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ALTERATION STUDY OF THE 1981 DRILLING AT THE TROUT LAKE MOLYBDENUM DEPOSIT, B.C.

Newmont Exploration Limited Metallurgical Department Danbury, Connecticut

DMH/FK:pk

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METALLURGICAL DEPARTMENT

September 14, 1984

Mr. H. Craig Boyle Newmont Exploration of Canada Ltd. Suite 1400 - 750 West Pender Street Vancouver, B.C. V6C 1K3

Dear Craig:

Enclosed herewith is the final topical report on alteration contouring of the Trout Lake molybdenum deposit. As requested, we have revised the principal sections, AA', BB', CC' and EE', that have been updated by the 1981 drilling.

I call to your attention that measurable alteration holes of silicification, feldspar alteration and antithetic sericitization are associated spacially with MoS₂ mineralization to the northwest and southeast of the high grade center section, AA', and especially down plunge to the southwest along dilation splay faults and apophyses peripheral to the granodiorite stock. This dilation zone of intermittent faulting associated with mineralization and alteration is expected to persist down plunge to the southwest at the steep angle defined by drilling to date below the limits of current drilling. For this reason, deeper development drilling is expected to intersect additional reserves along recurring faults and provide a continuing target for future exploration and mine development in this direction.

Limits of higher grade reserves (>0.5% MoS_2) appear to be confined within narrow limits laterally to the northwest and southeast of Section AA', whereas lower grade ores (approx. 0.1-0.2% MoS_2) persist noticeably to the southeast, coincident with major alteration trends. The persistence of en echelon alteration trends at depth to the southwest is favorable for the occurrence of additional ore-bearing structures below the limits of drilling in each of the sections.

Sincerely yours,

NEWMONT EXPLORATION LIMITED

D. M. Hausen

DMH:pk

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INTRODUCTION

This report describes the results of a continuing alteration study of the Trout Lake molybdenum deposit, including drill samples from nineteen additional holes drilled in 1981 from underground. Representative pulps were provided from the 19 holes by H. C. Boyle, ^{1,2} along with geologic sections and background information on the 1981 work program.

Sample pulps from each hole were analyzed by XRD-XRF methods, and calculated into normalized weight percentages of major alteration minerals by computer, as described in previous reports.^{3,4} Alteration data were then plotted and contoured onto vertical sections (Figure 1), from which trends of alteration and mineralization were projected.

The major areas of interest, as indicated by Mr. Boyle, ¹ include the following:

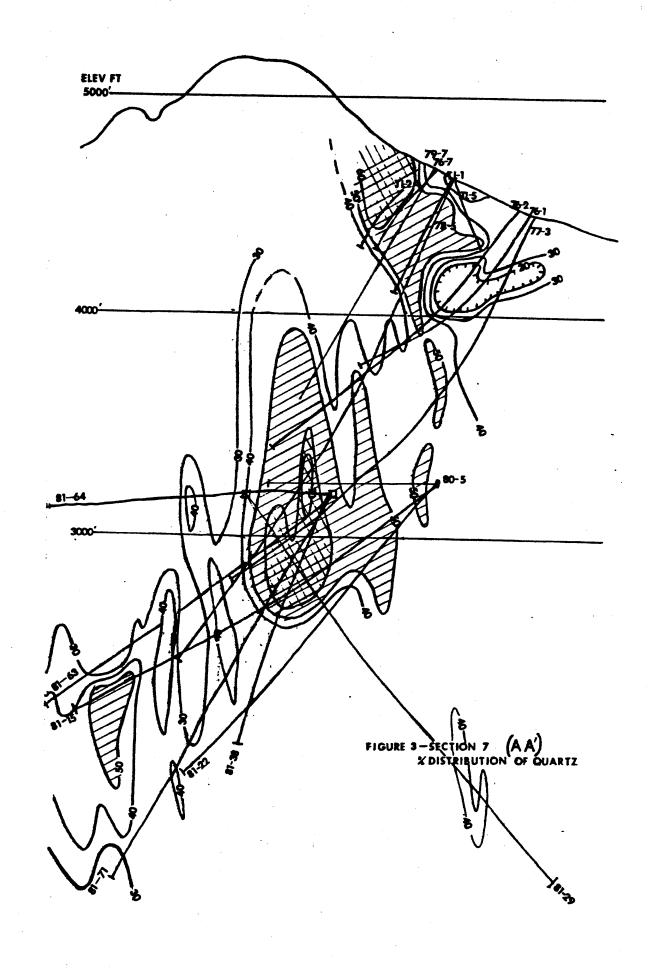
- A check to the northwest of the deposit for possible extensions of mineralization at depth. (Sections 3 and 4 shown on BB'.)
- A check for a possible down faulted zone of mineralization at depth on the east side of Z Fault. (Sections 8, 9 and 10, as shown on CC'.)
- 3. A check for alteration trends at depth to the southwest to evaluate the possibility of additional mineralization in the "F" zone and beyond. (Sections 6, 7 and 8, as shown on AA'.)
- 4. A check of alteration patterns in holes drilled from the end of No. 4 Drift south (Section 12), to see if any indication of further mineralization exists at depth to the southeast. (Shown on EE'.)

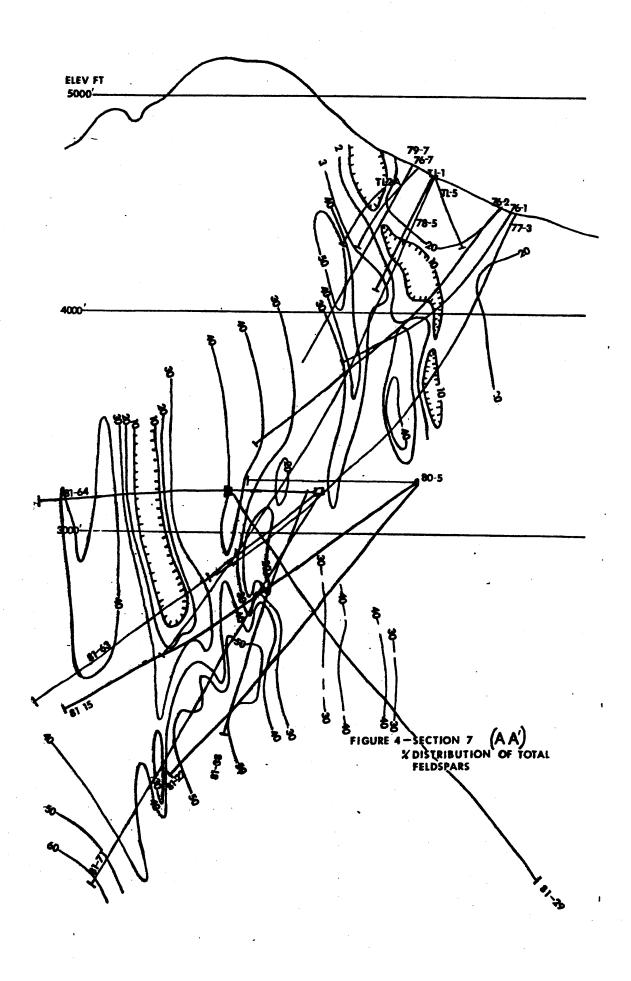
As requested, this ongoing study was conducted on a low priority basis whenever time was available between more pressing projects, resulting in an appreciable savings in overall cost to the Vancouver Newmont office.

