Owner/Operator: kelso Resources LTd.


## LILLOOET MINING DIVISION BRITISH COLUMBIA

NT 92J 16E
WEST LONGITUDE: 122 DEG. $15 \times 12^{\prime} 24^{\prime \prime}$ NORTH LATITUDE: 50 DEG. $45^{*} 46^{\prime} 06^{\prime \prime}$

BY
MOUNTAINSIDE MANAGEMENT LTD.

JOHN FAIRLEY, B.A.Sc., P. ENG DARCY KROHMAN, B. SC., GEOL. AUGUST 19, 1987
GEOLOGICALBRANCH ASSESSMENTREPORT

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## SUMMARY

At the request of Kelso Resources Ltd., a first phase exploration program was completed on the Matson Claim Group by Mountainside Management Limited. The program was performed during June of 1987, and included geological, geochemical and geophysical surveys, and blasting and trenching. The purpose of the program was to define targets with potential for gold/silver mineralization.

The Matson Claim Group consists of 12 located 2-post mineral claims and 2 located 4-post mineral claims for a total of 38 units. The claim group is situated approximately 50 kilometers west of Lillooet, B.C. in the Lillooet Mining Division. A B.C. Hydro access road transects the property.

The Matson claim group lies near the Bralorne Mining Camp, which has been prospected since the 1890's. Development work consisting of a single adit and several pits was done on the Matson property during the 1940's. There is no history of production from the property.

The present exploration program was concentrated on a control grid established on the Matson property. Encouraging geological, geochemical, and geophysical results were obtained. An anomalous zone approximately 600 x 400 m 's near the west central portion of the grid appears to be related to sulfide mineralization. Assays of rock chip samples from the old workings returned significant gold and silver values (from trace values to $0.179 \mathrm{oz} / \mathrm{t} \mathrm{Au}$ and $8.36 \mathrm{oz} / \mathrm{t} \mathrm{Ag}$ ).

Signed at Vancouver, B.C.

John Fairley, P.Eng. August 18, 1987


PART A

Introduction

From June 1 to June 12, and from June 20 to June 24, 1987, Mountainside Management Limited conducted a first phase exploration program on the Matson property with the objective of defining targets with potential for precious metal deposition. The program consisted of grid establishment, geological mapping, and geochemical and geophysical surveys on the property, as well as some blasting and trenching. The exploration program was undertaken for Kelso Resources Ltd.

Location And Access

The Matson claim group is located approximately 45 km west of Lillooet approximately 20 km northeast of the community of Seton Portage (Fig. 1). Lillooet is 150 km north of Hope along the Fraser River, while Seton Portage is 130 km east of Pemberton between Anderson and Seton Lakes. The claim area is situated on the steep slopes of Mission Mountain, which separates the Bridge River and the Seton Lake valleys. The NTS map sheet which covers the area is 92 J 16.

Access to the property is obtained by either of two ways. From Lillooet follow the Bridge River road approximately 40 km to BC Hydro's Carpenter Lake Dam, and proceed along the south shore of the lake until the road turns south and climbs to the summit of Mission Pass. At the summit a BC Hydro access road turns east; this road provides access to the property.

An alternate route provides quicker access from Vancouver. From Pemberton proceed east along Highway 99 for 80 km to the community of D'Arcy. From D'Arcy a secondary access road contours above the north shore of Anderson Lake for approximately


40 km to Seton Portage. From Seton Portage continue east to Shalath and north to the summit of Mission Pass. At the summit the previously mentioned B.C. Hydro access road is reached. proceeding east provides access to the property. Though generally well maintained by B.C. Hydro, many of the dirt roads are steep and require four-wheel drive vehicles.

The BC Railway line runs along the northern shore of Anderson and Seton Lakes through Shalath and seton Portage and provides access to both Vancouver and the British Columbia interior.

## Property Status

The Matson claim group consists of 14 located mineral claims in the Lillooet Mining Division of British Columbia. The claims are shown on the Department of Mines Mineral Claim map 92J 16E (Fig. 2). The claims are owned by Kelso Resources Ltd. A complete title search was not conducted for this report.

NAME
RECORD NO.

| AREA | EXPIRY |
| :---: | :---: |
| (units) | dd $/ \mathrm{mm} / \mathrm{yr}$ |


| MATSON | 1 | $849(7)$ | 1 | $26 / 07 / 87$ | KELSO RES. LTD. |
| :---: | ---: | ---: | ---: | ---: | :--- |
| $"$ | 2 | $850(7)$ | 1 | $26 / 07 / 87$ | KELSO RES. LTD. |
| $"$ | 3 | $851(7)$ | 1 | $26 / 07 / 87$ | KELSO RES. LTD. |
| $"$ | 4 | $852(7)$ | 1 | $26 / 07 / 87$ | KELSO RES. LTD. |
| $"$ | 5 | $853(7)$ | 1 | $26 / 07 / 87$ | KELSO RES. LTD. |
| $"$ | 6 | $854(7)$ | 1 | $26 / 07 / 87$ | KELSO RES. LTD. |
| $"$ | 7 | $3757(7)$ | 1 | $* 09 / 07 / 88$ | KELSO RES. LTD. |
| $"$ | 8 | $3758(7)$ | 1 | $* 09 / 07 / 88$ | KELSO RES. LTD. |
| $"$ | 9 | $3759(7)$ | 1 | $* 09 / 07 / 88$ | KELSO RES. LTD. |
| $"$ | 10 | $3760(7)$ | 1 | $* 09 / 07 / 88$ | KELSO RES. LTD. |
| $"$ | 11 | $3761(7)$ | 1 | $* 09 / 07 / 88$ | KELSO RES. LTD. |
| $"$ | 12 | $3762(7)$ | 1 | $* 09 / 07 / 88$ | KELSO RES. LTD. |


| $" 14$ | $3683(4)$ | 14 | $24 / 04 / 88$ | KELSO RES. LTD. |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $"$ | 15 | $3684(4)$ | 12 | $24 / 04 / 88$ | KELSO RES. LTD. |

*The Matson 7 through 12 claims were restaked on July 8, 1987.

## History

The Bridge River Area is one of British Columbia's oldest gold camps. Production from numerous hard rock and placer operations dates back to before the turn of the century. Placer mining commenced in 1858 when placer gold was recovered from the bed of the Bridge River near its confluence with the fraser River. The placer gold deposition was followed for approximately 16 km upstream from the Fraser. In 1859 a second discovery was made on Gun Creek near its confluence with the Bridge River, close to the future site of the Minto Mine. Extensive placer operations were also initiated on Tyaughton and Hurley Rivers and on Cadwallader Creek.

It wasn't until the late $1800^{\prime}$ s, however, that an interest emerged in identifying the placer source. This lead to the discovery of the Bralorne and the Pioneer deposits near the turn of the century. The Bralorne Mine, the largest gold producer in the region, has yield over 2.8 million ounces of gold and over . 7 million ounces of silver since 1900 . The ore is reported to grade from 0.25 to $0.30 \mathrm{oz} /$ ton gold.

The Pioneer Mine, south of the Bralorne Mine in the same greenstone belt, has produced over 1.3 million ounces of gold and .25 million ounces of silver since 1908.

Numerous smaller operations were scattered throughout the region. One of the larger of these operations was the Minto Mine, also known as the Congress Mine, located on the northern shore of Carpenter Lake near Bridge River. Production between

the years 1934 and 1940 totalled over 17,000 ounces of gold, 50,000 ounces of silver, and appreciable amounts of copper and lead. The deposit occurs in a fault fissure with mineralization consisting of stibnite, arsenopyrite, pyrite, pyrrhotite, sphalerite, galena and chalcopyrite. The showings on the Matson claims appear to be very similar to the Minto Deposit.

Other operations in the Bridge River camp include the Wayside Mine on the Bridge River a few miles upstream from the mouth of Gun Creek, the Pilot Mine situated near the center of the west shore of Gun Lake, and the Goldside Mine in the upper Taylor Creek Basin.

