

COMINCO LTD.

W.D. J.

EXPLORATION

WESTERN DISTRICT

NTS: 92I/10

840838

1981 YEAR-END REPORT

ROPER LAKE PROPERTY

HAPPY DAYS, G.G. CLAIMS

GREENSTONE MTN. AREA

120°39'30" 50°34'45"

92 I/10

24 FEBRUARY 1982

R.U. BRUASET

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APPENDIX I	1981 Diamond Drilling Summary
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APPENDIX III	1981 Percussion and Diamond Drilling Composite Summary

*Attachments and
Sections kept in
pocket file folder
with this file*

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INTRODUCTION

The Roper Lake property is situated in the southern B.C. porphyry belt near the halfway point between the City of Kamloops and the Highland Valley copper molybdenum porphyry camp. The Afton copper-gold porphyry deposit is situated in the Iron Mask alkaline complex about 12 km NE of the property.

Granitic and monzo-dioritic intrusions in the Roper Lake-Greenstone Mtn.-Durand Lake triangle apparently are of Lower Cretaceous age intruding Upper Triassic volcanics of the Nicola Group. Associated metals are molybdenum in the granitic (Happy Day, Gil Claims) and copper-gold in the monzo-dioritic intrusions (Rag Claims).

Active interest in the area by Cominco dates back to 1969 when during a regional geological-geochemical reconnaissance program the Durand Lake alkaline porphyry environment was identified. Claims located at the time were called Rag and Apollo and these adjoined the then existing claims covering the Roper Lake molybdenum system.

In 1978 Cominco optioned the Happy Days claims from Keda Resources and embarked on a rigorous exploration campaign in search for porphyry molybdenum ore deposits in the Roper Lake area. Geological, geochemical and geophysical work programs and percussion and diamond drill testing with a total value of about \$850,000 have been carried out, leading to the discovery of a very large subeconomic molybdenum stockwork deposit in an open pit setting. The style of mineralization and form of the deposit resemble the classic stockwork molybdenum deposits of the Colorado Mineral Belt. Because of the low grades indicated and other mineral priorities, the decision has been made to postpone further exploration on the property at this time.

The Roper Lake deposit represents a substantial holding position of molybdenum in the potential reserve category. Several untested extensions exist within the deposit and some of these may contain above average grades. There is also molybdenum potential at depth cutting the core zone of the stock, but ore deposits in that setting would have to be amenable to mining by block caving. The molybdenum potential and the copper-gold potential in the adjoining alkaline environment, which lies partly on the Roper Lake ground, makes this property a good acquisition and one on which persistence is likely to result in economic discoveries.

SUMMARY

Seven NQ diamond drill holes, totalling 1582 m, and fifteen percussion holes, totalling 1241 m were drilled on the property in 1981. The diamond drilling tested the Roper Lake molybdenum deposit to a maximum depth of 334.6 m. Percussion drilling completed the approximately 150 m square grid over the deposit and achieved a preliminary test of coincident molybdenum-copper-tungsten geochemical and geophysical anomalies west of the Roper Lake stock in an area underlain by Nicola volcanics believed to contain unroofed intrusive at shallow depths.

The best diamond drilling intersections in 1981 were 19 m @ 0.112% Mo and 62.8 m @ 0.064% Mo in D8101, 30.5 m @ 0.07% Mo in D8104, 37.6 m @ 0.057% Mo in D8105 and 15.3 m @ 0.088% in D8107. Encouragement in the percussion drilling includes the two most easterly step out holes from the A-Zone namely P8105 and P8106. Both of these holes were collared in essentially barren volcanics, each encountering substantial intervals of 0.04% Mo beginning at a depth of 49 m. It appears that these holes were collared in the hanging wall of the Roper Lake deposit. The grade shows marked improvement upon entering a swarm of Roper Lake granitic dykes or the main body of the intrusion. P8107 drilled in the central part of the B-Zone, where earlier percussion drilling had indicated above average grades, bottomed in 12.2 m @ 0.082% Mo.

Percussion and diamond drilling composites - usually 50' - have been analyzed geochemically for copper, silver, gold and tungsten. A summary of the results is given in Appendix III. Copper values in the 1981 diamond drill samples have a mean of 38 ppm with the highest value 165 ppm. Silver values are generally less than a detection limit of 0.4 ppm, and gold values are generally similarly low (<10 ppb). The composite intervals from 510' to 590' in D8102 are anomalous for gold with values of 92 and 60 ppb. Moderately high background values for gold at 22 ppb occur in the first sample above and below this interval of anomalous gold. The copper values corresponding to the higher gold are below average, silver is average and tungsten is slightly above average. In D8105 from 930' to 1137' silver is weakly anomalous with an average of 1.5 ppm. A high composite value in tungsten occurs in the sample from 480'-530' in D8105. This sample was checked and gave values of 170 and 230 ppm. Copper, silver and gold are all average for this interval. Percussion holes P8109, 10, 11 in the Roper Lake deposit are all anomalous in tungsten with individual averages up to 32 ppm. Copper values over 100 ppm generally reflect Nicola volcanics.