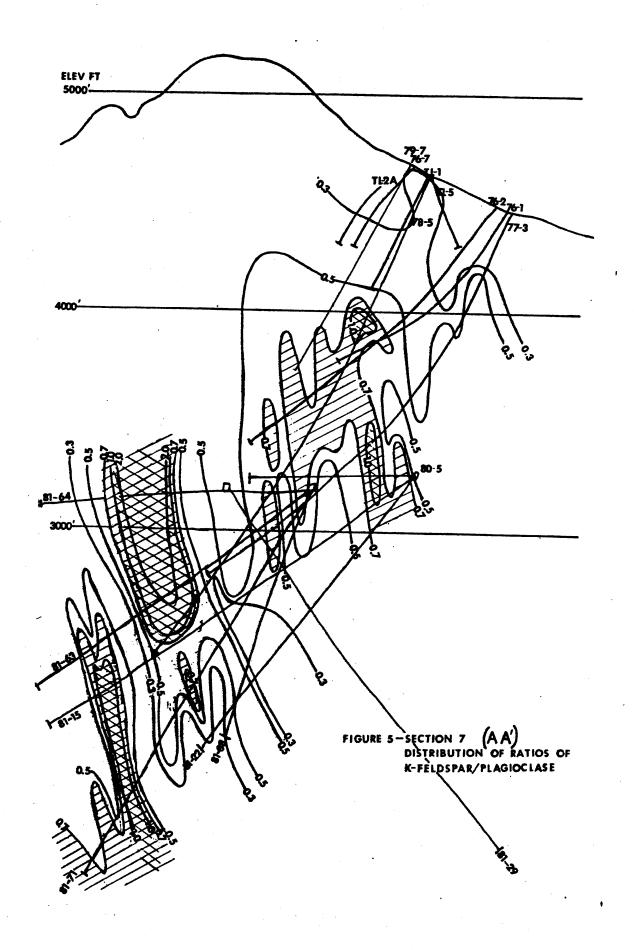
SUMMARY

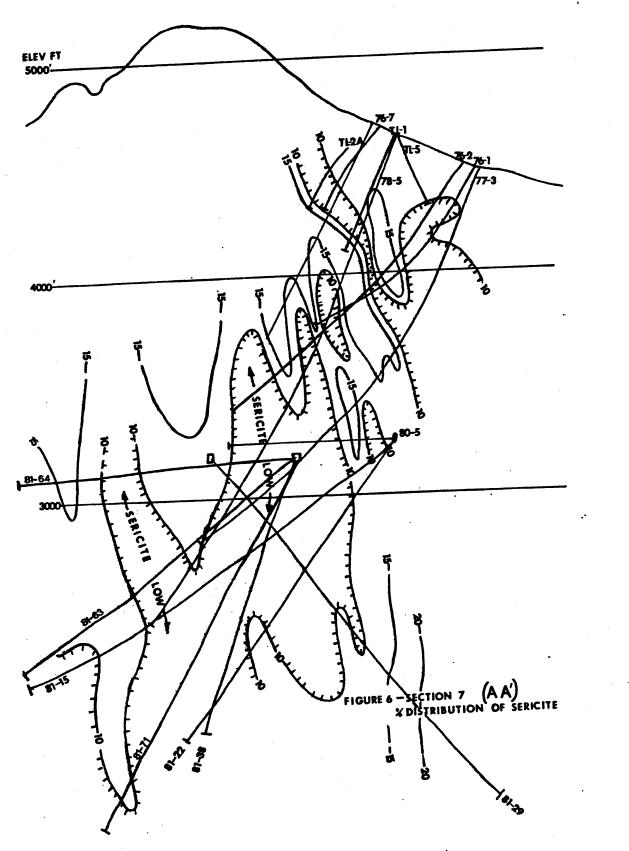
Although MoS₂ mineralization drops off appreciably in grade and thickness along sections northwest (BB') and southeast (CC' and EE') of the high grade center section (AA'), lower grade mineralization associated with measurable alteration halos persists pervasively to the northwest and southeast, and especially down plunge to the southwest along intermittent splay faults and peripheral apophyses from the granodiorite contract. These premineral structures appear to represent dilation zones that apparently opened up at the time of mineralization, and provided channels for the penetration of late pneumatolytic solutions that mineralized and altered the host schists southwest of the intrusive stock.

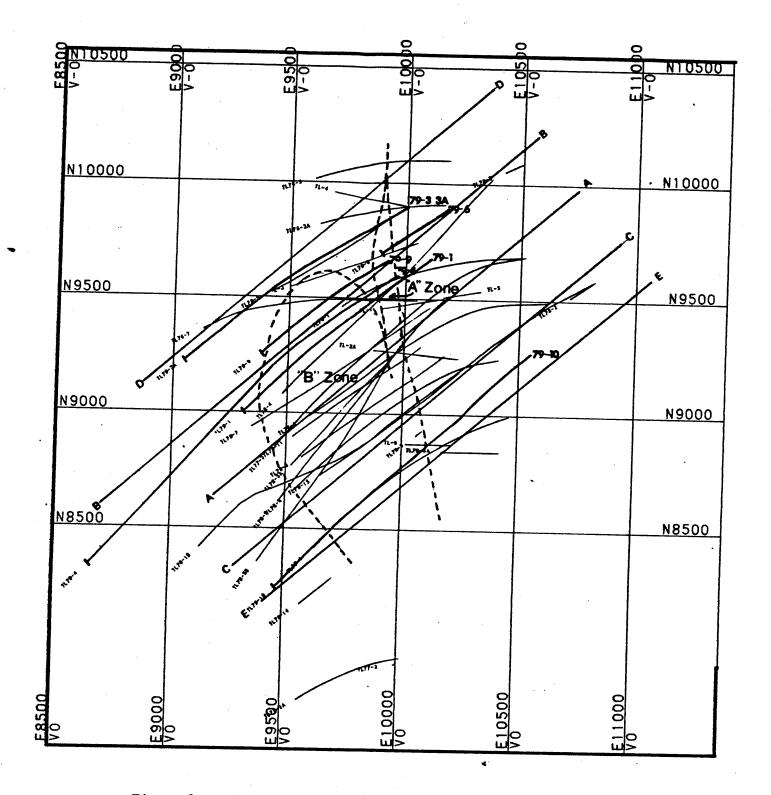
This dilation zone would be expected to persist down plunge to the southwest at the steep angle defined by drilling to date, and should provide a continuing target for future exploration and development drilling in future years.

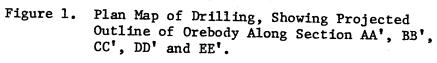












DESCRIPTION AND ANALYSIS OF SAMPLES FROM THE 1981 DRILLING

A suite of 290 samples from 19 drill holes was shipped to NEL Danbury by H. C. Boyle¹ for XRD analysis and alteration contouring. A listing of composite samples in this suite is provided, as follows:

Sections 3 and 4 (BB')

DDH 81-8; 340-706m - Composite Samples 81-1 to 81-18 DDH 81-9; 330-606m - Composite Samples 81-165 to 81-175 DDH 81-61; 200-518m - Composite Samples 81-99 to 81-114

Sections 8, 9 and 10 (CC')

DDH 81-29; 380-636m - Composite Samples 81-69 to 81-86 DDH 81-84; 340-705m - Composite Samples 81-230 to 81-247

Sections 6, 7 and 8 (AA')

DDH 81-15; 349-632m - Composite Samples 81-19 to 81-33 DDH 81-22; 350-603m - Composite Samples 81-34 to 81-46 DDH 81-38; 170-380m - Composite Samples 81-115 to 81-125 DDH 81-63; 239-575m - Composite Samples 81-131 to 81-150 DDH 81-64; 150-432m - Composite Samples 81-151 to 81-164 DDH 81-71; 169-639m - Composite Samples 81-206 to 81-229

Section 12 (EE')

DDH 81-10; 191-618m - Composite Samples 81-47 to 81-66 DDH 81-13; 229-472m - Composite Samples 81-87 to 81-98 DDH 81-39; 274-367m - Composite Samples 81-126 to 81-130 DDH 81-68; 0 -186m - Composite Samples 81-176 to 81-184 DDH 81-70; 0 -275m - Composite Samples 81-193 to 81-205 DDH 81-72; 0 -166m - Composite Samples 81-185 to 81-192 DDH 81-74; 0 -322m - Composite Samples 81-275 to 81-290 DDH 81-79; 0 -539m - Composite Samples 81-248 to 81-274

Each sample composite represents approximately 20 meters of drilling, as compared with 50-foot composites in previous suites of drilling described in earlier reports.^{3,4} Composites were finely pulverized at NEL Danbury prior to XRD analysis. XRD analyses were run by standard methods, described in earlier reports, followed by computer normalization into semiquantitative weight percentates (Appendix 1).

XRF analyses were run only for molybdenum and included in Appendix 1 as semiquantitative MoS_2 percentages, which are plotted and contoured along with alteration mineral assemblages in this report. All holes have been

plotted and integrated with results from previous drilling, with the exception of 81-68 and 81-70 which were drilled off section from the end of No. 4 Drift south from Section 12. However, the XRD data are included in the Appendix, which indicate that both holes appear to have been drilled away from, rather than towards, economic mineralization.