The showings on the present Matson group of claims were first discovered in the 1930's. At that time an adit and several pits were developed between the 5,100 and 5,800 foot elevations. A second phase of exploration was conducted by Benn Explorations Ltd. in 1966-67 on the claims, then known as the King Group. Benn Explorations isolated an anomalous area $500 \times 300 \mathrm{~m}$ directly above and adjacent to the old workings by use of soil geochemistry. A short VLF-EM follow up program was conducted in 1977. The claims were subsequently dropped by Benn Explorations. The claims were restaked in 1979 and 1983 as the Matson Group.

In 1984 Odessa Explorations Inc. conducted an exploration program over the exposed mineralized zones. Encouraging magnetometer and soil geochemistry results were obtained. Odessa completed a second phase of sampling on the showing in July of 1985.

## Physiography

Mission Mountain lies directly west of Mission Ridge in the Chilcotin Ranges on the eastern edge of the Coast Mountains. Elevations on the Matson Claim group range from $750 \mathrm{~m}(2,500 \mathrm{ft})$ to almost $2,000 \mathrm{~m}(6,500 \mathrm{ft}$.$) above sea level. The majority of$ the property is heavily forested and steep. The northern extent of the claim group is precipitous, with cliffs of over $1,200 \mathrm{~m}$ $(4,000 \mathrm{ft})$. The western portion of the property is generally densely forested and steep or precipitous in areas. The southern portion is also steep but is generally less formidable than the northern and western areas.

Outcrop exposure is abundant near the summit of Mission Mountain, but less abundant at lower elevations and virtually non-existent in many of the densely wooded areas. The best outcrop exposure at lower elevations is seen in the road cuts.

There are several deep cut valleys which appear to represent geological features. Very little water exists on the property. A small stream flowing down the south face of Mission Mountain provides the only water on the property and this would be dry at any time other than peak run off periods.

Because of the elevation and location of Mission Mountain, the climate varies dramatically. Snow remains on many of the north facing slopes year round and snow falls are not uncommon during the summer months. Conversely, the river and lake valleys of the area are the driest and warmest semi-arid regions in Canada.

Grid Establishment

A single grid with a 1.9 km baseline was established over the Mason claim group (Fig. 3). A total of 29 km of grid was chained and flagged at 12.5 m spacings. Line intervals were 100 $m$ except in areas of interest, where detail lines were established at 50 m intervals. Compasses, clinometers, and hip chains were used. Station locations were slope corrected.

Geological Mapping

Detailed geological mapping at 1:2500 scale was conducted on the grid. Reconnaissance traverses were conducted on the Matson 14 and 15 claims. Geological results are presented in Figs. 3-7, and Fig. 11.

Rock and Soil Geochemical Surveys


A total of 118 rock samples and 904 soil samples was collected. Rock chip, grab, float and channel samples were collected from areas where signs of mineralization, alteration, and/or leaching were observed. The adit and veins uncovered by blasting and trenching were systematically sampled. Rock sample descriptions are found in the discussion of results and in Appendix C. Geochemical results are presented in Figs. 8a-h, and Fig. 11.

Ground VLF-EM Survey Method

The ground very low frequency electromagnetic (VLF-EM) survey was conducted using a sabre Electronics Model 27 VLF Electromagnetometer. This instrument acts as a receiver only. It utilizes the primary electromagnetic fields generated by

United States Navy VLF marine communication stations. These stations operate at frequencies between 15 and 25 kHz , and have a vertical antenna current resulting in a horizontal primary magnetic field.

Secondary magnetic fields arise due to currents induced in conductors. The VLF-EM instrument measures the dip of the magnetic field resulting from the sum of the primary and secondary fields.

For maximum coupling, a transmitter station located in the direction of the geological strike and/or the strike of possible conductors is selected. At the Matson project area the transmitter located at Annapolis, Maryland was used.

Readings were taken at 12.5 m intervals along grid lines. The data was filtered as described by D.C. Fraser, Geophysics, Vol. 34, No. 6. This is essentially an averaging and differentiation filter technique applied to remove "DC" bias and attenuate long spatial wavelengths to increase resolution of local anomalies. VLF-EM conductors are indicated by positive values.

Ground VLF-EM survey results are presented in Fig. 9 and 11. A total of 29 line-km was surveyed.

Ground Magnetometer Survey Method

The magnetometer survey was conducted using an EDA OMNI IV Proton Precession magnetometer. This instrument measures the magnitude of the earth's total magnetic field to an accuracy of 0.5 gammas. Corrections for diurnal variation were made by an EDA PPM 337 proton precession base station magnetometer. The


## PART C GEOLOGY

Regional

The geology of the Bridge River area consists of a very complex sequence of sedimentary, metasedimentary, intrusive and volcanic rocks located between the boundary of the Intermontane and the Coastal Crystalline Belts. The area is considered to be an anticlinorium with complicated folds on the southwest limb. In many areas the limb is pierced by intrusive bodies associated with the coastal batholith. The antiform is bounded on the southwest by the main mass of the Coast Crystalline Belt and on the north-west by the Yalakom Fault zone.

Sedimentary and volcanic rocks of the Triassic Bridge River Group are the most extensively exposed lithologies in the region. Along the southwestern flank of the antiform, the Bridge River Group is overlain by clastic and volcanic rocks of the Triassic Cadwallader Group. However, on the northeastern limb of the structure the Cadwallader is all but completely removed by the Yalakom Fault zone. Granodiorite and less common occurrences of diorite, gabbro and basalt are seen in the Bridge River area with the Bendor Pluton and the Rexmount Porphyry constituting two of the larger igneous bodies.

## Lithology - Bridge River Group

The Bridge River Group, also known as the Fergusson Group, is the most prominent as well as the most important rock unit in the area, for it is the host rock of the mineralization on the Matson Claims. The group consists mainly of a thick sequence of thin-bedded chert, cherty argillite, and argillite intercalated with altered basaltic flows, peridotite, serpentinite and minor limestone. In many areas on the Matson claim group the argillites appear to have been altered by contact metamorphic
effects, which has produced hornfels facies. The process involves recrystallization of the original sedimentary rock at high temperatures, but without shearing stresses. Dark altered argillite (hornfels), dark to light grey weathered chert and dark cherty argillite are the most abundant rock types. The chert commonly forms lensoid or nodular layers separated by thin films of argillite. Because of this characteristic, the rock is often referred to as ribbon-chert. The altered argillites (hornfels) are generally compact and massive, breaking with a splinting fracture into sharp angular pieces.

In many areas the sediments are so highly altered that the original lithology can not be clearly identified. The rock often resembles an andesite; the abundance of chert leads to the assumption that the rock is of sedimentary origin.

Pods or lens of light-grey weathered, recrystallized limestone are scattered throughout the Bridge River Group. Most are relatively thin (ie. less than 2 m ) and discontinuous. One bed near $\mathrm{BL} 00 / 500 \mathrm{~W}$, however, is approximately 25 m thick and traceable along strike for over 75 m . Although rare occurrences of skarn deposits in the Bridge River Group are documented, none were identified on the Matson claim group.

A basaltic flow striking northwest is exposed for over 1 km in the eastern portion of the property. The flow is generally more than 200 m wide. In many areas the flow exhibits pillow structures, indicating it was extruded in a marine environment. Although the flow appears to overlie the Rexmount unit, it is thought to be part of the older Bridge River Complex. The rock is a massive, medium to dark green chocolate brown weathered metabasalt. The principal mineralogy of the metabasalt consists of plagioclase, pyroxene and olivine. In areas the rock is broken into large, highly resistant boulder size blocks.

