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MINERAL CATALOG FOR THE MOUNT PLEASANT DEPOSIT OF BRUNSWICK TIN MINES

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Abstract

The mineral deposit at Mount Pleasant, New Brunswick is a prime example of a multi-metal porphyry tin-tungsten deposit. The minerals occur as original rock-forming constituents, alteration products, impregnations, and open-space fillings.

Wolframite is the earliest of the introduced minerals, followed by cassiterite, molybdenite, bismuth, sphalerite and chalcopyrite. The modal composition shows that the opaque minerals constitute only 3% of the rock: arsenopyrite, sphalerite and wolframite are the most prevalent of these.

More than eighty minerals are listed in the catalog of minerals for Mount Pleasant, including native metals, sulfides, arsenides, sulfosalts, oxides, carbonates, fluorides, phosphates, arsenates, tungstates and silicates.

Sommaire

Le gîte de Mount Pleasant, au Nouveau-Brunswick, est un exemple typique de gisement d'étain et de tungstène dans un porphyre multi-métallique. Les minéraux s'y présentent sous forme de constituants lithogénétiques primaires, de produits d'altération, d'imprégnation et de remplissage de cavités.

La wolframite est le premier des minéraux introduits; viennent ensuite la cassitérite, la molybdénite, le bismuth, la sphalérite et la chalcopyrite. La composition modale indique que les minéraux opaques ne représentent que 3% de la roche; l'arsénopyrite, la sphalérite et la wolframite prédominent.

La liste des minéraux trouvés à Mount Pleasant comprend plus de quatre-vingts espèces, entre autres: métaux élémentaires, sulfures, arséniures, sulfo-sels, oxydes, carbonates, fluorures, phosphates, arséniates, tungstates et silicates.

(Traduit par la Rédaction)

Introduction

The mineral deposit of Mount Pleasant, New Brunswick, represents a major period of mineralization in the northern Appalachians and is a prime example of a multi-metal porphyry tin-tungsten deposit. The deposit is unique because it contains a large amount of minerals including several exotic tin and indium varieties. The mineralogy has been the subject of numerous reports but no previous reference describes all of the minerals present. This catalog provides a description of the mineral species at Mount Pleasant and also contains a summary of modal composition, mode of occurrence, and paragenesis.

Mount Pleasant is in southern New Brunswick (Fig. 1). The property has been under intermittent investigation since 1954; the Sullivan Mining Group, through a subsidiary, Brunswick Tin Mines Ltd., has carried on an intensive exploration and development program since 1967. Several mineralized bodies have been found and tested (Parrish & Tully 1971; Petruk 1973a). The bodies are present in two zones. The main, or Fire Tower, zone lies beneath the fire tower at Mount Pleasant. The second, or North, zone is about 1.5 km north.

Modal Composition, Mode of Occurrence and Paragenesis

The modal composition of the deposit is difficult to define because of the complexity of the deposit and the profusion of mineral species. The following modal composition of a bulk sample from the main zone is given to illustrate the mineral abundance: 70% quartz, 10% topaz, 5% fluorite, 4% micas and clays, 4% chlorite, 4% K-feldspars, and 3% opaque minerals. The last is made up of 1% arsenopyrite, 1% sphalerite, 0.4% wolframite, 0.15% molybdenite, 0.1% bismuth, 0.05% galena, 0.05% tin minerals and 0.1% others.

The modes of occurrence of the mineral species are dependent upon their depositional history. The minerals are classified as original, alteration, impregnation and open-space fillings. *Original* minerals are the rock-forming constituents of the local argillites and porphyries: quartz, feldspar, amphibole, pyroxene and certain micas.

