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MT. MILLIGAN COPPER-GOLD DEPOSITS

CONTINENTAL GOLD CORP.

PLACER DOME INC.

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N.W.M.A Short Course - Porphyry Copper Model

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SUMMARY

This paper describes the history, exploration methodology, geology, and metal zoning of the copper-gold porphyry deposits known to occur on the Mt. Milligan property. The property is in north-central British Columbia, 155 km northwest of Prince George.

Mineralized outcrops and float were discovered in the Mt. Milligan area in the mid-1980's by prospecting. Following this, areas containing the outcrops and float were investigated by geological mapping, soil sampling, ground geophysical surveys, trenching and diamond drilling. This work led to the discovery of the Main deposit in 1987. Following this discovery, ground geophysical surveys continued and an airborne geophysical survey was conducted followed by extensive diamond drilling. This work, which was conducted up to 1991, delineated the Main deposit, and led to the discovery and definition of the Southern Star deposit.

The Mt. Milligan deposits lie within the Early Mesozoic Quesnel Terrane. The deposits, which occur within porphyritic monzonite stocks and adjacent volcanic rocks of Takla Group, comprise the Main and Southern Star deposits. The Main deposit is centred around the MBX stock and Rainbow dyke; the Southern Star deposit, around the Southern Star stock.

Potassic alteration is extensive within the stocks and in volcanic rocks adjacent to the MBX stock and Rainbow dyke. Propylitic alteration surrounds the potassic alteration and decreases away from the stocks. Mineralization consists mostly of pyrite, chalcopyrite, lesser magnetite, and minor bornite and gold. Copper and lower grade gold mineralization are more structurally controlled and occur close to and within the MBX and Southern Star stocks, whereas higher grade gold mineralization is more stratigraphically controlled and occurs away from the stocks.

The key feature that allowed the Mt. Milligan deposits to attain their size was the intersection of the intrusions and their associated hydrothermal system with a porous permeable stratigraphic interval that permitted the system to spread laterally. This allowed for the development of the copper-gold rich MBX and gold-rich 66 zones.

LOCATION, ACCESS AND PHYSIOGRAPHY

The Mt. Milligan property is in north central British Columbia at 55° 08'north latitude and 124° 04' west longitude within N.T.S. mapsheets 92N/1 and 92O/4 (Figures 1, 2 and 3). Prince George is 155 km to the southeast; Vanderhoof, 155 km to the southwest; Fort St. James, 86 km to the southwest; and MacKenzie, 95 km to the east. The property is in the Omineca Mining Division and in the Bulkley - Nechako Regional District.

The Mt. Milligan property lies near the northern boundary of the Southern Plateau and Mountain Region of the Canadian Cordilleran Interior System. More specifically, the property is within the Nechako Plateau near the southern limits of the Swannell Range of the Omineca Mountains.

The property is dominated by a chain of peaks aligned in a north-south direction. Mt. Milligan, which is in the northern portion of the property (Figure 3), is the highest of these peaks. It rises to an elevation of 1,508 m, and is rounded and symmetrical in shape. The Mt. Milligan and Southern Star deposits are to the south of Mt. Milligan on the eastern slopes of the chain, at an elevation of 1,100 m in an area of gentle relief.

The Nechako Plateau was covered by the Cordilleran ice cap, which moved eastward and northward from the Coast Ranges towards the Rocky Mountains near McLeod Lake, over-riding the mountains, coating the surface with a blanket of glacial drift, and altering the pre-glacial drainage patterns. Drumlins, flutings, eskers and melt-water channels of various dimensions are noticeable features of the plateau surface. The property is well-drained except for depressions where natural vegetation succession has filled in ponds to form bog-like fens. Drainage from the area is to the northeast via Nation River into Williston Lake, which forms part of the Peace-MacKenzie River basin (Figure 2).

HISTORY OF THE PROPERTY

The earliest record of exploration activity in the area is by prospector G. Snell, who found gold-bearing float on the southern flank of Mt. Milligan in 1937. In 1945, Snell returned to the area and staked mineral claims. Five samples of pyritic andesite float returned assays ranging from trace up to 148.8 g/t of gold. However, no gold-bearing mineralization was found in place.

In 1972, Pechiney Development Ltd. (Pechiney) staked mineral claims to cover an area just north of the Main deposit. Subsequent exploration work identified induced polarization and soil geochemical anomalies. To evaluate the anomalies, Pechiney drilled five diamond-drill holes, which did not identify significant copper mineralization, and the claims were allowed to lapse.

No further significant exploration work in the Mt. Milligan region was done until 1983 when Selco Inc. (Selco) took an interest in the region and staked mineral claims over the ground covered by the original Pechiney claims, and completed preliminary surveys. In early 1984, Selco amalgamated with BP Resources Canada Limited (BP).

In early 1984, R. Haslinger staked mineral claims adjacent to those staked by BP. BP optioned these claims from Haslinger in mid-1984, and in late 1984 and early 1985 staked more claims in the area. The claims staked by R. Haslinger covered most of the Main and Southern Star deposits.

In 1984 and 1985, BP completed geological, soil geochemical, magnetic and induced polarization surveys, and a trenching program. The work identified polymetallic-auriferous vein systems and weak copper-gold porphyry mineralization.

In 1986, Lincoln Resources Inc. (Lincoln) entered into an agreement with BP to continue exploration of the claims. In September 1987, Lincoln undertook a diamond drilling program that resulted in the first discovery of significant gold-copper mineralization (Main deposit).In 1988, Lincoln reorganized to become United Lincoln Resources Inc. (United Lincoln) and in 1989, it amalgamated with Continental Gold Corp. (Continental Gold). About one year later, additional diamond drilling discovered additional gold-copper mineralization on the property (Southern Star deposit).

In mid-1990, Placer Dome Inc. (Placer Dome) purchased from BP its share of the mineral claims that covered the Main and Southern Star deposits. Placer Dome then acquired Continental Gold and in late 1990, Placer Dome resumed diamond drilling on the property.

EXPLORATION METHODOLOGY

Exploration methodology that led to the discovery and definition of the Mt. Milligan deposits consisted of prospecting, geological mapping, soil geochemical surveys, geophysical surveys, trenching and diamond drilling. Mineralized float and then mineralized outcrops were discovered in the Mt. Milligan area by prospecting. Areas containing the outcrops and float were investigated by geological mapping, soil sampling, ground geophysical surveys, trenching and diamond drilling. This work led to the discovery of the Main deposit when diamond-drill hole 13, which was drilled into a small magnetic anomaly, intersected high-grade copper-gold mineralization over large intervals. Following the discovery, ground geophysical surveys continued and an airborne geophysical survey was conducted followed by extensive diamond drilling. This work delineated the Main deposit, and led to the discovery and definition of the Southern Star deposit.

Geological Mapping and Prospecting

Geological mapping and prospecting were conducted mostly in upland areas that extend from west of the Southern Star and Main deposits, to north of Mt. Milligan (Figure 3). A continuous layer of till and fluvial material covers the deposits and the lowland areas to the east and south. In the area of the deposits, diamond drilling indicated that the overburden is up to 100 m thick and is composed of a mixture of clay, silt and sand, and pebbles, cobbles and boulders of rocks that occur in the region.

Soil Geochemical Surveys

Approximately 2,000 soil samples were collected from a six by seven kilometre area that covers and surrounds the Mt. Milligan deposits (Figure 3). Most of the soil samples were taken from the B horizon developed in till or fluvial material. The majority of samples were collected at 100 m intervals on lines 200 m apart. Within an area of two by three kilometres, which partly overlaps and lies to the west of the Mt. Milligan deposits, samples were collected at intervals of 50 m along lines 50 or 100 m apart.

All soil samples were analyzed for 31 elements by Inductively Coupled Plasma Spectrometry (ICP) after digestion with aqua regia. Analytical results outlined numerous copper-gold anomalies within the two by three kilometre area of detailed sampling. This area covers the Creek and Esker vein systems, and adjacent areas where weak gold-copper porphyry mineralization was subsequently discovered. Over the Main and Southern Star deposits, an extensive cover of glacial fluvial and morainal material masked the soil geochemical response. In the adjacent North Slope area, west of the deposits, the response is much higher as outcrop is close to, or at, surface and downslope dispersion is prevalent.

Geophysical Surveys

Ground magnetic, induced polarization and VLF-EM surveys were completed over a five by five kilometre area that covers the Mt. Milligan deposits, and the area around Heidi Lake to the west (Figure 3). An airborne magnetic survey over a 10 by 15 km area that coincides with the western portion of the Mt. Milligan property was completed also.

The magnetic surveys outlined a large regional magnetic high centred over Mt. Milligan, with the deposits on its southeastern flank. This magnetic high is related to the Mt. Milligan Intrusive Complex, which indicates that the complex is more extensive than its area of exposure. The Mt. Milligan deposits are characterized by weak magnetic highs that lie above the complex on its southern flank.

The induced polarization surveys outlined a large donut-shaped chargeability anomaly with its centre west of the Mt. Milligan deposits. The strongest portion of the chargeability anomaly coincides with a sulphide-rich halo associated with the deposits.

Trenching

Extensive trenching was conducted on the Mt. Milligan property after the discovery of the Main and Southern Star deposits. It was targeted at copper and/or gold soil geochemical anomalies in areas adjacent to the deposits.

Diamond Drilling

Diamond drilling was the primary exploration tool used to find and delineate mineralized zones. A total of 194,467 m of geotechnical and diamond drilling in 919 holes was completed by Lincoln, United Lincoln, Continental Gold and Placer Dome between February, 1987 and April, 1991.

GEOLOGY

Regional Geology

The Mt. Milligan deposits lie within a belt of Triassic-Jurassic rocks of the Early Mesozoic Quesnel Terrane (Figure 4). This terrane comprises a north-northwesterly trending belt of rocks stretching about 1,200 km through British Columbia from the United States border to the Yukon border. The Mt. Milligan deposits are midway along the belt.

The Quesnel Terrane includes rocks of Upper Triassic to Lower Jurassic Takla Group and Nicola Group. In the Mt. Milligan area, the Quesnel Terrane comprises several intrusive complexes and coeval volcanic and sedimentary rocks of the Takla Group (Figure 5). In the northern part of the area, the Hogem Batholith forms the axis of the Takla Volcanic Arc along the western margin of the terrane. A volcanic complex is present between Mt. Milligan and Chuchi Lake (Nelson et al., 1992), in the central portion of the area. In the southeastern part of the area, the Mt. Milligan intrusive complex occurs on the eastern side of the Takla Arc. This shift of intrusions implies that the axis of the arc is offset from the western to the eastern side of the Quesnel Terrane, suggesting a major cross-arc structure is present.

