00
Total	99.97	100.62	100.83	100.09	100.14	100.14

Cations Based on 6 Oxygens

Si	1.977	1.956	2.002	1.993	1.969
Ti	0.001	0.006	0.000	0.001	0.001
Al	0.009	0.044	0.007	0.007	0.030
Fe	0.055	0.004	0.221	0.159	0.188
Mg	0.960	1.006	0.731	0.801	0.806
Mn	0.003	0.000	0.032	0.045	0.009
Ca	1.010	0.996	0.993	0.996	1.004
Na	0.001	0.007	0.018	0.003	0.016
K	0.000	0.000	0.000	0.001	0.000
Sum	4.017	4.019	4.003	4.004	4.023

Mole %

Di	94.4	99.6	74.3	79.7	80.4
Hf	5.4	0.4	22.4	15.8	18.7
Jo	0.3	0.0	3.2	4.5	0.9

Assay

Cu (ppm)	18700	33000	33000	33000	94000
Ag (ppm)	12.7	4.4	4.4	4.4	15.4
Au (ppb)	210	2950	2950	2950	650

TABLE 4 ELECTRON MICROPROBE ANALYSES OF GARNET

Sample #	AC-21-153	AC-21-180	AC-21-180	AC-21-180	AC-21-185	AC-21-189	AC-21-241	AC-51-268	AC-51-268	AC-51-269	AC-51-269	AC-51-338
SiO2	36.24	35.71	35.49	36.34	36.25	36.50	36.85	38.15	37.00			
TiO2	0.99	0.06	0.02	0.15	0.00	2.41	2.34	1.08	0.12			
Al2O3	4.72	0.17	0.74	4.71	2.91	9.27	10.18	14.09	7.24			
Fe2O3	24.28	31.13	30.41	24.85	27.14	16.40	15.86	11.31	21.23			
MgO	0.20	0.12	0.12	0.09	0.08	0.24	0.14	0.22	0.12			
MnO	0.24	0.18	0.16	0.16	0.28	0.33	0.36	0.51	0.31			
CaO	34.43	33.04	33.28	34.41	33.46	34.48	34.71	35.17	34.44			
Na2O	0.00	0.04	0.01	0.10	0.00	0.14	0.03	0.03	0.09			
K2O	0.00	0.00	0.00	0.01	0.00	0.03	0.01	0.00	0.00			
Total	101.10	100.45	100.23	101.25	100.12	99.80	100.48	101.04	100.55			
Cations based on 16 Oxygens												
Si	5.913	6.004	5.971	5.976	6.021	5.874	5.874	5.984	5.984			
Ti	0.121	0.008	0.003	0.018	0.000	0.291	0.281	0.126	0.015			
Al	0.907	0.034	0.147	0.904	0.569	1.757	1.913	2.572	1.381			
Fe	2.982	3.939	3.850	3.047	3.392	1.985	1.903	1.319	2.583			
Mg	0.048	0.030	0.031	0.023	0.020	0.058	0.033	0.051	0.030			
Mn	0.033	0.025	0.024	0.034	0.039	0.045	0.048	0.066	0.043			
Ca	6.019	5.952	5.999	6.008	5.955	5.945	5.929	5.837	5.968			
Na	0.000	0.014	0.002	0.031	0.001	0.042	0.008	0.008	0.029			
K	0.000	0.000	0.000	0.002	0.000	0.005	0.002	0.000	0.000			
Sum	16.022	16.006	16.026	16.044	15.997	16.002	15.990	15.961	16.032			
Mole %												
Pyralspite	2.0	1.4	1.3	1.4	1.5	2.5	1.9	2.9	1.8			
Andradite	75.8	97.8	95.0	76.1	84.4	55.0	52.3	64.2	65.8			
Grossularite	22.2	0.8	3.6	22.5	14.1	42.5	45.8	32.9	32.4			
Assay												
Cu (ppm)	200	72	72	18	46000	124000	10000	12400	530			
Ag (ppm)	3.9	9.0	9.0	0.4	507.5	88.4	18.8	80.2	0.6			
Au (ppb)	60	10	10	15	1510	2530	70	28490	15			