The plan configuration of the Roper Lake deposit to the depth of percussion testing is U-shaped and spans 270° of arc. This is a departure from the more typical circular configuration exhibited by domal stockwork molybdenum deposit eroded in a flat plane. In the case of Roper Lake the asymmetry indicated may be a reflection of the physiochemical conditions imposed by the Roper Lake pendant on the mineralizing system. The Upper Triassic pendant appears to have been less susceptible to mineralization than the underlying Roper Lake granites. The strong increase in grade exhibited by molybdenum in the 1967 diamond drilling in the direction of the pendant indicates highly anomalous molybdenum values in these rocks and possibly in the hanging wall of the deposit. Concentric and radial patterns of quartz veins in the Roper Lake stock shown on Plate 2 of this report resemble patterns of structures related to mineralization in the classic stockwork molybdenum deposits of the Colorado Mineral Belt. In these deposits radial and concentric structures are thought to result from adjustments in the magna chamber during successive stages of intrusion. Temporary imbalances in the hydrostatic and lithologic pressures may result in the development of domal and radial fracture patterns in the country rock of highly SiO_2 - K_2O enriched molybdenum source rocks. As the system boils, magmatically derived hydrothermal solutions move into the favourable fracture patterns depositing molybdenite and forming domal molybdenum stockwork deposits. Repeated periods of mineralization accompanying several periods of boiling and fracturing tend to enhance the molybdenum grade or could produce nested stockwork deposits.

Given the characteristic large vertical dimension of important molybdenum stockwork systems, about 800 m for Climax and 1700 m for Henderson-Urad, it is clear that deeper testing within the very large Roper Lake system is required. One could visualize a high grade deposit amenable to block caving on which production decisions could be made and payback achieved. Such an operation could also allow mining of the lower grade reserves now indicated by open pit mining. Reserves in the order of 150 to 200 MT @ 0.2 to 0.25% Mo may be economic for block caving (B. Hancock, personal comm.).

LOCATION

The property is centered a few km south of the Greenstone Mtn. summit and about 12 km southwest of Afton Mines. The property is reached in one hour by car from Kamloops via Highland Valley and Paska Lake roads. A route across the property is being considered for the Coquihalla Highway which, when completed, would put the property within one half hour's drive to Kamloops and four and a half hour's drive to Vancouver. Property elevations range from 1400 to 1600 m. The terrain consists of gently rolling hills treed with spruce and pine. Logging actively in the area during the past seven years has greatly improved the road access. Logging activity in the area planned for the next few years should be monitored for possible new exposures of mineralization and structures.

HISTORY

Kennco Exploration identified molybdenum potential in the area in 1959 through regional geochemical and prospecting programs. Detailed soil sampling and IP the following year yielded substantial anomalies which remained largely untested until 1967 when C.W. Dansey's Dominic Lake Mining undertook major programs of geochemical sampling, road building, bulldozer trenching and percussion and diamond drill testing. The scope of this work was considerable, covering all metal groups now known to exist in the area. Dansey abandoned the ground during the NDP years in the early 70's and it remained variously open or inactive until Jim Dawson and John Kerr of Keda Resources located Happy Days and Happy Days #3 in 1975 and 1976, respectively. These are the core claims of the present Roper Lake property.

D.L. Cooke examined the property for Cominco in 1977 and recommended acquisition. We embarked on a systematic program during the summer of 1978 which included remapping of the Roper Lake stock and the more immediate areas, I.P. surveying to confirm and extend the anomalies obtained by Kennco and, finally overburden sampling. Several small outcrops and/or suboutcrops consisting of porphyritic intrusive with quartz-molybdenum veins and potassic alteration were found east of the volcanic belt now known as the Roper Lake pendant. Since these rocks are strikingly similar in texture to those located to the west of the pendant it was felt that the Roper Lake stock could be very much larger than originally thought. This considerably enlarged the area for molybdenum exploration. A reinterpretation of the Dominic Lake ground magnetic survey in the light of the new mapping enabled us to project, with considerable accuracy the overall outline of the Roper Lake stock. A large I.P. anomaly of intermediate chargeability was indicated in the eastern half of the Roper Lake stock. This information together with metal trends indicated in the 1967 diamond drilling and the soil and bedrock geochemical samples obtained by Bema Industries in the overburden sampling had indicated a substantial percussion drilling target by the end of the 1978 season.

In 1979 work program was intended to give a preliminary indication of the potential of this property by drilling several fences of percussion holes in a ENE direction across the trend of the IP anomaly. The discovery hole was the first percussion hole in the program. This hole was drilled on the strongest geochemical anomaly defined in the Bema sampling. Following the completion of the initial percussion drilling in the spring and summer of 1979 (P79-1 to 17), other programs of percussion drilling were carried out beginning in the fall of 1979. By the end of 1981 a total of 64 percussion holes had been drilled in and around the Roper Lake molybdenum deposit. Diamond drilling, which began in 1980, total ten holes. Miscellaneous targets in and around the Roper Lake stock were tested by other percussion holes.

On the basis of percussion drilling two zones containing intersections of plus 0.06% Mo were indicated. These were the Main Zone, the area of P79-1, 3, 4, 6, 27, and the North Zone, the area of P79-7, 8 etc. With the completion of the roughly 150 m square grid in 1981, it appears that the Main & North Zones represents areas of higher grade within much broader zones defined by the surface projection of 0.03% Mo cut off. The broader zones are called A & B Zones and cover the Main and North Zone areas, respectively. The mutual boundary of the A & B Zones is the indicated Central fault, a major E-W post mineral fault believed to displace the B-Zone downward with respect

to the A Zone. The principal peculiarity of the A Zone is that all but one of the eight diamond drill holes in it intersected a gently WNW dipping post mineral fault apparently with reverse movement. This structure is termed Flat fault and may be a thrust.