FEATURES OF MOS₂ MINERALIZATION AND ASSOCIATED ALTERATION

The distribution of MoS_2 values is plotted and contoured along four vertical sections (Fig. 1), including Sections 4 (BB'), 7 (AA'), 10 (CC') and 12 (EE'). Drilling in 1981 did not update the features of mineralization and alteration in Section 1 (DD'), described in a previous report, ³ and was therefore not evaluated in the current report. However, the MoS_2 distributions for DD' are included in the Appendix of this report as Figure 22.

Mineralization and Alteration Along AA' (Sections 6, 7 and 8)

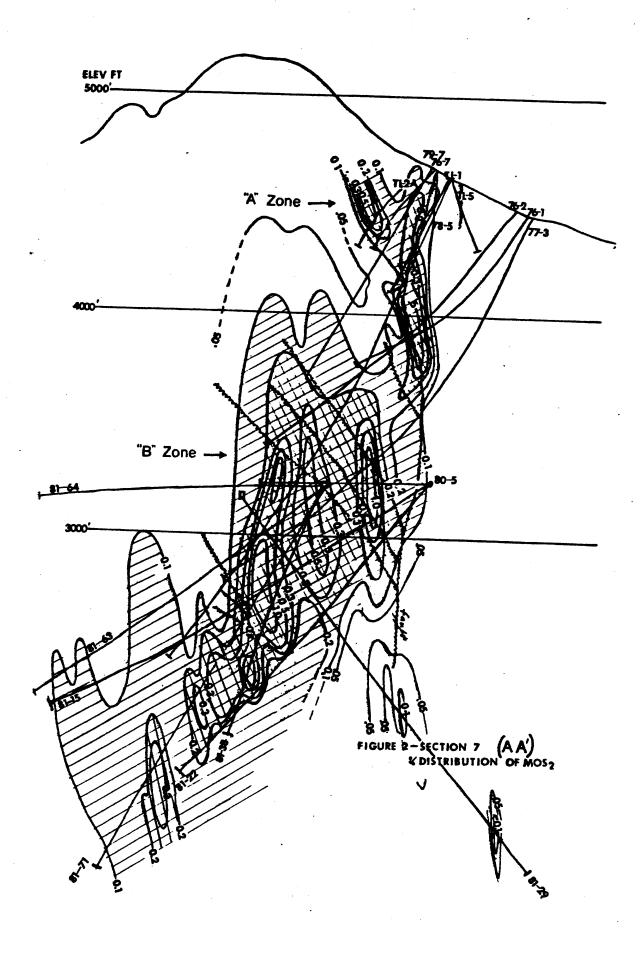
MoS₂ Distribution

Section AA' (Fig. 1) represents a NE-SW cross section through the center of the Trout Lake orebody, as currently defined by drilling to date. Actually, the orebody has been categorized into a series of zones, beginning with the "A" zone near surface, and extending through the "B" zone at intermediate depths (Fig. 2), to the "F" zone at depth referred by H. C. Boyle¹ to the deeper western portions of the deposit. The discovery hole, 77-3, for the "B" zone was drilled in the late 1977 field season, below a "target" area recommended on the basis of early alteration contouring^{5,6} of wholerock surface and drill samples.

 MoS_2 values are contoured at intervals of 0.03, 0.05, 0.1, 0.2, 0.3, 0.5, and 1.0 percent to outline trends through Section AA'.

In the "A" zone, mineralization was confined mostly along a steeply dipping fault structure that intersected granodiorite and schists, extending to surface in the vicinity of Holes 76-7 and 79-7. In the "B" zone, mineralization was pervasively distributed along peripheral apophyses near the granodiorite contact, and along splay faults that branch out to the west from major vertical faults. This was confirmed by 1979 drilling," as was the continuity of high grade MoS_2 mineralization by the horizontal hole, 80-5, shown in AA' (Fig. 2).

A number of subsurface holes (long holes) were drilled from underground stations in 1981 to establish the shape and continuity of the indicated ore reserves. Several significant holes that appear in Section AA' include 81-15, 81-22, 81-29, 81-63, 81-64 and 81-71 (Fig. 2). These holes served to delineate (a) the general continuity of the orebody to the west at depth, and (b) the termination of economic mineralization to the east at depth, as well as to the west at shallow elevations. Holes 81-15, 81-22, 81-38 and 81-71show the general continuity of high grade MoS_2 values at depth to the west, apparently controlled in part by splay faults, discussed above. However, Hole 81-29, drilled across structures to the east, intersected no significant widths of economic mineralization at depth after passing through the center of the orebody. Likewise, Hole 81-64 shows a sharply defined end to economic mineralization on the western side of the deposit at intermediate elevations.



The deepest penetration (Hole 81-71) shows highly anomalous MoS_2 mineralization (>0.1%) to nearly the bottom of the hole, where significant values would be expected to continue intermittently with further depth in this general direction.

Silicification

Silicification occurs as quartz veins, veinlets and impregnations in sheared host rocks. Quartz values, ranging from less than 10 to over 70 percent, are plotted in Figure 3. Highest values of quartz, representing greatest intensities of silicification, correspond to the "B" zone at intermediate depths of mineralization (Fig. 3). Patterns of silicification are generally steeply dipping to the east, possibly controlled by splay faults described above.

Quartz values exceed 50% near the bottom of 81-15, suggesting that silicification may continue intermittently at greater depths in association with MoS_2 mineralization.

Feldspar Alteration

Two parameters were plotted in evaluating types of feldspar alteration. These include (a) total feldspars (Fig. 4), and (b) K-feldspar/plagioclase (K/P) ratios (Fig. 5). Plagioclase feldspars are usually susceptible to various forms of hydrothermal and supergene alteration, resulting in lower amounts of total feldspars and higher values of K/P. Total feldspar "lows" may therefore indicate paths or trends of lower temperature-hydrothermal solutions.

Feldspar "lows" do not necessarily follow the outlines of the ore zones at Trout Lake, as illustrated by the close correlation with the "A" zone, and poor correlation with the "B" zone (Fig. 4). However, the steeply dipping contours of total feldspar distributions indicate structural control, as well as continuity of feldspar alteration at greater depths to the west.

K-feldspar/plagioclase ratios (Fig. 5) also show steeply dipping contours to the east, and a persistence of high values (>0.7%) at depth to the west, correlating with continuing MoS_2 mineralization in this direction, presumably along near vertical splay faults. Feldspar alteration associated with mineralization is therefore expected to continue at depth to the west beyond the limit of current drilling.

Sericitization

An antithetic relationship of sericitic alteration to molybdenum mineralization continues to hold for Trout Lake drilling in the revised sections of this report. Sericite "lows" (<10% sericite) overlap most of the

zones of high grade mineralization, as shown in Figure 6, providing an excellent "overprint" outlining the high grade zones of MoS_2 mineralization. The continuation of steeply dipping contours of sericitization at depth to the west suggests that alteration associated with mineralization may persist at depth beyond the limits of drilling in this general direction.

Mineralization and Alteration Along BB' (Sections 3, 4 and 5)

MoS₂ Mineralization

Section BB' (Fig. 1) represents a section paralleling AA' along the northwest end of the orebody. MoS_2 values are contoured at intervals of 0.03, 0.05, 0.1, 0.2, and 0.3 percent to show the outlines and trends of mineralization through Section BB' (Fig. 7).

