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METALLIC MINERALS IN THE SILBAK PREMIER SILVER-GOLD DEPOSIT, STEWART (104B/1)

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SUMMARY

This is a preliminary report on metallic minerals in the Silbak Premier silver-gold deposit near Stewart. Distribution and crosscutting relationships of veins on surface, underground and in drill core indicate two main vein types where silica-rich precious metal veins are crosscut by base metal veins. Samples of vein material have been collected from a number of locations spanning over 500 metres of vertical distance along a strike length of 1800 metres. Determination of individual mineral species, their composition, and spatial and temporal relationships augment descriptive work from over the past 50 years.

Veins range from silica-rich low-sulphide assemblages rich in precious metals to semimassive base metal-bearing and sulphide-rich assemblages. The precious metal veins contain polybasite, pyrargyrite, argentiferous tetrahedrite, native silver, electrum and argentite. Combined pyrite, sphalerite, chalcopyrite and galena is normally less than 5 per cent. Base metal veins contain from 20 to 45 per cent combined pyrite, sphalerite, chalcopyrite and galena with minor amounts of pyrrhotite, argentiferous tetrahedrite, native silver, electrum and arsenopyrite.

Precious metal veins are more prominent in the upper levels of the deposit and in the northeast-trending Main zone and base metal veins are dominant in the lower part of the deposit and the northwest-trending West zone. As a consequence, polybasite, pyrargyrite and argentite are concentrated in the upper parts of the deposit and base metal sulphides increase with depth and are more prevalent in the West zone. Tetrahedrite, native silver and electrum maintain relatively constant proportions within each vein type and throughout the Main and West zones.

Anhedral pyrite aggregates are intergrown and contain inclusions of sphalerite, chalcopyrite and galena. Chalcopyrite and galena are present as inclusions in sphalerite and replace sphalerite along grain boundaries. Galena forms mutual boundaries with, and is traversed by, polybasite, pyrargyrite, tetrahedrite and argentite. Minute inclusions of native silver and electrum are present in galena and silver sulphosalts, but wire silver traverses the same mineral assemblage. Idiomorphic pyrite normally contains rounded inclusions or embayments of galena, native silver, tetrahedrite and electrum.

VEIN STOCKWORKS AND BRECCIA ZONES

DISTRIBUTION AND THICKNESS

Sharply defined veins in stockworks and siliceous breccia matrix contain metallic mineral assemblages and follow a number of subparallel trends within and marginal to a potassium-feldspar porphyritic dacite. The porphyritic dacite and metal-bearing veins and breccias exhibit both conformable and crosscutting relationships with andesite and dacite country rocks of the Hazelton Group. Vein stockwork and breccia zones typically range in width from 1 to 20 metres; they have an *en échelon* continuity of over 1800 metres and a down-dip extent of greater than 500 metres.

The Silbak Premier deposit consists of two distinct breccia and vein stockwork zones that dip steeply at surface and gently at depth. The Main zone trends 050 degrees and is cut by the West zone which strikes 290 degrees.

EARLY-STAGE BRECCIA

The early-stage breccia is observed within andesite peripheral to potassium-feldspar-porphyritic dacite. This crackle breccia consists of rounded to angular fragments that vary in size from 1 to 15 centimetres. A darker matrix contains primarily pyrite, chlorite and carbonate.

The proportion of fragments may vary from less than 25 per cent up to 90 per cent. Where the proportion of fragments is low, fragments are rounded and poorly defined; with increasing density, fragments are angular and show little or no rotation.

EARLY-STAGE VEINS

The early-stage veins consist of quartz and chorite and locally have pyritic margins. They crosscut the crackle breccia, but are themselves cut by middle-stage stockwork veins. Quartz-chlorite veins are fairly narrow (0.5 to 3 centimetres), tabular and usually banded.

MIDDLE-STAGE VEINS AND BRECCIA

Middle-stage stockwork veins form irregular networks of banded veinlets that vary in thickness from 0.5 to 4 cen-

British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1987, Paper 1988-1.

timetres. Matrix to the breccia is normally chalcedonic and contains patches of metallic minerals. These veins and breccias constitute the bulk of the metal-bearing stockwork and contain the highest silver-gold grades.

In general, the earliest veins are confined to the stockwork area and are quartz-rich with minor carbonate ± potassium feldspar along the margins. Locally, quartz carbonate veins and breccia matrix may contain patches of pyrite, sphalerite and galena with minor tetrahedrite, polybasite, pyrargyrite, native silver and electrum. Veins and breccias with as much as 45 per cent pyrite, galena, sphalerite, chalcopyrite, pyrrhotite, tetrahedrite, native silver and electrum cut the more quartz-rich veins.