In the Mt. Milligan area, Takla Group rocks comprise the informal Rainbow Creek, Inzana Lake, Witch Lake and Chuchi Lake formations (Nelson et al., 1991). Volcanic rocks of the Witch Lake and Chuchi Lake formations form the core of the volcanic complex and are flanked by sedimentary rocks of the Inzana Lake and Rainbow Creek formations (Nelson et al., 1992). Slate, and lesser siltstone and epiclastic sedimentary rocks form the lowermost Rainbow Creek formation. The overlying Inzana formation contains epiclastic sedimentary rocks, which are overlain by, and interfingered with, augite porphyritic volcanic rocks and pyroclastic rocks of the Witch Lake formation. These rocks grade upward into polymictic lahars and subaerial flows of the Chuchi Lake formation.

The volcanic complex coincides with a composite regional magnetic high that is the manifestation of several small intrusive complexes. These intrusive complexes are composed of large plutons and stocks ranging in composition from gabbro to syenite. They occur at Mt. Milligan, and southwest and northeast of Chuchi Lake. Other single and composite plutons are present between these areas.

Crowded feldspar porphyritic monzonite stocks and dykes that are associated with copper-gold volcanic-type alkalic porphyry-style mineralization are related to the intrusive complexes and occur within and around the margins of the volcanic complex. These plutons are manifested by small magnetic highs on the flanks of the large composite regional magnetic high. The best examples of these monzonite stocks are MBX, Southern Star and Goldmark stocks at Mt. Milligan. Several monzonite bodies also are present southwest, north and northeast of Chuchi Lake.

Property Geology

The Mt. Milligan property is underlain mostly by volcanic rocks of Witch Lake formation (Figure 6; Nelson et al., 1991). Minor sedimentary rocks of Rainbow Creek formation, and Early Tertiary volcanic and sedimentary rocks are also present. The Witch Lake formation is intruded by coeval Takla Group and post-Takla Group intrusions. Coeval intrusions comprise most of the Mt. Milligan intrusive complex, which consists dominantly of monzonitic rocks with minor dioritic/monzodioritic and gabbroic/monzogabbroic rocks. The MBX, Southern Star, Goldmark and North Slope stocks, which host mineralization on the Mt. Milligan property, are composed of monzonitic rocks. Post-Takla Group intrusions are composed of granitic rocks, which form a minor portion of the Mt. Milligan complex.

Deposit Geology

The Mt. Milligan deposits comprise the Main and the Southern Star deposits (figures 7 to 10). The Main deposit comprises the MBX zone, the 66 zone, the WBX zone, and the DWBX zone. The Main deposit occurs within the MBX stock and adjacent latitic and trachytic volcanic rocks of Witch Lake formation (Table 1). The Great Eastern fault, a moderately easterly-dipping, northerly to northwesterly-trending structure truncates the extreme southeastern portion of the Main deposit, separating it from sedimentary rocks of Rainbow Creek formation and Early Tertiary volcanic and sedimentary rocks. The Main deposit is separated from the Southern Star deposit by the steeply-dipping northwesterly-trending Divide fault. The Southern Star deposit occurs within the Southern Star stock, and adjacent andesitic volcanic rocks of Witch Lake formation (Table 1).

Rocks of Witch Lake formation generally trend north-northwest and dip moderately to steeply to the east (Figure 7). However, north of the Main deposit, this strata dips steeply to the west. In the southeastern portion of the Mt. Milligan deposits, the stratigraphy trends northerly to northeasterly. Graded bedding and cross-bedding in tuffaceous rocks indicate that the stratigraphy faces east.

Andesitic Volcanic Rocks

Andesitic volcanic rocks underlie most of the area around the Southern Star stock and areas away from the MBX stock. Monolithic fragmental varieties form most of the unit. They are characterized by actinolite-altered augite porphyritic lapilli tuff with minor augite crystal and lithic tuff. Minor augite porphyritic flows ~~and~~ heterolithic ~~debris~~ flows are interbedded with the fragmental rocks. Plagioclase and/or hornblende phenocrysts are locally present within flows, individual lapilli or crystal tuff.

Table 1

Rock Units of the Main and Southern Star Deposits

Post-Mineral Dykes

Plagioclase diorite porphyry
Plagioclase monzonite porphyry
Trachyte

MBX and Southern Star Stocks

Plagioclase monzonite porphyry
Plagioclase - hornblende monzonite porphyry
Zenolithic monzonite porphyry
Monzonite - volcanic hybrid
Hydrothermal breccia

Trachytic Volcanic Rocks

Trachytic flow
Bedded trachytic tuff

Latitic Volcanic Rocks

Latitic rocks - undifferentiated
Pyroxene latitic crystal tuff
Pyroxene latitic lapilli tuff
Latitic tuff
Pyroxene latitic porphyry flow

Andesitic Volcanic Rocks

Andesitic rocks - undifferentiated
Pyroxene andesitic porphyry flow
Pyroxene andesitic crystal tuff
Pyroxene andesitic lapilli tuff
Andesitic tuff

Latitic Volcanic Rocks

Latitic volcanic rocks are texturally similar to andesitic volcanic rocks because they are potasically-altered andesites. They underlie most of the area around the MBX stock and, less commonly, areas adjacent to the Southern Star stock. The latitic volcanic rocks can be distinguished from andesitic volcanic rocks by the following characteristics: a darker colour; general absence of visible hornblende; presence of biotite; and based on staining, greater than one-third potassic feldspar content. The darker colour is probably due to the presence of biotite, which may be related to potassium metasomatism. The general absence of hornblende may be a result of destruction during potassium metasomatism.

Trachytic Volcanic Rocks

Trachytic volcanic rocks are interbedded with latitic volcanic rocks in the eastern portion of the Main deposit (Figures 8, 9 and 10). They are the only indication of stratigraphy in the area of the deposits. They are characterized by high potassium feldspar content and a lack of mafic minerals. Minor fine-grained plagioclase is also present.

Massive and bedded varieties of trachytic rocks occur on the property. Massive varieties contain curvilinear pyrite-chlorite partings and clots of chlorite, calcite and rare epidote around the core of pyrite. Bedded varieties locally exhibit cross-bedding and graded bedding. Pyrite and chlorite are common along bedding planes and throughout. Bedded varieties are generally discontinuous. They occur above and below the massive trachytic volcanic rocks and extend laterally from them. Trachytic volcanic rocks are porous rocks that are intensely potassically-altered.

Intrusive Rocks - Pre and Synmineral

The MBX stock is a moderately westerly-dipping monzonite body approximately 400 m in diameter (Figures 8, 9 and 10). In the southeastern portion of the Main deposit, the Rainbow dyke, a large dyke up to 50 m wide, protrudes from the footwall of the MBX stock forming an elongate bowl-like shape with gently-dipping sides open to the southeast. The southwestern side is subparallel to stratigraphy as defined by interbedded trachytic volcanic rocks. The northeastern side appears to cross-cut stratigraphy.

The Southern Star stock is a moderately westerly-dipping, north-northwesterly striking, tabular body of monzonite, which forks at its northern end (figures 9, 10 and 11). In plan view, its margins are more irregular and undulose than those of the MBX stock. The stock is approximately 800 m long by 300 m wide.

The MBX and Southern Star stocks contain up to 30% plagioclase feldspar phenocrysts, 1 to 10 mm in length. These phenocrysts occur within a fine-grained greyish-pink groundmass composed mostly of potassium feldspar with lesser plagioclase feldspar, and minor quartz, hornblende, biotite and accessory magnetite.

Within the stocks, monzonite varies texturally and compositionally. In general, the Southern Star stock has coarser plagioclase phenocrysts than the MBX stock. Some of the margins of stocks, particularly of the Southern Star stock, are characterized by a plagioclase hornblende porphyritic monzonite border phase. Rafts of volcanic rocks are common in both stocks. Localized areas of monzonite contain xenoliths of mainly volcanic rocks and/or lesser earlier monzonite.

Along the contact of the stocks, particularly the MBX, is a monzonite-volcanic hybrid. This rock has gradational boundaries and its textures are characteristic of both monzonitic and volcanic rocks. It contains ghosts of plagioclase phenocrysts and remnants of augite phenocrysts.

Late synmineral plagioclase hornblende porphyritic monzonite dykes are common throughout the Southern Star stock.

Hydrothermal breccia occurs extensively throughout the Southern Star stock, and less commonly in adjacent volcanic rocks and along the margins of the MBX stock. It is characterized by potassium feldspar veinlets and flooding that vary in amount and size. This rock appears to grade from massive relatively-unaltered monzonite to a crackle breccia, and then to a well-developed breccia with a potassium feldspar-rich matrix. In volcanic rocks, clasts appear rotated in areas of much veining, brecciation and potassium feldspar flooding. The clasts are generally of the same composition as the host rock, although uncommon exotic lithologies are present. The veinlets are composed dominantly of potassium feldspar with minor quartz. In areas of extensive brecciation and intense potassium feldspar flooding, the matrix is aplitic.

Intrusive Rocks - Post-Mineral

Three types of post-mineral dykes cut the Main and Southern Star deposits: trachytic, monzonitic and dioritic varieties. These dykes are generally fresh-looking and lack sulphide mineralization that is common throughout the deposits.

The trachytic dykes are the earliest and are most common in the southwestern portion of the Main deposit, and northern portion of the Southern Star deposit. They are up to 15 m wide, strike northeasterly and dip moderately to the northwest. Trachytic dykes are grey, fine-grained and may contain accessory magnetite.

The monzonitic dykes formed after the trachytic dykes. They occur throughout the Main and Southern Star deposits. Monzonitic dykes are up to 10 m wide, strike northeasterly and dip moderately to the northwest. They are characterized by abundant plagioclase phenocrysts, up to 2 mm, and may contain augite phenocrysts up to 5 mm. The phenocrysts occur in a fine-grained potassium feldspar-rich matrix, as indicated by staining. Accessory magnetite is always present. Some monzonitic dykes are weakly propylitized.

The dioritic dykes are latest. Although they occur in both deposits, they are most common in the northern portion of the Main deposit. These dykes are up to 5 m wide, strike northwesterly and dip steeply to the northeast. Dioritic dykes are characterized by abundant plagioclase phenocrysts, up to 10 mm, in a fine-grained matrix. Lesser hornblende phenocrysts, up to 2 mm, and minor quartz eyes, up to 1 mm, are present also. Some dioritic dykes are weakly carbonate altered.