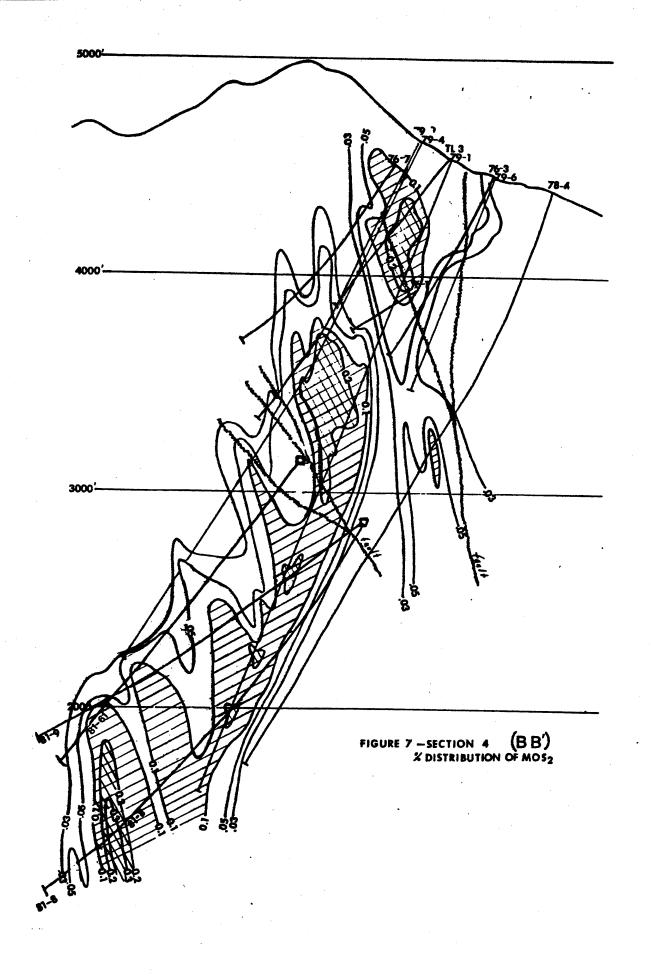
Mineralizing trends are similar to those shown in AA' (Fig. 2), showing a more or less continuous zone of economic grade mineralization (>0.1% MoS_2) extending from near surface to virtually the bottom of drilling in 81-8. Mineralization appears to occur along steeply dipping zones (possibly splay faults) that are intermittently spaced en echelon at depth to the west. On the basis of available MoS_2 distributions, mineralization would be expected to continue at depth beyond the limits of drilling in this direction.

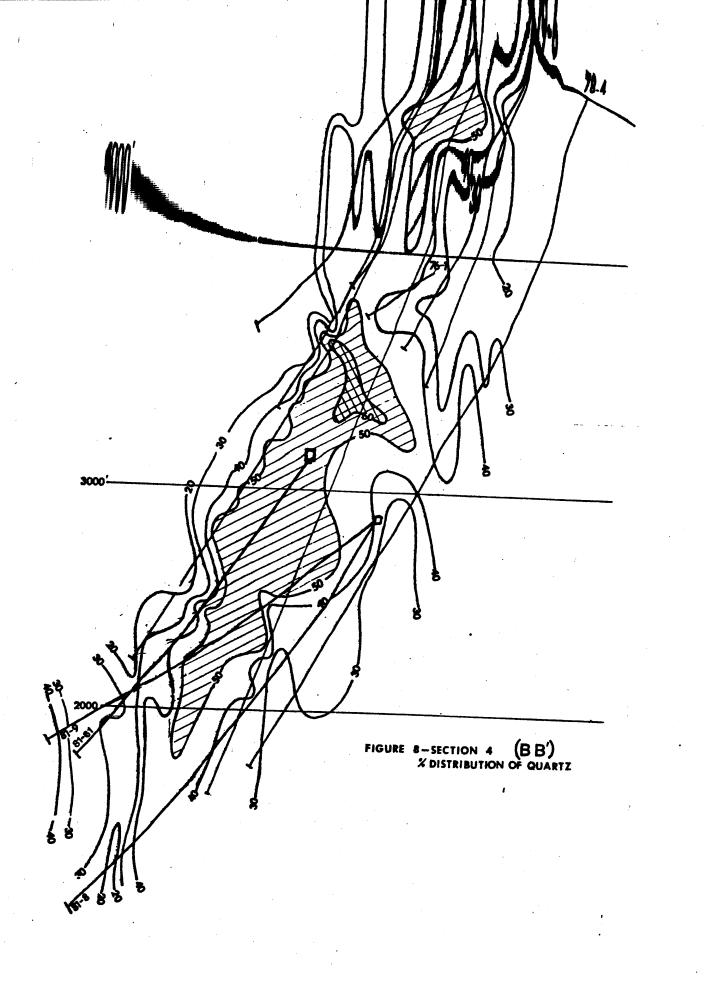
Silicification

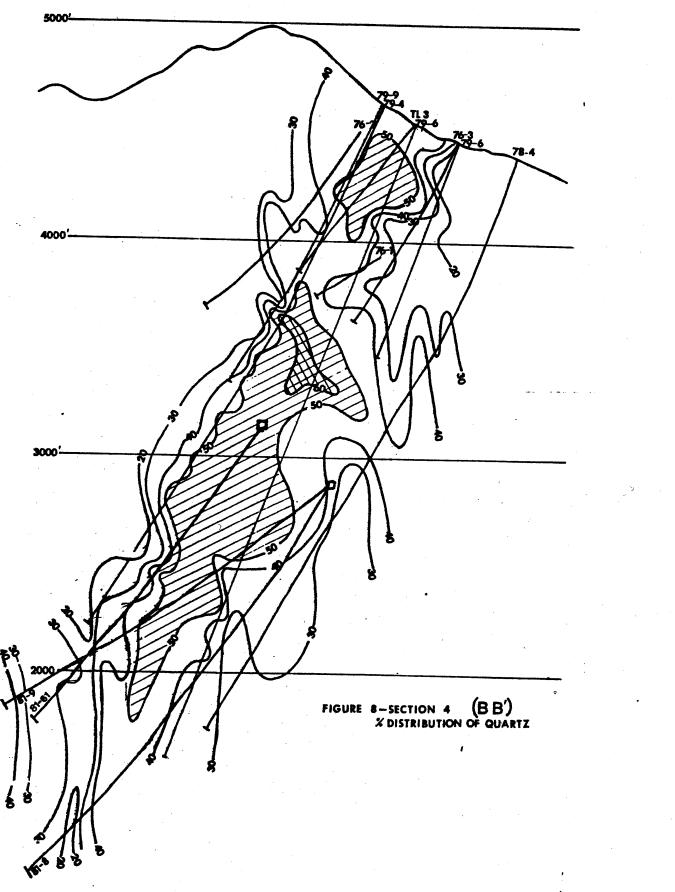
Values of quartz, used as a measure of silicification, are contoured in Figure 8 at intervals of 20, 30, 40, 50, and 60 percent. Quartz within the 50% contour has been cross-hatched to emphasize the distribution of silicification in relationship to MoS₂ mineralization. As defined by drilling to date, the major axis of silicification follows a steeply plunging northwesterly trend which appears to be controlled by steeply dipping northeasterly dipping structures. The most intense silicification is coincident with the "A" and "B" zones of the deposit, which are separated by northeasterly dipping "lows". This also seems to be the case near the bottom of 81-8 and 81-9, where quartz lows are followed by increases in quartz near the bottom of each hole. It is therefore reasonable to expect increases in mineralization at depth below the limits of drilling in both holes, if the intermittent patterns of silicification continue to increase.

