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LTD. COMINCO

EXPLORATION

WESTERN DISTRICT

PUZZLE GROUP

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September 12, 1968 WJM/nc

crosses Horsethief Creek, another logging road which remains north of the Creek is followed for just over half a mile where a branch road leads uphill to the property. The branch road is very rough for the last mile and almost impassable in wet weather.

5. HISTORY

Previous work on the property consists of several hand dug trenches and one short partially caved adit. Some of the digging was done by Larrabee and some is old work.

As part of the 1967 work commitment, a four-wheel drive road was driven from the end of the logging road at elevation 5200 feet to the property at elevation 6350 feet.

6. <u>GEOCHEMISTRY</u>

A geochemical soil sample grid was run by Larrabee contiguous to the showings during 1967. Samples were taken at 100 ft. intervals and lines were run 200 feet apart. Resampling on this grid showed the results quoted were reliable. Larrabee's grid was extended northward this season to cover the thrust fault separating rocks of the Horsethief and Mt. Nelson formations (Plate 15).

Samples to check Larrabee's grid were assayed by atomic absorption methods. Subsequently, these check assays were used as standards for comparative tests to see whether cold extraction methods as outlined by Hardin (1965) would give reliable results for soil samples from the Puzzle Group. Since cold extraction and atomic absorption results were comparable, subsequent soil samples were analyzed in the field. Results were rated: not anomalous (< 200 ppm Pb + Zn), slightly anomalous (200 to 500 ppm Pb + Zn), and highly anomalous (> 500 ppm Pb + Zn).

Geochemical Results

Anomalous readings were associated with each known showing on the property. Similarly, trenching on highly anomalous readings in covered areas invariably led to discovery of mineralization. In some cases, this mineralization was only a few pounds of good grade ore. Hence geochemical soil sampling was extremely effective in locating even small pockets of mineralization in this area of steep, tree-covered slopes with shallow overburden. It should be noted that the type of orebody found was predictable since highly anomalous readings were very localized (see plate 15).

7. TRENCHING

Trenching (68-1 to 68-9) was carried out in a week with an Allis Chalmers 16 (equivalent to a D-7 Cat). Excavation sites were chosen on the basis of geochemical soil sample anomalies and from geological considerations. From this work facies changes within various units became evident and the extent of mineralization in various showings was checked. The decision to abandon the property stems largely from trenching results.

After completion, each trench was carefully chip sampled. Assay results for Pb, Zn, Cu and sometimes Ag are illustrated on 20 scale plates of trenches 68-1 to 68-9. Samples larger than hand specimen size typically run less than 0.2% Pb and Zn.

Away from the lower thrust fault, mineralization occurs only in Magnesian limestone interbeds in Horsethief slates. Ore grades never occurred over more than a foot or two in any trench. Veins adjacent to the lower thrust fault are traceable over tens of feet but widths are a foot and less and grades vary down to zero along strike and down dip.

From the assay results, it is evident that Pb .04%, Zn .02%, Cu Trace, represent background readings. This is inferred because barren slates grits and even a quartz diorite dike give similar readings (Plate 10).

Trench 68-1

Trench 68-1 is cut along the contact between quartz gait and pebble conglomerate and overlying folded and complexity faulted gray slates with dolomite interbeds (Plate 3). The section looking northeast illustrates a gently southeast plunging knee shaped fold and complex faulting.

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Pb-Zn mineralization occurs in white dolomite veins in dark gray magnesian limestone along the grit/slate contact as well as in veins cutting brecciated dolomite within the slates. Overall grades are above background which is Pb .05, Zn .04 in this trench but average well below 1% combined Pb and Zn.

Trench 68-2

Trench 68-2 exposes the base of a massive dark gray magnesian limestone zone which grades into slate both eastward and westward. It is in underlain by slate with dolomite interbeds at the southend of the trench (Plate 8).

Pb-Zn mineralization with some malachite occurs in the youngest of three periods of dolomite vein formation. Veins occur in both the massive magnesian limestone and the dolomite interlayers in the slates. Locally, veining is so intense that breccia type mineralization results. Apparently, slight replacement of the host rock results in these instances.

Although minerAlization occurs throughout the trench, overall grades are not far above background. A selected good grade hand-sized specimen dug up during trenching assayed close to 3% combined Pb & Zn.

Trench 68-3

Trench 68-3 was chosen to test a slight geochemical anomaly in an area of gray slates with grit and quartzite interbeds (Plate 10).

Small scale low angle faults are common and a quartz diorite dike cuts and deforms slates in the northeast corner of the trench. Metamorphic effects around the dike are negligable.

No mineralization was found.

Trench 68-4

Trench 68-4 adjoins a trench dug last fall while the road to the property was under construction (Plate 6). It is reported that the early trench hit a small high grade galena pod. Unfortunately, the pod was dug out and pushed over the bank, now galena remains only as coatings on joint surfaces.

In the new trench, slates predominate, but a two foot layer of thin bedded dolomite is exposed in the cut-face. Mineralization occurs only in small dolomite pods turned up on the road-bed of the new trench and is sporadic. Assay results from both trenches are close to background.

Trench 68-5

Trench 68-5 is entirely in dolomitic limestones. At station 109A oolitic magnesian limestone is exposed (Plate 11). It is overlain by thick bedded then laminated magnesian limestone. Locally the limestones are stylolitic with cone-in-con structures.

Assays are just slightly above background, although dolomite veining is prominent.

Trench 68 - 6

The upper cut of this trench is in slate with dolomite interlayers; the lower is in gray magnesian limestone (Plate 9). Southeast of Station 109D, the dolomitic limestone grades into slate with dolomite interlayers.

Galena and sphalerite occur in carbonate veins and as coatings on joint surfaces. Assays, however, are very close to background levels.

Trench 68 - 7

This trench is below trench 68-6 and exposes a facies change from dark gray magnesian limestone to slate with dolomite interbeds (Plate 12).

The slate-dolomite unit is underlain by buff dolomite which is rich in detrital guartz. Dark zones in this dolomite suggest it may be secondary after dark gray magnesian limestone grit.

Assays from the quartz-bearing dolomite gave background values whereas one from brecciated dark gray dolomite in the slates was slightly above background in Zn.

Trench 68-8

This trench ends on trench T-2 (Plate 13). Near Station 122B a side-cut exposes slate with intraformational conglomerate layers overlying light gray dolomite breccia. Neither rock type is mineralized. Near trench T-2, the dolomite breccia is veined and Pb-Zn minerals coat joint planes. Over 20 feet, it assays three times background but this is only 0.3% Pb + Zn. In the trench, a high grade vein with siderite gangue trends 119/32 SW. Mineralization in it varies radically down dip and it was not sampled.