LATE-STAGE VEINS

Late-stage veins generally occupy vertical and horizontal fractures filled by coarse-grained quartz and chlorite. They are thickest in the centre (up to 200 centimetres) and pinch out at each end. Although some crosscutting relationships are ambiguous, most late-stage veins crosscut stockwork veins in an *en échelon* pattern.

TABLE 2-8-1. VEIN RELATIONSHIPS

LATE-STAGE VEINS
(10) Quartz-chlorite ± carbonate.
(9) Quartz-carbonate ± white mica.
MIDDLE-STAGE VEINS AND BRECCIA MATRIX
(B) Base metal veins (20-45 per cent sulphides).
(8) Quartz-barite-carbonate with base and precious metal minerals.
(7) Pyrite-quartz-galena ± carbonate and K-feldspar.
(6) Quartz-carbonate ± chlorite ± pyrite ± K-feldspar.
(A) Precious metal veins (<5 per cent sulphides).
(5) Ferrocarbonate-quartz.
(4) Quartz and K-feldspar with precious and base metal minerals.
(3) Quartz-carbonate ± K-feldspar.
EARLY-STAGE VEINS
(2) Quartz-chlorite ± pyrite.
EARLY-STAGE BRECCIAS (CRACKLE AND MOSAIC BRECCIAS)
(1) Pyrite-chlorite matrix.

ORE MINERALS

The ore minerals were identified by ore microscopy and confirmed by electron microprobe and energy-dispersion spectrographic analysis. The metallic minerals are described in order of abundance.

PYRITE

Pyrite is the dominant sulphide mineral. Grain size and habit vary widely from microcrystalline aggregates to discrete euhedral grains 0.1 millimetre to 1 centimetre in size. In some base metal veins, pyrite forms distinct bands separated by discontinuous patches of gangue or base metal sulphide. Euhedral pyrite is commonly embayed and has partly or completely enclosed grains of sphalerite, galena, chalcopyrite, tetrahedrite, native silver and electrum. Fractured pyrite is infilled by ductile minerals such a sphalerite, galena, chalcopyrite and tetrahedrite.

SPHALERITE

Sphalerite is next to pyrite in abundance, occurring in both vein types. In hand specimen it has a light to medium brown colour with minor deep red and black varieties. It occurs as irregular grains 0.1 to 8 millimetres across or as narrow infillings between pyrite grains and filling fractures within grains. Sphalerite commonly occurs with galena, forming smooth mutual boundaries, however, some galena is included within sphalerite grains or forms ragged rims around them.

Many of the sphalerite grains contain inclusions of chalcopyrite 0.5 to 5 microns across (Plate 2-8-1). These inclusions vary from rounded to rectangular in shape and are fairly uniformly distributed. Most inclusions are randomly oriented, but some exhibit straight ordered patterns parallel to crystallographic axes.

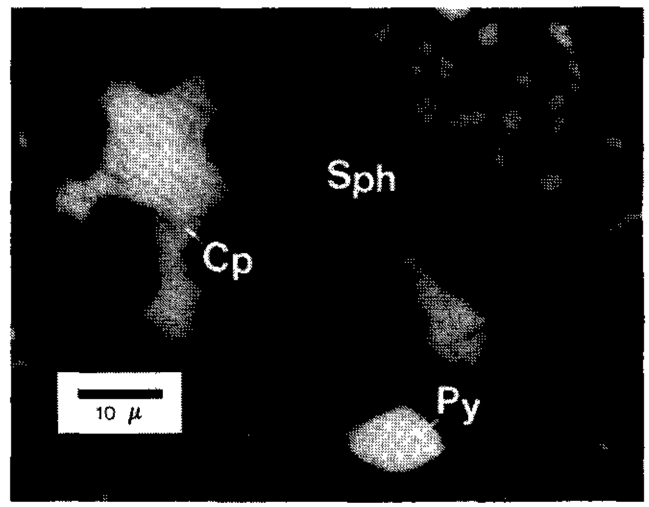

Plate 2-8-1. SP-219-A, ragged chalcopyrite (Cp) and rounded pyrite (Py) inclusions in sphalerite (Sph). Reflected light, oil immersion.