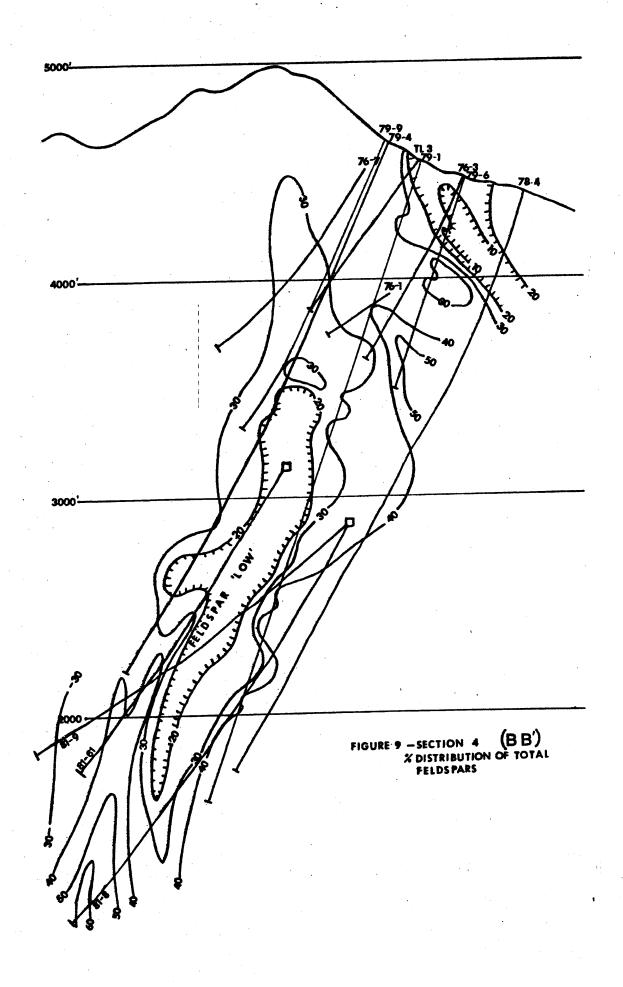
Feldspar Alteration

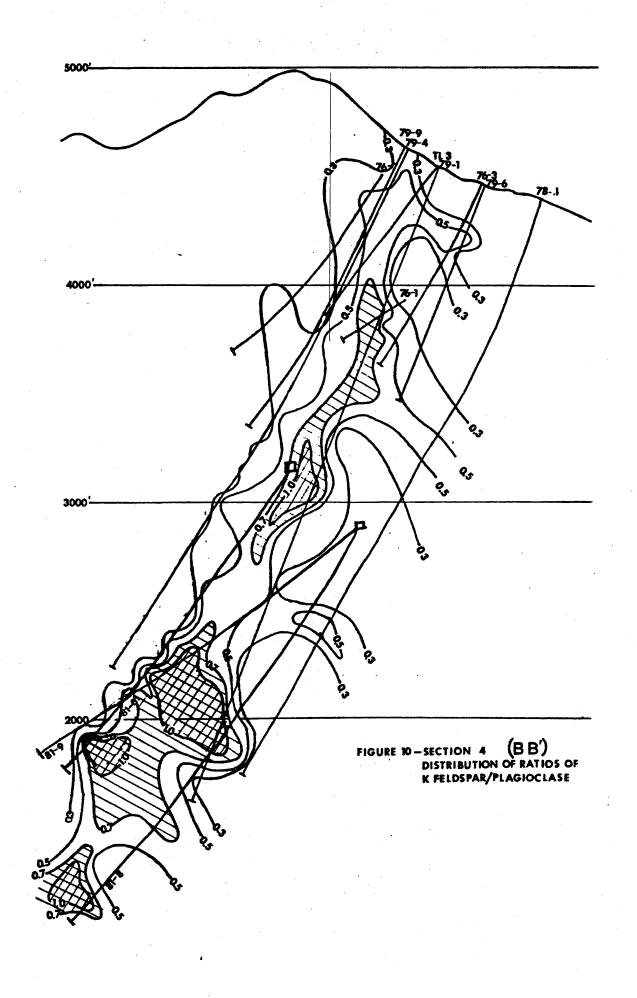
Patterns of feldspar "lows" and K/P "highs" follow intermittent trends along a steeply plunging zone to the northwest in Section BB', analogous to AA', as shown in Figures 9 and 10. K/P values are especially favorable near the bottom of 81-8 and 81-9, suggesting a continuation of MoS_2 mineralization beyond the limits of drilling in both holes.

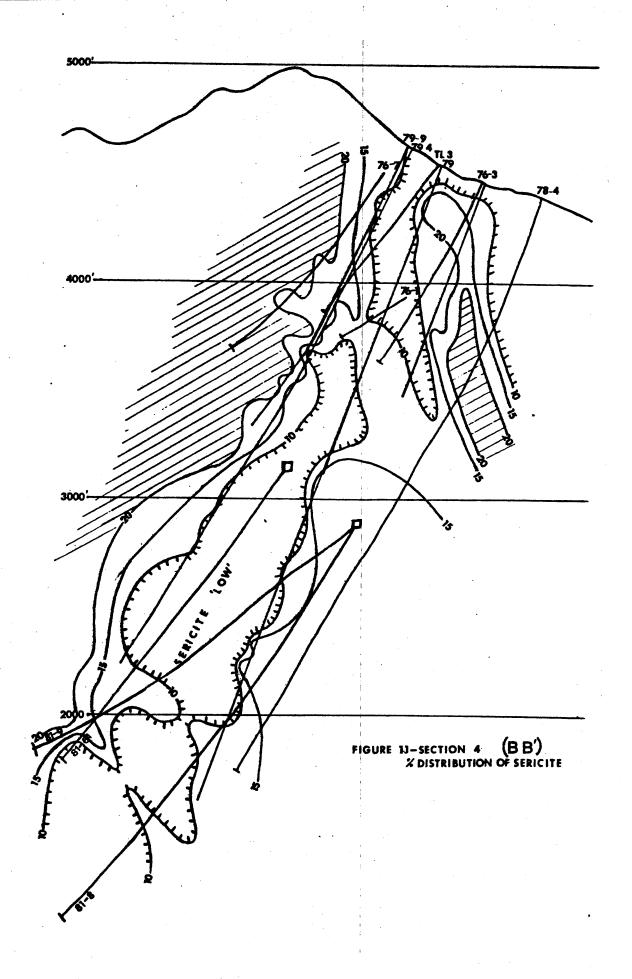












Sericitization

A strong sericite "low" ($\langle 10\% \rangle$) persists intermittently along a major steeply plunging zone to the northwest (Fig. 11), overlapping the major axis of MoS₂ mineralization (Fig. 7). On the basis of sericite values in both 81-8 and 81-9, the zones of antithetic sericitic alteration and economic grade MoS₂ mineralization are expected to continue along a northwesterly plunge for an indeterminant distance below the limits of drilling in this direction.

Mineralization and Alteration Along CC' (Sections 8, 9 and 10)

MoS₂ Mineralization

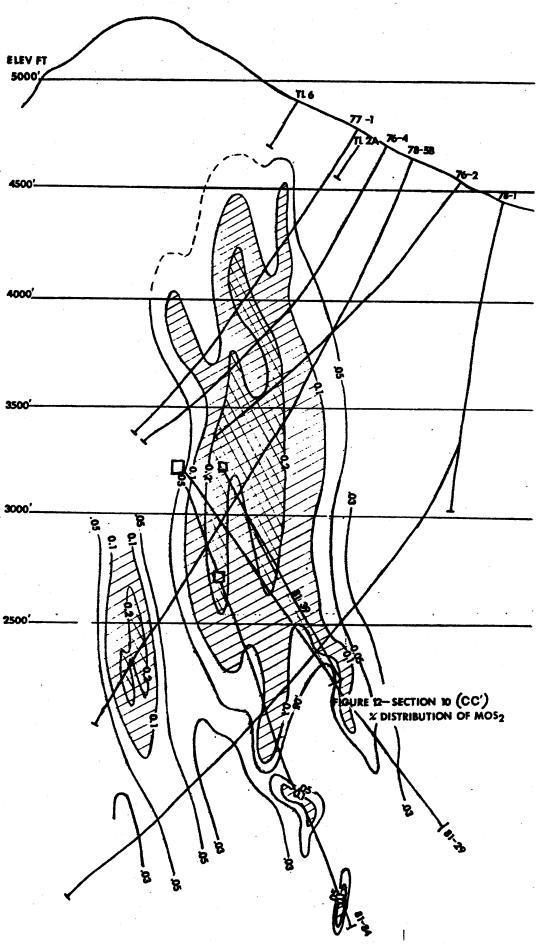
Section CC' (Fig. 1) represents a section paralleling AA' to the southeast. MoS_2 values are contoured at intervals of 0.03, 0.05, 0.1, and 0.2 percent, to outline the trends of mineralization through Section CC' (Fig. 12).

The distribution of MoS₂ values are similar in CC' to those in AA' and BB', with the exception that there appears to be more continuity along the steeply dipping northeast structures than along the major northwesterly plunging axis of mineralization. The upper "A" zone is absent in this section, and the "B" zone is the major ore trend in this section, plunging almost vertically, but splitting at depth and updip into narrow structurally controlled zones that appear to pinch out away from the main orebody.