Trench 68 - 9

Midway between Trench T-3 and adit T-4, trench 68-9 exposes the extension of the sideritic high grade vein from T-3. It occurs in massive dolomite near the fault contact between dolomite, and slate with dolomite interbeds (Plate 7).

Pb-Zn mineralization in the dolomite assays just over 0.3% combined Pb and Zn whereas a good grade sample of the vein assayed 13% Pb and Zn with 5.4 oz. of Ag. The vein pinches to 2" and swells to 6" and Pb - Zn minerals occur as stringers in the vein from 0 to 4" wide.

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Trenches - Conclusions

It is evident from the preceeding comments that nowhere do Pb-Zn values approach ore grades or appreciable tonnage potential in any of the old showings or the new trenches.

Ore is apparently localized by facies changes. Pb - Zn mineralization is almost exclusively in veins in magnesian limestone, but only where it is interbedded with slates. For instance, relatively mapsive magnesian limestone adjacent to the lower thrust fault is virtually unmineralized, despite extensive veining.

Perhaps ore-bearing solutions travelling up the thrust fault were concentrated above the relatively impermeable grit member and localized in the overlying upper slate member by permeability and ductility contrasts resulting from facies changes.

8. GEOLOGY

Contiguous to the Puzzle Group, Starbird Ridge consists of three geologic units separated by north dipping thrust faults. These are: the Upper Purcell Mt. Nelson formation which forms the Ridge Crest; the Windermere Horsethief formation which contains most of the Puzzle showings; and the Paleozoic Jubillee formations, McKay group, Beaverfoot Brisco formation, Mt. Forster formation, and Starbird formation. Each geologic unit has a different structural pattern and each must be treated as a separate entity.

Mt. Nelson Formation

Since no showings were found in Mt. Nelson formation rocks, discussions of it will be deferred until the regional prospecting proposal report is written. It will be sufficient to say that they consist of dolomites and quartzite which strike at right angles to the upper thrust and have near-vertical dips.

Paleozoic Rocks

The PaleOzoic rocks below the lower thrust fault comprise a syncline which plunges northwesterly (?) at a low angle. The western limb of the fold is crossed by a pre-thrust (?) fault which cuts off the Mt. Forster formation. Immediately below the lower thrust fault, Pb - Zn-siderite veins, identical to those cutting Horsethief formation carbonate rocks, occur in Starbird formation guartzite.

Vein mineralization in the quartzite was found only in the caved adit. In any case, this type of mineralization promises no tonnage potential so the Paleozoic rocks will not be considered further in this report.

Horsethief formation

Although facies changes cause rapid lateral variations in rock type, it has been possible to group Horsethief formation rocks on the Puzzle Group into five members. From the lower thrust upward in stratgraphic order these are: the carbonate member consisting of massive dark to light gray magnesian limestone or dolomite which is locally laminated and colitic toward the top of the division. It has slate and dolomite grit interbeds and is overlain gradationally by slate with dolomite interbeds; the lower slate member. The lower slate has local dolomite grit, black limestone and black limestone intraformational conglomerate interbeds. Above it is a poorly exposed division consisting of quartz grit and quartz pebble conglomerate with gray and red slate interbeds. Slate with dolomite interbeds

and local massive dolomite "mounds" comprises the upper slate member. Above it, exposure is minimal but trench 68-3, float, and scattered outcrops consist primarily of gray slate with quartz grit interbeds red slate and quartz grit or quartz pebble conglomerate. This upper division is cut off by the upper thrust fault.

Trenching and road building have provided exposures which illustrate rapid facies changes within the carbonate and slate members. These facies changes may have controlled mineralization. For example, the carbonate member is apparently favourable for vein formation and hence Pb-Zn mineralization, yet it is only mineralized in joints adjacent to fault controlled sideritic high grade veins and in an area where it grades laterally into slate with dolomite interbeds (trenches 68-6; 68-7). It is possible that the underlying impervious dolomite grit is also a localizing factor. In the upper slate member, mineralization occurs only in carbonate interbeds and is more prominent near the base of the slate. The role, if any, of the underlying grit member is speculative. Possibly its relative impermeability concentrated the mineralizing solutions which formed carbonate and Pb - Zn bearing veins in the dolomitic limestone

9. STRUCTURAL GEOLOGY OF ROCKS OF THE HORSETHIEF FORMATION

Strikes taken in Horsethief rocks vary widely. Characteristically, however,dips range from 0° to 20°. Three factors probably explain these facts: (1) rapid facies changes cause bedding to be undulose both along strike and down dip; (2) minor folds, especially in the slates are present, but because of poor outcrop, are recognizable only in trenches; (3) low and high angle small scale faults cause rotation and tilting of bedding.

10. MINERALIZATION

Except for siderite - galena - sphalerite ± chalcopyrite veins in Starbird quartzite along the lower thrust, all mineralization occurs in carbonate veins in Horsethief formation magnesian limestone and dolomite. Near the lower thrust sideritic veins, similar to those in the quartzite, cut massive magnesian limestone. Away from the fault, veins of this type do not occur. Instead, the carbonate rocks are fractured with introduction of at least three generations of white crystalline dolomite veins. In favourable locations, veins of the youngest set have galena ± sphalerite in their cores. Where veining is extreme, small high grade pods with a small amount of associated country rock replacement can occur.

Veining is most prominent where carbonates are enclosed by or in contact with slates. Possibly the ductility contrast between the two contributed to fracturing in the carbonate in response to flow in the slates. If the forces causing deformation were slight, intergranular movement might be the only result in thick carbonate layers. Hence, Pb - Zn mineralization, which occurred during the youngest episode of veining, would be confined to favourable zones in the slate.

Nowhere was the latest phase of veining intense enough to produce a substantial tonnage of ore grade material.

11. FINANCIAL CONSIDERATIONS

The option agreement with G. Larrabee included a down payment of \$500.00 and calls for additional payments of :-

\$10,000 on or before December 31, 1968 \$20,000 on or before December 31, 1969 \$50,000 on or before December 31, 1970 \$50,000 on or before December 31, 1971 \$69,500 on or before December 31, 1972

12. AREA POSSIBILITIES

Toby conglomerate crops out on Starbird Ridge northeast of the Puzzle Group and extends downhill into Forster Creek. This ground is presently held by Kodiak Mines under option from Lloyd Hemmelgarn of Windermere, B. C. A payment to Hemmelgarn is due next month (October). If it is not made, Cominco personnel should examine copper showings associated with lavas (?) in the Mt. Nelson formation which crop out near the base of the Toby conglomerate.