Cominco's work on the Roper Lake property spans the better part of an entire molybdenum price cycle. The property was optioned at the time of low metal prices and correspondingly low interest in molybdenum prospects. This fortunate timing enables us to obtain a deal conducive to a long-term holding position, if necessary. The high level of initial encouragement and spectacular increases in molybdenum prices during 1979 and 1980 helped to maintain a high level of interest in the property during these years. The difficulty of correlating diamond and percussion grades, first apparent with the 1980 diamond drilling, was distressing and with falling metal prices throughout 1981 and increased interest in other metal groups a decision was made to postpone further development of the property. Based on expenditures to date totalling \$850,000 on work, 80% or 90% interest can be obtained through cash payments of \$25,000 or \$75,000, respectively due variously by the end of 1982 (\$25,000) and by the end of 1985 (\$75,000).

SUMMARY OF 1981 EXPLORATION AND TOTAL DRILLING TO DATE

Diamond Drilling: 5188' (1582m) in 7 vertical holes

Percussion Drilling: 4070' (1241m) in 15 holes

Total diamond drilling by Cominco to date (all in the Roper Lake deposit): 10 holes total 2228.1 m (D8001-03, D8101-07). Total percussion drilling by Cominco to date in and around Roper Lake deposit: 64 holes total 5217.3 m (P7901-13, 15-23, 26-31, P8002-21, 23, 25-27, P8101-11).

Note: P79-14, 24, 25, P8001, 24, 8112-15 were drilled in targets remote from the Roper Lake deposit (P8022, not included, lost in O/B at 9.1 m next to P8023). Total diamond drilling by Dominic Lake Mining around Roper Lake deposit: 13 holes total 682.3 m (D6701-11, 13, 14).

Extensive improvements were made to the roads in the eastern part of the A-Zone and the central and eastern part of the B-Zone. Percussion and diamond drilling in these areas was carried out under very poor weather conditions necessitating extensive road up-grading during short breaks in the weather. These road improvements enabled us to complete the program more or less as planned. The 1981 road work resulted in much improved access for future programs. The right-of-way was cleared for a road to the molybdenum drill target located southeast of P79-02. Due to the wet weather the equipment was barely able to remove the trees from the right-of-way but no leveling could be done. As a result, this target remains untested.

TENURE

A tenure list is included with this report as well as a comprehensive claim map showing all claims in the Roper Lake group as well as some of the adjoining properties namely those held by Cominco Ltd. outright (RAG, AMRON); by Lakeview Mines (DOMINIC, CHERISE) and by Barrier Reef Resources (GIL). Comprehensive claim searches have been carried out in effort to verify mineral rights of claims covering the Roper Lake stock where the principal moly potential exists and the RAG-HAPPY DAYS #5 area where the principal Cu-Au potential occurs. It appears that mineral rights are well protected by existing claims. Extensive logging has been approved by the Forestry for the HAPPY DAYS and RAG claim. Loggers have the reputation of not being duly concerned with claim posts. Weyerhaeuser of Kamloops is the principal operator in the area and it has been our experience that by cooperating with them we can expect a minimum of disruption of our activity including damage to claim posts. A large area covering the western part of the B Zone is scheduled to be logged this year. There are no critical claim posts in this area and all drill holes have been surveyed.

AGREEMENT

The development work has been carried out under the Roper Lake Agreement which is dated May 24, 1978.

Agreement determined expenditures on work and option payments:

<u>Due Date</u>	<u>Accumulative Work</u>	<u>Option Payment</u>	<u>Total Interest</u>
Dec. 31, 1982	\$500,000	\$75,000 total (\$25,000 is due Dec. 82)	80%
Dec. 31, 1985	\$800,000	an additional \$75,000 in total @ \$25,000 per year for 1983-85	90%
June 30, 1986	Nil	\$1,500,000 cash	100%

Total work expenditures on the property to December 31, 1981 is about \$850,000.

Included in this total are administrative costs. Accordingly, all work requirements in the Agreement have been met. Cash payments to date total \$50,000.

REGIONAL GEOLOGY

The porphyry belt of southern B.C. in which the Roper Lake property is located is dominated by Upper Triassic island arc volcanics, associated sediments and coeval intrusions of both alkaline and calc alkaline compositions. Alkaline intrusions and/or coeval volcanics of Upper Triassic age are favourable hosts for copper-gold porphyry deposits such as the Copper Mountain deposits, Ingerbelle and the Iron Mask deposits. The principal examples of porphyries in the calc alkaline setting are the large copper (+ molybdenum) deposits found in the Guichon Batholith. A productive copper-molybdenum porphyry environment in southern B.C. younger than the dominant Upper Triassic group is the Brenda deposit associated with the Lower Jurassic Brenda stock (K/Ar 176 m.y.) In this deposit, the mineralization appears to have an age of 146 m.y. based on K/Ar dating of biotite associated with ore. Younger deposits include Fish Lake (copper, gold) which is Upper Cretaceous with a K/Ar date of 77m.y. and Maggie (copper, molybdenum) which is Early Tertiary with a K/Ar age of 61 m.y. In the Roper Lake area no K/Ar dating has been done but a total of six Rb/Sr ages have been obtained - four from the Roper Lake and two from the Durand Lake stocks. A Lower Cretaceous age of 125 m.y. is indicated for these intrusions.