TABLE 4 ELECTRON MICROPROBE ANALYSES OF GARNET

Sample #	AC-51-338	AC-51-358	AC-51-503	AC-53-420	NS-15-1384	NS-15-1384	NS-15-1384	NS-15-1393	NS-15-1415	NS-15-1415
SiO ₂	37.45	36.99	36.14	35.85	35.93	35.56	37.23	35.78	37.92	36.06
TiO ₂	0.14	0.12	0.26	2.04	0.08	0.08	0.09	0.09	0.26	0.03
Al ₂ O ₃	9.71	6.92	2.87	6.92	1.52	0.03	8.46	0.72	12.42	1.94
Fe ₂ O ₃	18.68	21.92	27.36	20.39	28.75	31.50	19.91	30.30	15.13	27.42
MgO	0.14	0.14	0.06	0.26	0.09	0.08	0.10	0.13	0.03	0.00
MnO	0.34	0.28	0.25	0.38	0.17	0.18	0.39	0.18	0.67	1.19
CaO	34.35	34.32	34.14	34.04	33.55	32.95	33.66	33.54	35.05	32.81
Na ₂ O	0.07	0.06	0.02	0.04	0.05	0.05	0.01	0.00	0.06	0.05
K ₂ O	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	100.88	100.76	101.10	99.92	100.14	100.44	99.85	100.74	101.54	99.50
Cations based on 16 Oxygens										
Si	5.972	5.981	5.960	5.853	6.014	5.990	6.020	5.986	5.941	6.061
Ti	0.017	0.014	0.032	0.250	0.010	0.010	0.011	0.011	0.030	0.004
Al	1.825	1.318	0.558	1.331	0.299	0.007	1.613	0.142	2.293	0.385
Fe	2.242	2.667	3.395	2.505	3.621	3.992	2.423	3.814	1.784	3.469
Mg	0.034	0.034	0.016	0.064	0.024	0.020	0.023	0.032	0.008	0.000
Mn	0.046	0.038	0.035	0.052	0.024	0.026	0.054	0.025	0.088	0.169
Ca	5.869	5.946	6.031	5.955	6.016	5.947	5.832	6.012	5.884	5.909
Na	0.021	0.200	0.007	0.013	0.015	0.016	0.003	0.000	0.017	0.017
K	0.000	0.002	0.000	0.001	0.000	0.003	0.000	0.006	0.000	0.000
Sum	16.025	16.021	16.033	16.024	16.022	16.011	15.977	16.023	16.045	16.014
Mole %										
Pyrospite	1.9	1.8	1.2	2.8	1.2	1.1	1.9	1.4	2.3	4.2
Grossularite	54.3	65.8	84.9	65.6	91.3	98.7	59.0	95.1	43.2	86.2
Andradite	43.8	32.4	13.8	31.7	7.5	0.2	39.1	3.5	54.6	9.6
Assay										
Cu (ppm)	530	30	101	195	117000	117000	117000	184100	33000	33000
Ag (ppm)	0.6	0.8	3.0	0.3	149.7	149.7	149.7	219.2	4.5	4.5
Au (ppb)	15	10	15	10	2470	2470	2470	480	2950	2950

TABLE 5 ELECTRON MICROPROBE ANALYSES OF MISCELLANEOUS SILICATE MINERALS

Sample #	AC-51-498	AC-51-498	AC-53-420	AC-53-420	AC-53-149	AC-53-149	AC-51-268	AC-51-268	AC-51-351	AC-51-269	AC-51-282	AC-51-282	AC-51-503
	Feldspar	Feldspar	Feldspar	Feldspar	Olivine	Olivine	Muscovite	Muscovite	Muscovite	Phlogopite	Phlogopite	Phlogopite	Phlogopite
SiO2	65.80	66.41	64.29	64.39	42.43	42.57	47.26	47.33	46.76	37.46	40.40	43.01	40.78
TiO2	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.19	0.04	0.02	0.05
Al2O3	19.28	19.15	18.33	18.46	0.06	0.02	38.13	38.73	36.44	17.71	10.51	11.86	14.07
FeO/Fe2O3	0.04	0.04	0.00	0.09	0.42	0.41	0.25	0.24	1.70	8.43	3.85	2.82	1.67
MgO	0.00	0.01	0.01	0.02	56.79	57.13	0.37	0.25	0.41	22.38	29.91	28.14	26.77
MnO	0.00	0.00	0.04	0.00	0.03	0.00	0.00	0.03	0.07	0.27	0.06	0.00	0.00
CaO	0.00	0.03	0.07	0.07	0.02	0.05	0.07	0.07	0.05	0.07	0.03	0.04	0.00
Na2O	0.27	0.28	0.26	0.36	0.04	0.00	0.02	0.02	0.17	0.00	0.01	0.04	0.14
K2O	16.07	15.34	15.43	16.10	0.01	0.01	10.70	10.85	10.49	8.07	6.21	9.84	10.77
Total	101.49	101.28	98.45	99.49	99.80	100.19	96.80	97.53	96.10	94.58	91.02	95.77	94.25
# Oxygens	8	8	8	8	4	4	24	24	24	24	24	24	24
Si	2.986	2.993	3.014	2.991	0.998	0.997	6.129	6.098	6.162	5.408	5.874	6.001	5.795
Ti	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.021	0.004	0.002	0.005
Al	1.031	1.017	1.013	1.011	0.002	0.001	5.829	5.881	5.660	3.013	1.801	1.950	2.356
Fe	0.001	0.002	0.000	0.004	0.008	0.008	0.027	0.026	0.187	1.018	0.468	0.329	0.199
Mg	0.000	0.001	0.001	0.001	1.991	1.995	0.072	0.048	0.080	4.816	6.482	5.852	5.671
Mn	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.003	0.008	0.033	0.008	0.000	0.000
Ca	0.000	0.002	0.003	0.004	0.001	0.001	0.009	0.009	0.007	0.011	0.005	0.005	0.000
Na	0.024	0.025	0.023	0.032	0.002	0.000	0.006	0.005	0.042	0.000	0.004	0.012	0.039
K	0.930	0.940	0.863	0.954	0.000	0.000	1.770	1.783	1.763	1.487	1.153	1.751	1.952
Sum	4.974	4.979	4.921	4.996	3.002	3.002	13.842	13.854	13.909	15.806	15.798	15.902	16.016
Assay													
Cu (ppm)	29000	29000	195	195	156	156	10000	10000	20	12400	30000	30000	101
Ag (ppm)	17.5	17.5	0.3	0.3	0.7	0.7	18.8	18.8	0.2	80.2	36.3	36.3	3.0
Au (ppb)	1230	1230	10	10	20	20	70	70	5	28490	1160	1160	15

