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# Gold in Skarns of the Whitehorse Copper Belt, Yukon Territory, Canada

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## Introduction

Skarns in the Whitehorse Copper Belt have produced 134,000 tons of copper, 97,000 kg of silver, and 7,700 kg of gold from 11 million tons of ore between 1967 and 1982 (Tenney, 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 Au/ton for the Whitehorse deposits is probably too low but neither exploration nor production drill holes were routinely assayed for gold. Hurreau (1985) estimated that the 10 million tons of tailings from the Whitehorse deposits contain about 1,500 kg of gold and Tenney (1981) reported that tailings assays ranged up to 250 g Au/ton 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 $1.5 \times 10^9$ 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 Au/ton although some deposits (e.g. Bingham, Utah, Cameron and Garmoe, 1983) contain local zones with grades up to 70 g Au/ton. 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.

## 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 the city of Whitehorse, Yukon Territory (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 hornblende diorite margin (Morrison, 1981). The Whitehorse batholith is one of a suite of calc-alkaline intrusions (Coast Plutonic Complex) which were emplaced during deformation 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-kspar-bornite-chalcopyrite 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 arkoses and graywackes (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.

## 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 N 60° 41', W 135° 22'). 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., 1981)? 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.

## 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. 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).

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. In thin section, both isotropic and stongly birefringent, zoned grains were observed. 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 color 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 color 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 interpretted to have replaced, at least in part, previously formed skarn 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 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 sulfide replacement (mainly chalcopyrite 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, kspar (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 commonly is associated with the introduction of sulfides (especially bornite-chalcocite, Fig. 4b). The systematic association of epidote with bornite-chalcocite and amphibole with chalcopyrite may reflect the more oxidized environment of the former and a more reduced environment for the latter. A similar oxidation control on sulfide mineralogy was proposed by Morrison (1981).

Several unusual minerals occur in minor to trace amounts in the Whitehorse skarn deposits. Valleriite ($Cu_{1.20}Fe_{0.80}S_{2.00}\cdot1.67(Mg_{0.73}Al_{0.06}Fe_{0.21}(OH)_2)$, 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 sulfide-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 Grahber (1974) and Morrison (1981) but not observed in the present study include: scapolite, digenite, 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 absorbtion methods by Bondar-Clegg & Company Ltd. (Vancouver 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 $\leq$50 ppb and all Pd $\leq$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 $\geq$ 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 sulfide 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 sulfide minerals and that silver is probably deposited throughout the period of copper mineralization. The plot of Ag versus Au (Fig. 6c) further distinguishes 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 1um 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 sulfide 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 comparision 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, 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 sulfide mineralization, 4) skarn with abundant retrograde alteration, 5) skarn with abundant sulfide mineralization, and 6) skarn with both abundant retrograde alteration and sulfide 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 km$^3$) 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 fluids.

Relative to the diorite pluton and carbonate protolith, skarn that has not been affected by significant retrograde alteration or sulfide 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, sulfide-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 sulfides are minor or not visible in hand specimen. The highest average Ag and Au grades occur in skarn that is **both** sulfide-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 $\pm$ chlorite $\pm$ hematite, pyroxene to actinolite $\pm$ chlorite, and olivine to serpentine $\pm$ chlorite $\pm$ magnetite. The color, composition, and mineralogy of prograde and retrograde skarn minerals reflect the protolith composition.

The bulk of sulfide 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 sulfur-poor; iron sulfide 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 lithologies. 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 Captions for Meinert Whitehorse Paper

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

Fig. 2 Triangular plot of pyroxene electron microprobe compositions

Fig. 3 Triangular plot of garnet electron microprobe compositions

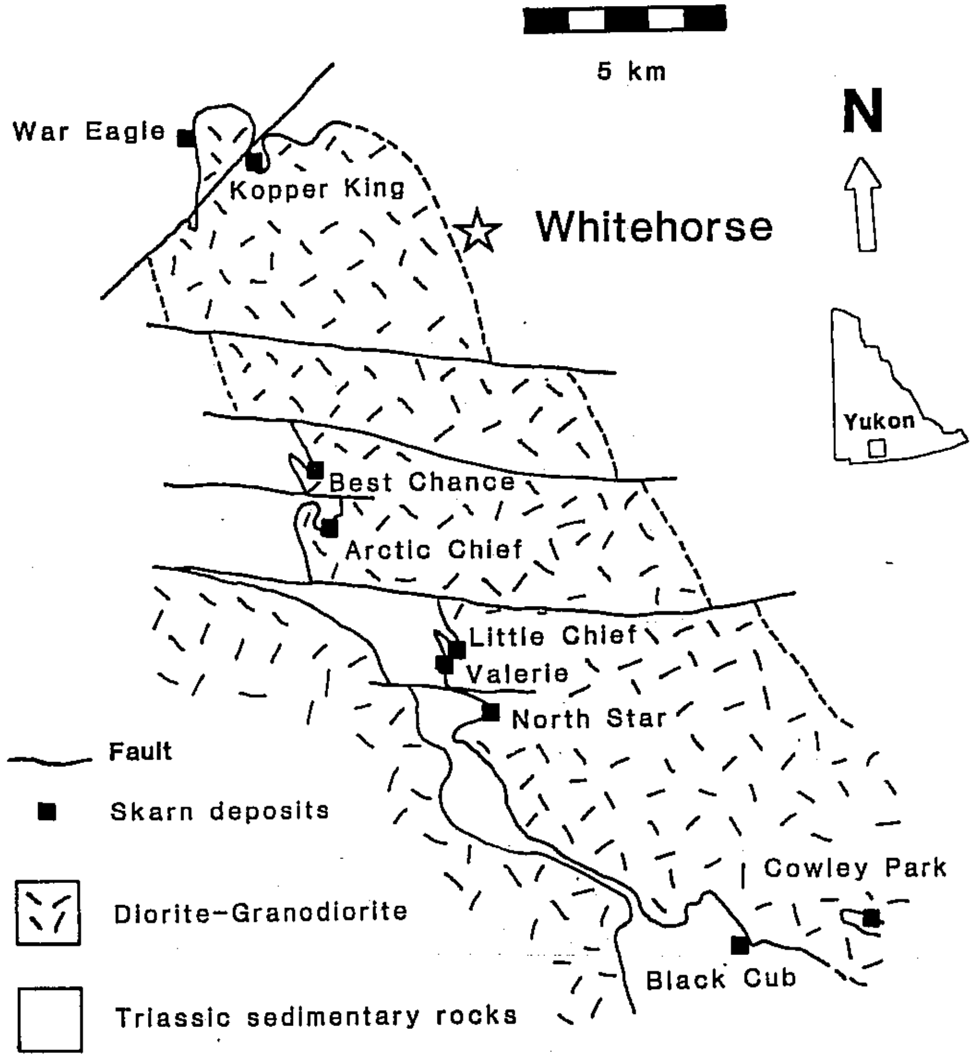
Fig. 4 Photomicrographs of associated retrograde alteration and sulfide mineralization: a) actinolite-chalcopyrite replacement of pyroxene, Sample AC-53-352 b) epidote-chalcocite-bornite replacement of garnet, Sample AC-51-269. a = actinolite, b-c = bornite-chalcocite, ep = chalcopyrite, e = epidote,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