CHALCOPYRITE

Chalcopyrite is a relatively minor component in base metal veins, but can reach concentrations of up to 4 per cent. Large

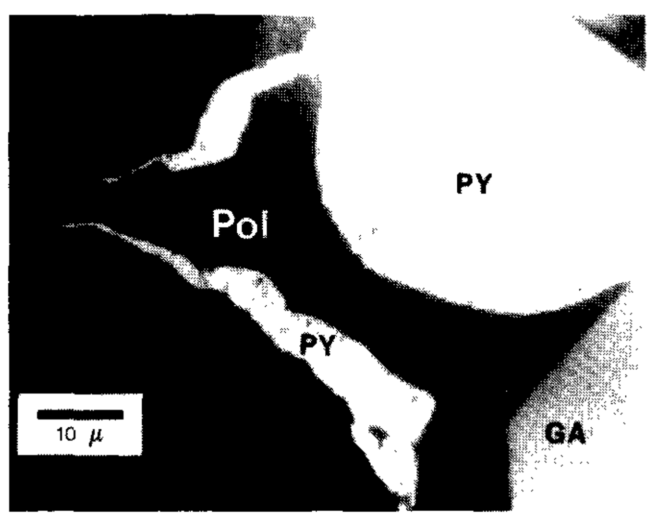

Plate 2-8-2. SP-182-A, polybasite (Pol) has smooth mutual boundaries with pyrite (Py) and galena (Ga). Pyrite partly encloses polybasite. Reflected light, oil immersion.

(0.5 to 10 millimetres) irregular grains of chalcopyrite have mutual boundaries with sphalerite, galena and pyrrhotite. Chalcopyrite aggregates fill voids within pyrite and form veinlets within quartz. In precious metal veins, chalcopyrite is almost exclusively present as inclusions in sphalerite.

POLYBASITE

Polybasite is the most abundant silver mineral and is largely confined to precious metal veins. It normally forms irregular aggregates and is intergrown with galena, pyrargyrite, tetrahedrite and pyrite (Plate 2-8-2). Locally polybasite is present as minute inclusions (5 to 25 microns) in tetrahedrite. Native silver rims and veins polybasite and may form random inclusion patterns.

TETRAHEDRITE

Argentiferous tetrahedrite has been identified in both base and precious metal veins. It forms irregular grains (0.05 to 2.0 millimetres) that have mutual boundaries with galena, polybasite and pyrargyrite. Inclusions and replacement textures of tetrahedrite are observed in galena and sphalerite. Native silver rims and veins tetrahedrite or forms minute inclusions within it.

GALENA

Galena normally makes up less than 1 per cent of the vein material, but may constitute up to 10 per cent. It occurs as irregular euhedral grains from 20 microns to 1 centimetre in width, or as narrow streaks in fractured pyrite.

Galena is closely associated and has mutual boundaries with polybasite, pyrargyrite, argentite and tetrahedrite. Crystals of galena are partly replaced by polybasite and tetrahedrite, and are cut by veinlets of native silver and argentite (Plate 2-8-3). In some instances, galena contains small inclusions of silver.

NATIVE SILVER

Native silver is present as minute inclusions in pyrite and galena, or as free grains in quartz. It also forms replacement rims and traverses grains of polybasite, pyrargyrite and tetrahedrite (Plate 2-8-4).

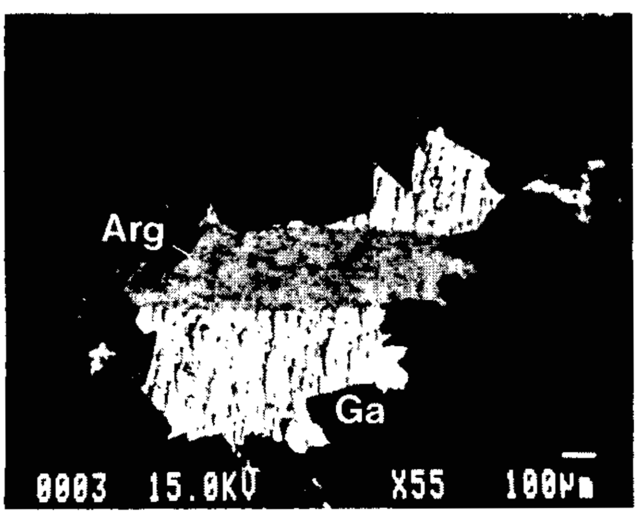

Plate 2-8-3. SP-182-B, narrow veinlet of argentite (Arg) traverses a grain of galena (Ga). SEM backscatter electron photograph.

ELECTRUM

Electrum is the principal gold-bearing mineral. Irregular blebs, 10 to 30 microns in size, are normally inclusions in pyrite and, to a lesser extent, galena. Larger gashes, up to 5 millimetres long, cut quartz-rich patches or vuggy sulphide-rich concentrations. Electrum is present in both precious and base metal-rich ores.

PYRARGYRITE

Pyrargyrite forms irregular grains that are intimately intergrown with polybasite. It is normally a minor constituent and is confined to precious metal veins.