TABLE 6 ELECTRON MICROPROBE ANALYSES OF AMPHIBOLES

Sample #	AC-21-180	AC-21-241	AC-21-246	AC-21-246	AC-21-191	AC-51-290	AC-51-290	AC-51-320	AC-51-339	AC-51-351	AC-51-490
SiO ₂	52.27	51.87	54.80	56.01	54.37	55.18	55.32	55.12	55.19	52.26	54.71
TiO ₂	0.04	0.01	0.04	0.05	0.04	0.06	0.18	0.18	0.10	0.06	0.06
Al ₂ O ₃	1.59	2.79	1.30	0.78	1.89	0.65	1.61	1.61	0.69	3.32	0.84
FeO	18.25	13.33	11.35	9.55	11.92	13.46	8.34	7.77	10.96	12.24	11.85
MgO	12.30	15.33	16.58	18.67	16.60	15.89	19.27	18.68	16.94	15.74	16.56
MnO	0.38	0.60	0.28	0.22	0.11	0.38	0.17	0.18	0.19	0.27	0.13
CaO	12.18	11.70	12.53	12.66	12.60	12.62	13.00	13.13	12.88	12.80	12.84
Na ₂ O	0.33	0.31	0.24	0.16	0.30	0.25	0.36	0.24	0.14	0.21	0.11
K ₂ O	0.08	0.10	0.05	0.03	0.06	0.02	0.03	0.07	0.01	0.12	0.01
Total	97.42	96.04	97.17	98.13	97.89	98.51	98.28	96.98	97.10	97.02	97.11
Cations Based on 23 Oxygens											
Si	7.768	7.642	7.872	7.893	7.778	7.900	7.763	7.816	7.920	7.588	7.885
Ti	0.005	0.002	0.004	0.005	0.004	0.007	0.019	0.020	0.010	0.007	0.006
Al	0.279	0.485	0.220	0.130	0.318	0.109	0.267	0.269	0.117	0.568	0.144
Fe	2.268	1.642	1.364	1.126	1.427	1.612	0.979	0.921	1.315	1.487	1.429
Mg	2.725	3.367	3.551	3.921	3.540	3.391	4.030	3.947	3.623	3.407	3.558
Mn	0.048	0.075	0.034	0.026	0.013	0.046	0.020	0.021	0.024	0.033	0.016
Ca	1.939	1.847	1.929	1.911	1.931	1.936	1.955	1.995	1.980	1.991	1.983
Na	0.095	0.088	0.068	0.042	0.083	0.070	0.099	0.065	0.039	0.060	0.030
K	0.015	0.018	0.009	0.006	0.011	0.004	0.005	0.013	0.002	0.022	0.002
Sum	15.142	15.166	15.051	15.060	15.105	15.075	15.136	15.068	15.030	15.161	15.051
Mole %											
Fe/Fe+Mg+Mn	45.0	32.3	27.6	22.2	28.6	31.9	19.5	18.8	26.5	30.2	28.6
Mg/Fe+Mg+Mn	54.0	66.2	71.8	77.3	71.1	67.2	80.1	80.7	73.0	69.2	71.1
Mn/Fe+Mg+Mn	1.0	1.5	0.7	0.5	0.3	0.9	0.4	0.4	0.5	0.7	0.3
Assay											
Cu (ppm)	72	124000	90000	90000	1900	15	15	11	29	20	14200
Ag (ppm)	9.0	88.4	35.3	35.3	5.1	0.2	0.2	0.4	0.1	0.2	33.2
Au (ppb)	10	2530	4280	4280	380	1	1	1	10	5	4380

TABLE 6 ELECTRONMICROPROBE ANALYSES OF AMPHIBOLES

Sample #	AC-51-490	AC-51-498	AC-51-498	AC-51-503	AC-51-503	AC-51-503	AC-53-349	AC-53-349	AC-53-420	LC-111-847	NS-15-1384
SiO2	52.19	54.64	53.73	51.53	55.16	57.73	53.42	55.70	52.97	56.28	54.19
TiO2	0.20	0.08	0.03	0.10	0.08	0.14	0.11	0.03	0.00	0.05	0.02
Al2O3	2.57	1.03	1.23	3.46	2.02	0.45	2.48	1.03	1.86	0.89	0.50
FeO	14.77	14.38	15.13	15.47	4.98	2.35	12.77	7.28	14.76	7.45	16.18
MgO	13.65	15.02	14.51	14.01	21.56	23.44	15.14	19.02	14.17	19.56	14.15
MnO	0.25	0.21	0.36	0.21	0.24	0.03	0.30	0.15	0.36	0.23	0.95
CaO	12.35	12.69	12.42	12.75	12.73	13.66	12.43	13.34	12.83	13.29	11.43
Na2O	0.38	0.18	0.23	0.49	0.40	0.15	0.31	0.19	0.21	0.10	0.38
K2O	0.11	0.02	0.10	0.11	0.08	0.04	0.13	0.00	0.05	0.00	0.05
Total	96.47	98.25	97.74	98.13	97.25	97.99	97.09	96.74	97.21	97.85	97.85
Cations Based on 23 Oxygens											
Si	7.703	7.873	7.828	7.523	7.708	7.894	7.747	7.892	7.760	7.887	7.920
Ti	0.023	0.008	0.004	0.011	0.009	0.014	0.012	0.003	0.000	0.005	0.002
Al	0.447	0.176	0.211	0.596	0.332	0.072	0.423	0.172	0.322	0.147	0.086
Fe	1.824	1.733	1.843	1.889	0.582	0.269	1.548	0.863	1.808	0.873	1.978
Mg	3.004	3.227	3.150	3.049	4.489	4.778	3.273	4.018	3.094	4.086	3.083
Mn	0.031	0.025	0.044	0.026	0.028	0.004	0.037	0.018	0.045	0.027	0.117
Ca	1.953	1.959	1.939	1.995	1.906	2.001	1.932	2.025	2.014	1.996	1.790
Na	0.109	0.051	0.065	0.138	0.109	0.041	0.088	0.052	0.058	0.027	0.106
K	0.020	0.004	0.018	0.020	0.014	0.007	0.025	0.000	0.010	0.000	0.010
Sum	15.114	15.057	15.103	15.246	15.177	15.079	15.085	15.043	15.111	15.047	15.092
Mole %											
Fe/Fe+Mg+Mn	37.5	34.8	36.6	38.1	11.4	5.3	31.9	17.6	36.5	17.5	38.2
Mg/Fe+Mg+Mn	61.8	64.7	62.5	61.4	88.0	94.6	67.4	82.0	62.5	82.0	59.5
Mn/Fe+Mg+Mn	0.6	0.5	0.9	0.5	0.5	0.1	0.8	0.4	0.9	0.5	2.3
Assay											
Cu (ppm)	14200	29000	29000	101	101	101	18000	18000	195	40000	117000
Ag (ppm)	33.2	17.5	17.5	3.0	3.0	3.0	25.0	25.0	0.3	56.5	149.7
Au (ppb)	4380	1230	1230	15	15	15	800	800	10	680	2470