PROPERTY GEOLOGY

The country rocks of the Roper Lake stock are Upper Triassic Nicola Group, consisting of augite porphyry andesite, crystal and crystal lithic tuff, augite porphyry lapilli and volcanic siltstone. South of the stock these rocks strike northerly but near the contact of the stock, they parallel the contact indicating possible doming of the country rock as a result of forceful intrusion. The Roper Lake stock is indicated to be of Lower Cretaceous age. The principal rock type in the Roper Lake stock and the principal host for molybdenum mineralization is K-spar megaphenocryst porphyry. This is a massive, porphyritic, granitic rock, containing 12-20% quartz in the form of quartz eyes. It has a highly variable percentage of 1½ cm - 4 cm megaphenocrysts of "perthitic" feldspar. The groundmass is medium grained containing K-spar, plagioclase, quartz and biotite (the sole mafic mineral). The second principal lithology is called Roper Lake granite, variety "A". This variety contains the same modal minerals as the K-spar megaphenocryst porphyry but differs only in grain size. variety "A" is fine to medium grained. K-spar phenocrysts present in variety "A" are rarely larger than ½ cm in diameter. The distribution and form of variety "A" is not known, however, variety "A" dykes are seen to intrude K-spar megaphenocryst porphyry with chilling of variety "A".

The distribution of the variety "A" in the 1967 diamond drilling near Roper Lake cannot be verified since the core has been destroyed. However, one gets the distinct impression from the remaining core located at the northwest end of Roper Lake near P80-25 that variety "A" may be the principal rock type in the area surrounding Roper Lake. Our own mapping and drilling support this to some extent. At the north end of the Roper Lake stock along the road to Dominic Lake K-spar megaphenocryst porphyry is again the dominant lithology exposed.

A fourty meter section of variety "A" occurs near the bottom D81-03. It appears to grade into K-spar megaphenocryst porphyry higher in the hole. At the bottom of this hole, variety "A" is in fault contact with the Nicola volcanics. It is assumed that variety "A" represents a major late pre-mineral intrusion centrally located in the Roper Lake stock.

Intruding the above are a variety of pre- and post-mineral dykes. Quartz porphyry and quartz feldspar porphyry dykes are both pre- and post-mineral without any distinctive lithological difference. Feldspar porphyry dykes appear to be post mineral generally. Premineral aplitic dykes, locally well mineralized, are indicated in a presently water-filled trench at the north end of Roper Lake near several angular blocks of aplitic rock containing well developed quartz-moly stockwork. The source of this material is unknown, however, at the same location, chalcopyrite bearing monzonite float is also located. The source of the monzonite is known to be the Durand Lake stock located to the NW. The classical stockwork molybdenum deposits of the Colorado Mineral Belt contain a great variety of intrusive types distinguished with difficulty only through textural and mineralogical characteristics.

It is felt that a similar pattern of intrusive complexity may be emerging at Roper Lake where the testing to date has been in the upper part of the system only. Complexity in igneous rock types in a stockwork molybdenum situation increases the probability of having several periods of molybdenum mineralization and the chances of forming ore grade mineralization.

Andesitic dykes which are clearly post-mineral are common in outcrop in the Roper Lake pendant and occur variously throughout most of the diamond drill holes. Such dykes are particularly numerous in D81-03 where they make up a significant percentage of the total rock. The dykes were also exposed in the eastern portions of the RAG group during logging activity there last summer. Their general strike appears to be east south-easterly. In the Roper Lake deposit the dykes are chilled against Roper Lake granite. Occasionally they contain fragments of mineralized Roper Lake granite. In outcrop the andesite dykes exhibit much less deformation than dykes of K-spar megaphenocryst porphyry which are typically faulted and intensely fractured. It is felt that the andesite dykes may be indicative of a major through going Tertiary fracture zone and could be feeders for overlying volcanics. In at least two areas, Tertiary volcanics are found in proximity to such dykes. These include the east central portion of the RAG group and near the north western corner of HAPPY DAYS #5.

Attempts have been made to classify the Roper Lake granites by means of etching and staining of slabbed specimens. The great abundance of K-spar filled fractures render the determinations of K-spar and plagioclase modes unreliable because it is difficult to determine what proportion of feldspar that is primary and how much is metasomatically introduced. Veins and fracture fillings of K-spar are thought to represent alteration. In view of these difficulties attempts have been made to classify the Roper Lake intrusives based on textures, grain size, and mineralogical peculiarities.

STRUCTURES

Major lineaments in the Roper Lake stock area include an E-W trend through Dominic Lake, a NW trend through the Roper Lake pendant and a NE trend through the NE quadrant of the stock.

Evidence of post mineral deformation is to be found everywhere in the deposit. Crushed moly stockwork vein material is frequently incorporated in major faults and minor gouge zones. A major fault which is indicated to strike NNE and dip very gently towards the west has been intersected in seven out of eight diamond drill holes in the A-Zone. This fault may be a small scale thrust with a minimum of 0.6 km apparent movement. Based on limited petrographic work on samples of Nicola volcanics from the structural footwall there is no indication of thermal metamorphism in the footwall which, if present, would indicate that movement on this structure may be less than the width of the contact aureole of the intrusion. The name "Flat fault" is assigned to this structure. Assuming the Climax - Henderson model for stockwork molybdenum deposits is a guide to ore at Roper Lake, it becomes crucial to determine the displacement of Flat fault. This structure is unlikely to outcrop hence the problem would have to be resolved through diamond drilling. A deep diamond drill hole in the vicinity of P79-15 could produce much needed structural information as well as providing a preliminary test of the block caving potential of the system. Certain geophysical surveys in the form of ground magnetics and EM-VLF should be carried out in the central part of the Roper Lake deposit to determine the position of a second post mineral fault, called "Central fault", which appears to have displaced the B-Zone downward relative to the A-Zone. At present there is no direct evidence to this structure. However, the control on Flat fault in the northern edge of the A-Zone is relatively good and the absence of the Flat fault in D81-05 at a depth of over 100 m below the projected structure makes the introduction of an E-W fault the simplest solution. Some indication of such a structure exists on the Roper Lake pendant where a bulge exists in the contacts of the pendant north of P79-15. If the pendant contacts dip inward, as they very likely do, the widening of the pendant may be a sign of faulting with the north block having been displaced downward in respect to the south block. A second feature that suggests the same sort of movement is the occurrence of numerous Roper Lake granitic dykes which cut the pendant south of P79-15 as indicated on the 1967 diamond drill holes. Scarcity of such dykes, as indicated in percussion holes north of P79-15, suggests that area is stratigraphically different from & probably higher than the south block.