Alteration

Potassic and propylitic alteration assemblages are present throughout the Main and Southern Star deposits. Gold and copper mineralization are mainly associated with the potassic assemblage. Minor post-mineral carbonate alteration is present also.

Potassic alteration is developed best around the contacts of the MBX and Southern Star stocks. It decreases in intensity towards the core of the stocks and away from the contacts into the country rocks. Propylitic alteration is developed best outside the zone of potassic alteration, away from the stocks. The propylitic alteration assemblage locally overprints the potassic alteration assemblage; less commonly, potassic overprints propylitic. These relationships exist because the two types of alteration are contemporaneous.

Potassic Alteration

Potassic alteration is characterized by secondary potassium feldspar. In areas of intense potassic alteration, secondary biotite, chalcopyrite, lesser magnetite and minor bornite occur in addition to potassium feldspar. The following discussion focuses on the non-metallic minerals of the potassic-alteration assemblage. Metallic minerals are discussed in the section on mineralization.

Secondary biotite is developed best in latitic and trachytic volcanic rocks. In these rocks, it occurs as fine-grained felted patches that comprise up to 40% or more of the volcanic rocks adjacent to monzonite intrusions, and it decreases away from them. Biotite also occurs along the margins of potassium feldspar veinlets within latitic and trachytic volcanic rocks. Within andesitic rocks, secondary biotite occurs only adjacent to potassium feldspar veinlets. In areas of intense biotite alteration, primary textures may be completely destroyed or relict porphyritic textures may be left, with augite phenocrysts being replaced by actinolite.

Secondary potassium feldspar alteration of andesitic volcanic rocks is responsible for the predominent occurrence of latitic and trachytic volcanic rocks in the Main deposit. It occurs as veinlets, or as patchy to pervasive fine-grained greyish alteration. Relict phenocrysts, replaced by actinolite and calcite, are present locally. Veinlets are composed of potassium feldspar with accessory quartz and minor calcite. In andesitic rocks, potassium feldspar occurs only in veinlets that are generally close to intrusive contacts.

Potassic-feldspar alteration within monzonitic rocks is similar to that in volcanic rocks but is greyish pink.

Propylitic Alteration

Propylitic alteration is characterized by epidote, albite, calcite, chlorite and pyrite, and is developed best in andesitic and latitic volcanic rocks. The following discussion focuses on the non-metallic minerals of the propylitic alteration assemblage. Metallic minerals are discussed in the section on mineralization.

Epidote, the most common and widespread propylitic alteration mineral, is generally associated with pyrite. It occurs in narrow alteration envelopes around pyrite-calcite veins, or as veinlets with chlorite and calcite. Epidote clots replaced mafic minerals and the groundmass of volcanic rocks. Some clots have pyrite cores and also contain minor albite. Minor late epidote is present in post-mineral dykes.

Albite forms irregular patches that pervade the groundmass of volcanic rocks. Albite may be intergrown with minor epidote although generally the two do not occur together in trachytic volcanic rocks. Minor albite may be present within clots of epidote, chlorite and calcite in andesitic and latitic volcanic rocks. Albite also occurs within pipe-like zones.

Calcite occurs mainly as a replacement of the groundmass in volcanic rocks and of actinolite, which is a pseudomorph of augite. It also occurs in clots and veinlets with epidote, chlorite and pyrite within latitic and andesitic volcanic rocks. Within trachytic volcanic rocks, it occurs in clots with chlorite and pyrite.

Replacement of plagioclase by sausserite is common within the MBX and Southern Star stocks, and the Rainbow dyke. Plagioclase phenocrysts are altered to pale-green aggregates of sericite, epidote, chlorite and calcite. Minor sericite also occurs within selvages of potassium feldspar and quartz veinlets in the Esker zone.

Carbonate Alteration

Post-mineral calcite and ankerite veinlets cut all rock types. The ankerite veins are commonly associated with major structures that locally contain tectonic breccias with carbonate flooding.

Hypogene Mineralization

Mineralization within the Main deposit occurs in the MBX, 66, WBX and DWBX zones (Figure 7). The MBX zone is in the central portion of the deposit, along the footwall of the MBX stock, and surrounds the Rainbow dyke where it protrudes from the stock. The MBX zone contains gold and copper, and grades into the 66 zone to the southeast. The gold-rich and copper-poor 66 zone surrounds the Rainbow dyke. The WBX zone and its downfaulted extension, the DWBX zone, are in the northwestern portion of the deposit. Both occur along the hanging wall of the MBX stock, and contain gold and copper.

The Southern Star deposit occurs in the hanging wall and footwall of the Southern Star stock. It contains gold and copper.

Mineralization consists mostly of chalcopyrite, lesser magnetite and minor bornite in areas of potassic alteration, and pyrite in areas of propylitic alteration. In areas of potassic alteration, mineralization is developed best in monzonitic and volcanic rocks adjacent to the footwall and, to a lesser extent, the hanging wall contact of the stocks. It is also present in and around trachytic volcanic rocks and the Rainbow dyke. In areas of propylitic alteration, mineralization generally decreases away from the stocks.

Chalcopyrite

Chalcopyrite is associated with potassic alteration in volcanic and monzonitic rocks. It is most abundant where potassium feldspar veinlets are present. A decrease in chalcopyrite occurs with increasing distance from intrusive contacts.

Chalcopyrite occurs mostly as fine-grained disseminations and fracture fillings, and less commonly as veinlets and selvages of veinlets. Disseminations commonly occur in biotite-rich envelopes that surround veins. Adjacent to the MBX stock, chalcopyrite may be accompanied by pyrite, forming coarse sulphide aggregates. Chalcopyrite-bearing veins contain pyrite and magnetite in a gangue of potassium feldspar, quartz and calcite. In massive trachytic volcanic rocks, chalcopyrite occurs with pyrite along curvilinear partings and as disseminations.

Chalcopyrite also occurs in gold-rich quartz veinlets in the WBX, DWBX and Southern Star zones. Minor potassium feldspar alteration envelopes are associated with these veins, which contain more quartz than other veins on the property.

Magnetite

Magnetite is present throughout the areas of potassic alteration and is less common within propylitic alteration. It occurs as disseminations, patches, and in veinlets and breccia matrix. A unique occurrence of magnetite breccia, called the Magnetite Breccia Zone, is a small zone of 50% massive magnetite veins along the contact of the MBX stock. Disseminated magnetite is most common in biotite-rich rocks. Veinlets with magnetite contain pyrite, chalcopyrite, potassium feldspar and calcite. Trachytic rocks contain magnetite-rich laminae.

Bornite

Bornite occurs as blebs and disseminations in lensoid zones within volcanic rocks close to the footwall contacts of the MBX and Southern Star stocks. Potassium feldspar veinlets are common in these areas. It also occurs within the southern portion of the Southern Star stock.

Pyrite

Pyrite content increases sharply from potassically-altered to propyliticallyaltered rocks, where it is most abundant. Pyrite occurs as disseminations, veinlets, large clots, patches and as a replacement of mafic minerals. In the 66 zone, gold is associated with 10% to 20% coarse pyrite. Several generations of pyrite veinlets are indicated by cross-cutting relationships. Pyrite occurs also as a minor constituent of veins in potassically-altered rocks. In trachytic rocks, pyrite occurs with chalcopyrite in curvilinear partings.

Gold

Gold occurs as grains ranging from 5 μm to 100 μm. The grains fill microfractures, adhere to imperfections on the outside of pyrite grains, and also occur as inclusions in pyrite, chalcopyrite, and magnetite grains. Visible gold is rare.

Supergene Alteration

Supergene alteration in the Mt. Milligan deposits is recognized in the MBX, WBX and Southern Star zones. The alteration is deeper and more extensive in the MBX and WBX zones than in the Southern Star zone. In the MBX and WBX zones it is approximately 20 metres thick over most of the area, with localized areas up to 60 metres. However, supergene enrichment is only sporadic and does not form a well-defined zone.

Secondary copper minerals identified in rocks with supergene alteration consist of sulphides (covellite, chalcocite and djurleite), oxides (cuprite and tenorite), carbonates (malachite and azurite) and native copper. The sulphides occur as rims around chalcopyrite. Oxides, in particular cuprite, occur as surface coatings on native copper.

Secondary copper minerals commonly occur with iron oxides (goethite, magnetite and hematite) and iron carbonate (siderite), particularly where malachite and azurite are present. Hydrous iron oxides, which are generally referred to as limonite and include goethite, commonly replace chalcopyrite and pyrite. Limonite either completely replaces sulphide minerals or occurs only as coatings on surfaces of fractures and hairline cracks. Limonitic coatings commonly occur at depths greater than those where pyrite or chalcopyrite are completely replaced.

Polymetallic Veins

Gold-silver-bearing veins are present in volcanic rocks adjacent to the MBX and Southern Star stocks. They comprise sulphide-rich and carbonate-quartz-rich types. The sulphide-rich veins occur in the Creek and Esker zones (Figure 7), and are hosted by andesitic volcanic rocks. They contain mostly pyrite with lesser chalcopyrite, sphalerite, galena, molybdenite, arsenopyrite and tetrahedrite-tennantite, and minor quartz, potassium feldspar, and carbonate. Potassium feldspar alteration envelopes are well-developed in surrounding intensely propylitically-altered andesitic volcanic rocks. The carbonate-quartz-rich veins, which contain sphalerite, galena and pyrite, occur in propylitically-altered latitic volcanic rocks northwest and northeast of the MBX stock.

Structure

At least four episodes of post-mineral faulting affected the area containing the Mt. Milligan deposits. The earliest is manifested by the northerly-trending, shallowly east-dipping Great Eastern and Rainbow faults (Figure 7). The Great Eastern Fault is a major regional structure, which truncates the extreme southeastern portion of the Main deposit. The Rainbow fault follows the Rainbow dyke, and may be a splay off the Great Eastern fault.

Northwesterly-trending steeply east-dipping faults that are manifested by the Divide fault and the #5, #7, #8, #9, #10, #12 and #13 faults occur in the Southern Star deposit and in the western portion of the Main deposit (Figure 7). The Divide fault separates the Southern Star and Main deposits.

Northerly-trending faults are manifested by the steeply east-dipping Harris fault (figures 7 and 10). The Harris fault separates the WBX and DWBX zones. The northerly-trending structures may be related to Tertiary block faulting.

Prominent east-northeasterly-trending cross faults are the latest episode of faulting in the Mt. Milligan deposits. These structures include the Oliver fault, the Caira faults and the Southern Star cross faults (Figure 7). The Caira faults may belong to an earlier episode of faulting that predates the Rainbow fault.

