system evolved from an early, probably juvenile fluid-dominated stage to one strongly influenced by meteoric waters, as the main heat source cooled and further intrusion and brecciation took place. At least three main stages of alteration-mineralization have been differentiated.

1) AN EARLY STAGE, related to the main intrusion of rhyodacite porphyry, involved the development of outwardly progressing zones:

- a) a stockwork core of quartz-magnetite-amphibole-Na plagioclase;
- b) a biotite-magnetite zone with chalcopyrite, pyrite and molybdenite;
- c) a chlorite zone with pyrite and minor chalcopyrite;
- d) an outermost epidote zone. All are developed in Bonanza Volcanic rocks except the quartz-amphibole-magnetite core, which in addition formed along the margins of the rhyodacite porphyry. The biotite alteration, along with the main copper mineralization, partly overprinted the quartz-magnetite-amphibole core.

2) A STRUCTURALLY CONTROLLED INTERMEDIATE STAGE, superimposed upon the earlier assemblages, was related to the emplacement of a quartz stockwork and is characterized by sericite, chlorite and kaolinite assemblages, with local concentrations of pyrite, molybdenite and chalcopyrite. It is mainly developed in the rhyodacite porphyry and immediate wallrocks. Much of the chlorite overprint currently observed in the pit could have been associated with this stage.

3) A LATE STAGE, related to the emplacement of breccias under extreme base-leaching conditions, is characterized by pyrophyllite, kaolinite, sericite and dumortierite. Further low temperature alteration episodes included "yellow dog" ankerite-calcite veining, widespread zeolite development, and the precipitation of remobilized carbon-bearing organic compounds.

The bulk of copper mineralization was introduced during the early stage, to be followed by the main episode of molybdenum. Almost all of the copper occurs in the form of chalcopyrite, predominantly hosted by biotitized Bonanza Volcanics.

Gold output since production started in 1971 is about 880 000 ounces with an annual rate of slightly higher than 50 000 ounces. This renders Island Copper one of the largest gold producers in British Columbia. Average head-grade in the deposit is about 0.22 ppm Au, with large volumes assaying in excess of 0.4 ppm Au. Only 50% of the gold is recovered in the copper concentrate, which averages 25% Cu and 8 ppm Au. Studies on gold occurrence, gold-contoured values from blast-hole samples, and bulk sampling tests indicate that gold was essentially associated with the early and intermediate stages of alteration-mineralization, although it is not clear whether gold of the latter stage was introduced into the system at that time or remobilized from earlier mineralization. Gold has been observed in the native form, as micron-sized inclusions in chalcopyrite, pyrite, molybdenite and silicates.

Certain features, such as the positive correlation between gold and copper, the overall association of gold with the potassic (biotite-rich) alteration zone, and the high content of magnetite in the system (+8% vol.), are characteristic of most known gold-rich porphyry copper deposits.

ORE GENESIS RESEARCH

Chemical controls on metal ore grades - an essential part of exploration models for economic ore deposits - are being investigated by the Australian Bureau of Mineral Resources using a new approach adapted from chemical engineering. The first application is on hydrothermal tin-tungsten deposits where ore fluid compositions are being analysed semi-quantitatively by a new heavy-ion analytical facility (HIAF) proton-microscope technique. The work is being carried out in collaboration with CSIRO's Division of Exploration Geoscience.

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MT. MILLIGAN
Alkaline Intrusive Au-Cu Deposit

The Mt. Milligan MBX porphyry gold-copper deposit, 90 miles northwest of Prince George, B.C., has a drill inferred inventory of 100 million tons. Grade ranges from 0.01 to 0.15 oz/t gold and 0.2% to 1.0% copper.

The project is a joint venture between Continental Gold Corp.(70%) and BP Resources Canada Limited (30%). The joint venture holds a large contiguous block of claims covering 42 square miles of the mineral belt, accessible by an allweather, heavy-duty gravel logging road from MacKenzie, 40 miles to the east.

In 1983 and 1984 BP acquired the property by staking and acquisition and identified a gold-copper soil geochemical anomaly approximately three square miles in extent. In 1985 after IP and magnetic surveys over the geochemical anomaly, BP exposed gold mineralization in trenches on the Creek and Esker zones.

United Lincoln Resources Inc., (a Continental Gold Corp. subsidiary) optioned the property from BP in 1986. Lincoln, having undertaken extensive trenching within the soil geochemical anomaly and additional magnetic surveys, commenced diamond drilling on the Creek and Esker zones and discovered the MBX deposit in 1987.

Regionally the property lies within the central volcanic core of the Upper Triassic-Lower Jurassic Takla Group. Takla volcanics are dominated by subaqueous alkalic pyroxene porphyritic andesite and basalt flows and pyroclastics with subordinate intercalated tuffs and argillites. Intruding the volcanic stratigraphy are comagmatic alkaline syenite, monzonite-diorite stocks.