Fig. 5 Triangular plot of amphibole electron microprobe compositions

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

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

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



5 km
N
War Eagle
Kopper King
Whitehorse
Yukon
Best Chance
Arctic Chief
Little Chief
Valerie
North Star
Cowley Park
Black Cub
Fault
Skarn deposits
Diorite-Granodiorite
Triassic sedimentary rocks


Figure 1

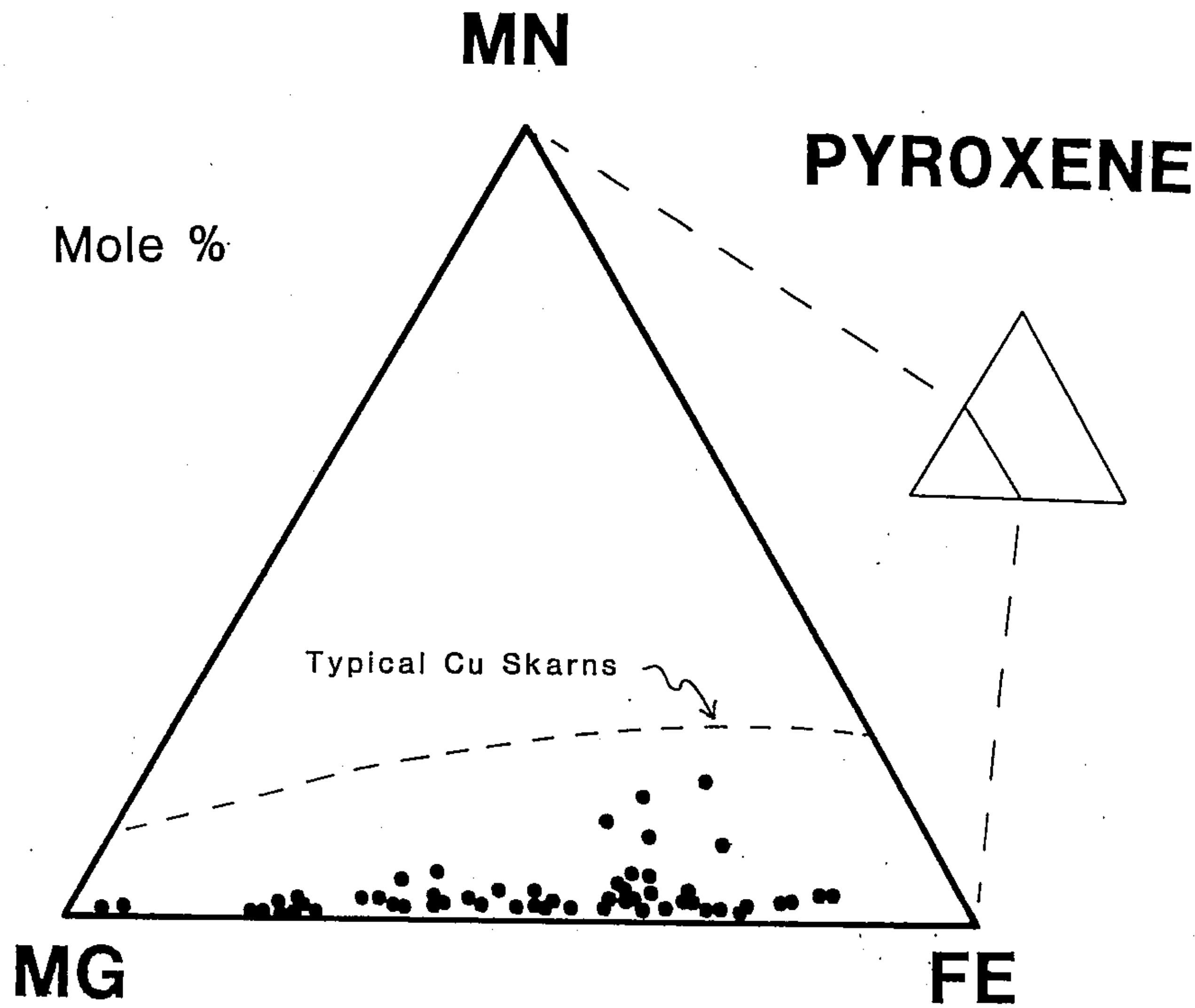



Fig. 2

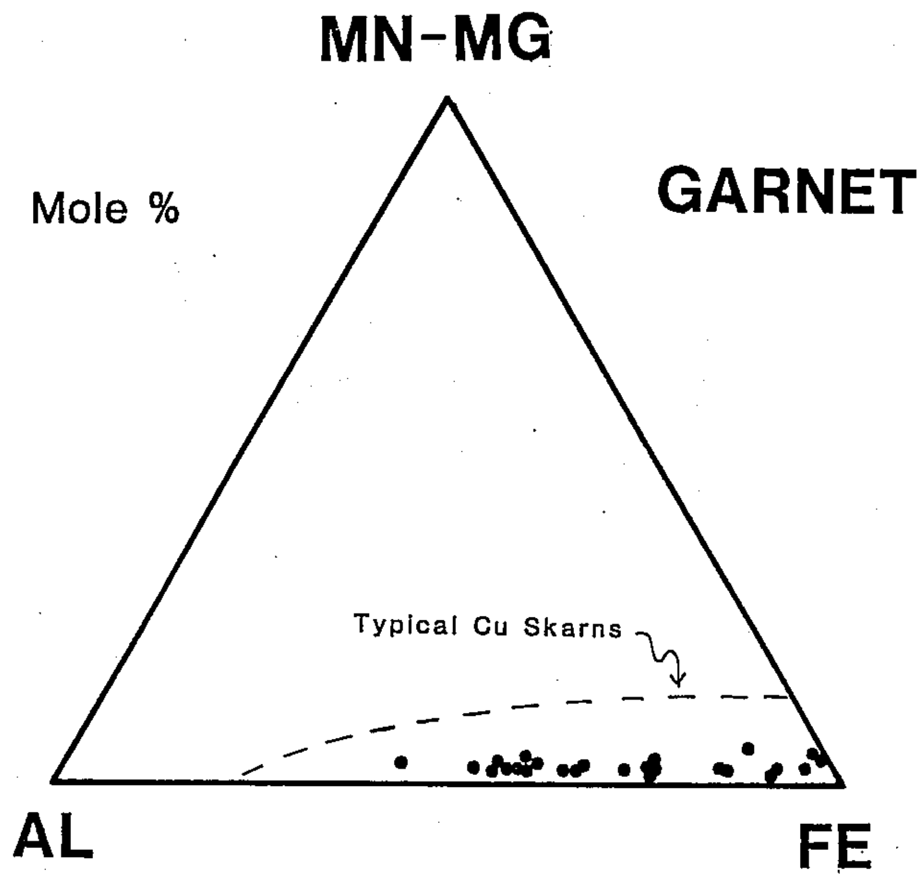



Figure 3

A)


B)