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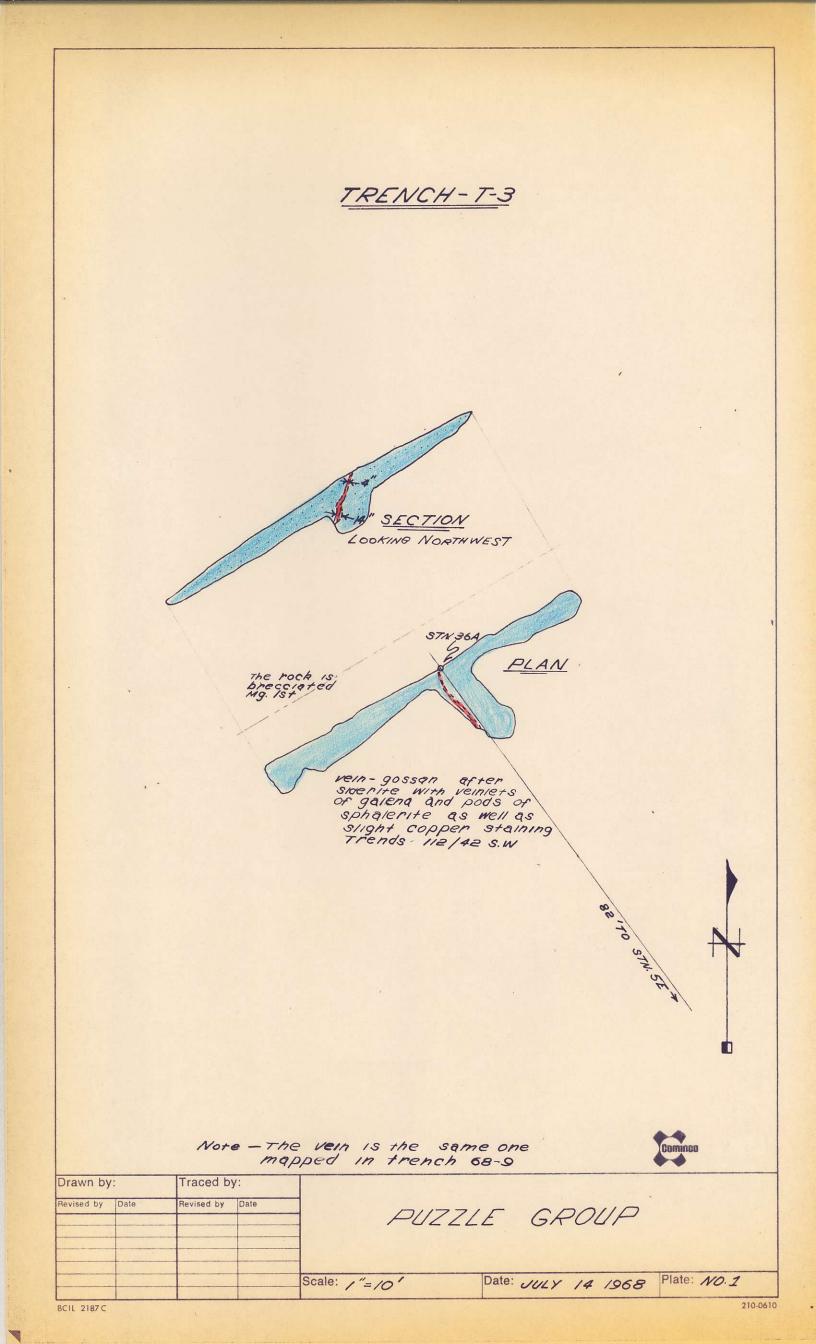
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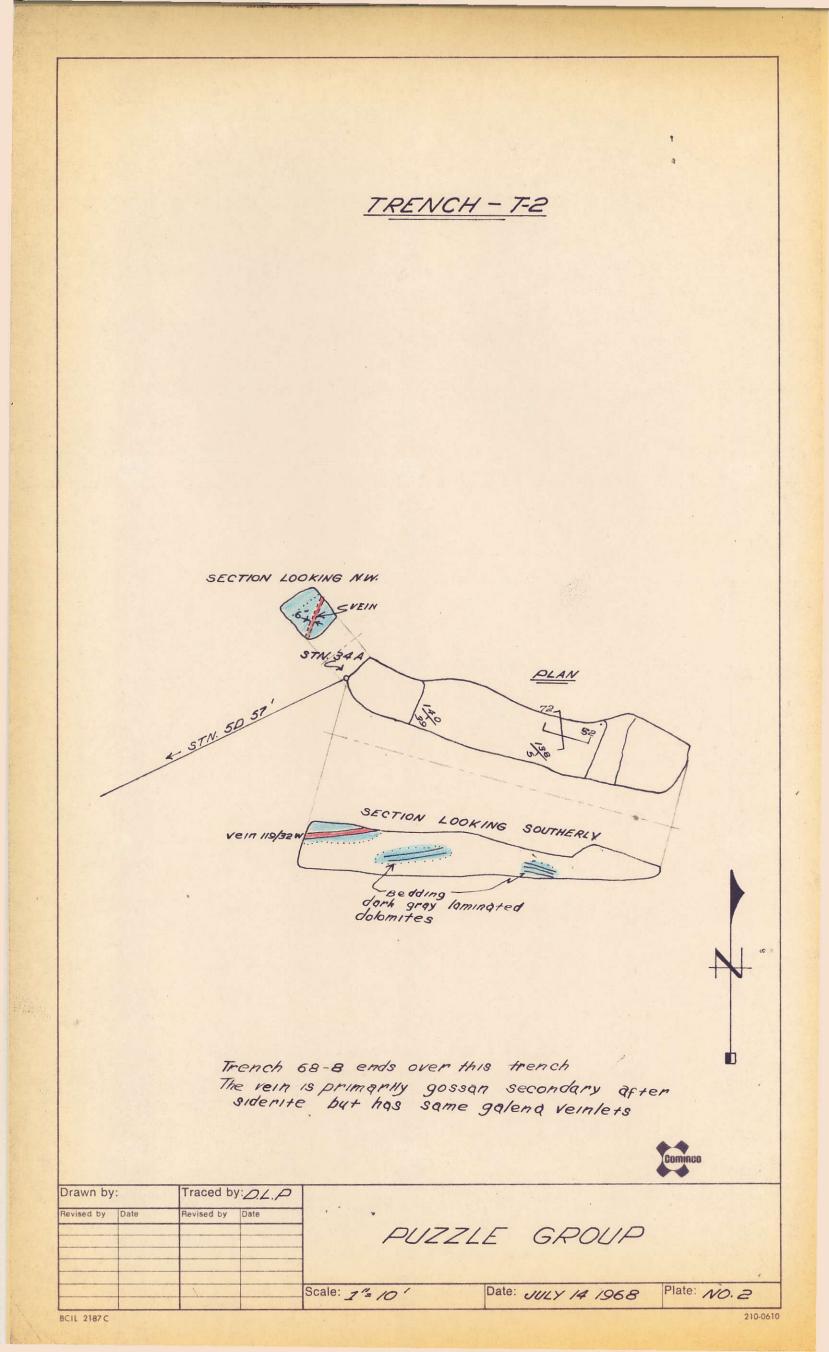
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Endorsed by:

