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THE MM ZINC-LEAD-SILVER DEPOSIT
A VOLCANOGENIC ORIGIN

WATSON LAKE MINING DISTRICT
YUKON TERRITORY

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pinkish white porphyroblasts of unknown mineral up to 10 mm in diameter occur (cordierite?), mainly within the mafic layers. Red garnet is present as thin lenses or layers within the gneiss. Generally associated with the garnet and other mafic minerals is fine to medium grained shredded wisps of pyrrhotite, in the order of 2 to 5 mm long. Pyrrhotite occurs as thin layers, veinlets and as disseminated grains. It makes up less than 5 per cent of the rock, but locally, as in the few feet below the mineralized horizon, it increases to about 20 per cent. Pyrite is present in very minor amounts throughout the rock as thin veinlets and rare euhedral porphyroblasts. In contrast to pyrrhotite, pyrite is euhedral and appears undeformed. Chalcopyrite is present as rare fine anhedral patchy grains within thin chloritic veinlets (458 feet). Throughout the rock, minor siliceous veinlets of quartzo-feldspathic composition are present lying both conformable with and transverse to the foliation.

Mineralized Zone

The mineralized zone intersection extends from 488 feet to 533 feet and is divisible into several lithologies. The basal sulphide-chlorite-quartz gneiss (488-494) consists of layers of sphalerite, pyrrhotite and chalcopyrite alternating with mafic and siliceous layers. Sulphides occupy about 20 per cent of the rock with $Sp \gg Po \gg Cp$. The mafic layers decrease gradually in abundance into the overlying sulphide-quartz gneiss (494-497) which consists of alternating sulphide and siliceous layers. Both sphalerite-pyrrhotite and sphalerite-pyrite layers are present with rare chalcopyrite.

Pale greenish-grey quartz-pyrite-sericite gneiss (497-503) and schist is in sharp contact with the underlying sulphide quartz gneiss. It consists of alternating layers of pyrite-quartz and sericite-quartz. Fine to medium grained euhedral pyrite (2-6 mm) forms about 20 percent of the rock. Locally, layers of sphalerite-pyrite-quartz about 1 cm thick are present and one 5 cm thick layer occurs at 501 feet with more than 20 per cent anhedral chlorite grains, each about 5 mm long (altered shards?). From 502.8 feet, sphalerite increases in abundance in the pyrite layers and appears 'streaked out'.

From 503.0 feet, sericite and chlorite increase in quantity so that the rock changes to a chlorite-sericite-quartz-sulphide gneiss (503-506) and lenses of sphalerite-pyrite-pyrrhotite occur up to 1 cm thick. From 506 to 507 feet, the lithology changes to a quartz-sericite schist with negligible sulphides.

Sulphide-sericite-chlorite-quartz gneiss occurs from 507 to 511.0 feet. The sulphides form 20 to 30 per cent of the rock, are layered and consist of fine to medium grained sphalerite, pyrrhotite, pyrite and chalcopyrite. Pyrite also occurs as medium grained porphyroblasts.

A zone of massive sulphides occurs from 511.0 to 513.4 feet. The 10 cm thick base consists of layered sulphides ($Sp \gg Py \gg Po = Cp \gg Gal$) alternating with layers of quartz-chlorite-sericite followed by a 3 cm thick zone of layered quartz and pyrite. From 511.4 to 513.4, massive to poorly layered fine to medium grained (0.1 mm to 3 mm) sulphides form 85 to 90 per cent of the rock, with the remainder being light grey blocky porphyroblasts of an unknown mineral (H 5 1/2, no HCl acid reaction, Carlsbad-type twinning, -andalusite?), quartz and sericite. Within the massive sulphides, the lower 15 cm are copper-rich with $Cp = Sp \gg Py \gg Po$ and the next 15 cm lead-rich, $Gal = Py \gg Sp$. The upper 30 cm portion is iron-rich with $Py \gg Sp \gg Gal$. The massive

lithologies.