TABLE 6 ELECTRON MICROPROBE ANALYSES OF AMPHIBOLES

Sample #	NS-15-1384	NS-15-1407	NS-15-1415	NS-15-1727
SiO ₂	45.42	55.35	56.38	58.08
TiO ₂	0.13	0.06	0.00	0.11
Al ₂ O ₃	9.28	0.34	0.20	0.24
FeO	19.80	10.54	8.06	1.17
MgO	9.69	17.48	18.95	23.86
MnO	0.21	0.49	0.42	0.04
CaO	12.41	12.59	13.31	13.65
Na ₂ O	1.27	0.26	0.09	0.14
K ₂ O	0.15	0.06	0.01	0.15
Total	98.36	97.17	97.42	97.44
Cations Based on 23 Oxygens				
Si	6.817	7.934	7.964	7.942
Ti	0.015	0.006	0.000	0.012
Al	1.641	0.057	0.034	0.039
Fe	2.486	1.263	0.953	0.134
Mg	2.167	3.735	3.991	4.864
Mn	0.026	0.060	0.050	0.005
Ca	1.995	1.933	2.014	1.999
Na	0.370	0.072	0.025	0.037
K	0.029	0.012	0.002	0.026
Sum	15.546	15.073	15.032	15.057
Mole %				
Fe/Fe+Mg+Mn	53.1	25.0	19.1	2.7
Mg/Fe+Mg+Mn	46.3	73.8	79.9	97.2
Mn/Fe+Mg+Mn	0.6	1.2	1.0	0.1
Assay				
Cu (ppm)	117000	18700	33000	43100
Ag (ppm)	149.7	12.7	4.5	63.7
Au (ppb)	2470	210	2950	1780

TABLE 7 ELECTRON MICROPROBE ANALYSES OF CHLORITE

Sample #	AC-21-241	AC-51-269	AC-51-331	AC-51-351	LC-111-774	NS-15-1422
SiO2	30.98	30.73	28.36	31.61	36.71	30.65
TiO2	0.03	0.06	0.03	0.01	0.06	0.05
Al2O3	16.46	17.31	17.79	16.53	11.84	15.38
FeO	14.65	8.33	20.09	14.46	2.95	14.71
MgO	23.27	28.03	20.09	24.70	31.45	24.08
MnO	1.77	0.34	0.46	0.15	0.02	0.38
CaO	0.21	0.04	0.13	0.18	0.09	0.33
Na2O	0.00	0.00	0.00	0.01	0.05	0.00
K2O	0.02	0.04	0.02	0.04	3.57	0.05
Total	87.39	84.88	86.97	87.69	86.74	85.63
Si	4.433	4.351	4.186	4.461	5.020	4.459
Ti	0.003	0.006	0.004	0.001	0.007	0.006
Al	2.775	2.888	3.095	2.749	1.909	2.637
Fe	1.753	0.987	2.479	1.707	0.338	1.790
Mg	4.963	5.915	4.419	5.195	6.411	5.222
Mn	0.214	0.041	0.057	0.019	0.003	0.046
Ca	0.032	0.006	0.021	0.027	0.013	0.052
Na	0.000	0.000	0.000	0.004	0.012	0.000
K	0.004	0.008	0.004	0.006	0.623	0.009
Sum	14.177	14.201	14.265	14.168	14.335	14.220
Mole %						
Fe/Fe+Mg+Mn	25.3	14.2	35.6	24.7	5.0	25.4
Mg/Fe+Mg+Mn	71.6	85.2	63.5	75.1	95.0	74.0
Mn/Fe+Mg+Mn	3.1	0.6	0.8	0.3	0.0	0.7
Assay						
Cu (ppm)	124000	12400	155	20	11500	94000
Ag (ppm)	88.4	80.2	0.4	0.2	3.4	15.4
Au (ppb)	2530	28490	30	5	180	650