WJM/nc September 12, 1968 Distribution Montreal Vancouver Office JR WJMcM

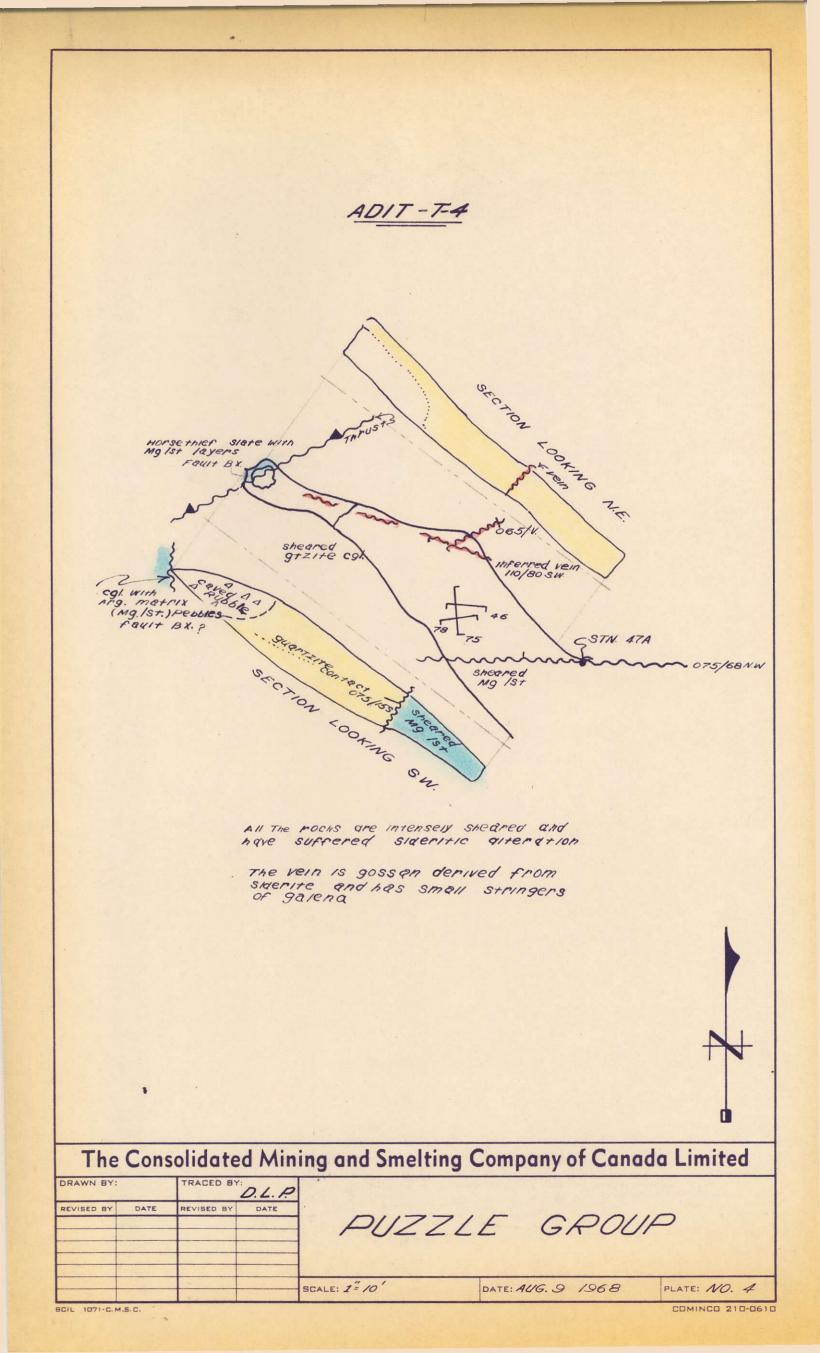




TRENCH 68-1 FACE 1 White Carbonate Veins in the dolomite pods Contain Veinlets and blebs of galena. Some Veins extend into the grits Where they are barren FACE 2 Carbonate Vein in dolomite breccia sometimes Contain blebs of galena and Sphalerite STN-94B lare P6 22 4 1m slate magnesian STN-7.5W limestone pods State NAX. Grix Pb Zh Cu Ag 63.08 Th .25 and grantzite dolomile. 49 -day Pb Zn Cu .05 .04 .01 bble lomarqte lerve ZA CU .02 TA -P6 SUINOON Slatez N.E. STN-94 A Cominco Traced by: D.L.P. Drawn by: Revised by Date Revised by Date PUZZLE GROUP Plate: NO . 3. Scale: 1 = 20' Date: AUG 20, 1968

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TRENCH 68-1 FACE 1 White Carbonate Veins in the dolomite pods Contain Veinlets and blebs of galena. Some Veins extend into the grits Where they are barren FACE 2 Carbonate Vein in dolomite breccia sometimes Contain blebs of galena and Sphalerite STN-94B Slate Stor King . sigte magnesian STN-7.5W limestone pods Store This Cont 20 0101010 Pub 949 m guantzite nang OOKING Slatez XX STN-94 A Traced by: D.L.P Drawn by: Revised by Date Revised by Date PUZZLE GROUP Plate: NO . 3. Date: AUG 20, 1968 Scale: 1 = 20' 210-0610



TRENCH -T-1 Rubbly outcrop ho mineralizian se same rock typ PLAN The best Vein - 1/4" occurs 4 Scattered outcrops of dark fg. magnesian limestone with traces of galena on some joint Surfaces 2 STN. 33A CALENA + SPHALERITE VEIN IN VOINT FD fractures SECTION LOOKING NORTH Drawn by: Traced by OLP Revised by Date Revised by Date PUZZLE GROUP Scale: 1"= 10' Date: AUG. 15 1968 Plate: NO. 5 210-0610 BCIL 2187 C

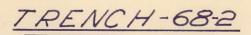
TRENCH 68-4
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PUZZLE GROUP
Scale: 1"=20' Date: AUG. 21, 1968 Plate: NO. 6

TRENCH 68-9 High grade Vein With Stringers of galeng in a limonite - altered Siderite matrix. Sphalerite is Accessory. Both the Veins and Contained Pb + Zn mineralization pinch and Swell. Potential tonnage from them is low SECTION LOOKING N.W Brecciated Dolomite 6" wide Dolomite STN. 124 A Slate Road bed PLAN Drawn by: Traced by: D.L.P Revised by Date Revised by Date PUZZLE GROUP Plate:NO. 7 Scale: 1'= 20' Date: AUG -20, 1968

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Galena and Sphalerite are common in Carbonate Vein but overall grade is low. At least three generation of Carbonate Veining occur and Pb. - Zn. mineralization is apparently confined to the latest Veining phase.