Along the western contact of the basalt, a lenticular body of serpentinite approximately 25 m wide outcrops for 150 m . Serpentinite float found 600 m to the south indicates that the serpentinite may be continuous along the full extent of the metabasalt contact with the Rexmount Porphyry. The serpentinite was probably formed by hydrothermal alteration of ultrabasic rocks in the area, such as peridotite. The serpentinite appears to be responsible for anomalous nickel and chromium values found in the soil survey.

In several areas an argillaceous quartzite is found in contact with the Rexmount Porphyry or the metabasalt. The quartzites are massive and black with a gossanous oxidized surface. They are generally found as small outcrops no more than 10 m across. However, near $50 \mathrm{E} / 75 \mathrm{~S}$ a large outcrop is found in contact with the trachyte along a well defined shear zone exposed for approximately 25 m . The Bridge River Group is considered to be of Triassic age.

Rexmount Porphyry

The Rexmount Porphyry is an intrusive body of granodioritequartz diorite, syenite, and their volcanic equivalents dacite and trachyte. Near the contact of the intrusive and the Bridge River Sediments, porphyritic trachyte is the dominant rock type. Well-formed phenocrysts of plagioclase in a light grey, feldspar-rich aphanitic groundmass characterize the unit. As the silica content increases in the rock at some distance from the contact, the rock grades to a dacite. A true granodiorite-quartz diorite is found in the northern and north eastern portion of the grid.

The granodiorite is medium to coarse grained with quartz and plagioclase forming the primary constituents of the rock. Minor components are hornblende, biotite and pyroxene.

Several aplite dykes associated with the Rexmount Porphyry cut the Bridge River Group on the property. The dykes are very fine grain felsic bodies generally greater than 25 m wide and often traceable for 100 m or more. Although not seen near the showings, it appears that these dykes may have provided a heat source for the mineralizing fluids. A Miocene age has been assigned to the Rexmount Porphyry.

Structure

The Matson Property lies on the northeast limb of a plunging anticline which is severed approximately 5 km to the northeast by the Yalakom Fault zone. The initial deformation of the sediments occurred during the Jurasside Revolution in late Jurassic time. Uplift and erosion followed until Tertiary time and the onset of the Laramide orogeny. It was during the Laramide Orogeny that several of the plutonic bodies in the region, including the Rexmount Porphyry, were intruded.

The intrusion of the Rexmount Porphyry appears to have a very close genetic relationship with the mineralization on the property. The contact between the sediments and the intrusive runs northwest to southeast across the property. In most areas the contact is inferred due to lack of outcrop. However, from the road along Carpenter Lake the contact and interfingering dykes can be seen on the cliffs above. Several strata-cutting dykes were also identified on the portion of the property covered by grid. Because of the proximity of the exposed mineralization to the sediment/intrusive contact it appears that these dykes may have an important relationship to the sulfide mineralization.

Contact features associated with intrusive bodies are obvious throughout the property. The intrusive has a trachytic texture near the contact, while the sediments have been altered by contact metamorphic effects to the hornfels facies. The dykes
are usually microcrystalline aplite.

A major fault, striking 054 deg. and dipping steeply cuts the Bridge River Group approximately 100 m north of the adit. The fault is apparently normal, and the offset is unknown. The major shear zone which hosts the mineralization at the adit runs almost parallel to this fault, striking 051 deg., dipping 62 deg. NW. The attitudes of the other shear zones vary dramatically, with measured strikes ranging from 0 to 120 deg. Dips are generally very steep to the north west or vertical. Much of the exposed mineralization is found in quartz veins associated with these shear zones, thus making them important features with respect to the economics of the property. The shear zones (in particular those with mineralized quartz veins) often appear to be discontinuous and are difficult to trace on the surface for any substantial distances.

An extrusive flow of basalt, which has subsequently been altered to metabasalt/greenstone, has remnant pillow structures indicating it was deposited in a marine environment.

Alteration and Mineralization

Alteration and mineralization within the Matson project area is spatially associated with granodiorite and quartz diorite of the Rexmount Porphyry. The Bridge River Group, which forms the country rock in the region, has been recrystallized, metasomatized and silicified near the intrusion.

The mineralization on the Matson property consists mostly of arsenopyrite, galena, sphalerite, and marcasite with minor amounts of pyrite, chalcopyrite, pyrrhotite and magnetite. The geology and mineral assemblage of the showings seems to indicate that the deposit is a volcanic-associated vein and shear zone hydrothermal system. Deposits such as these appear to have a



Massive light grey, jointed ribbon chert (qz) with qz stringers interbedded with argillaceous metasediments (hornfels)


To accompany report by J. Fairley , B. A. Sc., P. Eng.

LEGEND
$\times$ MKOI $-100,2,00$
Sample №.- $A u, A g$ in $0 z /$ ton or otherwise indicoted.
Shear zone


Indicates channel sample
Strike / dip vein

MATSON PROJECT
FOR: KELSO RESOURCES LTD.
By: MOUNTAINSIDE MANAGEMENT LTD.


LILLOOET M.D.,B.C.

| N.T.S. $92 \mathrm{~J}-\mathrm{IGE}$ | DATE: JULY 1987 |
| :--- | :--- |
| DRAWN BY: D.K. | FIGURE N. 6 |


close genetic relationship with the associated intrusion. However it is not certain whether the intrusion and structures associated with the intrusion serve as a structurally and chemically favorable trap, or as a heat source responsible for the establishment of circulating hydrothermal generated fluids. The mineralization occurs primarily in veins along fractures and fault zones in highly sheared, schistose sediments, with a gangue of quartz and calcite.

Alteration in the mineralized zones is quite evident with cerrusite (lead carbonate), smithsonite (zinc carbonate) and anglesite (lead sulphate) all being common. Both cerrusite and anglesite are found as secondary minerals that generally form from galena in the zones of surface alteration. Smithsonite is found as a secondary mineral formed from the oxidation of sphalerite in similar deposits. Lime green arsenopyrite alteration is also abundant throughout the mineralized zones.

Pods or lenses of recrystallized limestone are abundant throughout the Bridge River Group. Although minor skarn occurrences in the Bridge River Group are documented none were identified on the Matson Property.

A band of serpentinite is exposed along the western contact of the metabasalt dyke/flow. Serpentinite is usually formed by alteration of ultrabasic rocks such as peridotite and is composed mostly of chrysotile and antigorite. Minor amounts of nickel and chromium in the serpentinite are thought to be responsible for anomalous values of those elements in the soils.

VLF-EM Survey

The VLF-EM Fraser filtered contoured data is presented on Figure 9.

The most obvious feature on this map is the strong high zone, starting in the west at $400 \mathrm{~W} / 50 \mathrm{~S}$ and trending north-east to the baseline on line 400 E , then turning south-east up to 900 E/150 W. This feature is related to electric power lines used to supply the microwave transmission tower on the property.

In the immediate vicinity of the adit at $900 \mathrm{~W} / 00$, there are two parallel east-west trending anomalous areas. These anomalies are both centered on line 900 W . One is at station 30 N and the other at station 50 s . The anomaly to the north has maximum fraser filtered values between 15 deg . and 20 deg . and the one to the south between 20 deg. and 25 deg. Both anomalies have a strike length of at least 100 m . The two anomalies occur within a weaker anomalous area (greater than 5 deg.) which extends towards the west on the south side of the baseline between lines 600 W and 400 W near station 100 s . The anomalous zone has many values between 10 deg. and 15 deg. To the south of this anomaly on lines 500 W and 400 W at about 250 S there is another high with a maximum between 15 deg. and 20 deg.

In the southwestern section of the grid there are two anomalous areas which are roughly parallel. The northern most of the two is centered at about 500 S and trends from line 900 W to 600 W with maxima between 10 deg. and 15 deg.; it extends from 900 W to 700 W , with line 800 W having weaker values (between 0 deg. and 5 deg.).

