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RUDDOCK CK

PROPERTY FILE

N.T.S. Ref.: 82-M-15/W
Min. Div.: Kamloops, B.C.

REPORT ON

RUDDOCK CREEK LEAD-ZINC PROPERTY

1961 to 1963

PROPERTY FILE

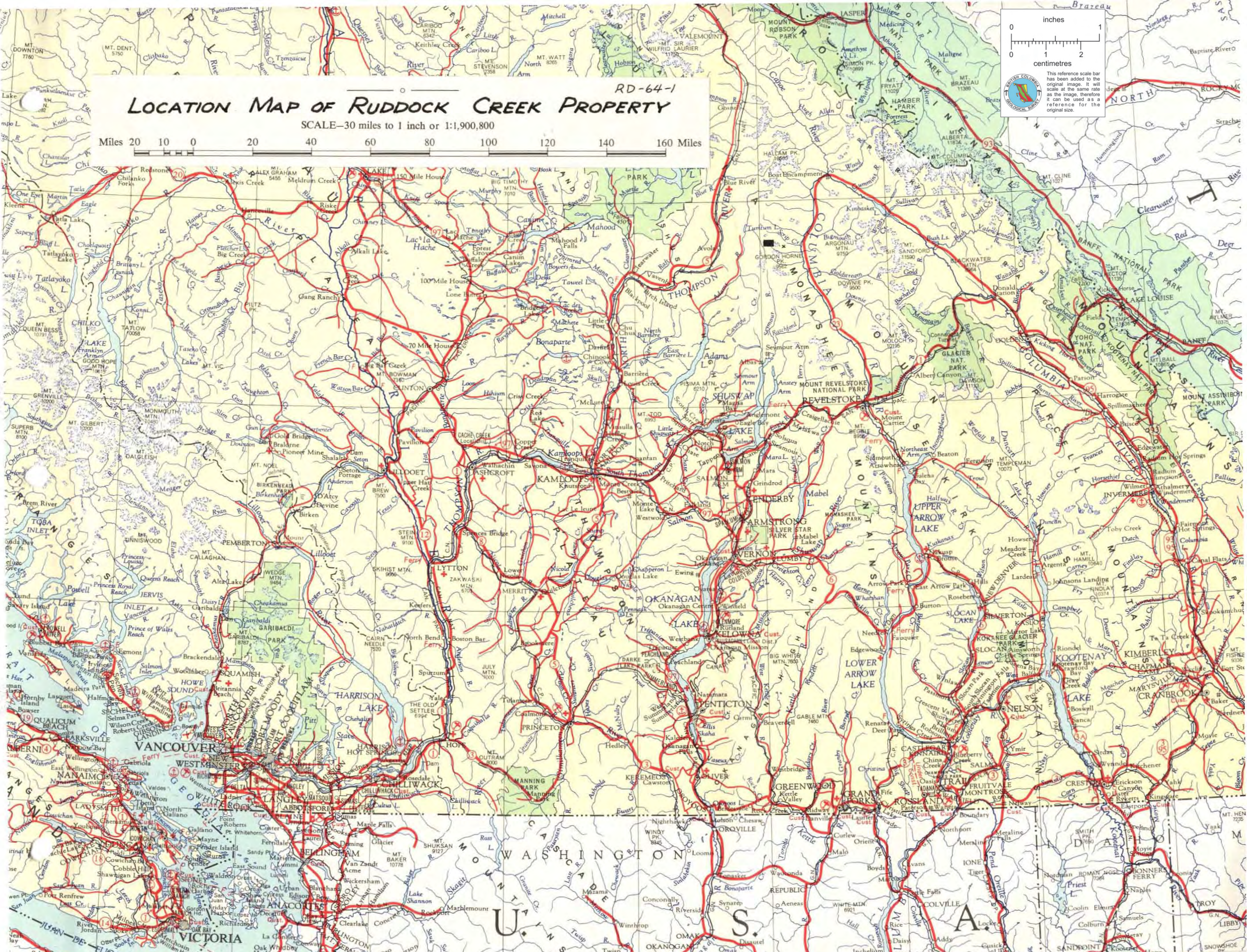
Vancouver, B. C.
March 12, 1965.