The MBX porphyry gold deposit is situated on the eastern side of a 3,000 foot diameter porphyritic monzonite stock. Mineralization is hosted by easterly dipping pyroxene porphyritic andesite to latite flows, pyroclastics, interbedded

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trachytic tuffs and a 30 to 150 foot thick porphyritic monzonite dike. Mineralization persists into the eastern margin of the monzonite stock but with decreasing grades.

The multi-phase monzonite stock is fine to medium grained with 20% plagioclase laths in an aphanitic potassium feldspar matrix. This is one of three alkaline plutons on the property that form a north-northeast alignment, suggesting a structurally controlled emplacement. The porphyritic character of the intrusive units and the number of dikes is indicative of a hypabyssal subvolcanic environment.

Potassium silicate and propylitic alteration assemblages have formed outwardly from the stock for 1000 and 8000 feet respectively. An early, fine grained felted hydrothermal biotite superimposed on the volcanics is over printed by pervasive grey potassium feldspar. Biotite comprises 10 to 35 per cent of the volcanic units and potassium feldspar up to 50 per cent, while pyroxene is typically replaced by actinolite within the potassic zone. In fine grained laminated tuffs massive potassium feldspar replacement is common. The potassium silicates overprint the enclosing propylitic assemblage which is principally comprised of epidote, carbonate and pyrite. Veinlets of magnetite with minor chalcopyrite post date the main period of sulphide precipitation and are restricted to the potassic zone. Weak but pervasive sericite partially replaces plagioclase phenocrysts in the monzonite stock and in the porphyritic monzonite dike within the zone of potassic alteration. Throughout the MBX deposit, alteration is typically pervasive and veining is infrequent.

Disseminated grains and coalescing grain aggregates of chalcopyrite and pyrite comprise approximately 60% of the total sulphide content. Fracture controlled pyrite-chalcopyrite mixed veinlets are less abundant. Chalcopyrite and pyrite-bearing K-feldspar-carbonate veinlets are relatively rare. Quartz veining is noticeably absent. The distribution of sulphides is zoned but not uniformly. At the north end of the MBX deposit pyrite and chalcopyrite occur in equal concentrations. Bornite, though present, is a minor constituent. Within the west central portion of the deposit the pyrite:chalcopyrite ratio is approximately 3:1. Along the east and southeastern margin of the deposit the pyrite content increases to 5 to 10%, and the pyrite:chalcopyrite ratio is approximately 20:1.

Metal zoning closely parallels that of the sulphides with gold concentrations increasing with the pyrite:chalcopyrite ratio. This relative gold enrichment, coincides with the transition from potassium silicate to the propylitic alteration assemblage.

Both chalcopyrite and pyrite are auriferous and occur as separate grains. Intergrown sulphides are rare, an important positive metallurgical feature. Gold associated with pyrite occurs as small particles on grain margins.

At the West Breccia zone, situated on the western flank of the monzonite stock, an intrusive breccia, comprised mostly of monzonite and a few scattered volcanic clastics, is enclosed by a broad zone of brecciated and fractured monzonite. Within the intrusive breccia pink secondary potassium feldspar is pervasive, however, moving outward from the breccia, the potassium feldspar is fracture controlled. Both chalcopyrite and pyrite occur as fracture fillings and as discrete fine grains partially replacing altered mafic minerals. Chalcopyrite predominates over pyrite and gold concentrations are low.

The Creek, Esker and 79 zones are located within propylitized hornblende-pyroxene porphyritic andesites approximately 1000 feet southwest and 1500 feet west, respectively of the MBX porphyry deposit. These zones are northeast striking, steeply northwest-dipping, tabular bodies of auriferous semimassive to massive sulphides occupying fracture systems radial to the monzonite stock. Each of the deposits comprises three to five subparallel, sulphide-rich bodies, spaced across 200 to 300 feet. Individual structures range from 1 to 10 feet in thickness and grade from 0.10 to 2.89 oz/ton gold and 0.2 to 10% copper. Each zone is open along strike and down dip. The propylitically altered andesites between the individual sulphide bodies carry 30 to 350 ppb gold and 200 to 2500 ppm copper. Silver, arsenic and antimony are present at background concentrations.

Pronounced metal zonation is related to the proximity to the monzonite stock. The MBX porphyry deposit adjacent to the stock, contains less than 10 ppm combined arsenic and antimony. At the Creek, Esker and 79 zones, combined concentrations increase to 300 ppm and to 2000 ppm respectively. Silver shows a similar relationship with concentrations ranging from 1.5 ppm in the MBX zone, to 10 to 40 ppm in the Creek zone, and 60 to 200 ppm in the Esker zone.

Mark Rebagliati, P.Eng., who conceived the original exploration program and Dave Copeland, P.Eng., are Vancouver-based consulting geological engineers who have directed and managed this project to its current stage.