Attitudes of quartz veins with or without visible molybdenite appear to exhibit concentric and radial patterns. A total of about seventy structures are plotted on Plate 2 of this report. Fracture patterns of these types are reported to occur in the classical stockwork molybdenum deposits of the Colorado Mineral Belt where fractures of this type are regarded as guides to blind stockwork molybdenum deposits.

On the diamond drill logs, core angles of mineralized structures have been tabulated at ten-foot intervals corresponding to the sample intervals. Because these structures represent prominent planes of weakness in a deposit of this type, their dips become an important factor in any pit stability considerations.

ALTERATION

Potassic alteration is expressed by K-spar selvages. Large "perthitic" megaphenocrysts, characteristic of some of the Roper Lake rocks, may have formed at least partly through metasomatism. G. Medford has found that each of the "megaphenocrysts" encompasses remnants of many plagioclase crystals with different optical orientation, not to mention quartz and mica. If the K-spar were true phenocrysts that nucleated around a pre-existing plagioclase, one would expect a central core of plagioclase with few other impurities. However, the K-spar is "perthitic" to some extent. Medford finds that at the edge of some of the large K-spar there exists a "frozen" non-perthitic growth zone with frequent protrusions out into the ground mass of the rest of the rock. He concludes that K-metasomatism is the most likely source of the K-spar. This alteration clearly predates mineralization based on commonly observed cross cutting relations.

Quartz veins are everywhere present and generally mineralized except for D81-03 where the bulk of the veins contain no visible molybdenite. Another expression of silicification noted is the apparent re-crystallization of quartz-eyes by the addition of SiO_2 , thereby enhancing the size of quartz grains. This is similar to the development of "irregular quartz-eye porphyry" noted in moly deposits such as Climax and Mount Tolman.

Alteration of plagioclase leads to the formation of clay minerals. In the drill core plagioclase is typically greenish in appearance while remaining quite hard to the knife blade. In more intense alteration of plagioclase, the feldspar becomes soft and clayey in appearance suggesting more advanced breakdown of plagioclase to clay minerals.

Sericite development, while present is not strongly developed. Locally, an emerald green colouration of feldspar is noted. Similar material is widespread in the Valley Copper deposit where the material was X-rayed and found to be sericite.

Alteration of biotite to form chlorite is widespread. Occasionally a few ragged brown biotite grains have been noted on the percussion cuttings. This form of biotite could be regarded as hydrothermal biotite.

D81-03 intersected a low grade area central to the deposit. Here the alteration consists of abundant barren quartz veins and K-spar-filled fractures, vein selvages and "kspathized" albite phenocrysts. The intensity of quartz veining is striking and certainly the most intense silicification noted to date in the deposit.

MINERALIZATION

The molybdenum mineralization is controlled by structures occurring as fracture and open space fillings in quartz veins. Kspathized fractures frequently contain molybdenite. Quartz veins are typically less than 1 cm wide, and most commonly range from 2 to 5 mm in width. Abundant molybdenite is frequently noted in the edges of quartz veins where slippage has taken place. Faults frequently contain crushed and sheared quartz vein material which was mineralized before deformation. Narrow breccia zones in the Roper Lake granite and in relatively wide brecciated quartz veins frequently contain high grade mineralization. Chlorite is frequently found in the gangue of such breccia zones. Other sulphides present include pyrite (ubiquitous) and chalcopyrite which is very rarely seen. The moly grade is highly sensitive to the frequency of post mineral gouge zones in which evidence of post mineral movement include crushed and sheared quartz veins. It appears that molybdenite may have become remobilized into these structures mechanically or injected hydrothermally.

COMPARISON IN GRADE BETWEEN VARIOUS SAMPLING METHODS

Shown below in tabulated form are comparisons between our own sampling and that of another operator together with miscellaneous grade comparisons. While one could not expect two different sample techniques to yield exactly the same results in low grade mineralization such as this, a more random variation in results is expected than that indicated to date. In the comparisons to date, diamond drilling grades are always lower than percussion grades by highly varying amounts. The suggestion is made that a systematic sampling error is involved. Based on geostatistical work by G.F. Raymond on frequency distributions and variograms for the percussion results to date it appears that a low "nugget" effect is present in the data which would not be expected for mineralization that is characteristically as erratic as molybdenum. A possible explanation for this is "smoothing" of the grade distribution due to erosion of soft structures and salting. A similar statistical study should be made on the diamond drill data. In diamond drilling small losses from individual high grade shears that generally represent extremely soft rock have potential for significant metal losses.