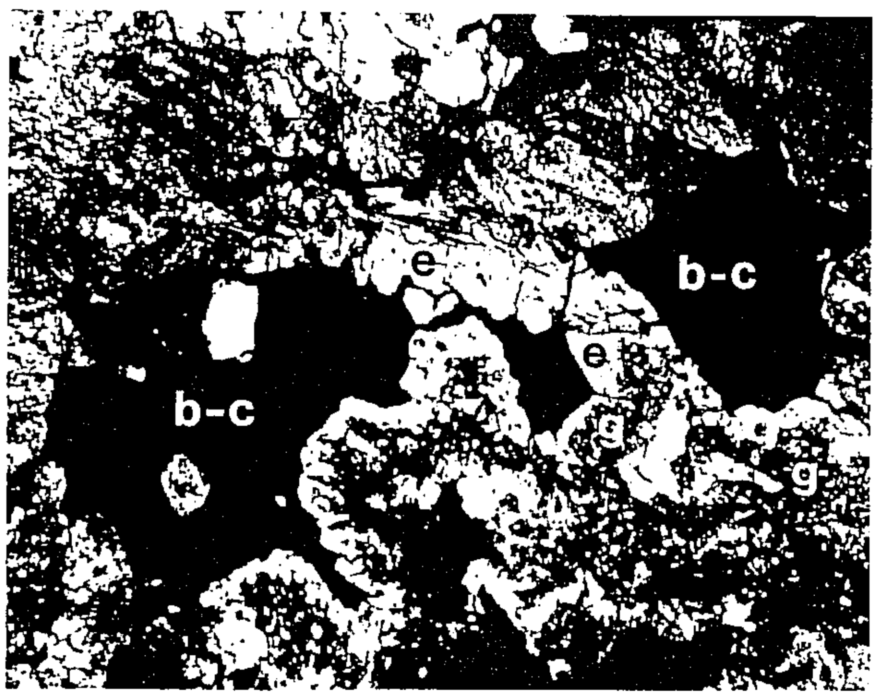



Figure 4

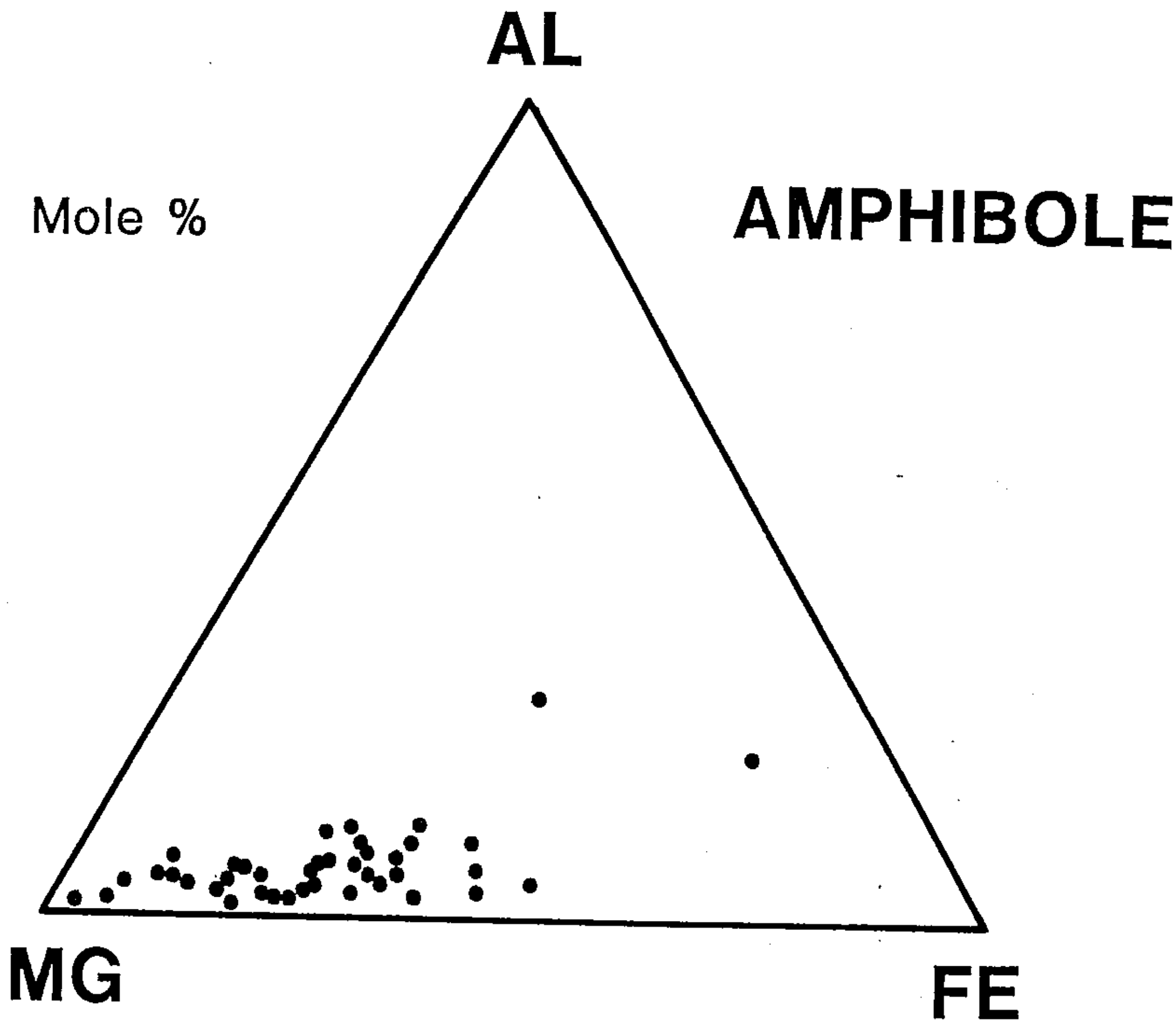