H. R. Morris
Geologist.

C O N T E N T S

List of Maps in Folder to accompany report on Ruddock Creek, 1961-1963:

RD-64-3	-	Geological & Topographical - East sheet	1" = 400'
RD-64-4	-	" " - West sheet	1" = 400'
RD-64-5	-	Longitudinal Section - E to U	1" = 400'
RD-64-6	-	Geology E showing	1" = 40'
RD-64-7	-	E Sections DS 87 E	1" = 40'
RD-64-8	-	" DS 00	1" = 40'
RD-64-9	-	" DS 150 W	1" = 40'
RD-64-10	-	" DS 400 W	1" = 40'
RD-64-11	-	" DS 500 W	1" = 40'
RD-64-12	-	" Section S. 0	1" = 40'
RD-64-13	-	" " S. 1	1" = 40'
RD-64-14	-	" " S. 2	1" = 40'
RD-64-15	-	" " S. 3	1" = 40'
RD-64-16	-	" " S. 4	1" = 40'
RD-64-17	-	" " S. 5	1" = 40'
RD-64-18	-	" " S. 6	1" = 40'
RD-64-19	-	" " S. 1800	1" = 40'
RD-64-20	-	E Zone Sub Surface Structure	1" = 100'
RD-64-21	-	M Showings and Drill Sections	1" = 40'
RD-64-22	-	Lower 'T' Showing Geology	1" = 40'
RD-64-23	-	Upper 'T' Showing Geology	1" = 40'
RD-64-24	-	Q and R Showings and DDH Sections	1" = 40'
RD-64-25	-	U Showings Geology	1" = 40'


RD-64-1
LOCATION MAP OF RUDDOCK CREEK PROPERTY
SCALE—30 miles to 1 inch or 1:1,900,800
Miles 20 10 0 20 40 60 80 100 120 140 160 Miles
inches
0 1
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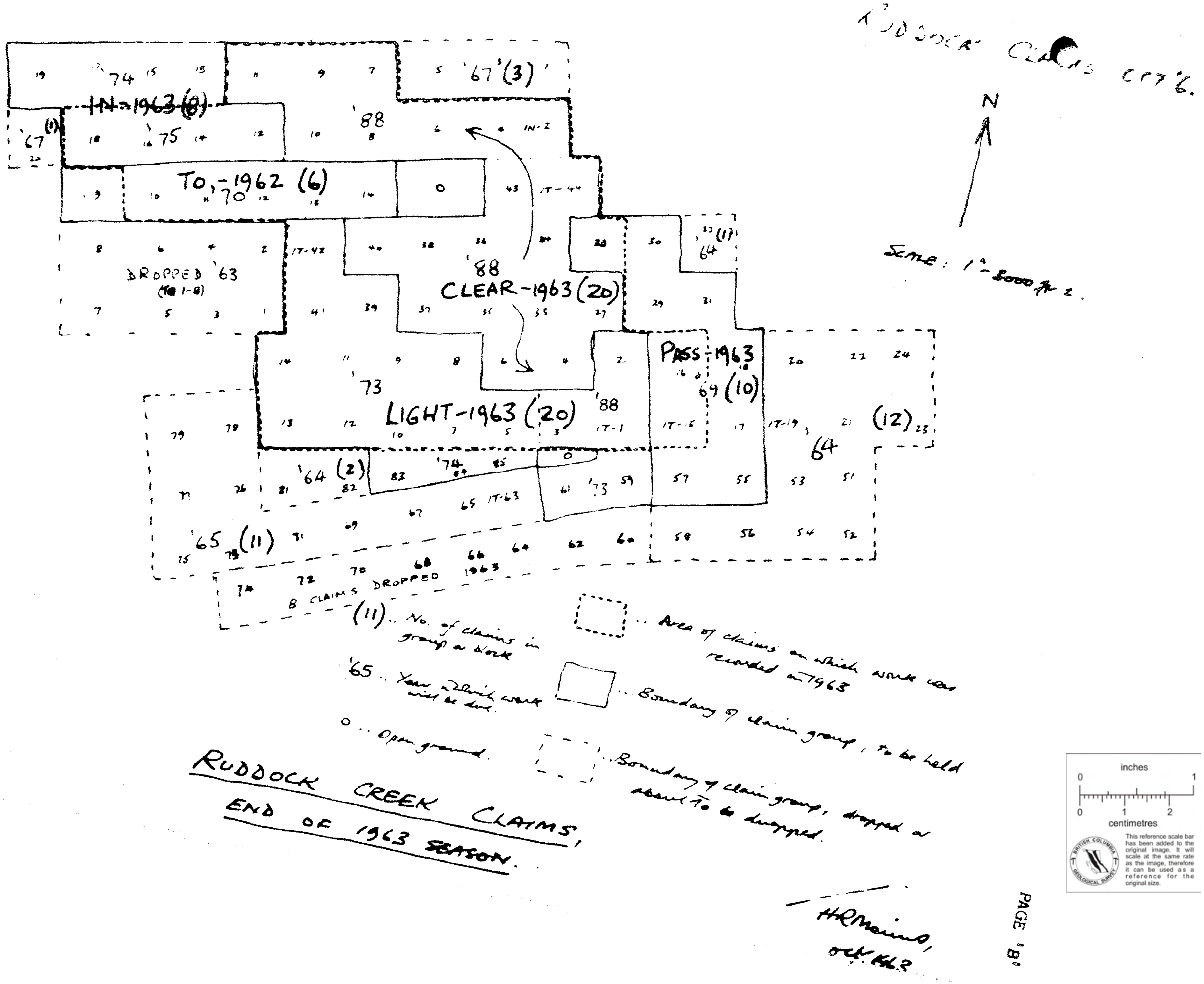
centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.
BRITISH COLUMBIA GEOLOGICAL SURVEY
VANCOUVER
VICTORIA
KAMLOOPS
REVELSTOKE
NELSON
PENTICTON
VERNON
WASHINGTON
U. S. A.