TABLE A

Comparing Percussion and Diamond Drilling
Molybdenum Assay Results for Nearby Holes

Hole Location	Percussion Drilling		Diamond Drilling				Separation of Collars	
Hole Location	Hole No.	Average % Mo/m	Hole No.	Average % Mo/m	Percent Core Recovery	Sample Type	(m)	% Percussion Samples Exceed Core Samples
A-Zone Zone	79-01	$\frac{0.078}{77.1}$	8001	$\frac{0.071}{78.1}$	96.1	Whole Core	4	10
A-Zone Zone	79-03	$\frac{0.072}{51.8}$	8101	$\frac{0.026}{50.1}$	99.7	Split Core	15	177
A-Zone Zone	79-04	$\frac{0.027}{73.1}$	8102	$\frac{0.016}{73.0}$	98.7	Split Core	7	69
A-Zone Zone	79-06	$\frac{0.072}{60.9}$	8002	$\frac{0.047}{61.0}$	99.6	Split Core	7	53
B-Zone Zone	80-15	$\frac{0.052}{95.4}$	8106	$\frac{0.033}{97.0}$	98.4	Split Core	7	58
B-Zone Zone	80-14	$\frac{0.056}{87.0}$	8105	$\frac{0.044}{88.0}$	99.0	Split Core	15	27

Note: All of the above holes are vertical and the averages are weighted.

- B. Comparison between a 1967 diamond drill hole and a 1979 percussion hole, drilled vertically with collars about 3 m apart.

Hole	Grade	Total Length of Intersection	Core Recovery	Type of Sample
D67-13	0.026%	24.7 m	84%	Diamond drill sludge
P79-10	0.017%	24.4 m	-	Percussion sludge

- C. Comparison between averages based on core and diamond drill sludge for 1967 holes.

DDH 67-	Sludge Samples		Core Samples (BQ) with water		
	%Mo	Interval (m)	%Mo	Interval (m)	Core Recovery
1	0.015	45.7	0.015	48.8	95.9
2	0.026	53.7	0.025	54.6	96.3
3	0.025	54.9	0.022	56.4	91.6

Note: The former operator sludge sampled the remaining twelve diamond drill holes but assayed no core. This core was subsequently discarded near P80-25.

- D. Comparing the grades of the two intersections of the same mineralized zone in holes of different inclination.

10.

<u>DDH</u>	<u>Intersection</u>	<u>Grade</u>	<u>Hole Dip</u>	<u>Recovery in Intersection</u>
8002	The first 12.2 m	0.103	-90°	97.5
8003	The first 19.2 m	0.059	-55°	100.0

Note: Sharp grade changes occur after the first 12.2 and 19.2 in the respective holes.

E. Comparison within a diamond drill hole between the original split core and resampling based on remaining core.

<u>Footage in D80-03</u>	<u>Original assay (%Mo) ERL</u>	<u>Remaining Core (%Mo) ERL</u>
70 - 80	0.063	0.064
280 - 290	0.073	0.054
470 - 480	0.064	0.081
	mean 0.067	mean 0.066

Note: Although individual samples may vary considerably the means remain effectively the same.

F. Other checks that have been made include re-assay of various diamond and percussion samples variously by Bondar-Clegg and Chemex. These results are in close agreement with Cominco's own Exploration Lab results.

RESERVES

Reserve calculations were made for the A and B zones based on north-south cross-sections 11050E through 12100E using a 0.03% Mo cut off and assuming percussion results are reliable. In these calculations diamond drill holes were not taken into account in calculating the average grade. Possible reserves are those assumed to extend vertically beyond percussion hole depths where the zone is indicated open to depth. In the case of the A Zone such reserves are assumed to extend to Flat Fault. For the B Zone the possible reserves are assumed to extend to a depth equivalent to the bottom of D81-05.

<u>Zone</u>	<u>Indicated Reserves</u>		<u>Possible Reserves</u>
	<u>Reserves (tonnes)</u>	<u>%Mo Grade</u>	
A - Zone	50 x 10 ⁶	0.049	105 x 10 ⁶ tonnes
B - Zone	45 x 10 ⁶	0.050	150 x 10 ⁶ tonnes
TOTAL	95		255

Total indicated reserves 95 x 10⁶ tonnes @ 0.05% Mo

Total possible reserves 255 x 10⁶ tonnes

Potential 350 x 10⁶ tonnes

On the basis of diamond drilling information in the A-Zone two better than average areas are indicated. The first of these is a 12 to 15 m wide band intersected in D81-01, 02 and D81-01 and 06. This represents 3.5 x 10⁶ tonnes 0.11% Mo. Directly under this high grade is a zone estimated to contain 20 x 10⁶ tonnes grading 0.057% Mo.

*Doubtful
these can be
concluded*

Within the area of B-Zone tested by D81-05, P79-07, P81-07, 08 and 09 slightly above average grade material is indicated (+0.05). The tonnage potential of this better grade is $+50 \times 10^6$ tonnes.

PERCUSSION DRILLING TARGET ON HAPPY DAYS #9 (RECORD NO. 2194)


Copper, molybdenum, tungsten soil geochemical anomalies were indicated in 1980 in this area on the western flanks of the Roper Lake stock near the south side of Dominic Lake. The extension of a very large I.P. anomaly located on the northern and western flanks of the Roper Lake stock extends into the area of interest. P81-12 to 15 were drilled along an E-W road and a side road built in 1980 to provide access for a percussion drill which would drill a fence of holes across the various anomalies. All of the holes encountered Nicola volcanics including miscellaneous dykes indicated to be feldspar porphyries. Quartz veins occur in all holes. The I.P. anomaly may be explained by pyrite occurring in the volcanics (1-3%). Hole P81-12, drilled about 300 m west of the contact of the Roper Lake stock, returned 30.5 m @ 0.027% Mo in the top of the hole. The depth of overburden is about 6 m. There is considerable room for further percussion testing in this area primarily along the contact of the Roper Lake stock and northward to Dominic Lake. The nearest holes to P81-12 are D67-12 and P67-07; both over 300 m away. There was no encouragement from either of these holes which were drilled in the edge of the Roper Lake stock.