METAL ZONING

Copper and Gold Distribution

Higher copper grades are related to concentrations of chalcopyrite, which are greatest near the margins of the MBX and Southern Star stocks. In general, higher copper values occur along the footwall of the Southern Star stock and as a halo around the MBX stock.

The distribution of higher gold grades is similar to copper, but with several important differences. Where concentrations of chalcopyrite are greater near the margins of the MBX and Southern Star stocks, gold values are higher. However, within the 66 zone, where chalcopyrite is sparse and pyrite is abundant, higher gold grades are associated with zones where clots of pyrite, carbonate and chlorite are present. Generally, gold grades are lower around the Southern Star stock and have a much broader distribution around the MBX stock, particularly in the 66 zone where the highest grades occur.

Lower Au/Cu ratios (gm/%), occur in the Southern Star deposit, whereas higher ratios, which indicate higher gold, occur away from the MBX stock. In particular, the highest ratios occur in the Esker vein zone and the 66 zone.

In summary, copper and gold mineralization form a core zone around which peripheral gold-only mineralization occurs in the upper portion of the hydrothermal system.

Gold Fineness

The fineness of gold $\{(Au/(Au+Ag))x1000\}$ for a group of samples collected throughout the deposits was determined. Results indicate that two populations are present: a higher fineness for samples internal to the deposits; and a lower fineness for samples external to the deposits. This pattern is related to the occurrence of silver-bearing veins along the margins of the deposits.

CONCLUSIONS

The Mt. Milligan intrusions, which include the MBX and Southern Star Stocks that host the Mt. Milligan copper-gold porphyry deposits, are aligned along a north-northwesterly trending belt indicating that their emplacement was structurally controlled. Assuming that the stocks are coeval with their host rocks, a rotation of moderately east-dipping trachytic rocks in the MBX and 66 zones to a horizontal position indicates that the stocks were probably nearly vertical when they were emplaced. This rotation would place the Southern Star stock at a lower level than the MBX stock. The hydrothermal system that formed the deposits probably developed soon after the emplacement of the stocks.

In and around the Southern Star stock, the intrusions and hydrothermal system were laterally constrained indicating that structural control dominated. This is manifested by:

1. The narrow elongate shape of the Southern Star stock;
2. The restricted occurrence of potassic alteration in and adjacent to the stock.

In and around the MBX stock , the intrusions and hydrothermal system spread laterally indicating that stratigraphic control dominated. This is manifested by:

1. The alignment of the Rainbow dyke subparallel to stratigraphy;
2. Intense potassic alteration of porous stratigraphic rocks;
3. The large lateral extent of potassic alteration; and
4. Metal zoning patterns where copper and gold in, and adjacent to, the MBX stock grade laterally to gold in trachytic and latitic rocks away from the stock.

The key feature that allowed the Mt. Milligan deposits to attain their size was the intersection of the intrusions and their associated hydrothermal system with a porous permeable stratigraphic interval that permitted the system to move laterally. This allowed for the development of the copper-gold rich MBX and gold-rich 66 zones. Post-mineral faulting and rotation of the deposits about 45° to the east resulted in a movement of a 1,500 metre vertical portion of the deposits to a shallow depth.

REFERENCES

Nelson, J., Bellefontaine, K., Green, K., and MacLean, M., 1991. Regional Geological Mapping Near the Mount Milligan Copper-Gold Deposit (93K/16, 93N/1). In Geological Fieldwork 1990. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 1991-1.

Nelson, J., Bellefontaine, K., Rees, C., and MacLean, M., 1992. Regional Geological Mapping in the Nation Lakes Area (93N/2E,7E). In Geological Field Work 1991. British Columbia Ministry of Energy, Mines and Petroleum Resources, Paper 1992-1.2