> brecciated, veined Massive dark gray magnesian limestone or buff dolomite

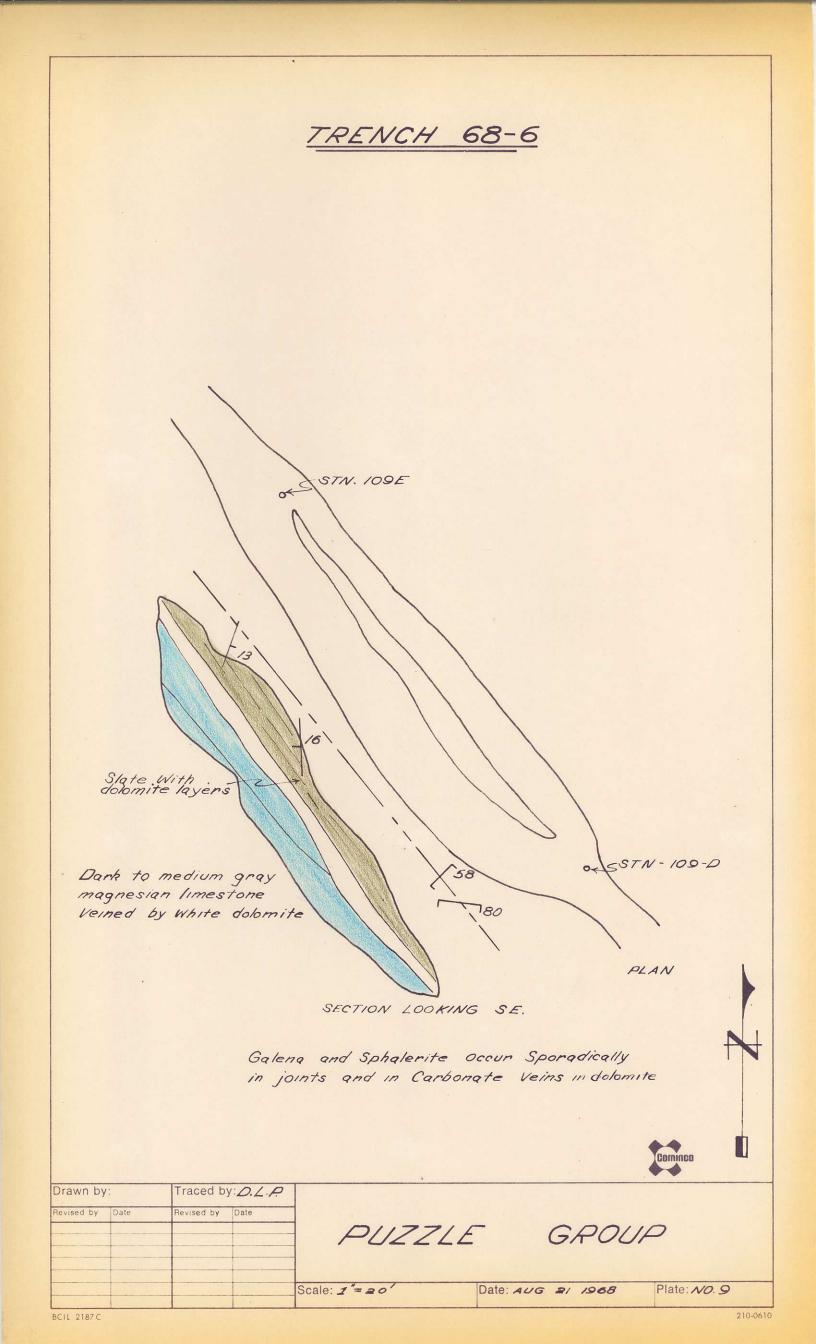
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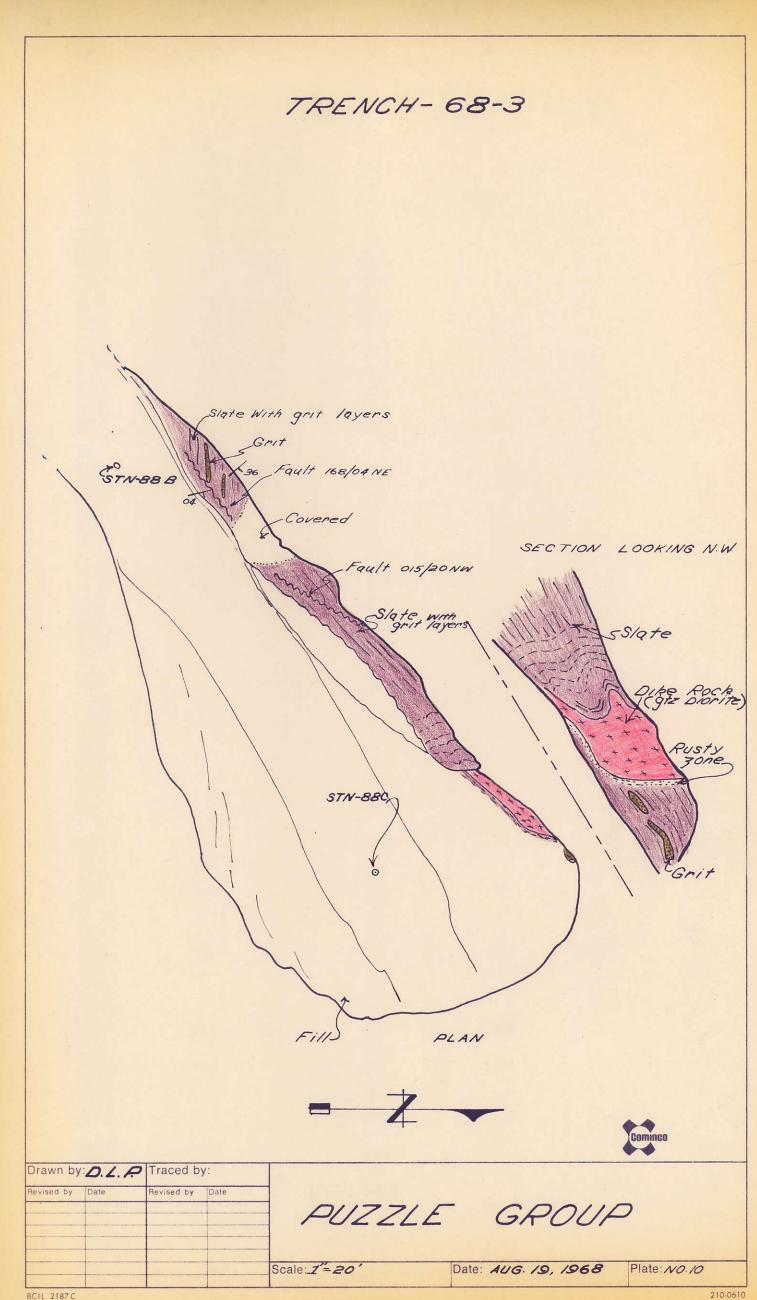
interlayered dolomite and Slate