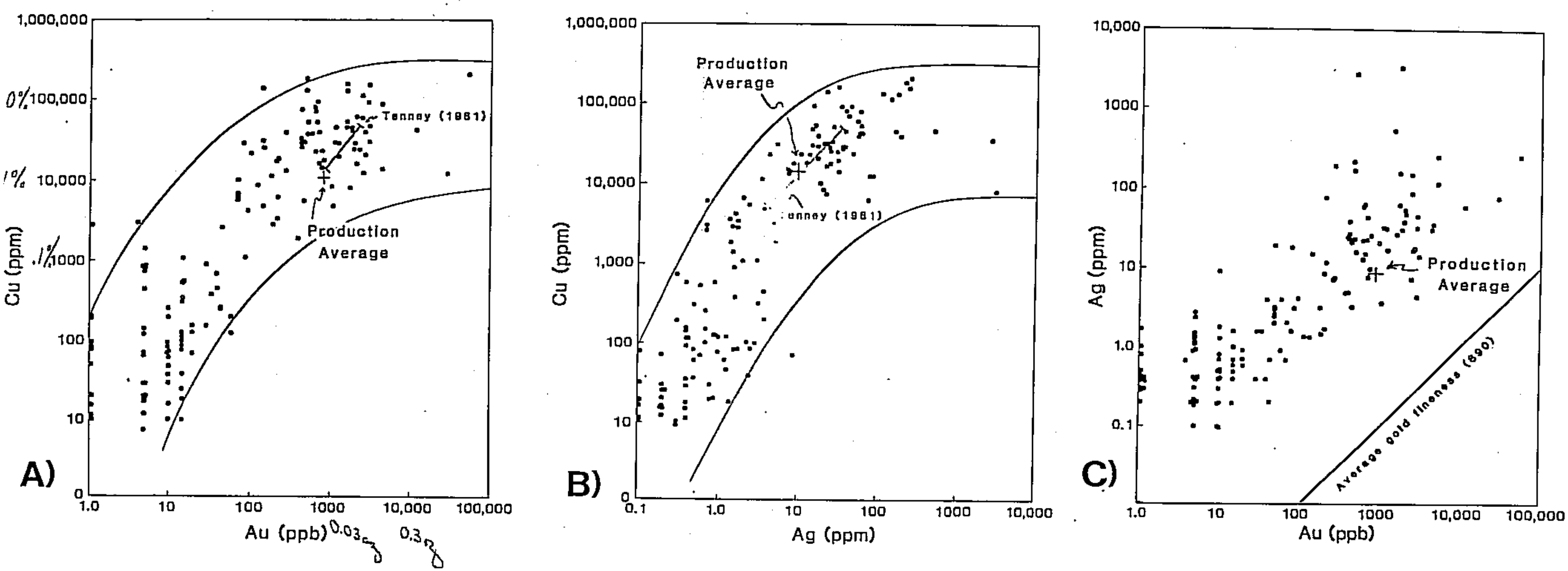
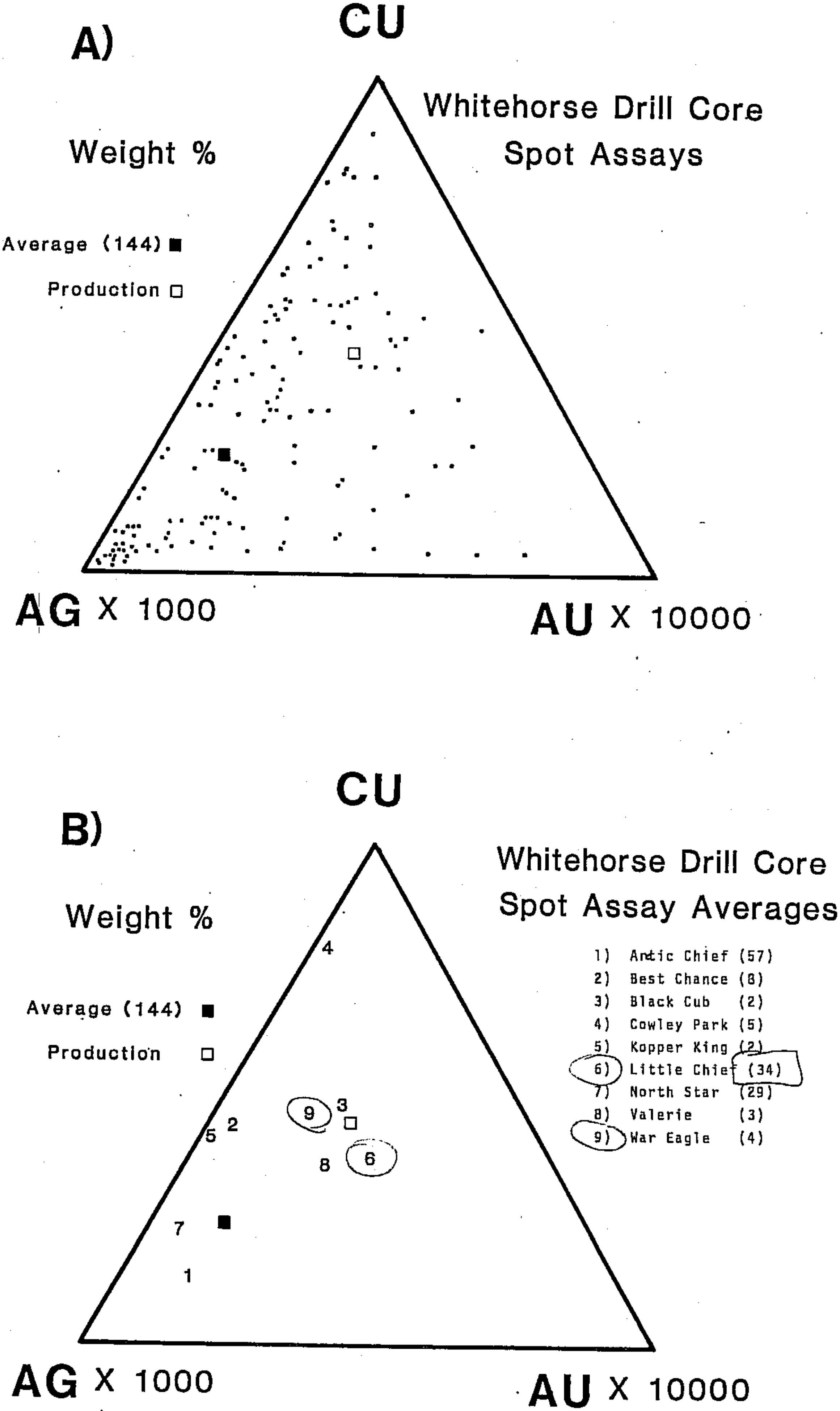