Alteration minerals form the bulk of the mineral assemblage; most formed by interaction of original minerals with elements introduced from the pervasive silica and fluorine-rich solutions derived from an intrusive "microgranite", and by subsequent interaction of minerals and elements during the various stages of mineral deposition and secondary processes. The alteration

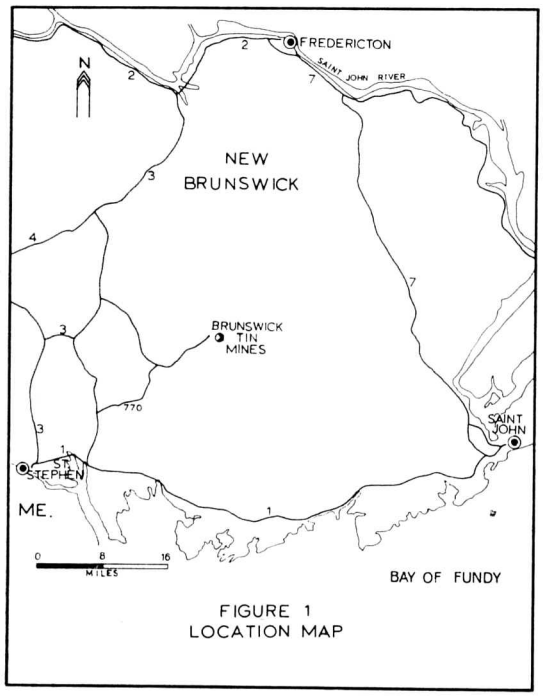

FIGURE 1
LOCATION MAP

minerals occur as distinct grains, as replacements and cement derived partly from the breakdown of minerals, and as overgrowths on minerals such as quartz. Minerals included here are quartz, fluorite, topaz, kaolinite, chlorite, some micas and others.

Impregnation minerals are economically the most important mineral class. They occur as fine-grained specks and aggregates disseminated through well-silicified rhyolite porphyries, and as short, narrow veinlets associated with fluorite and quartz. The most important minerals in this class are wolframite, molybdenite, bismuth, bismuthinite, sphalerite, arsenopyrite, chalcopyrite, tennantite, cassiterite, stannite and galena; arsenopyrite is the most abundant.

Many of the minerals classified as *open-space fillings* are also found in some of the above classes, but their mode occurrence here is decidedly different. Minerals in this class occur as well-developed crystals, large grains or masses in vugs or cavities, or as veins formed late in the depositional sequence. Minerals included here are fluorite, kaolinite, sphalerite, chalcopyrite, stannite, cassiterite, galena and, to a lesser extent, molybdenite and wolframite. Deposits of this class are most prevalent at or near the contacts of the brecciated intrusive rhyolite porphyry.

The paragenesis of the Mount Pleasant deposit has been described by Petruk (1973a). His conclusions, based on microscopic evidence, compare well with field relations noted by mine geologists.

Wolframite is the earliest of the main economic minerals and it occurs mostly as impregnations. However, there are also important open-space fillings of wolframite deposited late in the sequence (Petruk 1973a). Wolframite veinlets cut earlier-formed veinlets of molybdenite and bismuth.

Earliest cassiterite is contemporaneous with, or slightly post-dates wolframite, but its main period of emplacement was late.

Molybdenite and bismuth were deposited after the first stage of wolframite and cassiterite and before the late phase of those minerals. Bismuth sulfosalts and sulfides were very late.

Copper, as chalcopyrite, was late and, as tennantite, was even later than the chalcopyrite. Tin sulfides are contemporaneous with chalcopyrite.

Fluorite was deposited throughout the emplacement of the deposit; the earliest fluorite can be differentiated from the latest by trace-element contents as outlined by Petruk (1964, 1974a).

Sphalerite is late middle and later. Dagger (1972) described four separate ages of sphalerite with characteristic sulfide inclusions. The earliest has 70-95% of its inclusions as pyrrhotite; the next has chalcopyrite as the principal contaminant; the third has stannite inclusions, with minor chalcopyrite; the fourth, or youngest, is usually free of inclusions.