A lower zone of steeply dipping mineralization was intersected near the bottom in 78-5B that continues at lower grade in 78-1. This serves to confirm the repetitive en echelon pattern of MoS_2 mineralization, persisting at greater depths to the west along the major axis of mineralization.

Holes 81-29, 81-39 and 81-84 were all drilled to the east in this section, and confirm the absence of mineralization at depth in this direction. There is no indication of down faulted mineralization across Z fault to the east.

Additional underground drilling to the west below 78-5B, however, should intersect additional en echelon zones of mineralization along the major ore trend, analogous to those described in AA' and BB'. However, ore shoots along splay faults in this section appear to be widely spaced, with wider intervals of barren rock between mineralized zones.



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Silicification

Values of quartz were contoured in Figure 13 at intervals of 10, 20, 30, 40, 50, and 60 percent. The quartz within the 50% contour was cross-hatched to outline the major trend of silicification which plunges nearly vertically, coincident with MoS_2 mineralization in the "B" zone. Increases in silicification near the bottom of both 78-5B and 78-1 indicate the continuation of favorable alteration at depth and the likelihood of economic MoS_2 mineralization continuing to the west along en echelon splay faults.

Feldspar Alteration

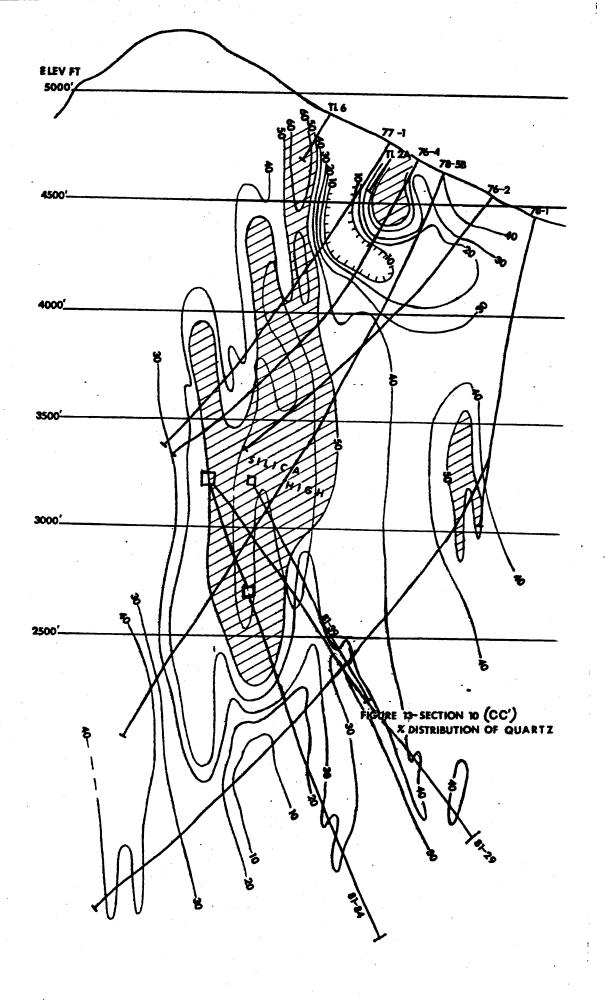
The distributions of feldspar "lows" (Fig. 14) and K/P "highs" (Fig. 15) correlate closely with the intensity and trend of MoS_2 mineralization in the "B" zone of Section CC', analogous to Sections AA' and BB'. Trends of feldspar alteration are nearly vertical, and apparently structurally controlled. Splay faults appear to be more closely spaced through the "B" zone, becoming more widely spaced at depth to the west, according to feldspar alteration patterns.

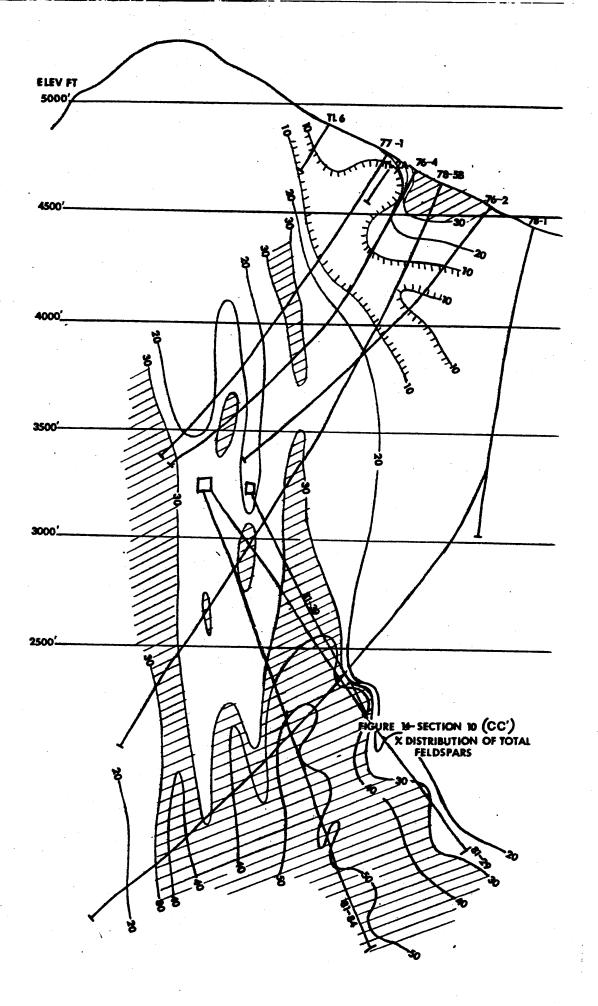
Although patterns of feldspar "lows" continue at depth to the west, as indicated by decreasing total feldspar near the bottom of 78-5B and 78-1, such lows appear to be weaker and more widely spaced. Deeper drilling is therefore required to confirm the presence or absence of significant silicification and attendant MoS_2 mineralization beyond the limits of drilling in this direction.