MAP No. RD 64-2



PAGE 'B'

N.T.S. Ref.: 82-M-15
Min. Div.: Kamloops, B.C.

REPORT ON
RUDDOCK CREEK LEAD-ZINC PROPERTY
1961 to 1963

INTRODUCTION

The description of the 1963 summer field work contained in these pages is intended to supplement my earlier progress reports on the property. Where appropriate a summing-up is made of data gathered since 1960 on each of the lead-zinc showings, and on the general area. An account is also given of methods of work and some of the difficulties encountered, as an aid to future planning.

SUMMARY OF 1963 RESULTS

Seventeen men drilled, trenched, surveyed and mapped geology during the four-month season. Over 12,000 feet of drilling were completed in this time, at three camps, supported by a helicopter chartered from Okanagan Helicopters Ltd. in Revelstoke. Total cost (for the full year) was about $140,000.

The attempt to prove the down-plunge continuation of the 'E' Zone ore, at a distance of 1000 to 4000 feet from outcrop was on the whole unsuccessful. Six diamond-drill holes averaging 1530 feet in depth were drilled to this end. A post-ore fault (named the No. 1 fault) cutting across the plunge of the ore structure at 600 to 1000 feet from ore outcrop, was found to have moved the down-plunge block 600-800 feet deeper than anticipated. Lowgrade mineralization in the down-thrown block was found at a depth near the limit of the drilling apparatus used, in three boreholes collared at an elevation of 7800 feet a.s.l. The high-grade ore of the ore-bearing fold structure is believed to have been missed by three drillholes, due partly to unexpectedly great deviation of of the holes during the drilling. The evidence appears to support, rather than cast doubt on, the present working hypothesis of a tight fold structure formed of stratigraphically controlled ore material continuing at depth through the property. Further deep drilling is recommended. (See proposals dated January 7, 1965.) (See Map RD-64-5)

Going underground, by editing from a point between the Main Camp and Light Lake, at 6000 ft. elevation, involves 3000 ft. of rock tunnelling, and seems from preliminary estimates to be equivalent in cost to the 22,000 ft. of deep drilling contained in my Jan. 7, 1965 proposal (appended to this report), i.e. $200,000 to $240,000.

On the west end showings, designated Q, R, U and V, seventeen shallow holes were drilled and rock trenches were cut, at elevations of 4000 to 6500 feet. The continuity was further established of the mineralization occurring in certain strata in the metamorphosed series of sedimentary rocks, between sheets of later intruded pegmatite. No ore concentrations of an economic interest comparable to the "E" were disclosed at the west end of the property.