On the northern portion of the grid, between lines 100 W and 200 W at station 100 N , there is a VLF peak running east-west with maximum values between 30 deg. and 35 deg. This peak is contained within a highly anomalous trend which strikes northwest up to $500 \mathrm{~W} / 300 \mathrm{~N}$. The north-west trend is roughly parallel to the contact between the Bridge River sediments to the west and the Rexmount Porphyry to the east. To the east of the peak the trend curves toward the east and extends up to $900 \mathrm{E} / 250 \mathrm{~N}$. Within the eastward trending portion of this high there are a number of local peaks with two values greater than 20 deg . One is at $100 \mathrm{E} / 140 \mathrm{~N}$ and the other is at $700 \mathrm{E} / 200 \mathrm{~N}$.

One other significant anomalous zone can be seen in the northern portion of the grid. It starts at $00 / 525 \mathrm{~N}$ and trends towards the east up to $900 \mathrm{E} / 500 \mathrm{~N}$. Within this zone there are two peaks with values greater than to 20 deg. One is at 400 $\mathrm{E} / 510 \mathrm{~N}$ and the other is at $600 \mathrm{E} / 485 \mathrm{~N}$.

The VLF anomalies may represent mineralized zones or shearing in the rock. If the VLF trends observed in the immediate vicinity of the adit relate to mineralized zones, it is not surprising that the amplitude is relatively low. This is due to the presence of the non-conductive mineral sphalerite (zinc sulfide) seen in the adit. The conductive components of the mineralization would mostly be arsenopyrite (iron arsenic sulfide) and galena (lead sulfide). The east-west trending VLF anomalies could also reflect shearing in the rock, which crosscuts geological contacts.

## Magnetometer Survey

The total field magnetic contoured data is presented in Figure 10. The background level for the grid area is between 56,350 and 56,450 gammas. Anomalous peaks in the vicinity of line 300 E and the base line cannot be trusted because of the
presence of a power line.

In general the magnetic data trends to the north west, in the same general direction as the geological contacts.

There seems to be a recurrent relationship between some VLF and magnetic anomalies. For example, just to the north of the VLF high at $850 \mathrm{E} / 25 \mathrm{~N}$ (in the vicinity of the adit) there is a magnetic high flanking a VLF high. There is a similar situation in the southwest portion of the grid, where a magnetic high trends from $700 \mathrm{~W} / 650 \mathrm{~s}$ to $1000 \mathrm{~W} / 530 \mathrm{~s}$. This magnetic trend consists of two distinct peaks which flank both VLF highs.

Another magnetic peak which flanks a VLF high can be seen at $300 \mathrm{~W} / 150 \mathrm{~N}$. The magnetic peak at $600 \mathrm{~W} / 250 \mathrm{E}$ does not flank a VLF high as clearly as the other peaks, but it is close ( 50 m ) to the VLF trend which flanks the previously mentioned magnetic high.

There is one other magnetic high at $200 \mathrm{E} / 235 \mathrm{~N}$ which is flanked by a VLF high (Fig. 6, 7 and 8).

Magnetic peaks seen on lines 200 E and 300 E near the baseline are possibly related to localized enrichment of magnetite (iron oxide) and/or pyrrhotite (iron sulfide) in the metabasalt and serpentinite rock. It is difficult to be confident of this, however, because of the possible effect of the power line in this area.

The magnetic material which contributes to the anomaly in the vicinity of the adit, and possibly other magnetic peaks flanked by VLF highs, has not been positively identified. It is probably a local enrichment of magnetite. It is possible that the magnetic high is due to pyrrhotite, but this is thought unlikely since the high concentration necessary to produce an
anomaly of this amplitude would be easily observed. It is also possible that the source is a combination of magnetite and pyrrhotite.

Assuming a vein type model for the source of these magnetic anomalies it appears that they are near vertically dipping formations. The two magnetic anomalies in the west of the grid, one just north of the baseline and the other at the southern tip, seem to have a depth within 25 m of the surface. The three other magnetic peaks ( $600 \mathrm{~W} / 250 \mathrm{~N}, 300 \mathrm{~W} / 150 \mathrm{~N}$, and $100 \mathrm{E} / 135 \mathrm{~N}$ ) seem to be within 10 m of the surface.

## PART E DISCUSSION OF GEOCHEMICAL RESULTS

Rock Geochemistry

A total of 118 rock samples was analysed by 30 element ICP analysis at Acme Analystical Laboratories of Vancouver. Each sample was also analysed by atomic absorption for gold content. Of the 118,27 samples with particularly high gold and silver values were reassayed by fire assay method to give a more accurate gold and silver content. As well, 10 samples were also assayed for platinum and palladium content from areas containing soils anomalous in nickel and chromium.

The best rock geochemical results were received from the three showings on the property and their extensions exposed by our own blasting and trenching program. Three samples assayed greater than . $140 \mathrm{oz} /$ ton gold (MK43 - . $144 \mathrm{oz/ton} \mathrm{Au;} \mathrm{MS17-}$. oz/ton Au; MK 61 - . 179 oz/ton $A u$ ). As well, three samples assayed greater than $7.00 \mathrm{oz} / \mathrm{t}$ silver (MS19 - $7.91 \mathrm{oz} / \mathrm{t}$ Ag; MK54 - $8.36 \mathrm{oz} / \mathrm{t} \mathrm{Ag} ; \mathrm{MK55}-7.57 \mathrm{oz} / \mathrm{t} \mathrm{Ag}$ ).

The best gold results received were from the adit area. The mineralization, massive in much of the vein structure, consists mostly of arsenopyrite, galena, sphalerite, pyrite and occasionally minor pyrrhotite. A mineralogical analysis of sample $\mathrm{M}-100 \mathrm{~K}$ from the adit vein system was done by Orex Labs of Vancouver. Chemical analysis of the lead indicated $0.085 \mathrm{oz} / \mathrm{ton}$ gold and 9 oz/ton silver. No gold or silver minerals were observed in polished section, however. Figure 5 shows all gold and silver assays from channel and rock chip samples from the adit area.

The best silver results received were from the vein system exposed by blasting and trenching near $750 \mathrm{~W} / 175 \mathrm{~N}$. Silver values from channel samples taken along the vein system ranged from 0.49 to $8.36 \mathrm{oz} /$ ton Ag. The better results include values of 7.91 , 7.57 and $4.69 \mathrm{oz} /$ ton Ag . Good gold and silver results were also received from the vein system exposed near $650 \mathrm{~W} / 125 \mathrm{~N}$ (Figures 6 and 7).

An area of anomalous nickel and chromium values was also isolated by the soil survey. Using the association of nickel and chromium with platinum, 10 rock chip samples of ultramafic and metabasaltic rocks were analyzed for both platinum and palladium in this area. Neither platinum nor palladium values of interest were observed.

## Soil Geochemistry

A total of 904 soil samples was collected and analysed by ICP for a 30 element suite, and atomic absorption for gold by Acme Analytical Laboratories of Vancouver. The values for ten separate pathfinder and indicator elements were plotted and contoured in order to establish geochemical trends. Arsenic, cadmium, antimony, lead, zinc and copper are generally considered to be pathfinder elements for gold and silver mineralization in
sulfide ore complexes such as those occurring on the Matson property.

A simple statistical analysis was performed on the geochemical data to determine anomalous zones with a degree of probability. The threshold value for an element was taken to be its mean value plus plus two standard deviations. Appendix $E$ lists all anomalous pathfinder and indicator elements, their maximum and minimum analytical values, and their mean, median and standard deviations.

A zone approximately 400 x 600 m between lines 400 W and $1,000 \mathrm{~W}$ between stations 200 N and 200 s contains anomalous values for each of the pathfinder and indicator elements. This zone, which remains open ended to the west, has anomalous gold values ranging from 98 ppb to 765 ppb (threshold value $\mathrm{Au}=87.2$ ppb) with the greatest gold value - 765 ppb - being sampled at station $650 \mathrm{~W} / 125 \mathrm{~N}$, near remnants of past blasting and trenching. Anomalous silver values are also concentrated in the region. Values from 1.2 to 5.4 ppm and a single value of 28 ppm silver are found in the zone (threshold value $\mathrm{Ag}=1.1 \mathrm{ppm}$ ).