Fig. 5



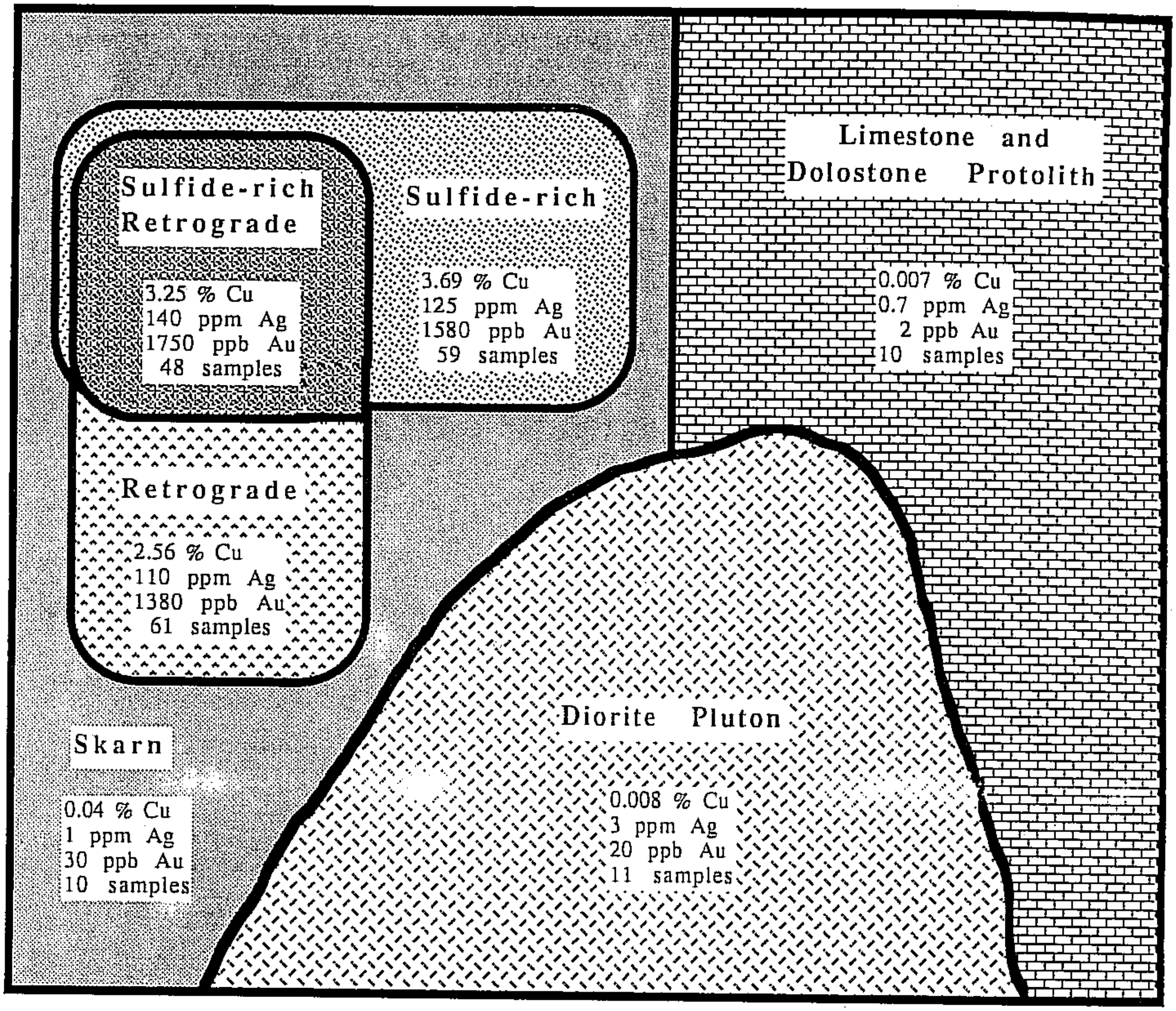
A)
Cu (ppm)
Au (ppb)
Production Average
Tenney (1961)
B)
Cu (ppm)
Ag (ppm)
Production Average
Tenney (1961)
C)
Ag (ppm)
Au (ppb)
Production Average
Average gold fineness (890)


Figure 6



A)
CU
Whitehorse Drill Core
Spot Assays
Weight %
Average (144)
Production
AG X 1000
AU X 10000
B)
CU
Whitehorse Drill Core
Spot Assay Averages
Weight %
Average (144)
Production
1) Artic Chief (57)
2) Best Chance (8)
3) Black Cub (2)
4) Cowley Park (5)
5) Kopper King (2)
6) Little Chief (34)
7) North Star (29)
8) Valerie (3)
9) War Eagle (4)
AG X 1000
AU X 10000


Figure 7



Sulfide-rich
Retrograde
3.25 % Cu
140 ppm Ag
1750 ppb Au
48 samples
Sulfide-rich
3.69 % Cu
125 ppm Ag
1580 ppb Au
59 samples
Limestone and
Dolostone Protolith
0.007 % Cu
0.7 ppm Ag
2 ppb Au
10 samples
Retrograde
2.56 % Cu
110 ppm Ag
1380 ppb Au
61 samples
Diorite Pluton
0.008 % Cu
3 ppm Ag
20 ppb Au
11 samples
Skarn
0.04 % Cu
1 ppm Ag
30 ppb Au
10 samples