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PLAN

Plate: NO.8

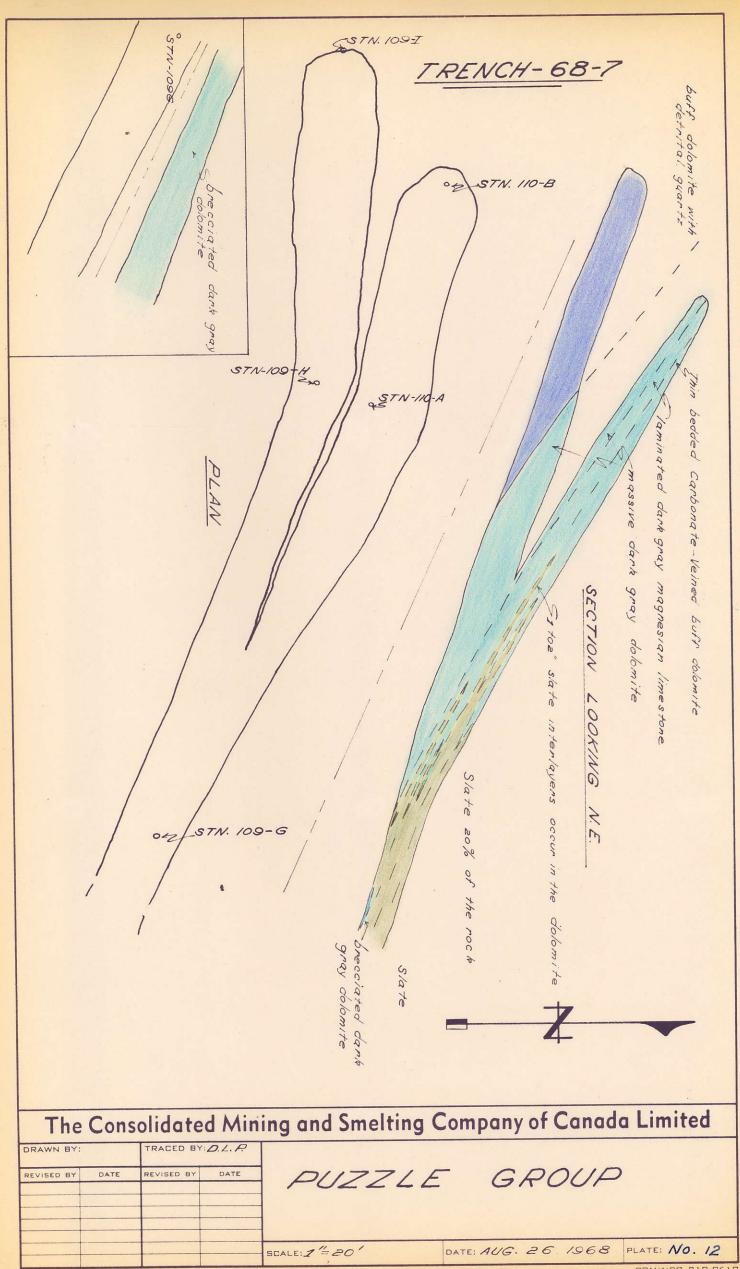




TRENCH 68-5

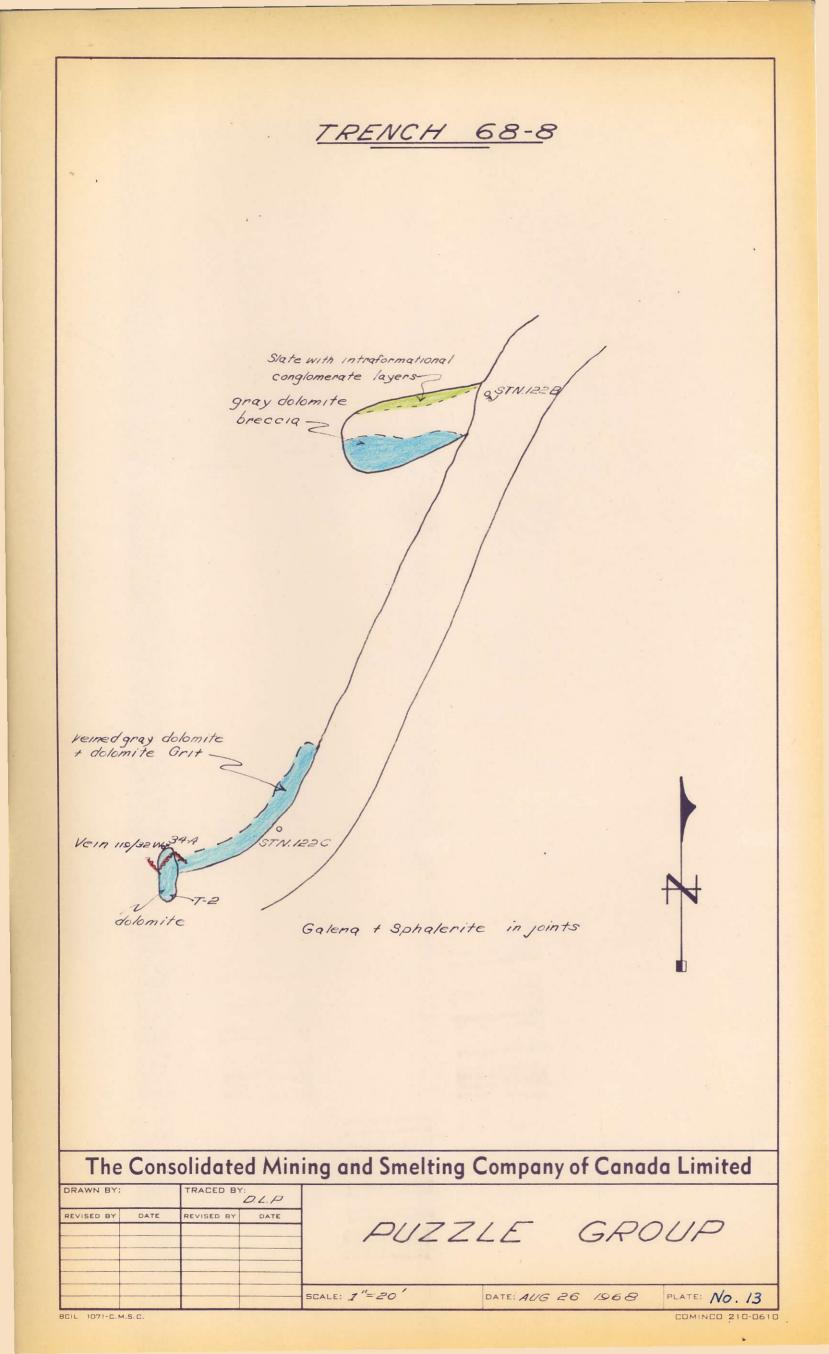
Most of the laminae are Stylolitic, Some have developed Come-in-Cone Structure. White dolomite Veins lie in and across bedding. Galena and Sphalerite are rare accessories in Veins.