Acknowledgments

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CATALOG OF MINERALS

The following catalog briefly describes each of the minerals known to occur at Mount Pleasant. The numbers following the mineral name indicate references for further information. The position in the paragenetic sequence is indicated in parenthesis at the end of each entry.

ABBREVIATIONS

asp	arsenopyrite	py	pyrite
cc	chalcocite	sp	sphalerite
cp	chalcopyrite	tenn	tennantite
gal	galena	tet	tetrahedrite
moly	molybdenite		

NATIVE METALS

BISMUTH: (0,14,16,19) Frequent, one of the most important ore minerals in the Fire Tower zone. Occurs as free grains in gangue, breccia, or veins of asp; 5-50 μm with samples 2-4 cm seen by resident geologists. Most often found where other mineralization is most intense, and may occur with chlorite, topaz, quartz or fluorite. Less commonly intergrown with or attached to wolframite. Seen more easily in drill core where the bit has polished the soft metal. (Late).

GOLD: (0,13) One grain 20 μm found in greisen from Fire Tower; traces (5-10 μm) in quartz gangue of lower Fire Tower. (Middle).

GRAPHITE: (0,19) Traces of graphite and hydrocarbon have been reported in molybdenum concentrates from different parts of the ore zones. Rhenium has been reported in the graphite.

SILVER: (16) Rare, as inclusions in asp. (Late).

SULFIDES, ARSENIDES, SULFOSALTS

AIKINITE: (0,16) Rare microscopic inclusions in gal or very fine grains attached to other sulfides. Bi content variable. (Very Late).

ARSENOPYRITE: (0,13,16,22,23) Common, from ∿10 μm to masses 25-30 cm in diameter -- average ∿125 μm, in greisen, breccia, wall rock, fluorite or sp. Often intergrown with py and contains inclusions of gal, py, sp, cp, glaucodot, stannite. Traces of Co, Ni, In may be present. The most common sulfide in the North zone and in parts of the Fire Tower zone but relatively uncommon in the western high-grade area of the Fire Tower. Early reports cited loellingite as predominant, but now all iron arsenide in North zone and ∿ 2/3 in Fire Tower is known to be asp. The ratio may change drastically from place to place and between samples. (Middle through Late).

BISMUTHINITE: (0,13,16,19) Common, 10-50 μm, almost always intergrown with native Bi or as inclusions in sp, moly, cp; also as rims on gal. More common in the upper reaches of the ore zones and more in the Fire Tower than in the North zone. (Very Late).

BORNITE: (0,16) Rare, alteration of cc, lamellar exsolution from cp and a purplish alteration tarnish of the gal-stannite mixture of the 900 adit. (Late, Secondary alt.).

CHALCOCITE: (0,5,13) Rare, mostly in North zone upper levels. Usually on, around and included in cp, but also with fluorite & stannite, as at #4 lode of North zone. Grains of ∿150 μm have been recorded. (Late).

CHALCOPYRITE: (0,3,13,16,19,22) Common, forms ∿0.15% of the ore rock; more common in Fire Tower than in North zone, and especially important in the 900 adit and in the copper zone as in the 750 adit. As minute grains, specks, masses to several cm diameter, veins and veinlets. Associated with sp and intergrown with gal and stannite. May replace wolframite or cut through wolframite grains. In the copper zone, cp occurs as specks and grains of about 2 mm in size, disseminated through chloritic quartz porphyry. A later cp occurs as masses in soft green, fine-grained sooty aggregates of clay and chlorite filling cavities in the porphyry. Contains inclusions of other sulfides and has significant Sn and In. Averages ∿25 μm in deep Fire Tower zone. (Late).

COSALITE: (2,5,16) Trace inclusions in some gal. (Late).

COVELLITE: (0,10,13,16) Rare hair-like veinlets in and around cp, or as an alteration of tet or stannite. (Late, Secondary alt.).

DIGENITE: (3) Rare inclusion in massive cp, coexisting with inclusions of cassiterite & hexastannite. (Late).