ARGENTITE

Argentite is a minor constituent and occurs exclusively with galena. Normally galena and argentite have sharp mutual boundaries.

ARSENOPYRITE

Arsenopyrite is a very minor component of base metal veins occurring as small (0.1 to 0.3 millimetre) rectangular to subhedral crystals. They are normally free grains, but in places can be composite grains with pyrite and less commonly chalcopyrite and galena.

PYRRHOTITE

Pyrrhotite is a minor component of base metal veins. It is closely associated with pyrite, rimming and infilling fractures within it.

INTERPRETATION

The interpreted age relationships of the metallic minerals are based on spatial associations and replacement textures as they appear in polished sections. The paragenesis diagram

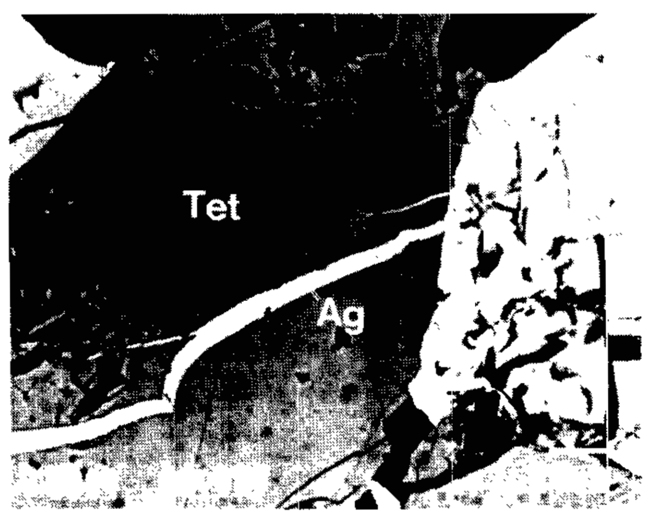

Plate 2-8-4. SP-1088-C, native silver (Ag) veinlets traverse polybasite (Pol) and tetrahedrite (Tet). Tetrahedrite and polybasite have smooth mutual boundaries. SEM backscatter electron photograph.

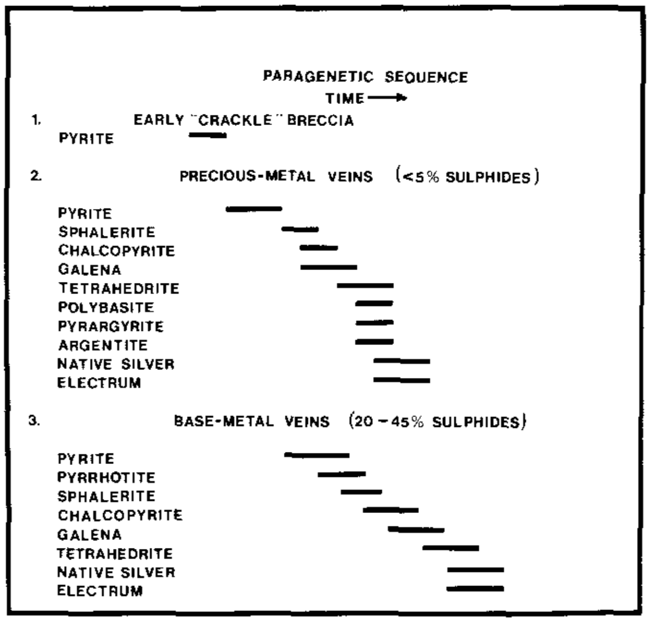

Figure 2-8-1. Paragenetic sequence, Silbak-Premier silver-gold deposit.

(Figure 2-8-1) is vein specific. Sulphide minerals precede sulphosalts and native elements in both vein types.

Some textural relationships described may have resulted from deformation in which more brittle minerals, such as pyrite, were brecciated or formed porphyroblastically. More ductile minerals, such as sphalerite, galena and chalcopyrite, may have been redistributed, obscuring original textures.

CONCLUSIONS

This study has identified a series of temporal veining relationships and the presence of specific silver and gold-bearing minerals. Base metal veins, containing 20 to 45 per cent sulphide minerals, are later than precious metal veins which have less than 5 per cent sulphides. In general, base metal-rich veining is more prominent in the lower parts of the deposit and in the West zone. Precious metal veins tend to be more prevalent closer to surface and in the northeast-trending Main zone.

Base metal sulphides, tetrahedrite, electrum and native silver are observed in both vein types, however, polybasite, pyrargyrite and argentite are confined to precious metal veins. The paragenetic sequence indicates a trend of sulphide-rich minerals to sulphosalts and native elements in both vein types.

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