TABLE 8 ELECTRON MICROPROBE ANALYSES OF EPIDOTE

Sample #	AC-21-153	AC-21-185	AC-21-189	AC-51-238	AC-51-269	AC-51-269	AC-51-331	AC-51-331	AC-51-338	AC-51-490	AC-51-490	AC-53-420
SiO ₂	37.90	37.55	37.65	37.53	38.26	38.87	37.30	37.37	37.42	37.88	37.30	37.24
TiO ₂	0.18	0.08	0.19	0.12	0.00	0.03	0.00	0.15	0.03	0.01	0.34	0.03
Al ₂ O ₃	24.12	22.12	22.69	21.67	24.61	28.86	23.18	23.34	21.16	21.74	21.45	21.17
Fe ₂ O ₃	11.17	13.46	12.61	13.97	9.71	5.89	12.69	11.93	14.53	13.36	13.39	14.04
MgO	0.08	0.02	0.03	0.00	0.04	0.03	0.60	0.13	0.08	0.04	0.08	0.00
MnO	0.07	0.16	0.11	0.03	0.00	0.02	0.11	0.46	0.17	0.03	0.00	0.10
CaO	23.78	23.24	23.55	23.69	23.59	24.35	23.13	23.25	23.25	23.15	23.55	23.07
Na ₂ O	0.00	0.01	0.05	0.04	0.00	0.03	0.05	0.03	0.00	0.03	0.00	0.03
K ₂ O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Total	97.30	96.64	96.88	97.05	96.21	98.08	97.06	96.66	96.64	96.24	96.11	95.69
Cations Based on 13 Oxygens												
Si	2.605	2.633	2.622	2.631	2.633	2.568	2.605	2.601	2.642	2.662	2.634	2.648
Ti	0.009	0.004	0.010	0.007	0.000	0.002	0.000	0.008	0.002	0.001	0.018	0.002
Al	1.953	1.827	1.862	1.790	1.996	2.247	1.908	1.915	1.760	1.801	1.785	1.774
Fe	0.642	0.789	0.734	0.819	0.559	0.325	0.741	0.695	0.858	0.785	0.791	0.835
Mg	0.008	0.002	0.004	0.000	0.004	0.003	0.007	0.014	0.008	0.004	0.008	0.000
Mn	0.004	0.010	0.006	0.002	0.000	0.001	0.007	0.027	0.010	0.002	0.000	0.006
Ca	1.751	1.746	1.757	1.779	1.739	1.723	1.731	1.734	1.758	1.743	1.781	1.758
Na	0.000	0.001	0.007	0.005	0.000	0.003	0.007	0.004	0.000	0.004	0.000	0.004
K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Sum	6.972	7.012	7.002	7.032	6.931	6.871	7.006	6.997	7.038	7.001	7.017	7.027
Assays												
Cu (ppm)	200	18	46000	530	12400	12400	155	155	530	14200	14200	195
Ag (ppm)	19.0	0.4	507.5	0.6	80.2	80.2	0.4	0.4	0.6	33.2	33.2	0.3
Au (ppb)	15	15	1510	15	28490	28490	30	30	15	4380	4380	10