Anomalous values for the pathfinder elements arsenic, cadmium, antimony, lead, zinc and copper are also found in the zone, indicating that the mineralization may be much more extensive than originally thought. Extremely high spot anomalies of arsenic, lead and zinc (20,697, 17,965 and 5,659 ppm respectively) occur within the zone. The arsenic source can be explained by the mineralization exposed by the trenching at station $650 \mathrm{~W} / 125 \mathrm{~N}$, however, the source of the lead and zinc values found at station $700 \mathrm{~W} / 50 \mathrm{~s}$ remains unknown.

A second anomaly, smaller in magnitude and extent but which may indicate sulfide mineralization, occurs between lines 100 E and 200 E and stations 150 S and 175 N . Moderately high values
in both indicator and pathfinder elements coupled with a magnetic high/low sequence makes this area a definite target. The fact that the anomalous values for each element are spread over several stations may be explained by the varying mobility of the elements within the soils.

Two areas, one in the southwestern and one in the northwestern portion of the grid, indicate anomalous zones of copper. Both zones correlate to identified magnetic and VLF-EM anomalies. Values from the northwest zone between lines 500 W and 750 W and stations 300 N and 550 N range from 194 to 870 ppm Cu (threshold value $\mathrm{Cu}=191 \mathrm{ppm}$ ). Values from the southwest zone are not as impressive, but nonetheless indicate a zone of interest because of the correlation to the geophysical surveys.

A large volcanic flow and serpentinite body striking southeast near the center of the grid has produced very high chromite and nickel values. The zone is up to 300 m wide, extends for more than 1 km and is open to the southeast. From this zone, 24 nickel values and 23 chromium values were considered anomalous (threshold value $\mathrm{Ni}=509, \mathrm{Cr}=334 \mathrm{ppm}$ ). Maximum values for nickel and chromium are 2,307 and 1,551 ppm respectively. The economic significance of these elements can also lie in their association with platinum. Rock assay results do not indicate that such a relationship exists in this case.

## PART F TRENCHING PROGRAM

The most obvious showings on the property had been developed by an adit, and several trenches and pits. The present blasting and trenching program was used to help extend the strike length of the vein systems exposed by past programs. The most impressive results were received from the adit/portal area and the Pit No. 3 (Figures 5, 7, 8). Blasting on the face of the
portal was used to give better exposure of the vein system near the adit, while blasting on the No. 3 Pit was used to increase the strike length of the main vein. We were able to extend this vein for approximately 5 m with an average width of .3 to .4 m . The vein, however, pinches to approximately .15 m near the surface. A second pit (Pit No. 5) was blasted 10 m north of Pit No. 3 in an attempt to locate the main vein along strike. The vein was not located.

Past reports have attempted to correlate the vein system exposed by Pits No. 1 and 2 with that exposed by Pits No 3 and 4. Due to the discontinuous nature of the exposed veins and the lack of geophysical evidence, correlation of the vein system over this distance (greater than 115 m ) is not definitive. Blasting and trenching were also conducted on Pits No. 1 and 2 to give better exposure of the vein system.

## PART G DISCUSSION OF RESULTS

Correlation of the geological, geophysical and geochemical results obtained indicate three main areas of interest on the Matson Property (Fig. 11). The most promising is a $600 \times 400 \mathrm{~m}$ zone enclosing the old workings. This zone includes a VLF-EM conductor encompassing a magnetic high. Several values for indicator and pathfinder elements from this zone are considered anomalous.

A second conductive zone flanked by a magnetic high is situated in the extreme southwest corner of the grid area. Although anomalous gold and silver values were not observed in the soil samples, this second zone has similar VLF-EM and magnetic signatures to the zone noted above, suggesting a relationship may exist.

A third zone extends for approximately 700 m between 200 E and 500 W just north of the baseline, trending in $a$ west/northwest direction. In this area three very conductive zones exist. Strong magnetic anomalies also exist over each of the VLF-EM anomalies. Anomalous gold and silver values were not observed in the soil samples, but slightly anomalous pathfinder elements (lead, zinc and arsenic) were found in the soils.

Anomalous copper values were found in two areas. The first appears to be associated with the magnetic and VLF-EM anomalies situated in the south western corner of the grid. The second occurs near the contact of the Bridge River Group and the Rexmount Porphyry between lines 500 W and 700 W in the northern portion of the grid.

Magnetic and VLF-EM anomalies occurred in many areas in the south central and south eastern portion of the survey area. However it is believed that these anomalies are due to the presence of $B C$ Hydro transmission lines and the BC Telephone microwave tower located on Mission Mountain. Some transmission lines are buried, making accurate geophysical interpretations in this area difficult.

PART H CONCLUSIONS AND RECOMMENDATIONS

Encouraging geological, geochemical and geophysical results were obtained from the exploration program carried out on the Matson Property. The magnetic and VLF-EM survey outlined three distinct anomalous zones. The most promising area is located from 600 W to $1,000 \mathrm{~W}$ and 200 S to 200 N on the established grid and is open ended to the west. An IP survey is warranted over this zone to define the extent, depth and the sources of the anomalies. The IP survey should also be used to delineate targets in the other areas of interest.

The geology of the area is conducive to high-grade, low tonnage gold/silver mineralization hosted by shear zone controlled quartz veins. A second phase of exploration is recommended in order to further ascertain the sources of the geophysical and geochemical anomalies, to delineate additional targets, and to test for anomalous concentrations of sulfide mineralization at depth.

## ESTIMATED COST OF PHASE II EXPLORATION PROGRAM

Grid Establishment ..... \$ 7,000
Geological mapping and support ..... 10,000
Soil geochemical surveysay 300 samples @ \$18/sample 5,400(Incl. collection and analysis)
Analysis of rock samples
say 100 samples @ \$15/sample ..... 1,500
Induced Polarization survey (over selected areas) allow ..... 25,000
Trenching and blasting ..... 20,000
Engineering supervision and reports ..... 8,500
Contingencies, allow approx. 15\% ..... 11,600
Estimated Total Cost for Phase II ..... \$89,000

Contingent upon obtaining positive results from the proposed exploration program, a third phase consisting of road building, drill testing and additional trenching of specified targets may be necessary.

Signed at Vancouver, B.C.

John Fairley, P.Eng. August 18, 1987


McCammon, J. W., 1938, The Geology and Mineral Deposits of The Bridge River District, British Columbia, B.A.Sc. Thesis University of B.C.

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AR 14,326; Assessment Report on the Matson Claims, Odessa Explorations Ltd., 1985.

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Benn Explorations Ltd. Prospectus, Assessment Report on King Claims Group, 1968.