FAMATINITE: (0) Rare, ∿30 μm, noted as being either famatinite or enargite (?). (Late).

GALENA: (0,3,13,16,22) Frequent, mostly 20-100 μm but occasionally coarser. The richest lead area is at the 900 adit where masses of gal several cm in diam. are readily found. At the 900 adit, in the upper Fire Tower zone, much of the gal has pronounced rounding at the edges of the cubes. A bluish tinge on the slightly oxidized gal is due to a bornite-like mineral evolving from the breakdown of stannite inclusions within the galena. Contains trace Bi, In. In the 900 adit vein, gal makes up to 40% of the ore. In most of the Fire Tower zone, gal is much less common and represents no more than 0.1% of the ore zone. (Late).

GALENOBISMUTITE: (0,2) Rare, in Cu-Pb concentrate from Fire Tower zone, and as inclusions in gal from North zone.

GEOCRONITE: (0) Tentatively identified in the study. (Very Late).

GLAUCODOT: (13) Rare minute rounded inclusion in asp within fluorite. (Late).

KESTERITE: (16,17,19) Common. At Mount Pleasant the most common forms of the stannite-kesterite series are mid-point minerals ferrian kesterite and zincian stannite, the former being the most important tin sulfide at Mount Pleasant. Found as minute droplets, lamellae, or veinlets in sp, and in gangue or tenn. It is also intergrown with stannite and stannoidite. Usually found where cp is rare. An important carrier of In with 0.2-0.5% In. (Late).

LOELLINGITE: (0,5,16) Rare, apparently absent in North zone and is no more than 1/3 of the iron arsenide of the Fire Tower zone. The asp-loellingite ratio is highly variable but evidence indicates asp is prevalent. Loellingite is found as euhedral crystals to masses, but usually is 50 μm with grains to 2 mm recorded. Contains some Bi as inclusions and often surrounds asp. (Middle).

MARCASITE: (0,10,16,23) Rare fine veinlets cutting sp, cp, tenn, or stannite, or partly replacing py. Noted on fracture surfaces in drill core. (Very Late).

MAWSONITE: (0,16,17,20) Very rare, first occurence in Canada; in tenn, asp, and gangue of Fire Tower Northeast high-grade zone. (Late).

MOLYDBENITE: (0,5,10,13,16,19,23) One of the most important sulfide minerals at Mount Pleasant, it increase in importance with depth, but constitutes only about 0.5% of ore. Flakes are present as separate grains and clusters up to 2 mm or more. Commonly 50-100 μm long but only 5-10 μm thick; plates usually curved and crinkled. As veinlets and fracture coatings and as minor inclusions in sp; most commonly as disseminated grains, bundles and clusters in mineralized fractured rocks. Has few inclusions but will, in places, include wolframite and small amounts of graphite. Some moly coats quartz grains, necessitating extra-fine grinding to effect complete liberation. (Middle to Late).

PYRARGYRITE: (19) Rare minute grains in gangue of a sulfide-rich sample from the deep western Fire Tower zone. (Late).

PYRITE: (0,13,16,19,22) Frequent, subhedral, intergrown with sp, cp, pyrrhotite; >80% is 20-40 μm, but up to 0.5 mm in 900 adit. Contains few inclusions. Trace Ni found by microprobe. (Middle).

PYRRHOTITE: (0,9,16) Rare 25-40 μm grains in massive py, sp, cp, gal, and in adjacent gangue. (Late).

ROQUESITE: (16,25,26) Rare 10-15 μm, subhedral to rounded, in sp and sp & cp grain boundaries; also with calcite, fluorite. (Late).

SPHALERITE: (0,3,5,10,12,13,16,19,22,27) The major ore mineral of the upper North zone and, with asp, the major sulfide throughout the mountain. Occurs in veins, masses, disseminated; probably 80% is >100 μm. Much less common in the deep Fire Tower zone, where probably ∿0.15% of the ore. (Late).