Table 9 Hand sample descriptions of assayed samples

<u>Sample #</u>	<u>Cu(ppm)</u>	<u>Ag(ppm)</u>	<u>Au(ppb)</u>	<u>Hand Sample Description</u>
AC-21-120	77	19.00	15	Diorite endoskarn (gar<pyx).
AC-21-153	200	3.90	60	Ep-act patch in gar-pyx endoskarn.
AC-21-160	39	2.50	15	Pale gar-pyx endoskarn.
AC-21-180	72	9.00	10	Banded gar-pyx skarn with qtz-mt vugs.
AC-21-185	18	0.40	15	C.g. pyx-mt skarn, no sulfides.
AC-21-189	46000	507.53	1510	Qtz-ep-cp retrograde vein in gar skarn.
AC-21-191	1900	5.14	380	Py vein of pyx-mt skarn.
AC-21-192	7100	22.26	620	Pyx skarn cut by qtz-gar-mt vein with cp-py env.
AC-21-193	53000	27.40	1640	Pyx skarn with (mt-cp-py)=20%.
AC-21-215	70	0.60	20	Pyx=mt skarn with no sulfides.
AC-21-223	45000	156.52	1780	C.g. brown garnet skarn with 3-5% cp stringers minor mt fringe.
AC-21-241	124000	88.37	2530	Gar-pyx-cp vein cutting mt>pyx skarn.
AC-21-245	48100	14.39	3010	C.g. pyx (1-2cm) with interstitial cp and mt.
AC-21-246	90000	35.28	4280	Ca-qtz vein with cp env cutting mt>pyx skarn.
AC-21-262	5700	3.43	450	Pale gar>pyx skarn with cp vugs.
AC-21-265	35	0.40	5	Dolostone at marble front.
AC-21-288	37	0.50	10	Dolostone 24ft. from skarn.
AC-51-115	29	0.20	5	Gray dolostone.
AC-51-262	12	0.20	5	Pure white dolostone.
AC-51-268	10000	18.84	70	Pale gar-pyx skarn with bn±cc clumps.
AC-51-269	12400	80.15	28490	Pale gar-pyx skarn with ep retrograde and bn±cc clumps.
AC-51-272	8100	3014.00	1780	Mt-phl skarn with bn-cc.
AC-51-282	30000	36.31	1160	Mt-pyx skarn with bn-cp.
AC-51-290	15	0.20	1	Mottled f.g. pyx skarn.
AC-51-320	11	0.40	1	Pyx hornfels
AC-51-325	10	0.10	10	Phl-olv-pyx skarn, no mt.
AC-51-331	155	0.40	30	Qtz-ep-act-py vein-vug retrograde.
AC-51-338	530	0.60	15	Massive red brown garnet skarn.
AC-51-339	29	0.10	10	Qtz-ep-mt vug in garnet skarn.
AC-51-351	20	0.20	5	Pyx skarn with <5% garnet.
AC-51-358	30	0.80	10	Pyx skarn cut by planar qtz-act veins.
AC-51-400	8500	21.00	1000	Diorite endoskarn with gar-pyx± ep-py.
AC-51-445	129	0.90	20	"Fresh" diorite with mafic xenoliths.
AC-51-490	14200	33.22	4380	Py-cp-ep retrograde of pyx skarn at diorite contact.
AC-51-498	29000	17.47	1230	Cp-act- retrograde of pyx skarn.
AC-51-503	101	3.00	15	Gar-pyx skarn in small pendent-xenolith in diorite.
AC-51-645	85	1.60	15	Fresh diorite.
AC-53-135	15	0.20	10	Br specks in white dolostone.
AC-53-149	156	0.70	20	Fringe serpentine vein with env. of br specks
AC-53-167	25	0.20	45	Wavy convoluted contact between diorite endoskarn (gar-ep) and 10cm green sp-phl-br skarn.
AC-53-185	124	1.00	15	C.g. spinel, possible gahnite.
AC-53-340	22800	4.11	100	Contact of dolostone with massive mt-cp-olv(sp) skarn.
AC-53-342	70	0.10	10	Possible fresh olv. in fringe zone of skarn.
AC-53-345	43000	57.88	10170	Massive mt-bn-valleriite?skarn.
AC-53-348	21200	17.47	2600	Massive mt-valleriite ol.(sp) skarn.
AC-53-349	18000	25.00	800	Zonation sequence of dol to olv (sp) to pyx-py to gar skarn.
AC-53-352	153200	32.54	2910	10% cp disseminated in pyx with act retrograde.
AC-53-353	94.00	0.40	10	Garnet skarn.
AC-53-363	3000	0.69	4	1% cp in pyx±mt near gar vein.
AC-53-383	13000	7.54	270	Pyx skarn with cp veinlets near diorite dike.
AC-53-387	2600	0.70	45	Pyx skarn with cp veinlets near diorite dike.
AC-53-411	70	0.20	5	Gar-pyx skarn cut by qtz-ep vein (1mm).
AC-53-420	195	0.30	10	Gar- dark pyx skarn with qtz-chl-py fractures.
AC-53-453	17	0.10	5	Dark pyx skarn.
AC-53-515	6100	79.12	210	Gar-pyx-cp.

Sample #	Cu(ppm)	Ag(ppm)	Au(ppb)	Hand Sample Description
AC-53-604	25	0.20	15	C.g. olv-talc.
AC-53-607	16	0.20	10	Olv-br at diorite contact.
BC22-96	6600	2.06	70	Skarn.
BC-39-517	20	0.90	5	Pure CaCO ₃ limestone.
BC-39-570	585	0.90	5	C.g. 2 cm blue-green pxy-lim.
BC-39-591	325	3.30	15	Gar-tan pyx(Mn?) -hm.
BC-39-602	85	1.80	10	Dark green pyx-gar-hm.
BC-39-616	10	0.30	1	Fresh diorite.
BC-46-263	2800	1.70	1	Skarn.
BC-46-265	855	2.60	5	Skarn.
Black Cub South	70000	43.84	2360	Gar<pyx go to ep-act-cp.
BLC-46-543	4900	3.80	1050	Skarn.
CP-115-272	3700	1.37	140	Skarn.
CP-115-292	1100	2.00	15	Skarn.
CP-115-297	18000	8.56	210	Skarn.
CP-115-335	139300	22.61	140	Pyx-ep--cc-cp.
CP-70-250	735	0.30	5	Gar>pyx skarn; Tr ace mo-py.
KK-5-477	84	0.50	1	Skarn.
KK-5-515	1400	1.50	5	Skarn.
LC-111-769	104	2.40	5	Dolostone <1ft. from skarn.
LC-111-773	28300	37.00	80	Gar-pyx skarn with mt band.
LC-111-774	11500	3.40	180	Mt>pyx skarn±cp.
LC-111-775	131000	172.28	480	Skarn.
LC-111-776	31200	5.14	140	Mt-phl skarn with cp-bn in phl-rich bands.
LC-111-778	5600	2.40	70	Qtz-ca-wollastonite? zone with cp blebs.
LC-111-782	119	0.40	1	Biotitized siltstone with vertical qtz-py fractures.
LC-111-788	145	0.40	5	Biotitized siltstone with vertical qtz-py fractures.
LC-111-790	63	1.20	5	Biotitized siltstone with vertical qtz-py fractures.
LC-111-813	119	0.40	1	Strongly biotitized siltstone, no sulfides.
LC-111-829	47	1.30	10	Pale green siltstone with qtz-py veins.
LC-111-847	40000	56.51	680	Pyx-cp skarn at contact with siltstone.
LC-111-882	6000	0.69	70	Mt-cp±sp.
LC-111-887	23800	13.36	620	Mt-cp-bn and ca veins.
LC-114-914	25600	15.07	140	Diorite fractured with qtz-cp-feldspar flooding.
LC-111-947	450	3.80	40	Mudstone skarnoid (gar-pyx-ep) with py>cp.
LC-111-977	79	1.00	1	Salt-pepper graywacke.
LC-96-137	15	0.40	1	C.g. gar-pyx skarn no sulfides.
LC-96-150	124	1.30	5	Diorite with green pyx laths replacing hbd.
LC-96-45	29	0.40	5	C.g. pale grossularite gar with interstitial blue-green pyx.
LC-96-700	18	1.40	5	Typical gar-pyx of copper skarn.
LC-96-710	1870	1.40	120	Gar-pyx-ep endoskarn of diorite.
LC-96-750	71500	39.39	410	1/2 mt-phl-bn, 1/2 mt-dark sp.
LC-96-760	80000	60.28	620	Mt.>bn>pyx (1mm laths 5%).
LC-96-770	212400	255.16	53240	1-2cm euhedral pyx crystals with 2% 1mm brown gar and 10% bn.
LC-96-780	33600	26.37	410	Mt-sp-phl skarn with 5% bn patches.
LC-96-820	60900	55.83	2050	Felted 1-5mm green pyx-mt skarn with 1% bn.
LC-96-835	134300	116.11	1510	1cm euhedral green pyx-phl-mt with 5% bn.
LC-96-840	32800	23.29	480	Pyx>sp>mt>phl 1% bn skarn.
LC-96-845	54000	16.44	510	Sp-cp skarn.
LC-96-855	15600	7.54	2050	Mt-olv goes to sp-valleriite skarn.
LC-96-86	7	1.10	5	Buff pyx hornfels with 5mm green pyx eyes and stockwork act fractures.
LC-96-930	14100	7.88	750	Mt>sp>cp skarn.
LC-96-800	32000	21.58	450	Banded mt-sp-bn.
NS-15-1375	100	0.70	15	Pale green pyx, no sulfides.
NS-15-1378	156000	249.68	1510	Retrograde pyx to clay 10% cp.