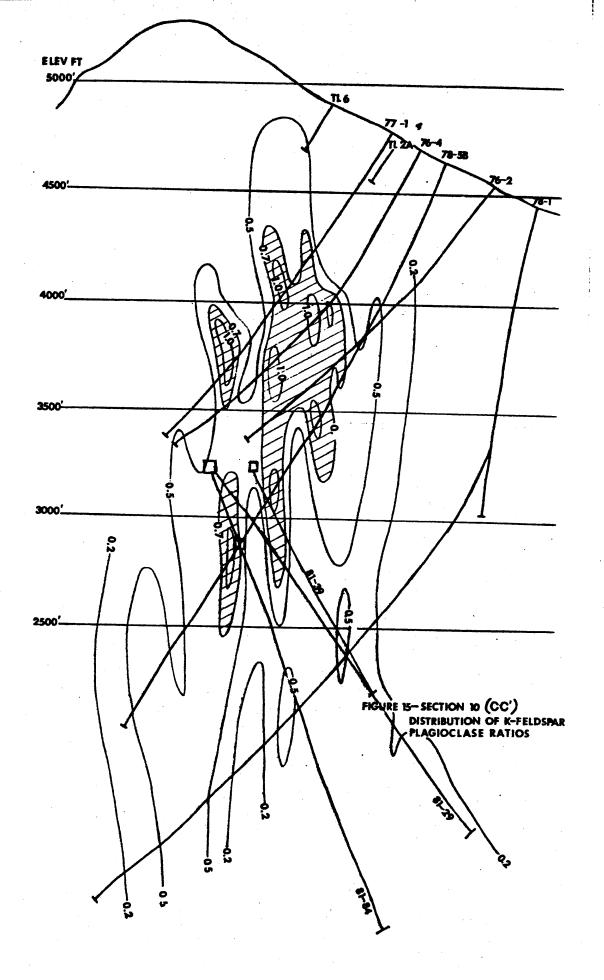
Sericitization

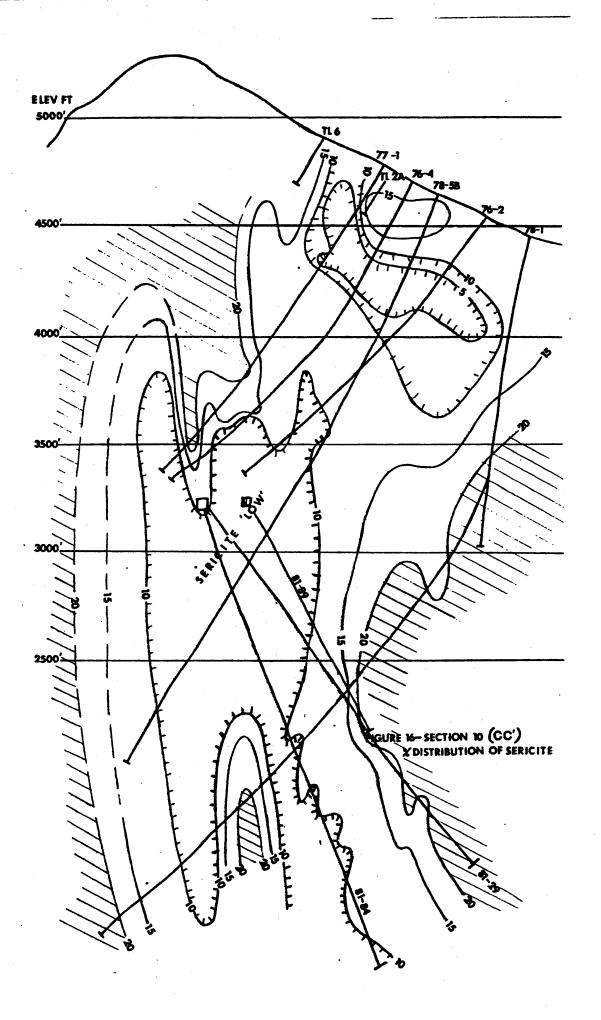
A very strong sericite "low" overlaps the "B" zone and extends vertically below the orebody in Section CC' (Fig. 16). This "low" is defined by the 10 percent contour, which exhibits strong structural control throughout the ore zone. The antithetic relationship of sericite to MoS_2 mineralization is thus strongly established, and offers an excellent alteration pathfinder to mineralization in all sections examined to date at Trout Lake.

The relatively high sericite values at the bottom of 78-1 are less favorable for persistent MoS_2 mineralization in this direction. However, deeper drilling to the west would be expected to intersect more splay faulting, where sericitization could decrease antithetically with MoS_2 mineralization.









Mineralization and Alteration Along EE' (Sections 11 and 12)

MoS₂ Mineralization

Section EE' (Fig. 1) represents a section through the southeastern edge of the deposit paralleling other sections described above. MoS_2 values are contoured at intervals of 0.03, 0.05, 0.07, 0.1 and 0.2 percent, showing the general outlines and trends of mineralization through Section EE' (Fig. 17). Distributions of MoS_2 in EE' are very similar to those in CC', showing essentially a near vertical plunge of the main orebody ("B" zone), and a separate, smaller orebody intersected to the west at greater depth in Holes 78-5B and 81-10. Mineralization shows strong structural control, both in the intermediate "B" zone and in the lower satellitic zone to the west.

Holes 81-74 and 81-79 drilled to the east confirm the sharp decrease in MoS₂ values and the absence of economic mineralization in this direction.

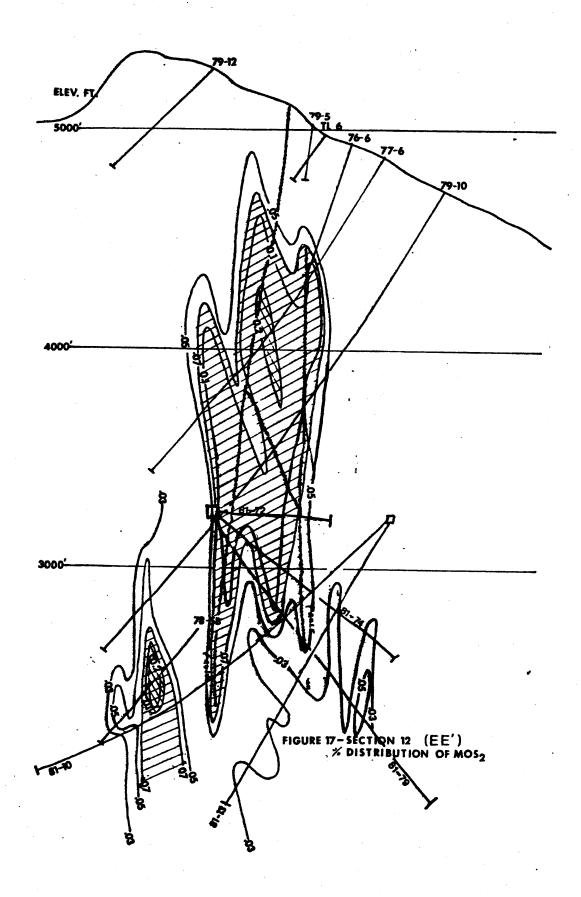
Silicification

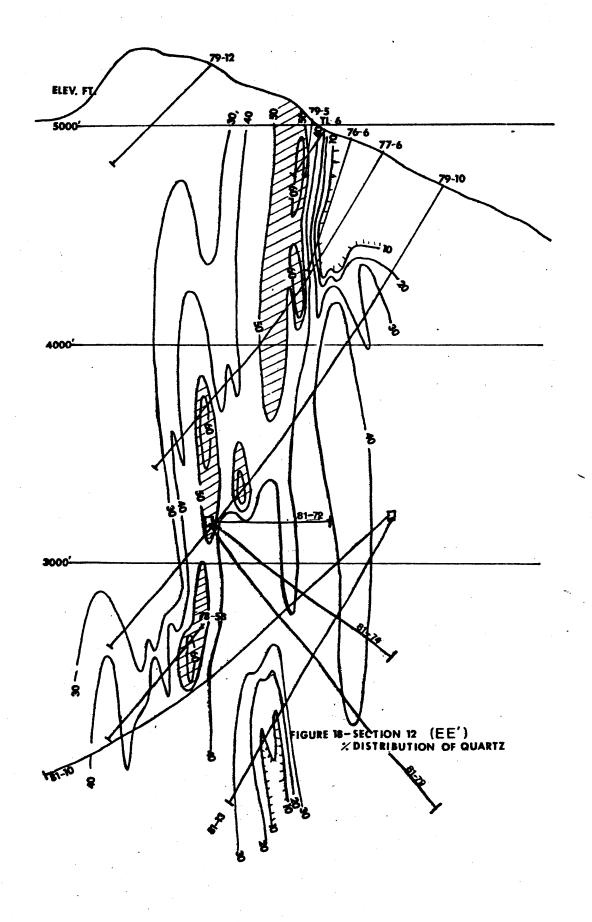
Values of quartz were contoured at intervals of 10, 20, 30, 40, 50, and 60% in Figure 18. The 50% contour was also cross-hatched to delineate areas of more intense silicification, analogous to other sections. Silicification in EE' varies from steeply dipping to essentially vertical, and is strongly structurally controlled. However, the total area of strong silicification, as defined by the 50% contour, is diminished in comparison to Sections AA', BB', and CC' to the northwest, and is spottily distributed through and around areas of moderate MoS₂ mineralization (Fig. 18).

Feldspar Alteration

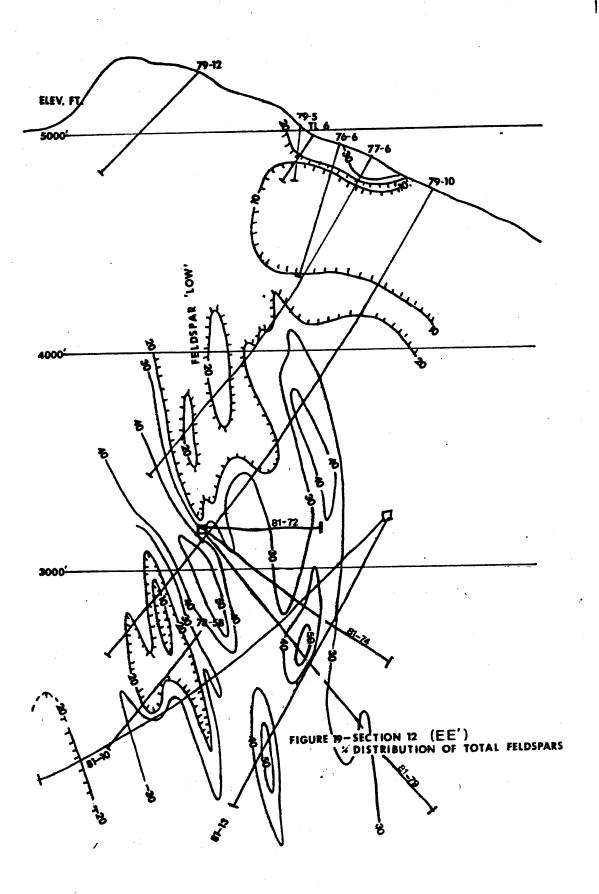
The distributions of feldspar "lows" and K/P "highs" are roughly coincident with zones of moderately high MoS_2 values, as shown in Figures 19 and 20. Zones of both types of feldspar alteration are structurally controlled and nearly vertical in plunge, following closely the trends and general outline of the molybdenum orebody through Section EE'.