AR 994, Assessment Work Report on The King Group of Mineral Claims, 1967

Woodsworth, G. I., 1977, GSC Open File Map 482, Pemberton (92J) Map Area
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B. C. Dept. of Mines; Geology, Exploration and Mining 1977 p. E171

## COST BREAKDOWN FOR PHASE ONE OF THE MATSON PROPERTY

| Geological mapping sampling and supervision | \$11,550.00 |
| :---: | :---: |
| Grid Emplacement: |  |
| Baseline $1.9 \mathrm{kilometers} \mathrm{@} \mathrm{\$ 200.00/km}$ | 380.00 |
| Crossline 29 kilometers @ \$200.00/km | 5,800.00 |
| Geophysical surveys: |  |
| VLF-EM $29 \mathrm{kilometers} \mathrm{@} \mathrm{\$ 200.00/km}$ | 5,800.00 |
| Magnetometer 29 kilometers \$200.00/km | 5,800.00 |
| Blasting and hand trenching <br> (including blaster, geologist and supplies) | 4,971.69 |
| Geochemistry: <br> (analysis and collection) |  |
| 904 soils @ \$15.00 | 13,560.00 |
| 133 rocks @ \$20.00 | 2,660.00 |
| 22 dual element fire assays | 380.00 |
| Computer plotting of geochem results | 1,200.00 |
| Mineralogical report | 1,000.00 |
| Camp costs, materials and vehicle | 5,624.98 |
| Analysis and report writing | 6,000.00 |
| Engineering, supervision and administration | 3,500.00 |
| Wordprocessing, printing, copying and binding | 2,000.00 |
| TOTAL COST FOR THIS PHASE | \$70,226.67 |

## CERTIFICATE

I, John Fairley, do hereby certify that;
I) I am a Consulting Engineer, residing at 3704 Mckechnie Ave., West Vancouver, B.C., V7W 2M8, for the firm of Mountainside Management Ltd. at 827 W. Pender Street, Vancouver, British Columbia.
II) I am a graduate of the University of British Columbia and hold a Bachelor of Applied Science in Geological Engineering.
III) I am a registered member, in good standing of the Association of Professional Engineers of British Columbia.
IV) Since graduation in 1963 I have been involved in numerous mineral exploration program, feasibility studies, and mining engineering throughout Canada, U.S.A., and Australia.
V) This report is based on a personal visit to the property, and an evaluation of information compiled by a Mountainside Management Ltd. crew on June 1 to June 12, 1987 and June 20 to June 24, 1987.
VI) I have no direct or indirect interest in the property described herein, or in any securities of Kelso Resources Limited, nor do I expect to receive any.
VII) This report may be utilized by Kelso Resources Limited for inclusion in a Prospectus or Statement of Material Facts.

Respectfully submitted at Vancouver, B.C.


## CERTIFICATE

I, Darcy Krohman, do hereby certify that;
I) I am a Consulting Geologist to the firm of Mountainside Management Ltd. at 827 West Pender Street, Vancouver, British Columbia.
II) I graduated in 1985 from the University of British Columbia, Vancouver, B.C. With a B.Sc., in Geology.
III) I have been involved in mineral exploration since 1983.
IV) This report is based upon field work carried out by myself and a Mountainside Management crew under my supervision from June 1st to 12 th and June 20 th to 24 th, 1987.
V) I have no direct or indirect interest in the property nor in Kelso Resources Ltd., nor do I expect to receive any.
VI) This report may be utilized by Kelso Resources Ltd. for inclusion in a Prospectus or Statement of Material Facts.

Respectfully submitted at Vancouver, B.C.


## MATSON PROPERTY ROCK SAMPLE DESCRIPTIONS

MK01 Very altered metasediments with massive mineralization consisting of arsenopyrite, galena, sphalerite, pyrite and minor chalcopyrite. Rock chip sample.

MK11 Very altered, easily fractured gossenous siltstone (hornfel). Original rock not identifiable. Rock chip sample.

MK12

MK13

MK14

MK15
MK16
MK17 Granodiorite (Rexmount Porphyry). Rock chip sample.

Very mafic medium to fine grain metabasalt (greenstone). Rock chip sample.

Felsic trachyte. Fine grain off white ground mass w. prismatic Hornblende/Tremolite crystals. Rock chip sample.

Altered argillaceous siltstone (hornfel) with minor chert occurrence. Fine grain, very brittle and fractured. Original rock difficult to identify. Rock chip sample.
same of MK05
same of MK05
Fine to medium grain green siltstone with very thin calcite stringers. Very altered. Rock chip sample.
same as MKO9

Ribbon chert (quartz) with siliceous argillite. Very resistant grey microcrystalline quartz. Rock chip sample.

Massive, fine grain, dark grey, altered siltstone? (hornfel). Grab sample.

Massive microcrystalline grey chert with very minor pyrite mineralization in argillaceous siltstones. Iron stained. Grab sample.
same as MK14
Fine grain, argillaceous siltstones. Rock chip sample.
Dark green metabasalt (greenstone). Is generally very siliceous and is often calcareous with minor calcite stringers. Rock chip sample.

| MK18 | same as MK17. |
| :---: | :---: |
| MK19 | same as MK17. |
| MK20 | Very siliceous argillaceous siltstones grading to |
|  | quartzites. Quartzites are black due to argillaceous |
|  | material with a gossenous oxidized surface. Rock chip sample. |
| MK21 | Serpentinite. Olivine, pyroxene rich with glassy sheen. Easily fractured along plane. Rock chip sample. |
| MK22 | same as MK20 |
| MK23 | same as MK17 |
| MK24 | Argillaceous quartzite with quartz stringers. Black with gossenous weathered surface. Rock chip sample. |
| MK25 | same as MK24 |
| MK26 | same as MK17 |
| MK27 | same as MK26 |
| MK29 | Massive microcrystalline white vein quartz. Gossenous on oxidized surface. Rock chip sample. |
| MK30 | same as MK29 |
| MK31 | Light green, fine green altered siltstone (hornfel). Very siliceous in areas. Rock chip sample. |
| MK32 | Siliceous foliated siltstone with abundant argillaceous material. |
| MK3 3 | same as MK32 |
| MK34 | Vein quartz with abundant arsenopyrite galena, sphalerite. Anglesite, cerrusite alteration. Channel sample across . 3 m . |
| MK35 | same as MK34 |
| MK36 | same as MK34 |
| MK37 | Grey argillaceous quartz with arsenopyrite, galena mineralization. Rock chip sample. |

MK38 Very fine grain bleached intrusive from contact margin. Very siliceous and gossenous on weathered surface. Rock chip sample.

MK39

MK40

MK42

MK43
MK44

MK45

MK46

MK47

MK48

MK49

MK50

MK51

MK5 2

MK53

Very altered siltstone with black massive chert. Chloritized. Rock chip sample.

Very altered argillaceous sediments with interbedded massive black chert. Very fractured and gossenous. Rock chip sample.

Massive light grey vein quartz with abundant arsenopyrite, galena and pyrite mineralization. Channel sample across 1 m .
same as MK42
Gouge from shear zone. Very easily broken down to sand size grains. Gossenous in color with minor arsenopyrite and galena.

Very altered metasediment wall rock. Chloritized. Rock chip sample.

Metasediments with arsenopyrite, galena. Quartz stringers and silica replacement. Rock chip sample.

Massive, white, microcrystalline vein quartz. Vein 1 m wide. Channel sample across 1 m .

Aphanitic bleached siliceous aplite dyke. Rock chip sample.

Very altered vein quartz with abundant arsenopyrite.
Grab sample.
Light grey colorless quartz with arsenopyrite mineralization. Gossenous on oxidized surface. Grab sample from blasting.

Massive light green and colorless quartz with minor pyrite mineralization gossenous. Grab sample from blasting.

Very altered gossenous schist. Minor arsenopyrite. Rock chip sample.

Very altered vein quartz with arsenopyrite channel sample across . 5 m .

MK54

MK55
MK5 6
MK5 7
MK58
MK5 9

MK60
MK61
MS01
MSO2

MSO3

MS05
MS0 6
MS07
MS08

MSO 9
MS10
MS11

MS12

MS13
MS14

MS15

Very altered medium grey vein quartz with abundant arsenopyrite and galena. Channel sample.
same as MK54
same as MK54
same as MK54
Very altered siltstone (Hornfel). Rock chip sample.
Massive microcrystalline medium grey vein quartz with quartz stringers. Abundant arsenopyrite, galena, sphalerite. Minor pyrite. Grab sample from blasting.
same as MK59
same as MK59
Metabasalt. Rock chip sample.
Aphanitic porphyritic trachyte. Plagioclase phenocrysts. Rock chip sample.

Metasediments (Hornfels). Very argillaceous. Rock chip sample.

Massive, dark green metabasalt. Rock chip sample.
same as MS02
same as MS05
Massive, white to colorless quartzite. Rock chip sample.
same as MS03
same as MS08
Phaneritic granodiorite with well formed quartz, plagioclase, hornblende crystals. Rock chip sample.
Massive, microcrystalline, white vein quartz. Rock chip sample.
same as MS12
Very siliceous phyllite. Chloritized. Rock chip
sample.