STANNITE: (0,10,13,16,17,22) Frequent, mostly zincian. Accounts for Sn equal to that of cassiterite in deep Fire Tower zone, but in North zone < 1/5 Sn is as stannite. Almost all of the stannite is present as inclusions in other sulfides, especially sp; usually <50 μm, but up to 1.5 cm. About 50% of the stannite in the west deep Fire Tower area is liberated at 150 μm. An important carrier of In. (Late).

STANNOIDITE: (16) Rare, alteration of kesterite and stannite where tenn and sp were principal ore minerals and where kesterite was exsolved from sp. (Late).

TENNANTITE: (0,5,13,16) With cp is one of the two dominant Cu minerals. Present in North zone as minor irregular grains; in veins of the Fire Tower constitutes a major source of Cu. About 50% is liberated at 150 μm. One vug in the 750 adit had crystals several mm in size. Veinlets of tenn have been noted cutting wolframite and various sulfides. Generally found where sulfides and asp are significant, but uncommon where cp is significant. Carries little or no silver. (Very Late).

TETRAHEDRITE: (0,22) Main source of Ag, Sb at Mount Pleasant and particularly in North zone; occurs as 5-40 μm inclusions in sphal and often with tenn;seldom as free grains in gangue. (Very Late).

WITTICHENITE: (16,23) Rare irregular grains intergrown with bismuthinite and other sulfides. (Very Late).

OXIDES

CASSITERITE: (0,3,10,13,16,22,23) Common, probably the main tin mineral of the North zone, but not in the Fire Tower zone. Usually red-brown but off-white to adamantine brown specimens have been described. Probably >90% is >20 μm; average 20-50 μm with individuals to 300 μm. As euhedral crystals in fluorite, kaolin or quartz and as anhedral grains in sphalerite, chlorite and rutile. Tin-bearing fluorite is usually brown & tin-bearing sp usually black. Cassiterite in the North zone was described in 5 assemblages by Sauve (0): in highly silicified rock as disseminated grains, often with sp and topaz; in sulfide-rich pods with cp & stannite;in chloritic rocks impregnated with scattered sulfides and, in particular, cp in dense, green, fine-grained assemblages of biotite-chlorite where the cassiterite is as a 10 μm cloud of grains; and as well-formed crystals and grains in kaolin with quartz and fluorite. (Early and Late).

COLUMBITE: (24) Only in the upper Fire Tower zone as rare microscopic intergrowths with rutile and wolframite.

FERRIMOLYBDITE: (0) Frequent, supergene, on surface above ore zones.

GOETHITE: (0,13) Rare irregular inclusions in sp and bordering py, asp, or cp in North zone. Limonite noted in table concentrate.

HEMATITE: (0,13,16) Rare as red stain on walls of adits, and as dust on grain boundaries. Found also in magnetic concentrates and intergrown with wolframite. Grain size ∿5 μm. Some hematite contains Mn. May be a guide to favorable host rocks. (Pre-ore, Early). Rare specularite noted in argillite and porphyry.

ILMENITE: (16,18) Rare, in tungsten concentrates and as intergrowths with rutile. (Pre-ore).

MAGNETITE: (0,16) Rare, as 20 μm grains associated with but not intergrown with hematite. (Pre-ore).

RUTILE: (0,5,16,19,22,24) Frequent as needle-shaped crystals to 1 mm in size, or as isolated grains and clusters usually <20 μm. Usually in chloritized rocks; almost absent in well-silicified material. In the Fire Tower area, occurs in pods and veins and as minute grains in wolframite. In the North zone, is intergrown with cassiterite and as irregular grains in greisen, sp and fluorite, or as needles associated with tourmaline, topaz, and fluorite. Titanium oxide, probably in the form of rutile, has been used to differentiate the rock types of Mount Pleasant. The most favorable host rock (the so-called tuffite) contains only 0.03% TiO_2, and that of the North zone 0.49% TiO_2. Early rutile contains abundant trace elements, including W, Fe, Sn, Ta, RE, Nb (rutile is the main source of Nb at Mount Pleasant). Later rutile contains cassiterite and occurs as inclusions in sulfides. (Early to Late).