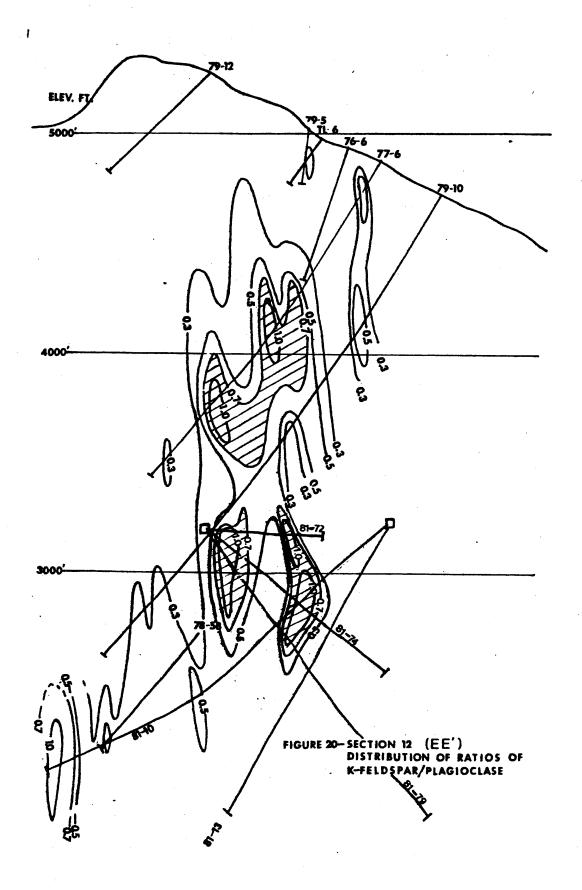
Holes 81-74 and 81-79 serve to delineate the eastern edge of the orebody, which is confirmed by both MoS_2 values and feldspar alteration parameters. The indication of a developing feldspar "low" and K/P "high" near the bottom of 81-10 drilled to the west suggests that deeper drilling in this direction may intersect significant MoS_2 mineralization along recurring splay faulting to the west.





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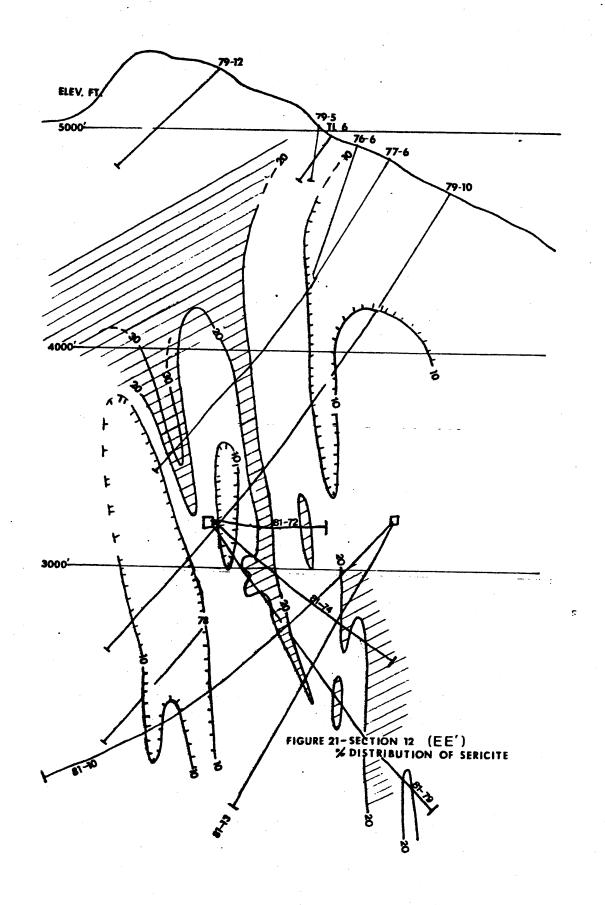


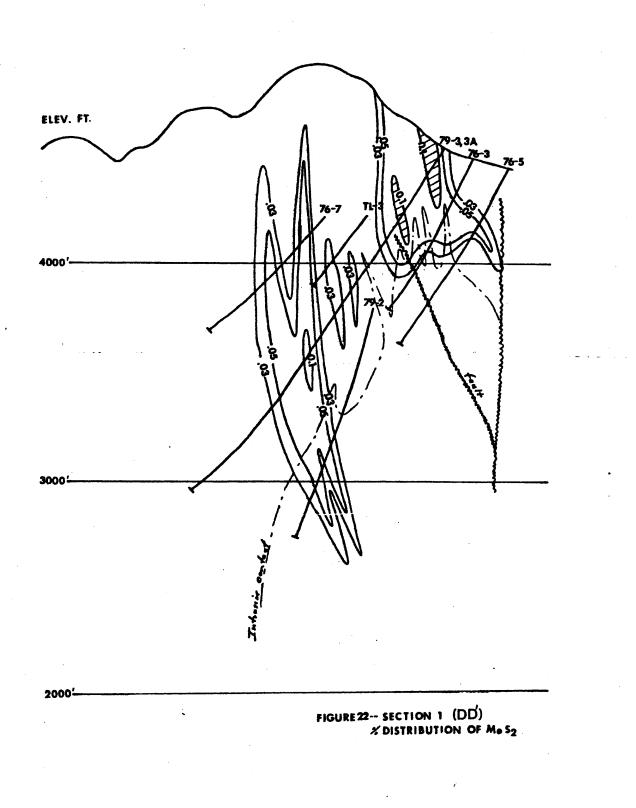


Sericitization

Sericite "lows" plunge steeply to the east (Fig. 21) in Section EE', correlating roughly with MoS_2 mineralization. The en echelon pattern of repetitive offsets of "lows" to the west suggests structural control and a down-stepping of antithetic sericitic alteration with mineralization.

On the basis of alteration parameters of drilling to date, there is a strong indication of further mineralization at depth to the southeast and southwest of the limits of current drilling.





CONCLUSIONS AND RECOMMENDATIONS

On the basis of XRD-XRF analysis of deeper underground drill samples from 1981 drilling, there is favorable evidence for the extension of MoS_2 mineralization at depth to the west in all sections, i.e., AA', BB', CC' and EE'. Features of silicification, feldspar alteration (including feldspar "lows" and K/P "highs"), and antithetic sericitization, all show close coincidence with centers of MoS_2 mineralization, and form narrow planar zones that dip vertically or steeply to the east.

Mineralization and alteration appear structurally controlled along splay faults that recur down plunge to the west, resulting in a repetitive en enchelon pattern of MoS_2 mineralization. This pattern of mineralization (and alteration) becomes more or less continuous between narrow, structurally controlled zones along both AA' and BB' to the northwest, resulting in an axis of continuous mineralization that widens and plunges steeply to the southwest in both sections. Splay faulting appears to be more widely spaced in CC' and EE' to the southeast, with wider zones of barren rock between vertically dipping zones of mineralization.

Although the intensity of MoS_2 mineralization decreases along sections to the northwest and southeast of AA', there is good evidence to indicate that a repetitive pattern of MoS_2 mineralization and associated alteration persists at depth to the west in all of the sections. Further deeper drilling is therefore recommended to the southwest through the major axis of en echelon mineralization to evaluate the possible continuation of economic grade MoS_2 values at depth.

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