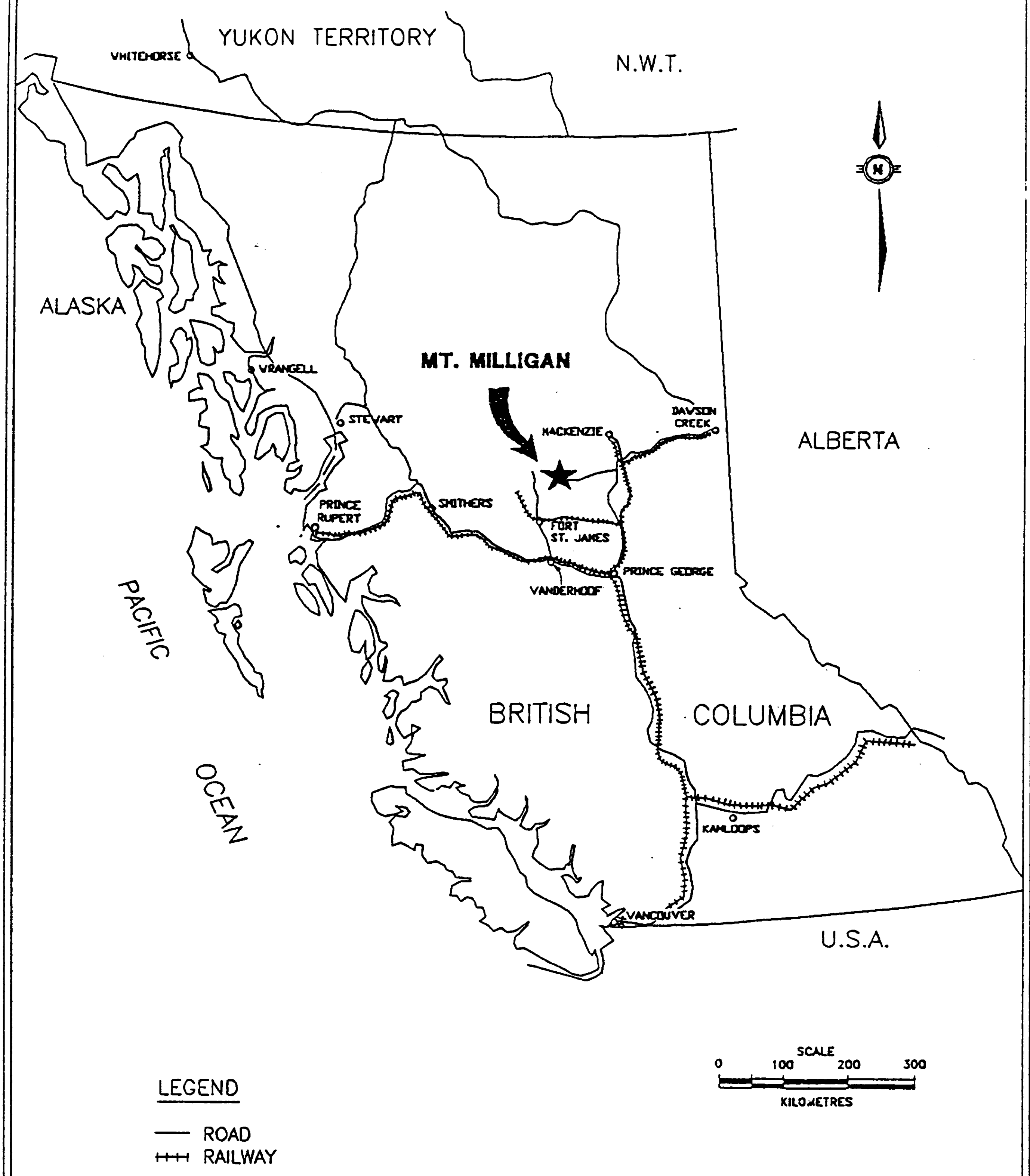


Figure 1

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

LOCATION MAP

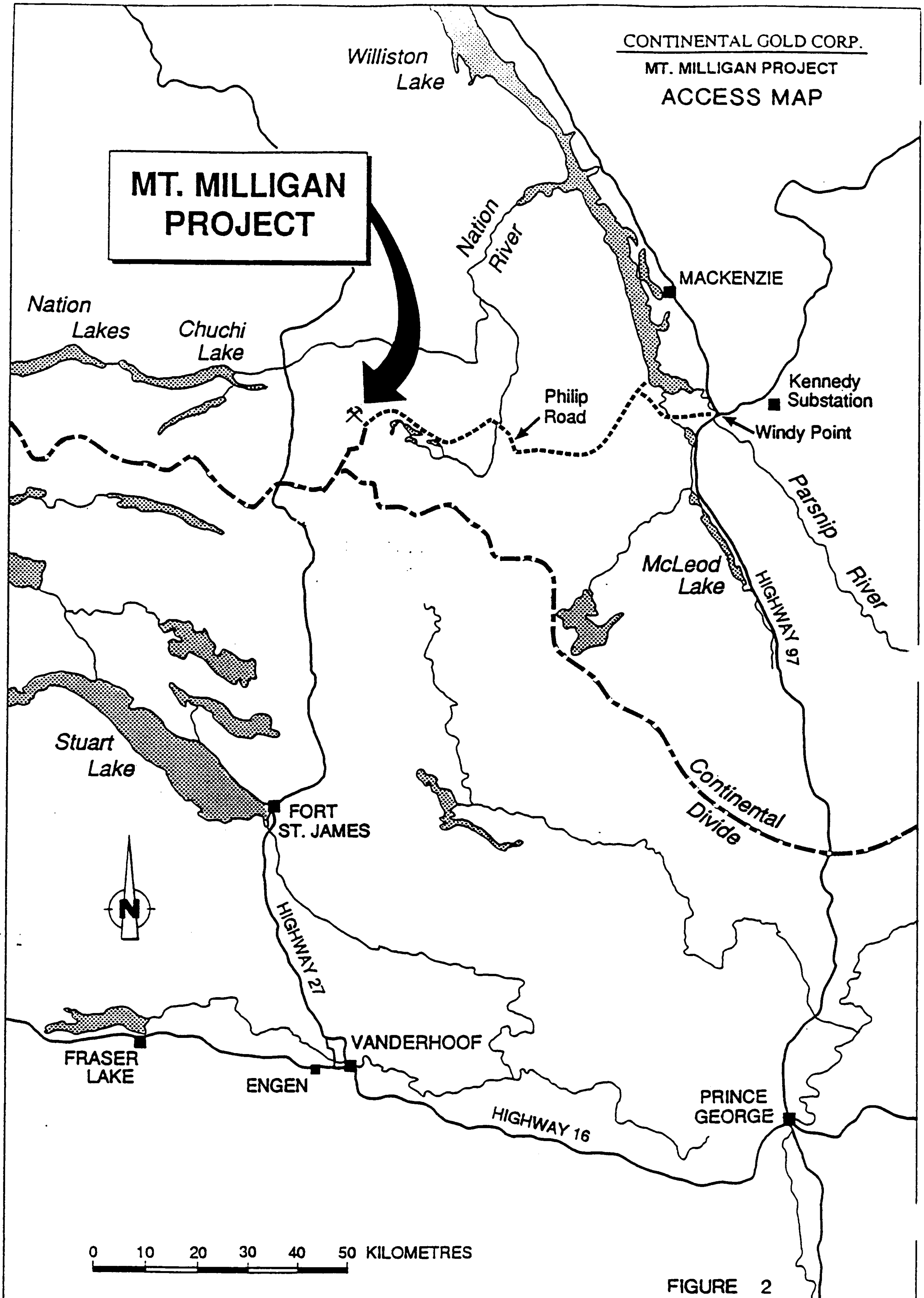
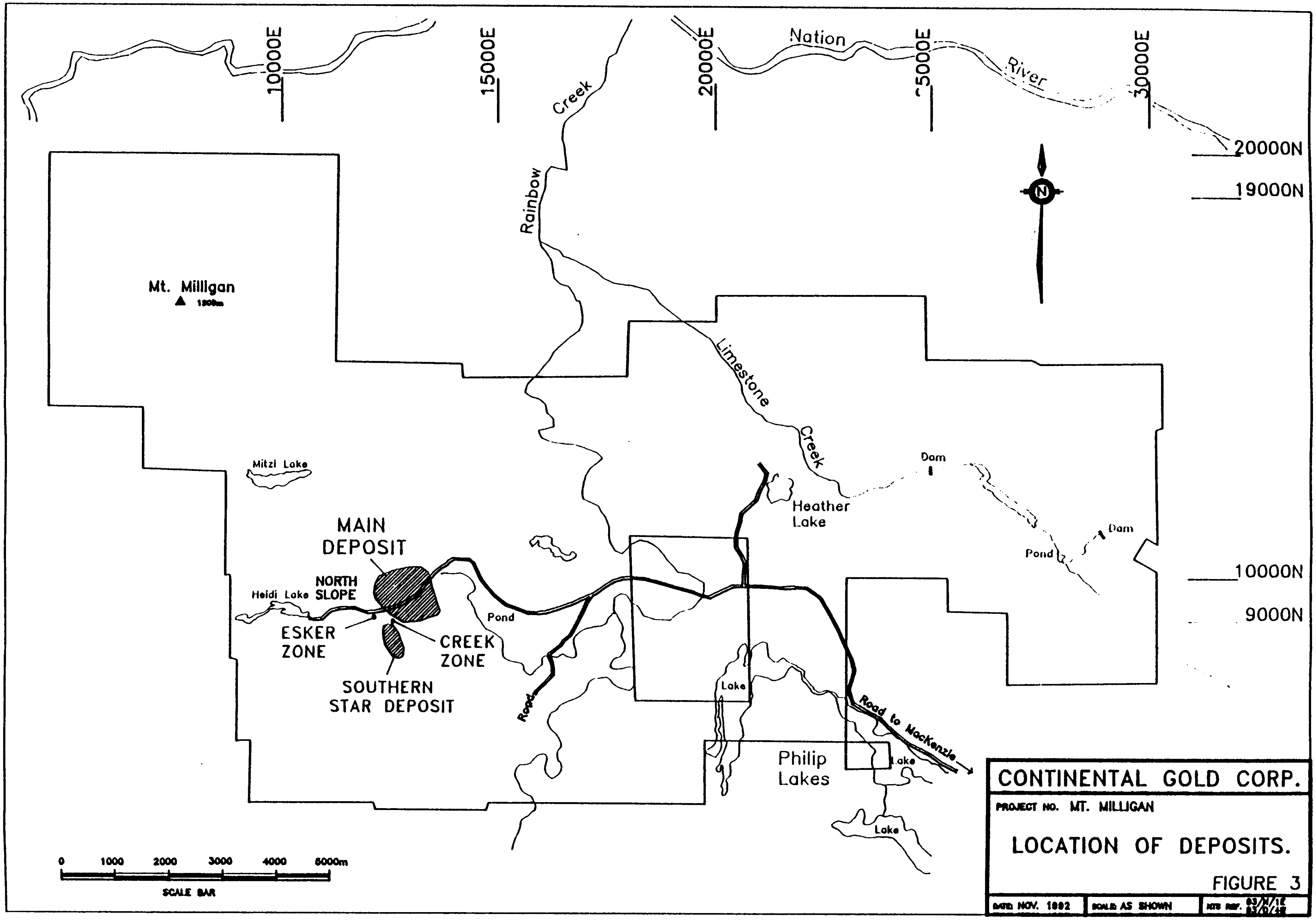
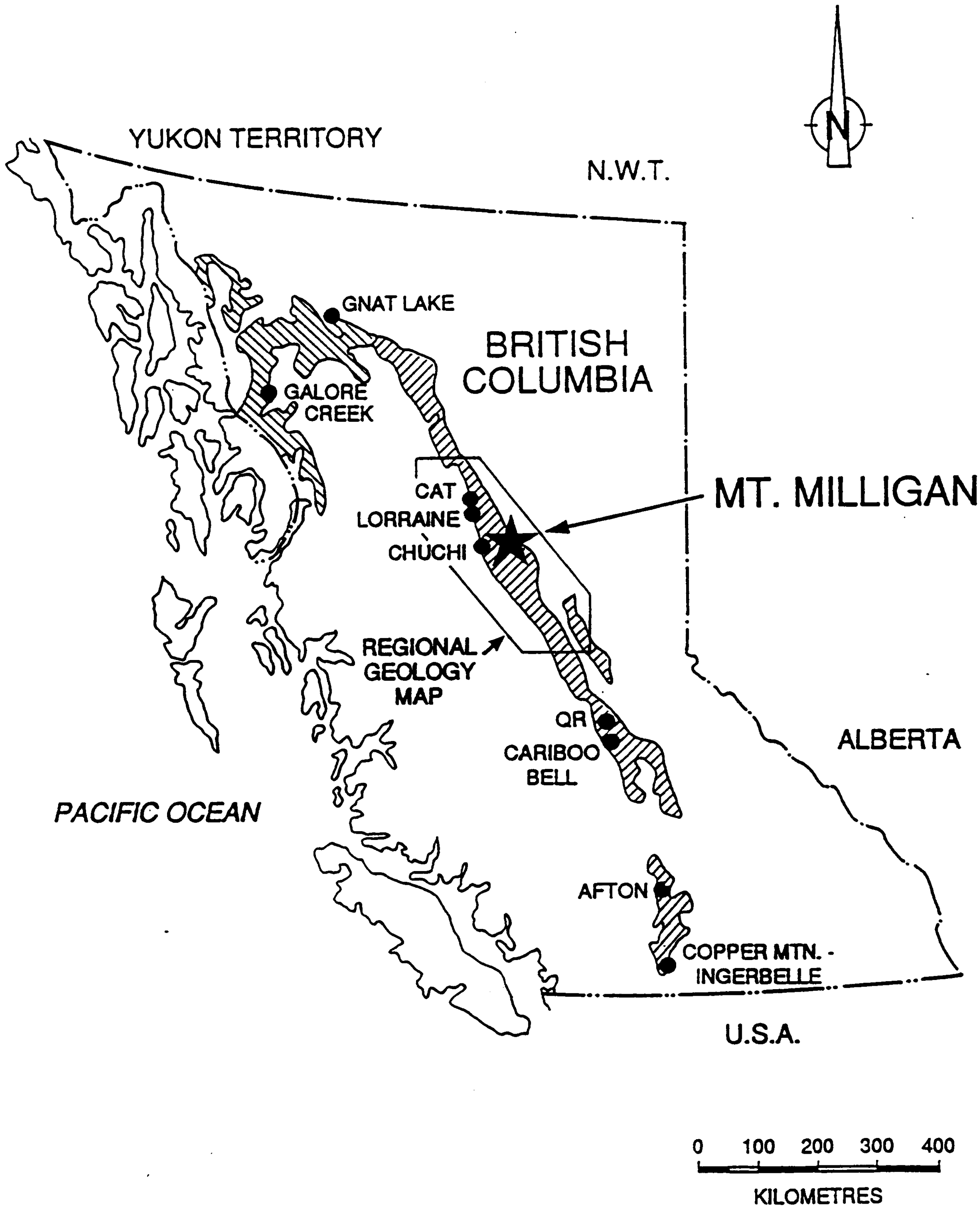

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT
ACCESS MAP
MT. MILLIGAN PROJECT
Williston Lake
Nation River
MACKENZIE
Nation Lakes
Chuchi Lake
Philip Road
Kennedy Substation
Windy Point
Parsnip River
McLeod Lake
HIGHWAY 97
Stuart Lake
FORT ST. JAMES
Continental Divide
N
HIGHWAY 27
FRASER LAKE
ENGEN
VANDERHOOF
HIGHWAY 16
PRINCE GEORGE
0 10 20 30 40 50 KILOMETRES

FIGURE 2


10000E
15000E
20000E
25000E
30000E
20000N
19000N
10000N
9000N
Nation
River
Rainbow
Creek
Limestone
Creek
N
Mt. Milligan
Mitzi Lake
MAIN
DEPOSIT
NORTH
SLOPE
Heidi Lake
ESKER
ZONE
CREEK
ZONE
SOUTHERN
STAR DEPOSIT
Pond
Road
Heather
Lake
Dam
Dam
Pond
Lake
Philip
Lakes
Lake
Lake
Road to MacKenzie
0
1000
2000
3000
4000
5000m
SCALE BAR
CONTINENTAL GOLD CORP.
PROJECT NO. MT. MILLIGAN
LOCATION OF DEPOSITS.
FIGURE 3
DATE: NOV. 1992
SCALE: AS SHOWN
NTS REF.