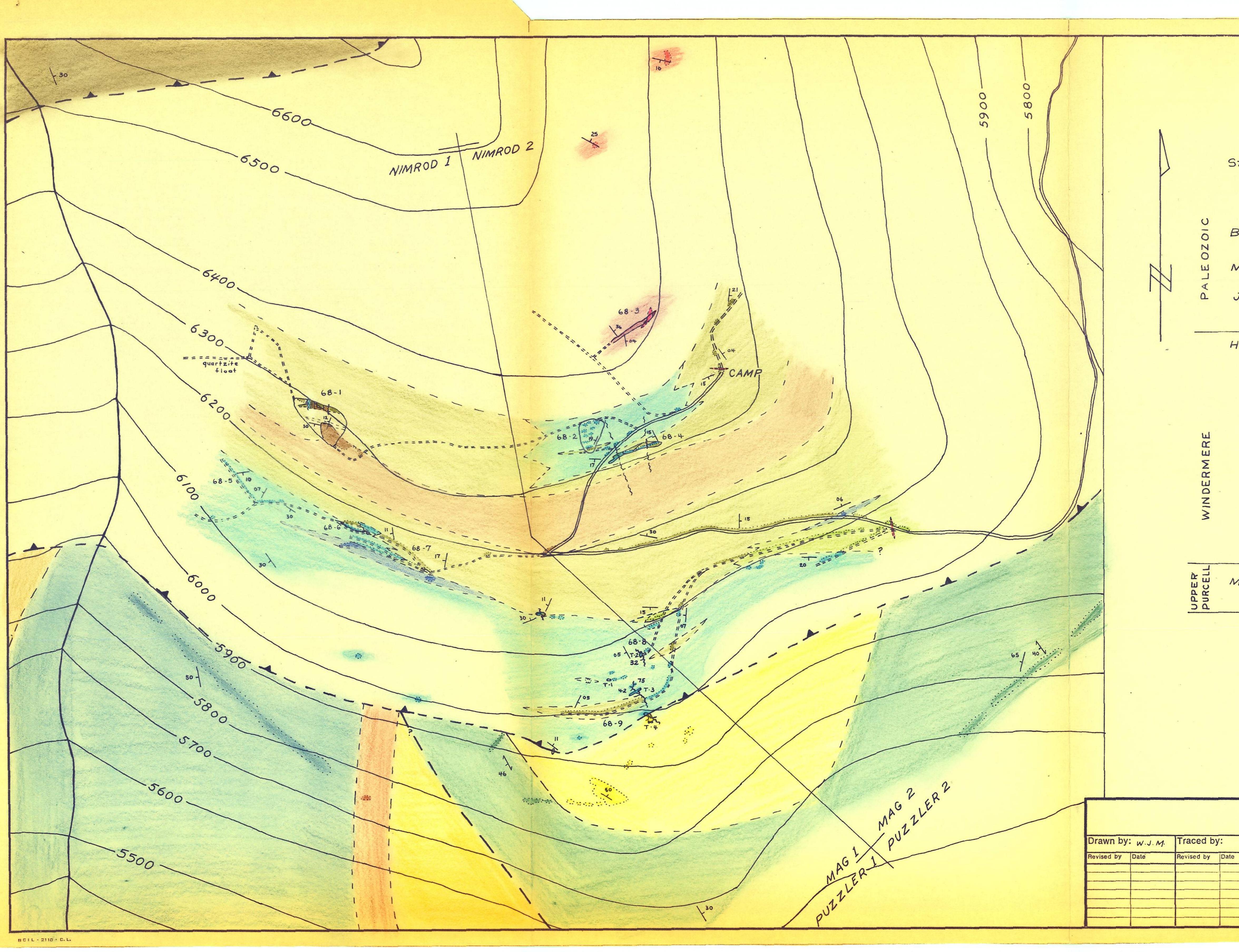
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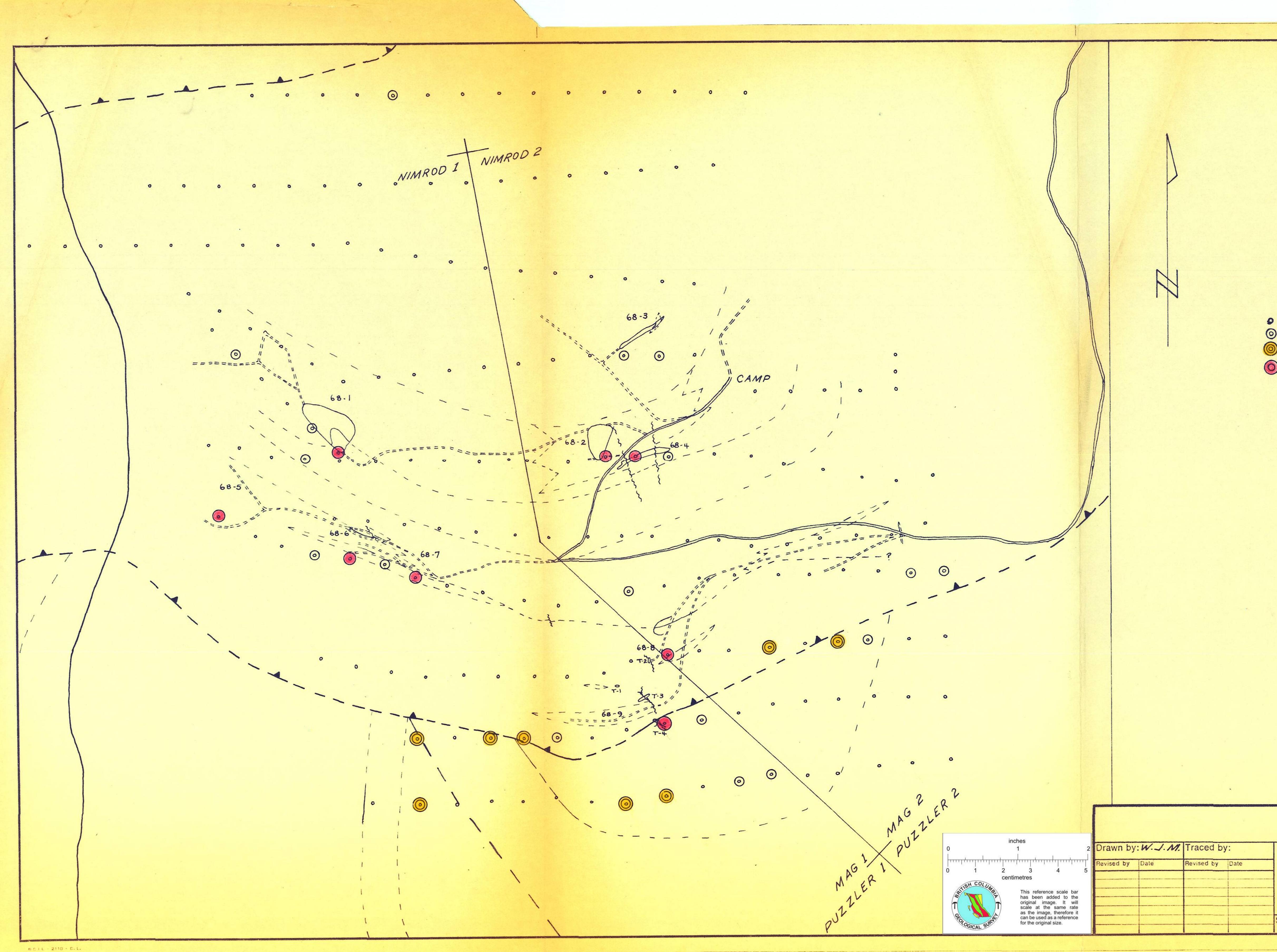
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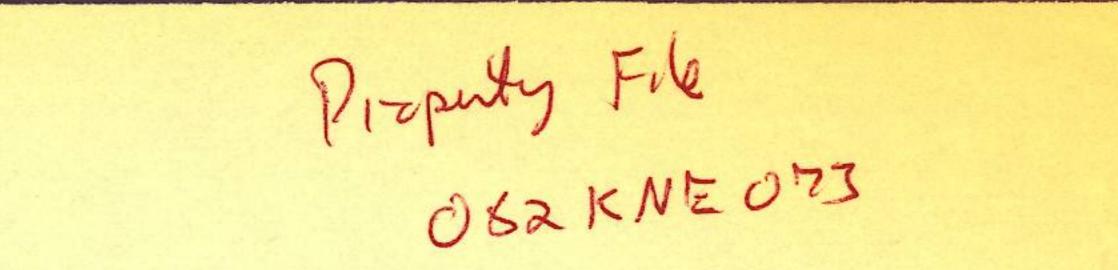