SPINEL: (0) Identified in a table concentrate.

URANINITE:(0) Rare small discrete grains.

CARBONATES, FLUORIDES

CALCITE, ETC.: (0,13,14,16) Common in greisen, breccia, and in some sulfide veins; also in concentrates and was one of the three main mineral constituents of the suspended slime in the discharge water from the 400 decline when the decline was still in waste rock. Dolomite rare (14). Siderite (0,13, 16) frequent as brown rhombs in both breccia and wall rock; a major constituent in fluorite veins in #4 lode of upper North zone. (Very Late).

FLUORITE: (0,13,16,23) Abundant, economically significant, forms up to 10% of the orebodies & averages 3-4%; >90% is 150-200 μm; masses of several cm are common. Occurs in greisen veins, masses or grains in mineralized and unmineralized rocks. Color ranges from black to colorless; black fluorite usually occurs as veinlets and contains sp. Brown fluorite almost always contains tin and often has rare-earth minerals as inclusions. One variety present may be yttro-fluorite. Mauve to purple fluorite occurs as veins, pods, and fracture coatings. Light green and colorless fluorite occur in kaolin and carry only minor amounts of copper and other impurities. Early fluorite is black and brown in color; light green and clear varieties were last to form.(Early through Late).

MALACHITE: (13) Rare, supergene encrustations in North zone.

PHOSPHATES, ARSENATES, TUNGSTATES

APATITE:(0,13,16,22,23) Rare grains in breccia, greisen, and intensely silicified rocks. (Early).

ARSENOBISMITE: (13) Rare pale green encrustations with scorodite on walls of 600 adit. (Secondary alt.).

MONAZITE: (0,21) Very rare, 1-5 μm but up to 50 μm, in gangue near rutile, zircon, xenotime; also as inclusions in sp. (Early).

SCHEELITE: (0,5,10,13,16) Rare discrete grains 20-100 μm, usually with wolframite. (Early).

SCORODITE: (13,22) Rare supergene pale green encrustations on walls of 600 adit in North zone.

WOLFRAMITE: (0,5,16) The most important of the ore minerals at Mount Pleasant, all is Fe-rich(ferberite) with Fe/Mn ≈ ∿10. Seldom seen in hand specimens in the upper zones, but specks, patches and veinlets are not uncommon in the workings off the 400 decline. Patches to 1 cm are not uncommon and 0.5 cm veinlets have also been recovered. All wolframite is largely free of inclusions. Averages ∿70 μm, range 20-200 μm; coarser in deep western Fire Tower zone with 80% > 150 μm. Intergrown with rutile in deep Fire Tower zone. Most occurs in gangue such as quartz, chlorite, fluorite, topaz or clay. A minor amount is in breccia matrix. (Early, Middle, Late).

XENOTIME: (0,21) Rare grains to 100 μm but average 20 μm in tungsten concentrate from upper Fire Tower zone. Important source of Y. (Early).

SILICATES

AMPHIBOLE GROUP: (0) Very minor pre-ore accessory mineral; rare hornblende reported in Jones magnetic concentrate. (Pre-ore).

CHLORITE: (0,10,13,16,23) Abundant, derived from breakdown of biotite and feldspars. At Mount Pleasant, the chlorite is highly enriched in iron and somewhat magnetic. Forms up to 20% of some rocks. Less-altered rocks have more chlorite than advanced greisen zones. Where massive, it frequently carries cp, cassiterite, rutile and kaolinite. (Pre-ore, Early).

DICKITE: (0,6) Frequent, white, well-crystallized, from upper North zone. Identified by X-ray. (Late).