LEGEND

TRIASSIC-JURASSIC VOLCANIC ROCKS

- Quesnel Terrane
- Stikine Terrane
- ● Alkaline Cu-Au porphyry deposits

FIGURE 4

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

GEOLOGICAL SETTING

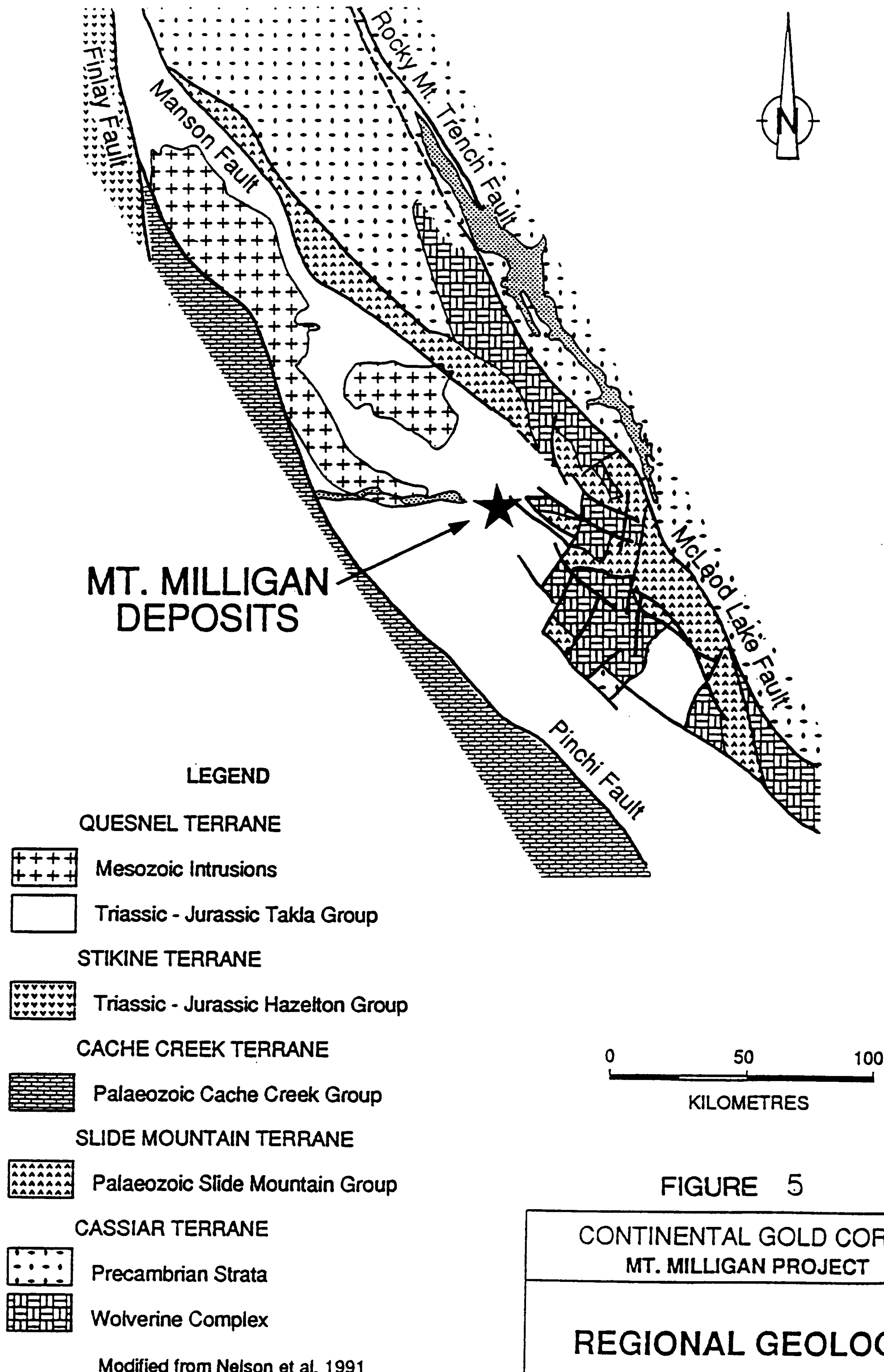
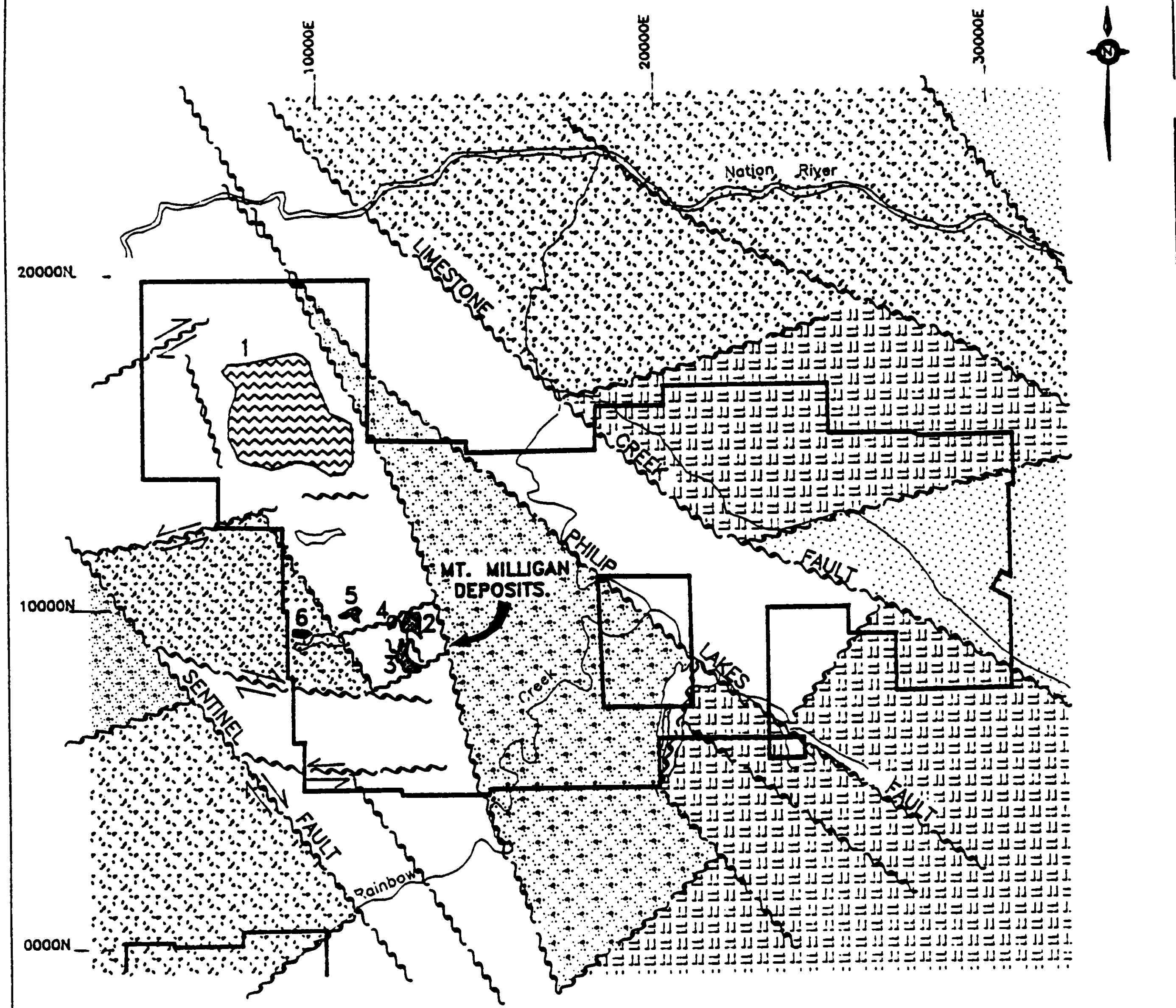


FIGURE 5

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

REGIONAL GEOLOGY



LEGEND

MESOZOIC – TERTIARY
- Sedimentary & Volcanic Rocks

TRIASSIC – JURASSIC
- Hornblende monzonite

MONZONITE
- Crowded feldspar porphyry
- Takla Group Sedimentary Rocks
- Takla Group Volcanic Rocks

UPPER PALAEOZOIC
- Slide Mountain Group

PROTEROZOIC
- Wolverine Complex

- Major Regional Fault
- Placer Dome Inc. Claims, Mt. Milligan Property

Modified from Nelson et al 1991.

1 Mt. Milligan Intrusive Complex
2 MBX Stock
3 Southern Star Stock
4 Goldmark Stock
5 North Slope Stock
6 Heidi Lake Stock

0 1000 2000 3000 4000 5000m
SCALE BAR

CONTINENTAL GOLD CORP.

PROJECT NO. MT. MILLIGAN.

PROPERTY GEOLOGY.