MS16
MS17

MS18
MS19
MS20
MS 21
MS22
MS23

MS24
MS25
MS 26
MS27

MS28
MS29
MS30
MS31
MS32
MS 34

Siliceous siltstone. Rock chip sample.
Vein quartz with arsenopyrite, galena, sphalerite mineralization. Channel sample across . 1 m .
same as MS17. Channel sample across . 5 m .
same as MS17. Channel sample across .1m.
Massive white quartzite. Rock chip sample.
Siliceous sandstone. Rock chip sample.
same as MS21 Siliceous aplite. Aphanitic and felsic. Rock chip sample.

Very fractured phyllite. Rock chip sample.
same as MS21
same as MSO2
Massive, microcrystalline, black chert with sandstone. Rock chip sample.

Massive quartzite. Rock chip sample.
same as MS28
same as MS03
same as MS03
same as MS03
Vein quartz with arsenopyrite, galena, sphalerite mineralization. Rock chip sample.

For: Shangri La Minerals
Project: Matson
Sample: M-100K
by C. L. Soux

## Location:

Collector:
Date Analyzed: July 31,1987

## MACROSCOPIC DESCRIPTION:

Pan concentrate of sample M-100 after crushing to $100 \%$ passing 5 mm . A polished section of the concentrate product was prepared in order to carry out the microscopic analysis.

## MICROSCOPIC ANALYSIS IN POLISHED SECTION

| Abr. | Mineral | Chem. Formula | \% | Description |
| :---: | :---: | :---: | :---: | :---: |
| Apy. | Arsenopyrite | Fe AS S | 75 |  |
| Py. | Pyrite |  | \% | with Gn . and Py . |
| Gn. | Galena | Fe S2 Pbs | 5 | Mainly as free particles |
| Gn. |  | Pb S | 8 | As free particles and in association |
| Sph. | Sphalerite | ZnS | 10 | with Apy., Sph. and F'y. |
| Cpy. | Chalcopyrite | CuFe S2 | 1 | Contains inclusions of Cpy. |
| Pyrr. | Pyrrhotite | FeS | $\ll 1$ | As exsolution blebs in Sph. |
| Qtz. | Quartz | Si 02 | 1 | As exsoiution blebs in Sph. As free grains |



Vandeveer Diagram


Tentative Paragenetic Sequence

## TEXTURES AND DESCRIPTION:

Arsenopyrite is the most abundant mineral in the sample. It usually contains numerous narrow veinlets of galena and in a few cases chalcopyrite.
Sphalerite invariably contains exsolution bodies of chalcopyrite and in some cases pyrrhotite. Sphalerite replaces arsenopyrite and pyrite.
Galena appears to be the latest mineral in the paragenetic sequence. This mineral is almost completely devoid of inclusions. Only two grains were observed to contain inclusions of tetrahedr ite. Galena replaces arsenopyrite, pyrite and sphalerite. Chemical analyses of the head reported $0.08502 /$ ton Au . and $902 /$ ton Ag. However, no gold or silver minerals were observed in polished section. The silyer values in the sample are probably tied up to tetrahedrite in part and argentiferous galena.

## EXPLANATION ON THE USE OF THE VANDEVEER DIAGRAM

## A NEW DIAGRAMATIC SCHEME FOR PARAGENETIC RELATIONS OF THE ORE MINERALS

The ore minerals are arranged on the circumference of a circle and represented by smaller circles. Lines connect each pair of minerals which are observed to be in contact. An arrowhead points toward the mineral replaced where replacement textures are represented. The absence of arrows indicates simultaneous deposition. Minerals formed by exsolution are attached to the primary minerals by a line to the exsolution mineral point, which is outside the hypogene ore mineral circle. Supergene minerals are arranged on an outer arc and connected by lines to the hypogene minerals which are replaced. The density of the connecting lines in the diagram indicates semiquantitatively the relative replaceability of the host minerals.

After Forbes Robertson and Paul L. Vandeveer
Department of Geology,
Montana School of Mines,
October 16, 1951.


## Example: (Above diagram)

Pyrite is replaced by sphalerite, galena and goethite. Arsenopyrite is replaced by galena and pyrite. Galena is replaced by sphalerite. Chalcopyrite is in contact with pyrite and sphalerite, but there is no evidence of replacement. Goethite and arsenopyrite are observed to be in contact. Sphalerite contains exsolution blebs of chalcopyrite and pyrrhotite:

MATSON GEOCHEMICAL STATISTICS ( ALL IN PPM EXCEPT AU (RPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :---: | :---: | :---: | :---: | :---: | :---: |
| COPPER | 5.0 | 870.0 | 59.3 | 66.1 |  |
| LEAD | 2.0 | 5000.0 | 47.0 | 66.1 218.6 | 41.0 |
| ZINC | 27.0 | 5659.0 | 175.7 | 233.4 |  |
| SILVER | 0.1 | 28.0 | 0.2 | 233.4 1.0 | 141.0 |
| NI CKEL | 10.0 | 2307.0 | 131.8 | 189.0 | 86.0 |
| ARSENIC | 2.0 | 5000.0 | 60.9 | 192.4 | 31.0 |
| CADMIUM | 1.0 | 100.0 | 1.6 | 19.9 3.9 | 31.0 1.0 |
| ANTIMONY | 2.0 | 28.0 | 2.4 | 1.7 | 2.0 |
| CHROMIUM | 17.0 | 1551.0 | 112.4 | 111.0 | 82.0 |
| GOLD | 1.0 | 765.0 | 7.4 | 111.0 39.9 | 1.0 |

MATSON GEOCHEMICAL HIGHS ( ALL IN PPM EXCEPT AU (PPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :--- | :---: | :---: | :---: | :---: | :---: |
| $-\cdots---$ | --0 | 870.0 | 59.3 | 66.09 | 41.0 |

VALUES ABOVE MEAN + 2 standard deviations POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE |  |  |
| :--- | ---: | ---: |
| --1000 | $-5 T N$ | VALUE |
| -1000 | -525 | 192 |
| -950 | -625 | 205 |
| -900 | -525 | 237 |
| -800 | -575 | 220 |
| -700 | 475 | 196 |
| $\sim 700$ | 450 | 518 |
| -700 | 425 | 348 |
| -700 | 400 | 579 |
| -700 | 375 | 574 |
| -700 | 350 | 287 |
| -700 | 225 | 194 |
| -700 | -50 | 246 |
| -650 | 300 | 534 |
| -650 | 125 | 312 |
| -600 | 525 | 366 |
| -600 | 500 | 214 |
| -600 | 450 | 649 |
| -600 | 425 | 870 |
| -600 | 400 | 195 |
| -500 | 350 | 225 |
| -500 | 325 | 227 |
| -500 | 275 | 206 |
| -200 | 100 | 213 |
| 100 | 50 | 220 |
| 300 | -275 | 295 |
| 500 | -525 | 197 |
| 800 | -425 | 200 |
| 800 | -450 | 320 |

MATSON GEOCHEMICAL HIGHS (ALL IN PPM EXCEPT AU (PPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :--- | :---: | :---: | :---: | :---: | :---: |
| $-\triangle--1$ | -0 | 5000.0 | 47.0 | 218.56 | 20.0 |

VALUES ABOVE MEAN + 2 STANDARD DEVIATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| :--- | :---: | :--- |
| --950 | --- | -154 |
| -850 | -100 | 1038 |
| -850 | -125 | 627 |
| -750 | 175 | 677 |
| -750 | 150 | 637 |
| -750 | 125 | 622 |
| -750 | 100 | 907 |
| -700 | -50 | 17965 |
| -650 | 125 | 3711 |

MATSON GEOCHEMICAL HIGHS (ALI IN PPM EXCEPT AU (PRB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Z INC | 27.0 | 5659.0 | 175.7 | 233 |  |