<u>Sample #</u>	<u>Cu(ppm)</u>	<u>Ag(ppm)</u>	<u>Au(ppb)</u>	<u>Hand Sample Description</u>
NS-15-1384	117000	149.67	2470	2cm euhedral gar-ep with interstitial 20% bn, 2% cp.
NS-15-1385	16700	22.00	700	2cm euhedral gar with vugs of specular hm-ca-qtz. <1% cp+bn.
NS-15-1393	184100	219.20	480	Gar-pyx skarn goes to ep-act with 20% cp, 2% bn.
NS-15-1398	92000	45.55	2810	C.g. fresh pale pyx with 5% cp, <1% bn.
NS-15-1400	380	1.60	35	C.g. white dolostone cut by mt vein.
NS-15-1404	29500	23.98	410	C.g. fresh pale pyx with 25% c.g. cp.
NS-15-1407	18700	12.67	210	Pale pyx rosettes with 25% c.g. cp.
NS-15-1409	24000	30.48	1880	Strong clay retrograde of pyx skarn, little sulfide.
NS-15-1415	33000	4.45	2950	Pyx>gar skarn with 10% cp 1% bn and minor qtz. vein.
NS-15-1422	94000	15.41	650	Clay retrograde pyx skarn with vugs of ca - specular hm, minor cp and bn.
NS-15-W1-1098	25600	25.00	410	C.g. olv in mt-cp skarn.
NS-15-W1-1102	20	0.80	1	C.g. white dolomitic marble.
NS-15-W1-1110	29000	39.73	1990	Contact of mt-cp skarn with mt-ca-cp vein.
NS-15-W1-1112	260	0.70	10	Gray peppery dolomitic limestone.
NS-15-W1-1116	23600	10.62	750	Mt-olv-tr-bn in middle of skarn.
NS-15-W2-1694	890	1.60	30	Green olv to sp, with isolated 1cm phl rosettes.
NS-15-W2-1700	38500	2071.10	550	Dark green-black olv-sp skarn 5% cp, 2% mt.
NS-15-W2-1705	46200	39.05	1160	Mt goes to pyx skarn 5% cp, 3% bn.
NS-15-W2-1710	39000	191.46	270	Mt>pyx-tr skarn with 5% cp.
NS-15-W2-1718	10	0.10	15	Dark diabase-diorite dike with 1 cm ep clots.
NS-15-W2-1727	43100	63.71	1780	Tr>phl-mt 1% bn.
NS-15-W2-1742	24000	48.29	2230	Ol to sp-mt skarn 5% vallerite, 3% bn, 1% cp.
NS-15-W2-1746	315	0.50	15	Olv-mt-gar skarn.
NS-15-W2-1758	9	0.30	1	Diorite.
NS-15-W2-1764	128	0.90	60	Ep endoskarn.
NS-17-26	61	0.50	10	Skarn.
NS-17-41	19200	30.83	1200	Retrograde skarn.
V-19-400	580	0.40	40	Skarn.
V-19-403	1100	3.20	85	Skarn.
V-19-405	2900	1.50	190	Skarn.
WE-54-182	53000	62.34	650	Pale gar>pyx with 5% bn 1 cm patches.
WE-8-250	3400	1.71	210	Gar-pyx>ep sk with 2% cp.
WE-D2-280	40000	17.47	2640	Pyx-skarn cut by cp-act veins 3% cp.
WE-D8-30	4200	1.60	90	Gar=pyx>ep-ca skarn 1% cp.