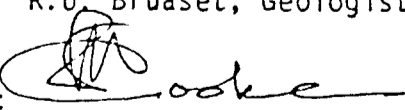
CONCLUSIONS AND RECOMMENDATIONS

A large subeconomic molybdenum deposit lying close to the surface has been indicated on the Roper Lake property. There is potential for economic mineralization within the system. The most likely place for economic mineralization is at depth within the system, but the grade would have to be sufficiently high to allow mining by block caving. A block caving target in this situation might be in the order of 150 to 200×10^6 tonnes grading 0.2 to 0.25% Mo.

A great deal of uncertainty exists in the grade potential of the A and B Zones. It is felt that the diamond drill grades indicated are generally on the low side because of molybdenite losses in the drilling, and percussion holes may be on the high side because of salting. Comparative figures for other deposits are scarce. The consensus of opinion is that the moly grade of low grade deposits is difficult to establish by drilling but bulk sampling or mining grades tend to be significantly higher than that indicated by drilling. A figure of 20% to 30% higher than percussion grades has been suggested at Lornex (M.J. Osatenko personal comm.) A 20% to 30% boost in the Roper Lake grade would not make the deposit economic but would very much enhance its long term potential especially if sufficient ore were found elsewhere in the system on which payback could be based.

An economic target for open pit mining is in the order of 100×10^6 tonnes, grading about 0.09% Mo. The potential for such a deposit has been greatly reduced by the work to date. However, the potential for a block cavable deposit has not been investigated. The proposed model suggests areas where investigations could start for such a deposit. Continued drilling is warranted in the better grade areas of the A and B Zones in an effort to firm up grades and reserves. Rotary drilling and/or whole core assay may increase the grade confidence level. Further percussion drilling in the area of P80-12 on the west flanks of the Roper Lake stock could lead to the discovery of open pit mineable molybdenum ore possibly with tungsten by product.

Report by: 
R. U. Bruaset, Geologist

Endorsed by: 
D. L. Cooke, Senior Geologist

APPENDIX IROPER LAKE1981 MOLYBDENUM RESULTSDIAMOND DRILLING(EXPLORATION RESEARCH LAB RESULTS)

NOTE: All lengths are in feet.

<u>Hole</u>	<u>Length</u>	<u>From</u> - <u>To</u>	<u>Width</u>	<u>Mean % Mo</u>	
8101	(776)	0 - 24	24	(Overburden)	
		24 - 57	33	0.022	
		57 - 370	313	0.036	
		370 - 457	37	0.005	
		457 - 519.5	62.5	0.112	
		519.5 - 725.5	206	0.064	
		725.5 - 776	50.5	0.003	
		(Volcanics)	END		
8102	(893)	0 - 22.5	22.5	(Overburden)	
		22.5 - 350	327.5	0.016	
		350 - 400	50	0.038	
		400 - 450	50	0.015	
		450 - 600	150	0.016	
		600 - 650	50	0.014	
		650 - 760	110	0.033	
		760 - 790	30	0.014	
		(Volcanics)	790 - 893	103	0.003
	END				
8103	(637)	0 - 64	64	(Overburden)	
		64 - 610	546	0.009	
		(Volcanics)	610 - 637	27	<0.001
	END				
8104	(623)	0 - 8	8	(Overburden)	
		8 - 260	252	0.034	
		260 - 490	230	0.046	
		490 - 590	100	0.070	
		(Volcanics)	590 - 623	33	0.002
	END				
8105	(1137)	0 - 61	61	(Overburden)	
		61 - 180	119	0.060	
		180 - 277.5	97.5	0.030	
		277.5 - 414	136.5	0.044	
		414 - 456.5	42.5	<0.001	
		456.5 - 580	123.5	0.057	
		580 - 830	250	0.030	
		830 - 910	80	0.048	
		910 - 990	80	0.026	
		(No "footwall"	990 - 1090	100	0.048
		volcanics in 8105)	1090 - 1037	47	0.024
			END		

<u>Hole</u>	<u>Length</u>	<u>From - To</u>	<u>Width</u>	<u>Mean % Mo</u>	<u>Location</u>
8110	300	12 - 300	288	0.013	North of the North Zone
	Includes	12 - 220	208	0.01	
	Includes	220 - 280	60	0.028	
	Includes	280 - 300	20	0.008	
8111	350	28 - 350	322	0.005	In low grade core of Roper Lake deposit
8112	300	19 - 140	121	0.025	In I.P. - soil anomalies west of Roper Lake stock. Hole nearest to Roper Lake stock.
		140 - 200	60	0.009	
		200 - 280	80	* < 0.001	
		280 - 300	20	0.006	

* Except for one, all samples below detection limit.

8113	220	0 - 90	90	0.002	Location as 8112
		90 - 220	130	* < 0.001	

* Average includes eight below detection limit.

8114	220	0 - 220	220	* ≈ 0.002	Location as 8112
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* Average includes five samples below detection limit.

8115	250	7 - 250	243	* ≈ 0.001	Location as 8112
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* Average includes seven samples below detection limit.