VALUES ABOVE MEAN + 2 STANDARD DEVIATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN, NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIEY SOUTH

| LINE | STN | VALUE |
| :---: | :---: | :---: |
| -950 | 75 | 799 |
| -950 | 25 | 674 |
| -850 | -100 | 867 |
| -850 | -125 | 725 |
| $-750$ | 150 | 670 |
| -750 | 125 | 772 |
| -750 | 100 | 932 |
| -750 | 75 | 709 |
| -700 | 125 | 666 |
| -700 | 100 | 725 |
| -700 | -50 | 5659 |
| -650 | 125 | 3236 |
| -600 | 125 | 809 |

MATSON GEOCHEMICAL HIGHS ( ALL IN PPM EXCEPT AU (PPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :---: | :---: | :---: | :---: | :---: | :---: |
| SILVER | 0.1 | 28.0 | 0.2 | 0.98 | . 1 |

VALUES ABOVE MEAN + 2 STANDARD DEVIATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| :---: | :---: | :---: |
| -750 | --- | ----- |
| -700 | 150 | 3 |
| -650 | -50 | 28 |
| -400 | 125 | 4.9 |
|  | -75 | 5.4 |

MATSON GEOCHEMICAL HIGHS ( ALL IN PPM EXCEPT AU (PPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :--- | ---: | :---: | :---: | :---: | :---: |
| $--\overline{-n}$ | -10.0 | 2307.0 | 131.8 | 188.99 | 86.0 |

VALUES ABOVE MEAN + 2 STANDARD DEVIATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| :--- | :---: | :---: |
| 50 | 0 | $-\cdots 70$ |
| 100 | -100 | 542 |
| 200 | 125 | 1685 |
| 200 | 50 | 1483 |
| 200 | -50 | 1270 |
| 200 | -250 | 2307 |
| 300 | 0 | 623 |
| 300 | -25 | 1125 |
| 300 | -275 | 697 |
| 300 | -300 | 1450 |
| 300 | -625 | 562 |
| 300 | 25 | 535 |
| 400 | -250 | 517 |
| 400 | -475 | 1309 |
| 400 | -500 | 1025 |
| 400 | -575 | 1044 |
| 400 | -625 | 755 |
| 400 | -650 | 669 |
| 400 | -650 | 511 |
| 400 | -400 | 939 |
| 500 | -575 | 650 |
| 500 | -600 | 587 |
| 600 | -450 | 687 |
| 600 | 0 | 1037 |
| 600 | 1811 |  |
| 800 | 822 |  |
| 900 |  | 1886 |

MATSON GEOCHEMICAL HIGHS (ALL IN PPM EXCEPT AU (RPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :---: | :---: | :---: | :---: | :---: | :---: |
| ARSENIC | 2.0 | 5000.0 | 60.9 | 192.41 |  |

VALUES ABOVE MEAN + 2 STANDARD DEVIATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| ---: | :---: | :---: |
| --750 | --- | $--7-$ |
| -750 | 175 | 869 |
| -750 | 150 | 739 |
| -750 | 125 | 1166 |
| -750 | 100 | 1397 |
| -700 | 75 | 571 |
| -700 | 125 | 631 |
| -700 | 100 | 454 |
| -700 | -50 | 1079 |
| -650 | -200 | 597 |
| 200 | 125 | 20607 |

MATSON GEOCHEMICAL HIGHS (ALL IN PPM EXCEPT AU (PPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :--- | :---: | :---: | :---: | :---: | :---: |
| $---\overline{-1.0}$ | 1.0 | 100.0 | 1.6 | 3.88 | 1.0 |

VALUES ABOVE MEAN +2 STANDARD DEVIATIONS
POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| :---: | :---: | :---: |
| --950 | 75 | 11 |
| -950 | 25 | 12 |
| -900 | -200 | 13 |
| -750 | 100 | 15 |
| -750 | 75 | 11 |
| -700 | 100 | 12 |
| -700 | -50 | 48 |
| -650 | 125 | 170 |
| -400 | 25 | 10 |

# MATSON GEOCHEMICAL HIGHS <br> ( ALL IN PPM EXCEPT <br> $A U$ (PPB)) <br>  

| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :---: | :---: | :---: | :---: | :---: | :---: |
| ANTIMONY | 2.0 | 28.0 | 2.4 | 1.70 | 2 |

VALUES ABOVE MEAN +2 STANDARD DEVIATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| :---: | :---: | :---: |
| $---\cdots 5$ | $-\cdots$ |  |
| -950 | 87.5 | 6 |
| -950 | 75 | 7 |
| -950 | -75 | 6 |
| -850 | -50 | 6 |
| -800 | 25 | 7 |
| -750 | 175 | 10 |
| -700 | 225 | 9 |
| -700 | 200 | 6 |
| -700 | -50 | 28 |
| -700 | -250 | 7 |
| -650 | 125 | 10 |
| -650 | -75 | 6 |
| -300 | -50 | 12 |
| 50 | 0 | 7 |
| 100 | 50 | 7 |
| 200 | -50 | 27 |
| 200 | -250 | 11 |
| 300 | -275 | 11 |
| 500 | -525 | 25 |


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHROMIUM | 17.0 | 1551.0 | 112.4 | 110.95 |  |

VALUES ABOVE MEAN +2 STANDARD DEVIATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| :---: | :---: | :---: |
| -1000 | -375 | 382 |
| -900 | -225 | 428 |
| -900 | -250 | 408 |
| -800 | -300 | 338 |
| -700 | -250 | 482 |
| -600 | -275 | 497 |
| -400 | 375 | 379 |
| -300 | -50 | 527 |
| 50 | 0 | 468 |
| 100 | -100 | 423 |
| 200 | 125 | 811 |
| 200 | 50 | 622 |
| 200 | -50 | 709 |
| 200 | -250 | 1551 |
| 300 | 0 | 611 |
| 300 | -275 | 797 |
| 300 | -325 | 374 |
| 400 | 25 | 336 |
| 400 | -250 | 395 |
| 400 | -450 | 744 |
| 400 | -475 | 798 |
| 400 | -500 | 530 |
| 400 | -575 | 360 |
| 400 | -650 | 565 |
| 500 | -525 | 372 |
| 500 | -600 | 461 |
| 500 | -650 | 434 |
| 600 | -400 | 428 |
| 600 | -575 | 681 |
| 600 | -600 | 915 |
| 800 | -450 | 511 |
| 900 | 0 | 612 |

MATSON GEOCHEMICAL HIGHS (ALL IN PPM EXCEPT AU (PPB))


| ELEMENT | MIN | MAX | MEAN | STD DEV | MEDIAN |
| :---: | :---: | :---: | :---: | :---: | :---: |
| GOLD | 1.0 | 765.0 | 7.4 | 39.86 | 1.0 |

VALUES ABOVE MEAN +2 STANDARD DEVTATIONS POSITIVE LINE NOS. SIGNIFY EAST, NEGATIVE LINE NOS. SIGNIFY WEST POSITIVE STN. NOS. SIGNIFY NORTH, NEGATIVE STN. NOS. SIGNIFY SOUTH

| LINE | STN | VALUE |
| :---: | :---: | :---: |
| --950 | 25 | 98 |
| -750 | 50 | 225 |
| -750 | -75 | 265 |
| -750 | -125 | 215 |
| -700 | -175 | 133 |
| -650 | 125 | 765 |
| -600 | 25 | 395 |
| -600 | 0 | 225 |
| -500 | -125 | 540 |
| -400 | -50 | 370 |


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[^0]:    ASSAY REQUIRED FOR $\begin{aligned} \mathrm{Pb}, & A_{S} \\ & >10,000 \mathrm{PPM} \\ z_{n} & >20,000 \mathrm{PPM}\end{aligned}$ A) $>35 \mathrm{ppm}$