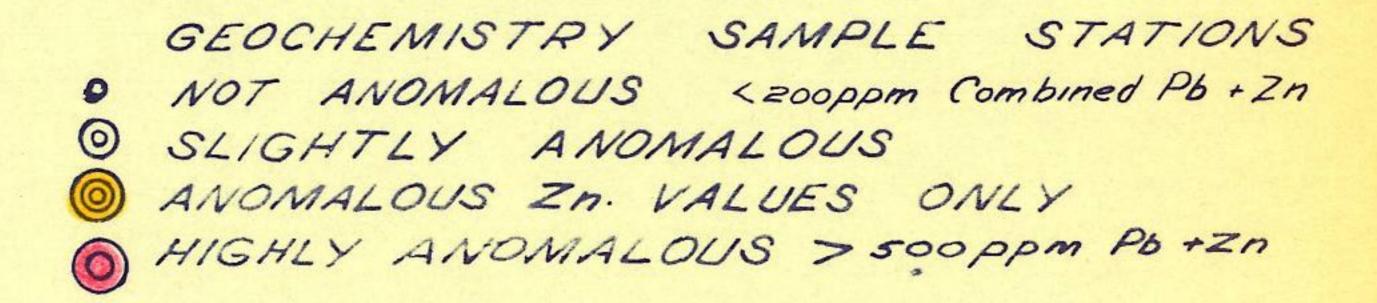
LEGEND STARBIRD FMN massive quartzite with siliceous carbonate pods phyllitic magnesian limestone with calcareous grit and quartzite interbeds BEAVERFOOT - BRISCO FMN pinkish-gray weathering dolomitic limestone MC KAY GROUP buff limestone conglomerate JUBILEE FORMATION massive to laminated pink to gray dolomite HORSETHIEF CREEK SERIES undivided red slate gray slote gray slate with laminated dark gray dolomite interbeds gray slate with black limestone intraformation al conglomerate interbeds gray slate with grit or quartzite interbeds quartz grit and pebble conglomerate with slate interbeds dolomite with detrital quartz and dolomite grit massive to laminated light to dark gray to boff magnesian limestone and dolomite. Locally oolitic. Often veined by white dolomite MT. NELSON FMN undivided INTRUSIVE ROCKS diorite and quartz diorite dikes SYMBOLS To bedding drivable road Tio cleavage == bulldozer track Tovein ~ minor fault T-10 hand-dug trench major fault 68-10 buildozer trench sthrust fault outline of mapped -teeth on upper plate outcrop -- geologic contact Comine PUZZLE GROUP Date: AUG. 21, 1968 Plate: No. 14 Scale: 1"= 200'

COMINCO 210-0640





SYMBOLS



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by Date	PUZZLE GROUP SOIL SAMPLE SURVEY FOR LEAD + ZINC
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