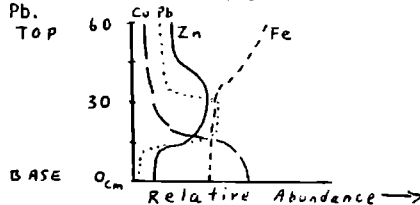
Silver, Lead

Silver and lead have a direct relationship throughout the deposit. They maintain low concentrations of about 0.2 oz/ton and 0.2 wt% respectively in the lower half of the deposit and sharply increase in concentration with the onset of the massive sulphide zone to 1.2 oz/ton and 4.2 wt%. This high concentration is reduced to 0.4 oz/ton and 0.8 wt% in the overlying sulphide-silicate gneiss and quartz-pyrite beds. Silver and lead are concentrated in the two barite-rich units - 2.4 oz/ton and 1.7 wt% in the lower unit, 1.4 oz/ton and 1.0 wt% in the top unit. The silver/lead ratio undergoes a drastic change in the massive pyrite between the two barite units. In the massive pyrite unit, lead is low at 0.4 wt% and silver is high, 2.4 oz/ton, indicating that the lead is locally richer in silver, and/or that a large portion of the silver is included in pyrite or that an undetected silver-bearing mineral is present.

Zinc, Copper

Zinc and copper also have a direct relationship in most of the deposit. Zinc maintains a relatively constant concentration in the sulphide-silicate gneiss units and barite units ranging from 1.9 to 3.8 wt%. Copper is very low in these units, averaging about 0.05 wt%, and is only moderately higher in the basal sulphide-silicate gneiss at 0.17 wt%. Concentrations of 10 wt% zinc and 0.4 wt% copper are attained in the assay interval that includes the massive sulphide zone. Both zinc and copper are at their lowest concentration in the barite enclosed massive pyrite unit, 0.51 wt% and 0.03 wt% respectively.

Undetected by the assays, is the obvious metal zonation within the massive sulphide zone, which from base to top gives the following: Cu, Zn, Fe → Pb, Fe, Zn → Fe, Zn, Pb.



Metal Distribution throughout massive sulphide unit.

Barium, Iron, Sulphur, Silicon

Barium is concentrated as barite within two units near the top of the deposit and occurs in negligible amounts throughout the middle and lower portions. Iron maintains a moderate concentration throughout most of the section and has a sharp increase in concentration in the massive sulphide and pyrite units in the middle to upper portion. Sulphur is similarly low to moderate throughout most of the section, but shows a sharp increase in the upper half where it forms massive sulphides and sulphates. Silicon is concentrated in moderate amounts in the lower to middle portion of the section as silicates and is sharply enriched in the quartz-pyrite and quartz-sericite units.

Comparison Between MM and Kutcho Creek Deposit

<u>Similarities</u>	<u>MM</u>	<u>Kutcho Creek</u>
1) Age - both Upper Paleozoic	Mississippian (?)	Triassic (?) to Permian
2) Host Rock - sericite schist	Sericite-chlorite-quartz gneiss	Sericite-chlorite schist
3) Hangingwall - rhyolite breccia	Porphyritic rhyolite breccia	Locally rhyolitic crystal tuff and porphyritic breccia, Dacitic tuff
4) Footwall - mafic to intermediate volcanics	Intermediate volcanic	
5) Nearby rocks of ultramafic composition - yes	Serpentinite across cirque from deposit	Serpentinite allochthon across creek from deposit
6) Grade of metamorphism - high	Amphibolite	Upper greenschist
7) Amount of sulphide deformation - high	Isoclinally folded and recrystallized	Isoclinally folded and recrystallized

<u>Differences</u>	<u>MM</u>	<u>Kutcho</u>
1) Metal content	Zn-Pb-Ag-(Cu)	Cu-Zn-Ag (Cd, Pb)
2) Sulphide mineralogy	Sp, Gal, Py, Po, Cp	Cp, Bn, Sp, Py, Te
3) Alteration	Basal silicification?	Basal Mg-chlorite Possible carbonate halo?
4) Metal zonation	Basal Fe-Zn-Cu Pb-Zn-Ag Fe-barite at top	Fe-rich base to Cu-Zn top