APPENDIX II

ROPER LAKE

1981 PERCUSSION DRILLING

MOLYBDENUM ASSAY SUMMARY

BASED ON EXPLORATION RESEARCH LAB RESULTS

Re Job V81-0732R

NOTE: All lengths in feet

Hole	Length	From - To	Width	Mean % Mo	Location
8101	300	34 - 300	266	0.008	South of Main Zone
	Includes	34 - 100	66	0.019	
		100 - 300	200	0.005	
8102	300	95 - 300	205	0.018	South of Main Zone
	Includes	95 - 280	185	0.016	
		280 - 300	20	0.040	
8103	300	23 - 300	277	0.027	Western extension of North Zone
	Includes	23 - 190	167	0.025	
	Includes	190 - 220	30	0.044	
	Includes	220 - 250	30	0.023	
	Includes	250 - 280	30	0.033	
	Includes	280 - 300	20	0.014	
8104	300	73 - 300	227	0.017	Western extension of North Zone
	Includes	73 - 190	117	0.014	
	Includes	190 - 240	50	0.03	
	Includes	240 - 300	60	0.01	
8105	220	33 - 160	127	*<0.001	East of Roper Lake Stock. Incr. amnts.
		160 - 220	60	0.044	of Roper Lake granitic rocks from 160.
* Average includes seven samples below detection limit (0.001)					
8106	350	35 - 160	125	*<0.004	East of Roper Lake Stock.
		160 - 290	130	0.037	Increasing amounts of Roper Lake
		290 - 350	60	0.019	granitic rocks from 160.
* Average includes six samples below detection limit.					
8107	260	27 - 260	233	0.042	Eastern extension of North Zone
	Includes	27 - 220	193	0.033	
	Includes	220 - 260	40	0.082	
8108	290	11 - 290	279	0.032	Eastern extension of North Zone
	Includes	11 - 90	79	0.01	
	Includes	90 - 150	60	0.045	
	Includes	150 - 260	110	0.018	
	Includes	260 - 290	30	0.010	
8109	110	18 - 110	92	0.004	East of the Roper Lake Stock

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APPENDIX III

ROPER LAKE

1981 PERCUSSION AND DIAMOND DRILLING

COMPOSITE SUMMARY

Note: All lengths in feet, highest value shown if above detection limit (Ag .4, Au 10, W 2), composite interval usually 50'.

Hole	Length (ft)	Cu ppm (highest)	Ag ppm (highest)	Au ppb (highest)	W ppm (highest)
P8101	266	47 (74)	<.4	(.5) (<12)	5 (20)
P8102	205	41 (46)	<.4	(<10)	4 (5)
P8103	277	101 (116)	<.4	(<10)	11 (20)
P8104	277	35 (46)	<.5	(.6) (<10)	15 (20)
P8105	187	110 (144)	<.5	(.6) (<10)	8 (10)
P8106	315	110 (185)	<.7	(1.6) (<10)	10 (12)
P8107	233	34 (37)	<.8	(1.2) (<10)	13 (20)
P8108	279	83 (224)	<.4	(.5) (<10)	9 (10)
P8109	92	157 (170)	<.4	(<10)	23 (25)
P8110	288	46 (86)	<.4	<10	25 (30)
P8111	322	16 (19)	<1.02	(3.7) <10	32 (120)
P8112	281	211 (320)	<.4	(.5) <10	17 (10) (40)
P8113	220	106 (138)	<.4	<18	6 (40) (8)
P8114	220	166 (213)	<.4	<10	15 (20)
P8115	243	151 (190)	<.4	<10	14 (20)

Reference Job V 81-0742R

DIAMOND DRILLING

D8101	752	48 (165)	<.4	<14	12 (64) (75)
D8102	870.5	27 (107)	<.4	<10	7 (92) (30)
D8103	573	25 (91)	<.4	<10	6 (10)
D8104	615	43 (136)	<.4	(.7) <10	5 (12)
D8105	1076	33 (140)	<.7	(1.7) <11	20 <19 (230)
D8106	421	36 (104)	<.4	<10	7 (10)
D8107	356*	53 (58)	<.4	<10	8 (12)

References: Jobs V81-0168R, 0181R, 0206R, 0244R, 0252R, 0269R, 0300R, 0309R

* 388' - 401' not analyzed

ANALYTICAL METHODS

Cu, Ag Aqua Regia Digestion/AA
Au Aqua Regia Digestion/solvent Extraction A/A
W Pyrosulphate fusion/colorimetric

<u>Hole</u>	<u>Length</u>	<u>From</u> - <u>To</u>	<u>Width</u>	<u>Mean % Mo</u>
8016	(463)	0 - 42	42	(Overburden)
		42 - 80	38	0.031
		80 - 109	29	<0.001
		109 - 180	71	0.025
		180 - 290	110	0.051
		290 - 350	60	0.025
		350 - 463	113	0.042
			END	
8107	(659)	0 - 32	32	(Overburden)
		32 - 200	166	0.029
		200 - 280	80	0.062
		280 - 330	50	0.088
		330 - 620	290	0.040
		620 - 625.5	5.5	0.040 (Est.)
		625.5 - 631.5	6.0	<0.001 (Est.)
		631.5 - 659	27.5	0.001 (Est.)
	END			

NOTE: The section from 620' to 659' has been retained unsplit as a type-section for the faulting which cuts off the mineralized zone in seven out of the ten diamond drill holes to-date.

This core, together with type samples from all diamond drill holes, is currently stored in the Cominco warehouse.