The area of the property in which the sphalerite-galena showings appear is about 2½ miles east to west by 1½ miles north to south.

Assessment requirements on 64 of the claims have been satisfied up to the years 1969 to 1988. On the remaining 30 claims bordering the property work was due in the years 1964 to 1967.

It is recommended that the company persevere with deep drilling, which could indicate, if the main ore zone persists, between ten and twenty million tons of ore grading over 10% combined lead and zinc.

LOCATION

The Ruddock Creek property consists of 94 mineral claims located in mountainous country (the northern part of the Monashee Range) 65 miles north of Revelstoke, B.C. The property is near the watershed separating Ruddock Creek - a tributary of the Columbia River, 10 miles eastward - and the eastern headwaters of Oliver Creek, which flows north and west to join the Adams River at Tumtum Lake. All but a small fraction of the claims are in fact in the Oliver Creek drainage area. Elevations lie in the range from 3100 feet in Oliver Creek at the west end of the property to 9400 feet in the north-east part, on a snow-topped mountain named Gordon Horne West. The highest peak of the Gordon Horne group, named Don Horne or Gordon Horne on government maps, is 3½ miles east of the Ruddock main camp.

The major part of the property is above the 6500 ft. tree line, and here, except for heather and stunted shrubs between 6500 and 7500 ft., the ground is either barren rock or is covered by permanent névé snow, small receding glaciers, or glacial moraine and talus. Rock exposure on recently glaciated surfaces is of course excellent and has allowed detailed mapping of the higher showings. Claims at lower elevations are well timbered with cedar, spruce and white pine, with alder on snow-slide areas. On steep timbered slopes mapping is slow, arduous and confined to small local cliffs and steep gullies.

Water supply, from streams fed by glacial and névé melt-waters, varies according to elevation and time of year, but has been found generally to be ample for exploration work in the summer and fall. The proposed permanent camp location in the Pass area may run into water difficulties in winter and early spring, and a site on timbered ground west of Light Lake, at 6000 ft. elevation, may be more suitable for year-round operation.

ACCESS

No roads exist into the property. An old trapper's trail follows the bottom of Oliver Creek through the west end of the claims and joins lumber roads coming up the Adams Valley from Adams Lake. A Forestry access road links the Adams to the North Thompson Valley, in which run the No. 5 provincial highway and C.N.R. line to Kamloops. An alternative and better exit route may soon exist via a 30-mile Forest access road, now being surveyed, along the Seymour Valley from the Seymour/Oliver watershed 5 miles south of the Ruddock claims to the Seymour Arm of Shuswap Lake. This point and the Trail smelter of C.M. & S. are linked by the following route: via Shuswap Lake to Sicamous (30 miles); C.P.R. to Kelowna (75 miles); via Okanagan Lake to Penticton (35 miles); C.P.R. (Kettle Valley R.R.) to Trail (250 miles).

A third route from the property lies east along Ruddock Creek (where no road or trail exists at this time) to the Columbia River, a distance of about 10 miles (with a drop of 6000 ft.), and thence via the Columbia River itself through the Arrow Lakes to Trail, a further distance of about 220 miles. However the dams planned at Downie Creek and Lower Arrow Lake will block this route. The new dam site at Mica Creek is about 20 miles up the Columbia River from the Ruddock/Columbia confluence, and the Downie Creek site a similar distance downstream.

For exploration purposes access to the camp has been made by helicopter based in Revelstoke or at a local base-camp on the Big Bend highway, 64 miles north of Revelstoke. Helicopter flight time from

Revelstoke to the camp is 45 to 60 minutes; from the 64-mile camp, 10 to 15 minutes.

HISTORY OF THE PROJECT

The first Ruddock Creek claims were staked in late September 1960 by prospectors Mike Donahue and Tom Cross under the supervision of Earl Dodson, at the end of a season of systematic prospecting of a large area between Revelstoke, Adams River, and the northern part of the Columbia 'Big Bend'. Prospecting of the Ruddock headwaters was done from a camp on Dark Lake at an elevation of 5400 feet, where the men were landed by a Piper "Super Cub" float plane, about a mile south-east and 1700 feet below the present main camp site. A helicopter piloted by Roy Hepworth allowed rapid staking of the generally rugged ground. At that time 74 claims were staked, but with changes in later years the total now held stands at 94 claims.