Figure 8

Table 1 Average* igneous whole rock composition

| | |
|---|---|
| $SiO_2$ | 58.27 |
| $TiO_2$ | 0.62 |
| $Al_2O_3$ | 15.65 |
| $Fe_2O_3$ (T) | 5.39 |
| MnO | 0.08 |
| MgO | 3.43 |
| CaO | 6.97 |
| $Na_2O$ | 4.12 |
| $K_2O$ | 1.54 |
| $P_2O_5$ | 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 >> limstone | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SiO2 | 53.63 | 53.98 | 53.52 | 54.50 | 54.66 | 53.48 | 53.59 | 52.91 | 53.98 | 52.82 | 54.32 | 52.51 |
| TiO2 | 0.11 | 0.11 | 0.02 | 0.01 | 0.02 | 0.05 | 0.05 | 0.16 | 0.06 | 0.07 | 0.06 | 0.09 |
| Al2O3 | 1.82 | 0.40 | 0.73 | 0.36 | 0.34 | 0.81 | 0.51 | 0.70 | 0.79 | 1.51 | 0.42 | 1.49 |
| FeO | 1.73 | 2.52 | 1.85 | 2.09 | 1.63 | 2.37 | 4.47 | 4.61 | 4.53 | 6.38 | 1.52 | 4.84 |
| MgO | 16.90 | 16.75 | 17.45 | 17.15 | 17.58 | 16.75 | 15.20 | 15.01 | 15.24 | 14.56 | 17.69 | 15.25 |
| Mn0 | 0.19 | 0.09 | 0.06 | 0.28 | 0.13 | 0.12 | 0.29 | 0.40 | 0.26 | 0.11 | 0.12 | 0.08 |
| CaO | 25.76 | 25.97 | 26.04 | 26.09 | 26.33 | 25.69 | 25.13 | 25.57 | 25.15 | 24.75 | 25.60 | 25.22 |
| Na2O | 0.00 | 0.04 | 0.11 | 0.05 | 0.03 | 0.05 | 0.23 | 0.22 | 0.28 | 0.25 | 0.06 | 0.20 |
| K2O | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Total | 100.14 | 99.87 | 99.78 | 100.53 | 100.73 | 99.32 | 99.47 | 99.58 | 100.29 | 100.45 | 99.80 | 99.68 |
| Cations Based on 6 Oxygens | | | | | | | | | | | | |
| Si | 1.949 | 1.976 | 1.958 | 1.979 | 1.977 | 1.968 | 1.985 | 1.966 | 1.982 | 1.953 | 1.979 | 1.947 |
| Ti | 0.003 | 0.003 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.005 | 0.002 | 0.002 | 0.002 | 0.003 |
| Al | 0.078 | 0.017 | 0.032 | 0.016 | 0.015 | 0.035 | 0.022 | 0.031 | 0.034 | 0.066 | 0.018 | 0.065 |
| Fe | 0.053 | 0.077 | 0.057 | 0.063 | 0.049 | 0.073 | 0.138 | 0.143 | 0.139 | 0.197 | 0.046 | 0.150 |
| Mg | 0.916 | 0.914 | 0.952 | 0.928 | 0.948 | 0.919 | 0.839 | 0.831 | 0.834 | 0.802 | 0.961 | 0.843 |
| Mn | 0.006 | 0.003 | 0.002 | 0.009 | 0.004 | 0.004 | 0.009 | 0.013 | 0.008 | 0.003 | 0.004 | 0.002 |
| Ca | 1.003 | 1.019 | 1.021 | 1.015 | 1.021 | 1.013 | 0.997 | 1.018 | 0.990 | 0.980 | 0.999 | 1.002 |
| Na | 0.000 | 0.003 | 0.008 | 0.004 | 0.002 | 0.004 | 0.017 | 0.016 | 0.020 | 0.018 | 0.004 | 0.014 |
| K | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sum | 4.008 | 4.014 | 4.029 | 4.014 | 4.016 | 4.015 | 4.010 | 4.022 | 4.009 | 4.021 | 4.013 | 4.025 |
| Mole % | | | | | | | | | | | | |
| Di | 94.0 | 91.9 | 94.2 | 92.8 | 94.7 | 92.3 | 85.0 | 84.2 | 85.0 | 80.0 | 95.0 | 84.7 |
| Hd | 5.4 | 7.8 | 5.6 | 6.3 | 4.9 | 7.3 | 14.0 | 14.5 | 14.2 | 19.7 | 4.6 | 15.1 |
| Jo | 0.6 | 0.3 | 0.2 | 0.9 | 0.4 | 0.4 | 0.9 | 1.3 | 0.8 | 0.3 | 0.4 | 0.2 |
| Assay | | | | | | | | | | | | |
| Cu (ppm) | 200 | 72 | 72 | 18 | 70 | 70 | 10000 | 10000 | 12400 | 15 | 15 | 11 |
| Ag (ppm) | 3.9 | 9.0 | 9.0 | 0.4 | 0.6 | 0.6 | 18.8 | 18.8 | 80.2 | 0.2 | 0.2 | 0.4 |
| Au (ppb) | 60 | 10 | 10 | 15 | 20 | 20 | 70 | 70 | 28490 | 1 | 1 | 1 |