EPIDOTE, ZOISITE: (22,23) Frequent aphanitic pistachio-green masses replacing feldspar near mineralization. Rare zoisite reported (23) as an alteration of feldspar.

FELDSPAR: (0,5,22) Pre-ore rock-forming mineral; abund. pre-ore orthoclase reported (0,5) from deeper Fire Tower ore & as replacement veinlets. Rhyolite porph. host of upper Fire Tower has quartz & sanidine (0) phenocrysts. Very little feldspar remains in greisen zones (some in crosscutting veins). At depth the feldspar is more potassic.

GARNET: (0,16) Rare, in table concentrates and as dark, red-brown dodecahedrons to ¼" in drill core from the porphyry east of the North zone. Almandine variety.

KAOLINITE: (0,4,6,13,16,22) Common, soft yellow to light grey to white material found as veins, dykes and masses. In all ore zones but notably more common in the North zone. Yellow variety is intergrown with hydromica and scorodite; white variety is more likely to have ore minerals. Fluorite and cassiterite are often found in white kaolin dykes. In wall rock, kaolin forms with topaz and fluorite in the greisinization process altering from feldspars. (Early and Late).

MICAS: *Illite* reported (0) as principal clay mineral in the suspended slimes of the discharge water from the 400 decline while that decline was in waste rock. *Hydromica* reported (13,16,22) as (Pre-ore, Early) white to yellow soapy encrustations and veinlets on fluoritic wall rocks. Also an alteration of pre-existing feldspar. Intensely altered rocks carry little mica due to formation of topaz and quartz. "Sericite" common (0,16,19,22) as interstitial material derived from alt. of alkali feldspar; sericite decreases as topaz increases. Also as fine grains in all rocks, and as selvages around tin-bearing veinlets. (Early). *Biotite* reported (0) as rare small greenish flakes in deeper parts of the ore zones. A dense, fine-grained, biotite-chlorite assemblage of the deep North zone often contains clouds of very fine-grained cassiterite with values of about 1% Sn. A very useful ore guide. Rare *lepidolite* reported (16,22) as separate grains in breccia and other rocks. Rare *zinnwaldite* also reported (22).

PYROXENES: Rare augite identified (0) in Jones magnetic conc.; rare hedenbergite tentatively identified by X-ray in gangue from upper Fire Tower zone; rare pre-ore orthopyroxene reported (0). (Pre-ore).

QUARTZ: (0,16,22,23) Normally accounts for 70% of the rock but in one area of the 750 adit and in another of the 600 adit, massive white bull quartz occurs in irregular replacement bodies several m in length. Such masses are uncommon. Wide quartz veins are also rare, but narrow veinlets are common. Most quartz is original, but larger grains, crushed grains, fine cement, and overgrowths were introduced into breccia and other rocks. (Pre-ore to Late).

SERPENTINE: (16,19) Frequent light green waxy coating in breccia and porphyry, along slips and intergrown with quartz and ore minerals. Usually denotes lower grade ore. (Early, Middle, Late).

TOPAZ: (0,11,13,16,19,22,23) Abundant near all ore contacts but highly variable; mostly 10-50 μm grains with ∿10% in coarse aggregates >100 μm; some specimens several cm long; forms about 18% of the rock in the upper Fire Tower and about 8% in the lower. Occurs as white metacrysts in kaolin, quartz or fluorite, and grey to yellow-white grains in greisen and breccia; common with cassiterite in North zone. (Pre-ore, Early).

TOURMALINE: (16,22,23) Frequent as very fine-grained pale green needles (in places in radiating clusters) or laths associated with cassiterite and base-metal mineralization. (Middle).

ZIRCON: (0,13,16,22) Rare minute grains in porphyries, traces in fluorite & sp. (Early, Middle).

Minerals referred to in company reports, but not verified-presence questionable: colusite, dzhalindite, huebnerite ilmenorutile, matildite, "ruby silver", stolzite, talc, teallite, thoreaulite, wulfenite.