Abbreviations used in table:

act=actinolite, bn=bornite, br=brucite, ca=calcite, cc=chalcocite, c.g.=coarse-grained, chl=chlorite, cp=chalcopyrite, do=dolomite, env=envelope, ep=epidote, f.g.=fine-grained, gar=garnet, hbd=hornblende, hm=hematite, lim=limonite, mt=magnetite, olv=olivine, phl=phlogopite, py=pyrite, pyx=pyroxene, qtz=quartz, sp=serpentine, tr=tremolite.

Table 10 Electron microprobe analyses of opaque minerals

Sample # Mineral	AC-51-269		CP-115-292		NS-15-1393		NS-15-1393		V-19-405		WE-D2-280		WE-D2-280		AC-51-269		AC-51-269	
	Bn	Cc in gold	Bn	Cc in gold	Bn	Cp	Bn	Cp	Bn	Cp	Bn	Cp	Bn	Cp	Bn	Cc	Bn	Cc
Cu	63.23	76.6	63.02	76.6	62.98	33.97	62.43	34.25	61.70	34.49	63.04	34.47	61.15	34.79	57.06	78.44	57.06	78.44
Fe	10.81	0.69	11.56	0.69	11.57	30.25	11.49	30.64	11.59	30.11	11.36	29.86	12.24	29.88	14.39	0.15	14.39	0.15
S	24.86	20.42	26.22	20.68	26	34.23	25.12	34.18	25.88	35.04	25.51	34.53	25.76	34.65	28.04	20.53	28.04	20.53
Ag	0.16	2.44	0.13	1.69	0.22	0.08	0.17	0.09	0.01	0.03	0.27	0.18	0.23	0.11	0.10	0.86	0.10	0.86
Au	0.04	0.04	0.04	0.04	0	0	0.06	0.18	0.05	0.08	0.00	0.01	0.00	0.09	0.10	0	0.10	0
Te	0.03	0.04	0	0.01	0.07	0.06	0.02	0	0.05	0.00	0.03	0.02	0.00	0.04	0.10	0.54	0.10	0.54
Total	99.13	100.97	100.97	99.71	100.84	98.59	99.29	99.34	99.28	99.68	100.21	99.07	99.38	98.77	99.79	100.52	99.79	100.52

Sample # Mineral	AC-51-269		AC-21-189		AC-21-241		AC-53-352		AC-53-352		AC-53-515		AC-53-515		Black Cub South		Black Cub South		BLC-46-549	
	Cc in gold	Cc in gold	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	Cp	
Cu	76.95	76.6	33.97	33.97	34.25	34.27	34.27	34.27	34.49	34.49	34.47	34.79	34.79	34.19	34.42	34.19	34.42	34.23	34.23	
Fe	0.15	0.69	30.25	30.25	30.64	30.25	30.25	30.25	30.11	30.11	29.86	29.88	29.88	29.96	29.87	29.96	29.87	30.05	30.05	
S	20.42	20.68	34.23	34.23	34.18	34.96	34.96	34.96	35.04	35.04	34.53	34.65	34.65	34.53	34.80	34.53	34.80	34.47	34.47	
Ag	2.44	1.69	0.08	0.08	0.09	0.00	0.00	0.00	0.03	0.03	0.18	0.11	0.11	0.05	0.00	0.05	0.00	0.06	0.06	
Au	0.04	0.04	0	0	0.18	0.20	0.20	0.20	0.08	0.08	0.01	0.09	0.09	0.00	0.00	0.00	0.00	0	0	
Te	0.04	0.01	0.06	0.06	0	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.04	0.00	0.01	0.01	
Total	100.04	99.71	98.59	98.59	99.34	99.68	99.34	99.68	99.75	99.75	99.07	99.52	99.52	98.77	99.09	98.77	99.09	98.82	98.82	

Table 10 Electron microprobe analyses of opaque minerals

Sample # Mineral	KK-5-515 Cp	KK-5-515 Cp	NS-15-1393 Cp	NS-15-1710 Cp	V-19-405 Cp	WE-54-182 Cp	CP-115-292 Cp adj. to Bn	BC-46-265 Cp in Bn-Cc	AC-51-269 Gold	AC-51-269 Gold	AC-51-269 Gold	AC-51-269 Gold
Cu	34.38	34.27	34.60	34.42	34.75	34.26	34.82	33.43	0.21	0.25	0.40	0.22
Fe	30.5	30.38	29.98	30.30	30.27	29.92	30.39	30.45	0.02	0.10	0.01	0.04
S	34.94	34.72	34.32	34.01	35.22	34.22	35.01	33.81	0.01	0.01	0.03	0.03
Ag	0	0	0.07	0.07	0.00	0.09	0.03	0.06	10.42	11.52	7.40	9.83
Au	0.08	0	0.00	0.00	0.00	0.03	0	0.03	88.02	87.76	92.95	89.18
Te	0.02	0	0.03	0.00	0.08	0.06	0.02	0.02	0.08	0.08	0.11	0.11
Total	99.92	99.37	99.00	98.80	100.32	98.58	100.27	97.80	98.76	99.72	100.90	99.41

Sample # Mineral	AC-21-189 Magnetite	AC-21-241 Magnetite	AC-51-269 Magnetite	NS-15-1710 Magnetite	AC-21-246 Py	NS-15-1107A Vallerite
Cu	0.01	0	0.00	0.00	0	22.47
Fe	64.76	67.86	65.44	66.50	45.74	13.86
S	0.03	0	0.00	0.00	52.58	19.04
Ag	0	0	0.07	0.00	0	0.14
Au	0	0.01	0.00	0.08	0	0.05
Te	0	0	0.05	0.02	0	0.00
Total	64.8	67.87	65.56	66.60	98.32	55.56