FIGURE 6

DATE NOV. 1992 | SCALE AS SHOWN | NTS REF. 93/N/1E, 93/O/4W

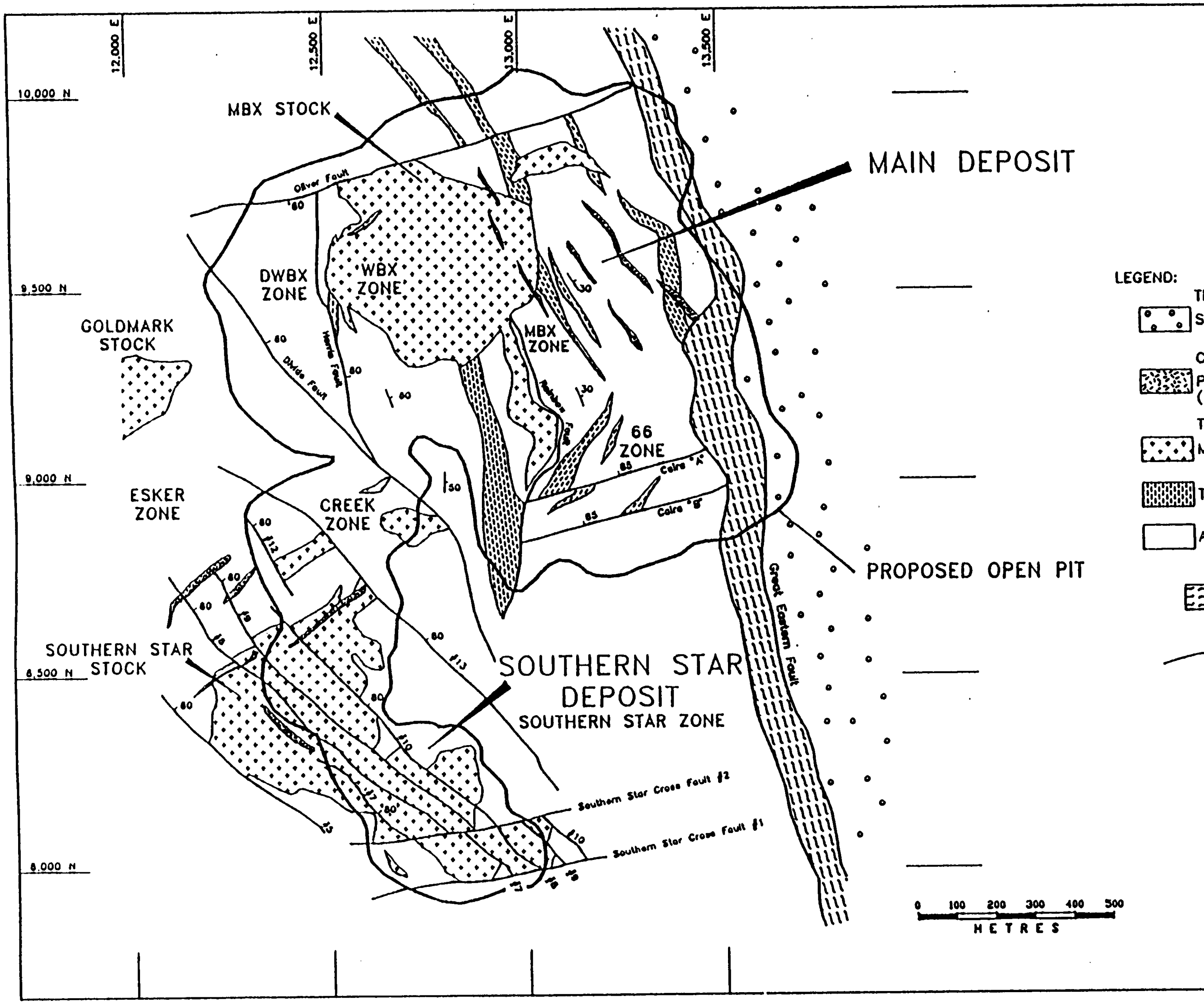


FIGURE 7

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

DEPOSIT GEOLOGY

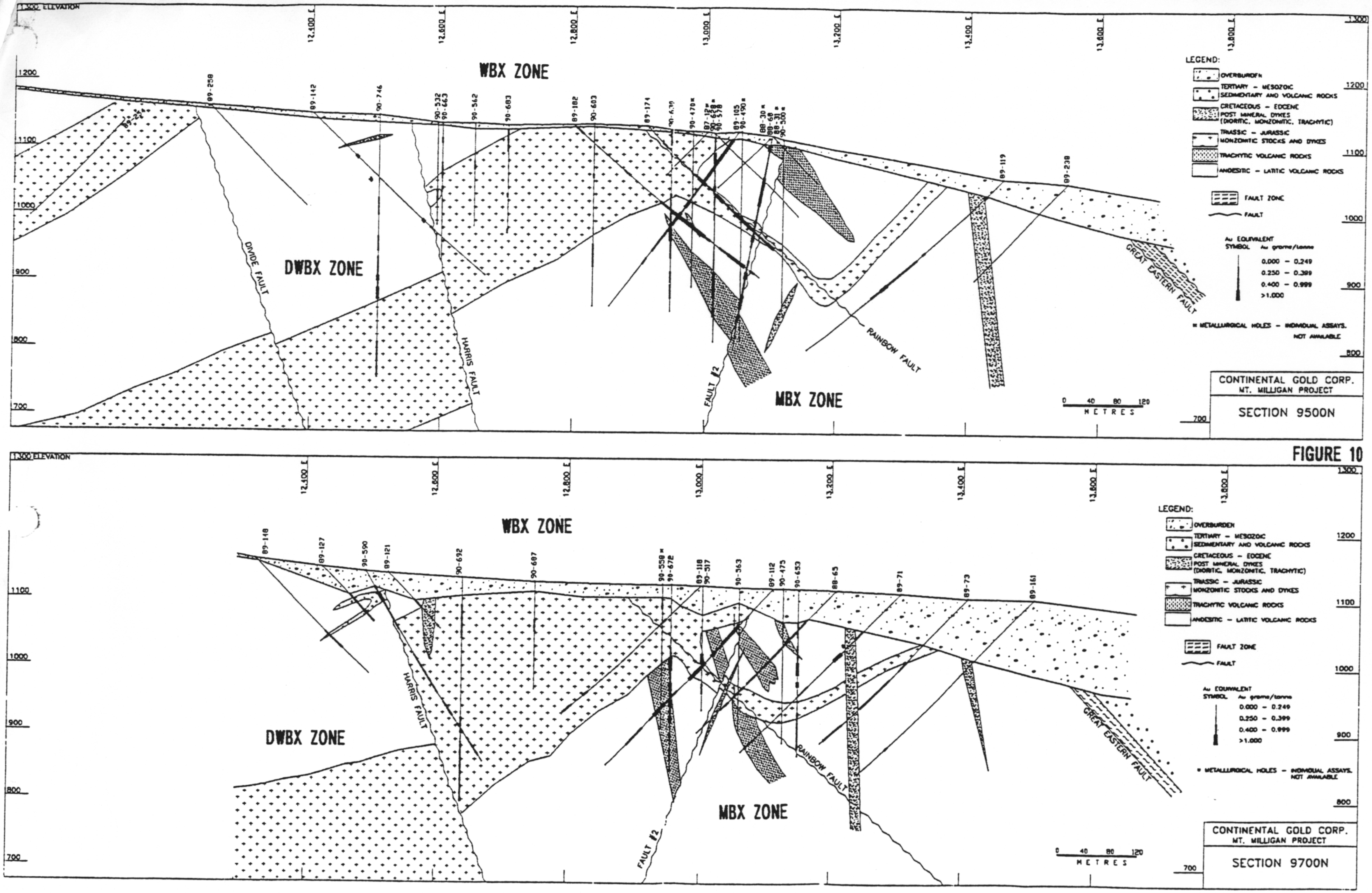

1300 ELEVATION
12,400 E
12,600 E
12,800 E
13,000 E
13,200 E
13,400 E
13,600 E
13,800 E
WBX ZONE
DWBX ZONE
MBX ZONE
DIVIDE FAULT
HARRIS FAULT
FAULT #2
RAINBOW FAULT
GREAT EASTERN FAULT
LEGEND:
OVERBURDEN
TERTIARY - MESOZOIC SEDIMENTARY AND VOLCANIC ROCKS
CRETACEOUS - EOCENE POST MINERAL DYKES (DIORITIC, MONZONITIC, TRACHYTIC)
TRIASSIC - JURASSIC MONZONITIC STOCKS AND DYKES
TRACHYTIC VOLCANIC ROCKS
ANDESITIC - LATITIC VOLCANIC ROCKS
FAULT ZONE
FAULT
Au EQUIVALENT SYMBOL Au grams/tonne
0.000 - 0.249
0.250 - 0.399
0.400 - 0.999
>1.000
* METALLURGICAL HOLES - INDIVIDUAL ASSAYS NOT AVAILABLE
0 40 80 120
METRES
CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT
SECTION 9500N
SECTION 9700N

FIGURE 10

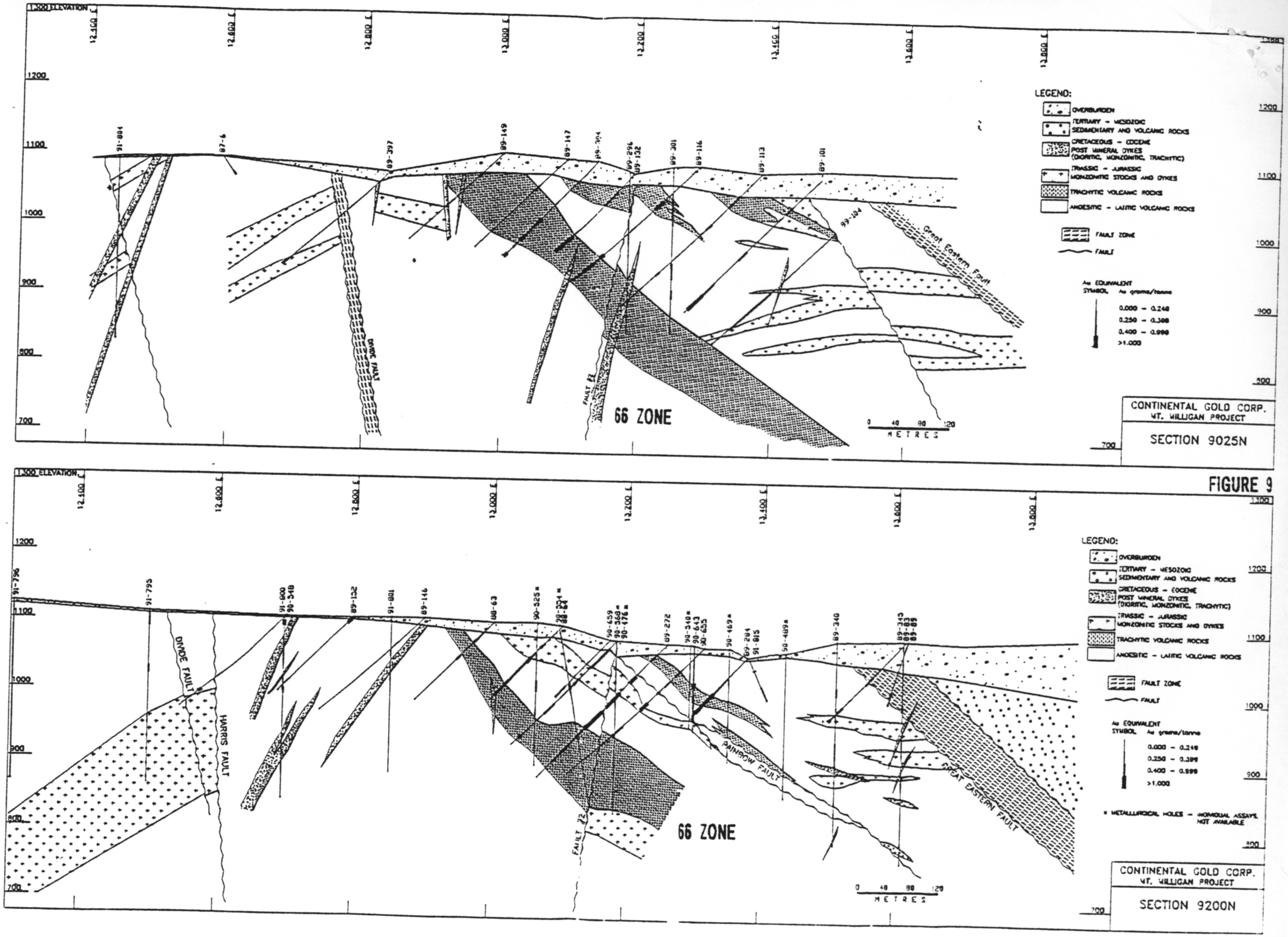

1300 ELEVATION
LEGEND:
OVERBURDEN
TERTIARY - MESOZOIC SEDIMENTARY AND VOLCANIC ROCKS
CRETACEOUS - EOCENE POST MINERAL DYKES (DIORITIC, MONZONITIC, TRACHYTIC)
TRIASSIC - JURASSIC MONZONITIC STOCKS AND DYKES
TRACHYTIC VOLCANIC ROCKS
ANDESITIC - LATITIC VOLCANIC ROCKS
FAULT ZONE
FAULT
Au EQUIVALENT
SYMBOL Au grams/tonne
0.000 - 0.249
0.250 - 0.399
0.400 - 0.999
>1.000
* METALLURGICAL HOLES - INDIVIDUAL ASSAYS NOT AVAILABLE
DIVIDE FAULT
HARRIS FAULT
FAULT 22
RAINBOW FAULT
Great Eastern Fault
66 ZONE
0 40 80 120
METRES
CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT
SECTION 9025N
SECTION 9200N