[Ed. Note: Recent news releases from Continental Gold Corp. indicate the Mt. Milligan Cu-Au deposit is a massive, blanket-shaped deposit 4,300 feet long, up to 3,100 feet wide and up to 800 feet thick. Over 150,000 feet of drilling has been completed in 200 holes. Reserves are reported to be in the 150 to 200 million ton range, grading 0.3% copper and 0.02 oz/ton gold].

STEWART - ISKUT BELT
Northwestern B.C.

K-Feldspar Connection: Relationship of K-Feldspar Intrusions to Cu Porphyries and Au Veins, Stewart-Iskut Belt

Hypabysaal copper-gold porphyries and mesothermal to epithermal gold-silver veins in the Stewart-Iskut gold belt are related to Early Jurassic intrusive rocks which are either alkaline or calc-alkaline in composition. In the Premier and Sulphurets areas the intrusive rocks feed and cut a Lower Jurassic volcano-sedimentary sequence of the Hazelton Group. At the Snip, Skyline and Galore Creek deposits the intrusive rocks cut Upper Triassic, Stuhini Group volcanic and sedimentary rocks. Porphyry and vein-type ore deposits are linked by:

1) their spatial and inferred temporal association with intrusive rocks, in particular distinctive two-feldspar porphyry with K-feldspar megacrysts (Premier porphyry is a well documented example)

2) potassic alteration - pervasive sericite, K-feldspar (adularia), and less commonly biotite

3) a structural control, interpreted to be syn-volcanic (ex. Premier and Galore Creek)

At Premier, hornblende-plagioclase-K-feldspar-quartz prophyritic dacite dikes (Premier porphyry), derived from the Texas Creek granodiorite batholith, are emplaced along intersecting northeast and northwest structures. These appear to control volcanic stratigraphy and are interpreted to be synvolcanic faults. The ore consists of quartz-K-feldspar (adularia) veins, stockwork and breccia that follow the same structures as Premier porphyry. Past production at premier is 4.7 Mt at 2.2 g/t Au and 80.3 g/t Ag. Mineralization dies out abruptly near overlying maroon (oxidized) strata, which suggests that ore deposition resulted from mixing of hydrothermal fluid with meteoric water. Silver and gold are most abundant in the upper part of the deposit, abundance of base metals and mineral grain size increase at depth. The sericite alteration zone flares outward toward the top of the deposit. These are classic features of an adularia-sericite epithermal deposit. Gold occurs primarily as electrum that has a close spatial association with tetrahedrite.

Mineralization in the Sulphurets area is controlled by two north-trending structures; the steep Brucejack fault and the Sulphurets fault, whose shallow west dip results in a sinuous map pattern. These, and secondary structures, control Early Jurassic diorite, syenite and granitic intrusions and localize sericite-K-feldspar alteration. An alteration zone of this type hosts the West Zone deposit (0.775 Mt at 12.1 g/t Au and 786 g/t Ag) adjacent to the Brucejack fault. Mineralization is an anastomosing network of vein stockworks and breccia, interpreted to be a silicified shear zone, bounded by intrusive K-feldspar porphyry.

The Kerr deposit (60 Mt at 0.84% Cu, 0.34 g/t Au and 2.05 g/t Ag) occurs within sheared and sericite-altered volcanic rocks that are bounded by splays of the Sulphurets fault. A diorite body, K-feldspar porphyry dikes and high grade Au-Ag-Cu veins are all contained within the north-trending structural zone. The Kerr porphyry deposit contains pyrite, chalcopyrite, tennantite, bornite and chalcocite occurring as disseminations and disrupted quartz veins.

The Snip deposit(Twin zone 1.43 Mt at 21.9 g/t Au) is a mineralized shear zone that trends 120 and dips moderately to the southwest (about 55). Discordant mineralization, that cuts massive feldspathic wackes, comprises pyrite, pyrrhotite, chalcopyrite, sphalerite, galena and arsenopyrite. The ore is both massive and strongly foliated, quartz is commonly brecciated with a crackle texture. Mineralization is restricted to the shear zone and contacts with wallrock are sharp. Potassic alteration is represented by pervasive biotite-flooding and irregular K-feldspar (adularia) replacement of the wallrock.

The Johnny Mountain gold mine, 1 km southeast of Snip, is a structurally disrupted mesothermal gold-bearing quartz vein deposit. Current reserves are 0.622 Mt at 19.5 g/t Au and 0.75% Cu. Silicification and potassic alteration occur along a series of northeast-trending structures in close proximity to an orthoclase porphyry.

The Galore Creek alkalic porphyry Cu-Au deposit (125 Mt at 1.06% Cu, 0.40 g/t Au and 7.7 g/t Ag) comprises 10 tabular to manto-shaped deposits. Mineralization is hosted in volcanics, breccia pipes and K-feldspar megacrystic syenite dikes and plugs. The mineralization and several phases of syenite porphyries are in part controlled by north and northeast