TABLE3 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-51-498 | 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 |
| Mn0 | 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 |
| Hd | 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-15-1393 | 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 |
| $Al_2O_3$ | 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 |
| Mn0 | 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 |
| $Na_2O$ | 0.06 | 0.20 | 0.12 | 0.06 | 0.02 | 0.06 | 0.02 | 0.19 | 0.18 | 0.02 | 0.22 | 0.13 |
| $K_2O$ | 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-15-1422 |
|---|---|---|---|---|---|
| $SiO_2$ | 54.25 | 54.46 | 54.04 | 53.75 | 53.04 |
| $TiO_2$ | 0.05 | 0.21 | 0.00 | 0.02 | 0.03 |
| $Al_2O_3$ | 0.21 | 1.04 | 0.15 | 0.16 | 0.68 |
| FeO | 1.79 | 0.13 | 7.12 | 5.12 | 6.05 |
| MgO | 17.68 | 18.78 | 13.23 | 14.49 | 14.58 |
| Mn0 | 0.09 | 0.00 | 1.02 | 1.43 | 0.29 |
| CaO | 25.88 | 25.88 | 25.02 | 25.07 | 25.25 |
| $Na_2O$ | 0.02 | 0.11 | 0.25 | 0.04 | 0.22 |
| $K_2O$ | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 |
| Total | 99.97 | 100.62 | 100.83 | 100.09 | 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 |
| Hd | 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-21-185 | 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 | 36.67 | 36.34 | 36.25 | 36.50 | 36.85 | 38.63 | 38.15 | 37.00 |
| TiO2 | 0.99 | 0.06 | 0.02 | 0.15 | 0.00 | 0.00 | 2.41 | 2.34 | 1.08 | 0.74 | 0.12 |
| Al2O3 | 4.72 | 0.17 | 0.74 | 4.71 | 4.76 | 2.91 | 9.27 | 10.18 | 14.09 | 13.94 | 7.24 |
| Fe2O3 | 24.28 | 31.13 | 30.41 | 24.85 | 24.46 | 27.14 | 16.40 | 15.86 | 11.31 | 11.55 | 21.23 |
| MgO | 0.20 | 0.12 | 0.12 | 0.10 | 0.09 | 0.08 | 0.24 | 0.14 | 0.22 | 0.10 | 0.12 |
| Mn0 | 0.24 | 0.18 | 0.16 | 0.25 | 0.16 | 0.28 | 0.33 | 0.36 | 0.51 | 0.51 | 0.31 |
| CaO | 34.43 | 33.04 | 33.28 | 34.41 | 34.40 | 33.46 | 34.48 | 34.71 | 35.17 | 35.22 | 34.44 |
| Na2O | 0.00 | 0.04 | 0.01 | 0.10 | 0.08 | 0.00 | 0.14 | 0.03 | 0.03 | 0.03 | 0.09 |
| K2O | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 |
| Total | 101.10 | 100.45 | 100.23 | 101.25 | 100.29 | 100.12 | 99.80 | 100.48 | 101.04 | 100.24 | 100.55 |
| | | | | | Cations based on 16 Oxygens | | | | | | |
| Si | 5.913 | 6.004 | 5.971 | 5.976 | 5.977 | 6.021 | 5.874 | 5.874 | 5.984 | 5.969 | 5.984 |
| Ti | 0.121 | 0.008 | 0.003 | 0.018 | 0.000 | 0.000 | 0.291 | 0.281 | 0.126 | 0.087 | 0.015 |
| Al | 0.907 | 0.034 | 0.147 | 0.904 | 0.923 | 0.569 | 1.757 | 1.913 | 2.572 | 2.570 | 1.381 |
| Fe | 2.982 | 3.939 | 3.850 | 3.047 | 3.027 | 3.392 | 1.985 | 1.903 | 1.319 | 1.360 | 2.583 |
| Mg | 0.048 | 0.030 | 0.031 | 0.023 | 0.022 | 0.020 | 0.058 | 0.033 | 0.051 | 0.023 | 0.030 |
| Mn | 0.033 | 0.025 | 0.024 | 0.034 | 0.022 | 0.039 | 0.045 | 0.048 | 0.066 | 0.067 | 0.043 |
| Ca | 6.019 | 5.952 | 5.999 | 6.008 | 6.062 | 5.955 | 5.945 | 5.929 | 5.837 | 5.905 | 5.968 |
| Na | 0.000 | 0.014 | 0.002 | 0.031 | 0.024 | 0.001 | 0.042 | 0.008 | 0.008 | 0.010 | 0.029 |
| K | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.005 | 0.002 | 0.000 | 0.000 | 0.000 |
| Sum | 16.022 | 16.006 | 16.026 | 16.044 | 16.058 | 15.997 | 16.002 | 15.990 | 15.961 | 15.991 | 16.032 |
| Mole % | | | | | | | | | | | |
| Pyralspite | 2.0 | 1.4 | 1.3 | 1.4 | 1.1 | 1.5 | 2.5 | 1.9 | 2.9 | 2.3 | 1.8 |
| Andradite | 75.8 | 97.8 | 95.0 | 76.1 | 75.8 | 84.4 | 55.0 | 52.3 | 64.2 | 63.9 | 65.8 |
| Grossularite | 22.2 | 0.8 | 3.6 | 22.5 | 23.1 | 14.1 | 42.5 | 45.8 | 32.9 | 33.8 | 32.4 |
| Assay | | | | | | | | | | | |
| Cu (ppm) | 200 | 72 | 72 | 18 | 46000 | 124000 | 10000 | 10000 | 12400 | 12400 | 530 |
| Ag (ppm) | 3.9 | 9.0 | 9.0 | 0.4 | 507.5 | 88.4 | 18.8 | 18.8 | 80.2 | 80.2 | 0.6 |
| Au (ppb) | 60 | 10 | 10 | 15 | 1510 | 2530 | 70 | 70 | 28490 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| SiO2 | 37.45 | 36.99 | 36.14 | 35.85 | 35.93 | 35.56 | 37.23 | 35.78 | 37.92 | 36.06 |
| TiO2 | 0.14 | 0.12 | 0.26 | 2.04 | 0.08 | 0.08 | 0.09 | 0.09 | 0.26 | 0.03 |
| Al2O3 | 9.71 | 6.92 | 2.87 | 6.92 | 1.52 | 0.03 | 8.46 | 0.72 | 12.42 | 1.94 |
| Fe2O3 | 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 |
| Na2O | 0.07 | 0.06 | 0.02 | 0.04 | 0.05 | 0.05 | 0.01 | 0.00 | 0.06 | 0.05 |
| K2O | 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 % | | | | | | | | | | |
| Pyralspite | 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 5 ELECTRON MICROPROBE ANALYSES OF MISCELLANEOUS SILICATE MINERALS