FIGURE 9

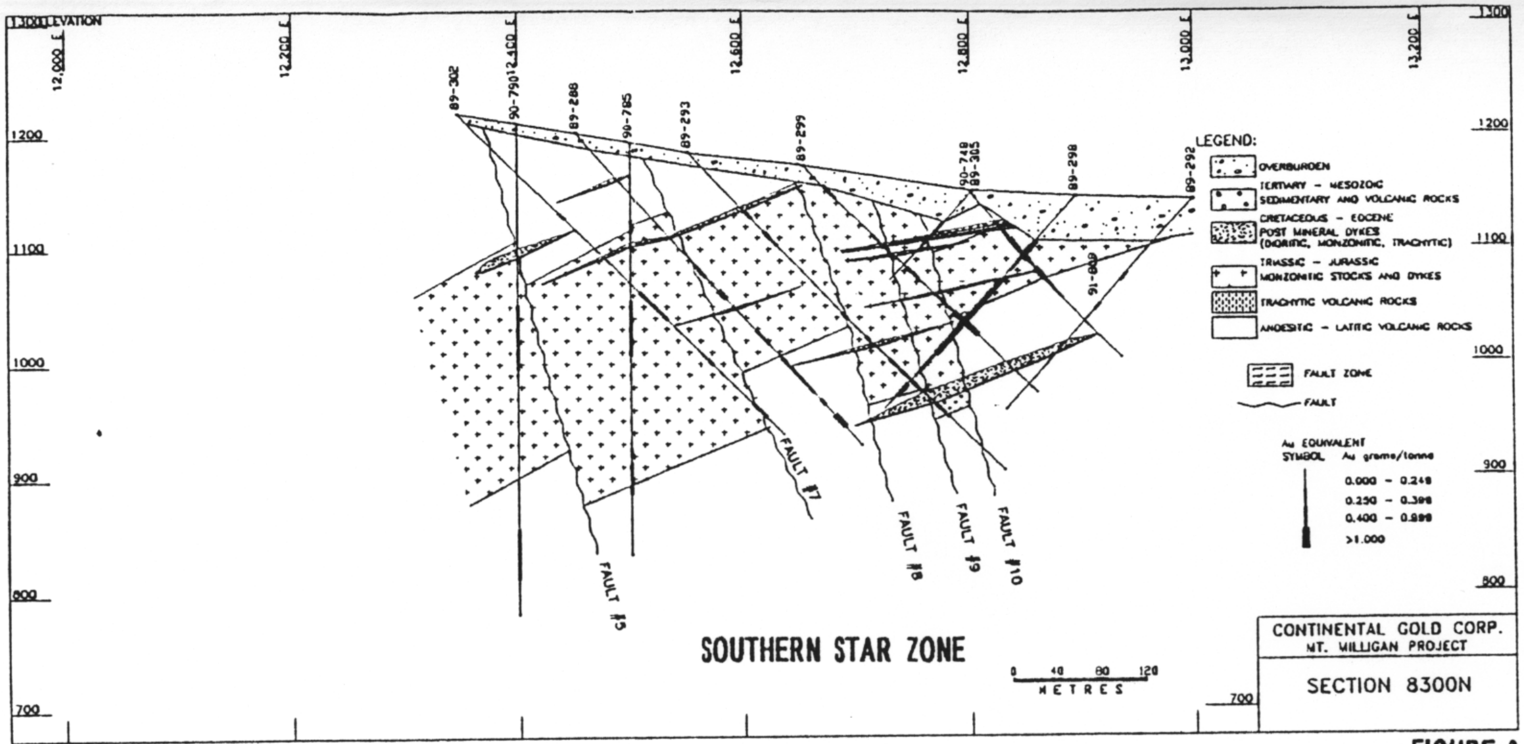
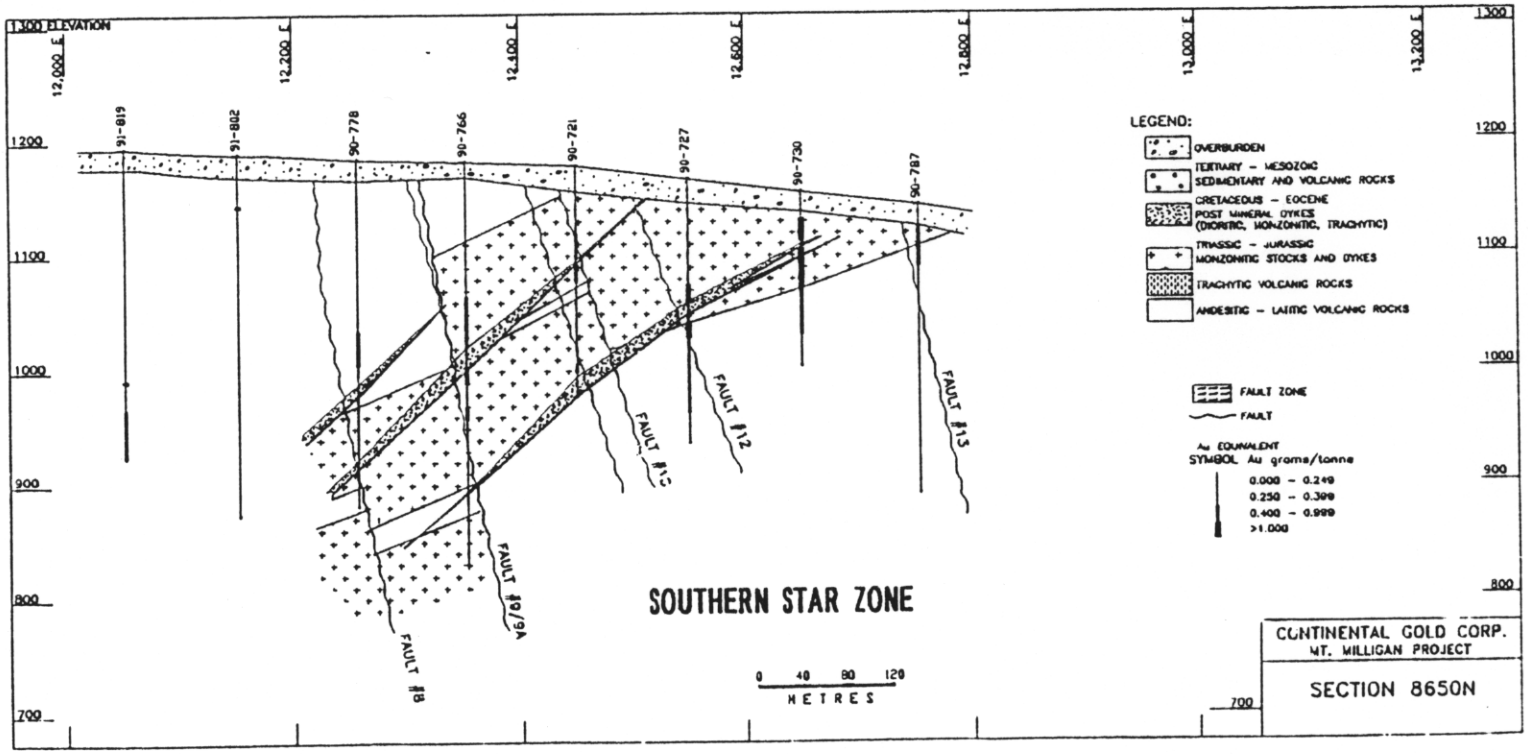

1300 ELEVATION
12,000 E
12,200 E
12,400 E
12,600 E
12,800 E
13,000 E
13,200 E
1200
1100
1000
900
800
700
89-302
90-790
89-288
90-785
89-293
89-299
90-749
89-305
89-298
89-292
91-809
LEGEND:
OVERBURDEN
TERTIARY - MESOZOIC SEDIMENTARY AND VOLCANIC ROCKS
CRETACEOUS - EOCENE POST MINERAL DYKES (DIORITIC, MONZONITIC, TRACHYTIC)
TRIASSIC - JURASSIC MONZONITIC STOCKS AND DYKES
TRACHYTIC VOLCANIC ROCKS
ANDESITIC - LATITIC VOLCANIC ROCKS
FAULT ZONE
FAULT
Au EQUIVALENT
SYMBOL Au grams/tonne
0.000 - 0.249
0.250 - 0.399
0.400 - 0.999
>1.000
FAULT #5
FAULT #7
FAULT #8
FAULT #9
FAULT #10
SOUTHERN STAR ZONE
0 40 80 120
METRES
CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT
SECTION 8300N

FIGURE 8


1300 ELEVATION
12,000 E
12,200 E
12,400 E
12,600 E
12,800 E
13,000 E
13,200 E
1200
1100
1000
900
800
700
91-819
91-802
90-778
90-766
90-721
90-727
90-730
90-787
LEGEND:
OVERBURDEN
TERTIARY - MESOZOIC SEDIMENTARY AND VOLCANIC ROCKS
CRETACEOUS - EOCENE POST MINERAL DYKES (DIORITIC, MONZONITIC, TRACHYTIC)
TRIASSIC - JURASSIC MONZONITIC STOCKS AND DYKES
TRACHYTIC VOLCANIC ROCKS
ANDESITIC - LATITIC VOLCANIC ROCKS
FAULT ZONE
FAULT
Au EQUIVALENT
SYMBOL Au grams/tonne
0.000 - 0.249
0.250 - 0.399
0.400 - 0.999
>1.000
FAULT #8
FAULT #9/9A
FAULT #12
FAULT #13
SOUTHERN STAR ZONE
0 40 80 120
METRES
CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT
SECTION 8650N

B