| Sample # | AC-51-503 | LC-111-774 | LC-111-847 | AC-53-348 |
|---|---|---|---|---|
| | Phlogopite | Phlogopite | Phlogopite | Serpentine |
| SiO2 | 41.62 | 39.56 | 37.98 | 43.60 |
| TiO2 | 0.07 | 0.33 | 0.36 | 0.02 |
| Al2O3 | 13.07 | 14.52 | 15.50 | 0.09 |
| Feo/Fe2O3 | 1.39 | 1.24 | 1.52 | 1.77 |
| MgO | 27.01 | 28.95 | 28.85 | 40.63 |
| Mn0 | 0.00 | 0.01 | 0.05 | 0.00 |
| CaO | 0.00 | 0.04 | 0.03 | 0.03 |
| Na2O | 0.16 | 0.11 | 0.07 | 0.03 |
| K2O | 10.77 | 7.97 | 7.02 | 0.01 |
| Total | 94.09 | 92.73 | 91.38 | 86.18 |
| # Oxygens | 24 | 24 | 24 | 36 |
| Si | 5.911 | 5.624 | 5.468 | 8.166 |
| Ti | 0.008 | 0.036 | 0.039 | 0.003 |
| Al | 2.187 | 2.433 | 2.630 | 0.020 |
| Fe | 0.166 | 0.148 | 0.184 | 0.277 |
| Mg | 5.717 | 6.315 | 6.191 | 11.342 |
| Mn | 0.000 | 0.002 | 0.006 | 0.000 |
| Ca | 0.000 | 0.007 | 0.005 | 0.005 |
| Na | 0.043 | 0.031 | 0.020 | 0.011 |
| K | 1.952 | 1.445 | 1.290 | 0.002 |
| Sum | 15.984 | 16.040 | 15.831 | 19.826 |
| Assay | | | | |
| Cu (ppm) | 101 | 11500 | 40000 | 21200 |
| Ag (ppm) | 3.0 | 3.4 | 56.5 | 17.5 |
| Au (ppb) | 15 | 180 | 7 | 2600 |

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SiO2 | 52.27 | 51.87 | 54.80 | 56.01 | 54.37 | 55.18 | 55.32 | 55.12 | 55.19 | 52.26 | 54.71 |
| TiO2 | 0.04 | 0.01 | 0.04 | 0.05 | 0.04 | 0.06 | 0.18 | 0.18 | 0.10 | 0.06 | 0.06 |
| Al2O3 | 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 |
| Mn0 | 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 |
| Na2O | 0.33 | 0.31 | 0.24 | 0.16 | 0.30 | 0.25 | 0.36 | 0.24 | 0.14 | 0.21 | 0.11 |
| K2O | 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 ELECTRON MICROPROBE 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 |
| Mn0 | 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 |
|---|---|---|---|---|
| SiO2 | 45.42 | 55.35 | 56.38 | 58.08 |
| TiO2 | 0.13 | 0.06 | 0.00 | 0.11 |
| Al2O3 | 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 |
| Mn0 | 0.21 | 0.49 | 0.42 | 0.04 |
| CaO | 12.41 | 12.59 | 13.31 | 13.65 |
| Na2O | 1.27 | 0.26 | 0.09 | 0.14 |
| K2O | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SiO2 | 37.90 | 37.55 | 37.65 | 37.53 | 38.26 | 38.87 | 37.30 | 37.37 | 37.42 | 37.88 | 37.30 | 37.24 |
| TiO2 | 0.18 | 0.08 | 0.19 | 0.12 | 0.00 | 0.03 | 0.00 | 0.15 | 0.03 | 0.01 | 0.34 | 0.03 |
| Al2O3 | 24.12 | 22.12 | 22.69 | 21.67 | 24.61 | 28.86 | 23.18 | 23.34 | 21.16 | 21.74 | 21.45 | 21.17 |
| Fe2O3 | 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 |
| Mn0 | 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 |
| Na2O | 0.00 | 0.01 | 0.05 | 0.04 | 0.00 | 0.03 | 0.05 | 0.03 | 0.00 | 0.03 | 0.00 | 0.03 |
| K2O | 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

| Sample # | Cu(ppm) | Ag(ppm) | Au(ppb) | Hand Sample Description |
|---|---|---|---|---|
| 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 wtih 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 | Possibe 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 wiht 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. |

→ Samples > 0.1 oz/ton

| 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 wtih vertical qtz-py fractures. |
| LC-111-813 | 119 | [illegible] | 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 wtih interstitital 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 wtih 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-vallerlite 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. |

7% 

21% Cu 1.6 g/ton Au

15.6%

| Sample # | Cu(ppm) | Ag(ppm) | Au(ppb) | Hand Sample Description |
|---|---|---|---|---|
| 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% valleriite, 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 wtih 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.

5 of 144 samples > 3400 ppb Au or 0.1 oz/ton
4 samples from Arctic Chief
1 " " Latter Chief

Table 10 Electron microprobe analyses of opaque minerals

| Sample # | AC-51-269 | CP-115-292 | CP-115-292 | NS-15-1393 | NS-15-1393 | V-19-405 | WE-D2-280 | WE-D2-280 | WE-D2-280 | AC-51-269 | AC-51-269 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mineral | Bn | Bn | Bn | Bn | Bn | Bn | Bn | Bn | Bn | Cc | Cc |
| Cu | 63.23 | 63.02 | 62.98 | 62.43 | 62.67 | 61.70 | 63.04 | 61.15 | 57.06 | 78.44 | 78.95 |
| Fe | 10.81 | 11.56 | 11.57 | 11.49 | 11.10 | 11.59 | 11.36 | 12.24 | 14.39 | 0.15 | 0.36 |
| S | 24.86 | 26.22 | 26 | 25.12 | 25.34 | 25.88 | 25.51 | 25.76 | 28.04 | 20.53 | 20.21 |
| Ag | 0.16 | 0.13 | 0.22 | 0.17 | 0.34 | 0.01 | 0.27 | 0.23 | 0.10 | 0.86 | 0.08 |
| Au | 0.04 | 0.04 | 0 | 0.06 | 0.00 | 0.05 | 0.00 | 0.00 | 0.10 | 0 | 0 |
| Te | 0.03 | 0 | 0.07 | 0.02 | 0.04 | 0.05 | 0.03 | 0.00 | 0.10 | 0.54 | 0.07 |
| Total | 99.13 | 100.97 | 100.84 | 99.29 | 99.49 | 99.28 | 100.21 | 99.38 | 99.79 | 100.52 | 99.67 |

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

Table 10 Electron microprobe analyses of opaque minerals

| Sample # | KK-5-515 | KK-5-515 | NS-15-1393 | NS-15-1710 | V-19-405 | WE-54-182 | CP-115-292 | BC-46-265 | AC-51-269 | AC-51-269 | AC-51-269 | AC-51-269 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mineral | Cp | Cp | Cp | Cp | Cp | Cp | Cp adj. to Bn | Cp in Bn-Cc | Gold | Gold | Gold | 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 # | AC-21-189 | AC-21-241 | AC-51-269 | NS-15-1710 | AC-21-246 | NS-15-1107A |
|---|---|---|---|---|---|---|
| Mineral | Magnetite | Magnetite | Magnetite | Magnetite | Py | 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 |