In 1961 a camp consisting of two 14' by 16' framed tents was set up by helicopter to house a crew of six to eight men at the present main camp site. Drilling with the Longyear "Prospector" EX rig by Jim Robertson (camp manager) and Norman Anderson, "Packsack" drilling by Mike Donahue and Mark Lemieux, and surveying by Jesse Cove assisted by Alex Smith Jr. and Rick Tipple, were carried out under the direction of the writer between June 1 and September 23, 1961. Drilling amounted to 3084 feet on the 'E', 'M' and 'T' showings, 2668, 340 and 76 feet respectively. The showings were also mapped in fair detail and a start made on the geological mapping of the whole property at a scale of 1 inch to 1000 feet.

The work was expanded in 1962 to include the west end showings, discovered and staked by Cross, Donahue and Dodson in 1961. A second camp was set up at 3500 feet elevation on the east side of the Oliver Creek valley, and 278 feet of "packsack" drilling done on the "Q" showing, by Doug Randall and Warren Fisher. Larry Collison and Don Williams took part in other work including the cutting of trails and the building of a heliport at 4300 feet near the "Q" showing. Some local surveying was carried out by two U.B.C. engineering students, Charles Wong and Harry Jang. Jim Robertson with several men hired for the summer added 3510 feet to the drilling of the "E" showing by means of the small Longyear "Prospector" drill. Having the services of an assistant geologist, Mike Stadnyk, to log and sample most of the drill core, I was able to spend a large part of my time on geological mapping and on the west-end work. Jim Robertson in 1962 as in 1961 took on most of the work of setting up the camp and ordering supplies as needed. In these two years camp maintenance was eased by the proximity of the "Adams River Project" prospecting camp directed by Earl Dodson, situated in 1961 at the Columbia Big Bend 64-mile site, and in 1962 on the Trans-Canada Highway 12 miles west of Revelstoke. The cost of the helicopter, based at Dodson's camp, was shared between the two projects, and was thereby kept to a minimum for each project.

During the winter of 1962-63 a contoured base map of the property area at a scale of 1 inch to 400 feet was produced by the firm of McElhanney & Co. using B.C. government air photos, and the geological information gathered to that date compiled on it. (The map has since been redrawn, following a more accurate and extensive triangulation survey of photo control points by Don Highe in 1963.) By the end of the

1962 season two-thirds of the 'E' zone ore-bearing structure east of the No. 1 fault had been drilled off at a spacing of 50 to 100 feet, and preliminary estimates of tonnage were possible.

GENERAL ACCOUNT OF 1963 WORK

An advance party of two men was landed at the main camp site by chartered Okanagan Helicopter Co. machine on May 16, six weeks earlier than in 1961 or 1962. Snow depth at the camp elevation of 7100 feet was then at least 10 feet, and some days were required for the men to dig out snow from tent-frames, while living in the "Butler"-type cookhouse erected in 1962. At the same time three men were flown to the Oliver Creek valley - the west end of the property - to dismantle tent frames at the old 1962 camp at 3500 feet elevation. During the following two weeks a new camp was erected one mile north, at 4000 feet, on the steep timbered slope near the 'Q' showing, on the eastern side of Oliver Creek valley.

The Falconbridge helicopter piloted by Roy Hepworth arrived at the Columbia River base camp on May 24th. After being used to spot a third campsite (in the small cirque between the earlier camps) and to locate tentative sites for the first deep drill holes, this aircraft ferried equipment, fuel and camp supplies the 10-14 mile haul across the Columbia River to the working camps. About 100 tons of material including fuel were moved by June 2nd, over half belonging to the drilling contractors, Canadian Longyear Diamond Drilling Co. Drilling began on May 31, 1963, on ED-1, sited in 12 feet of snow on a 22° rock slope a quarter-mile northwest of the main camp.

West camp building was completed early in June. "Packsack" drilling in hole Q-4 nearby began on June 4, while two men using a gasoline-operated "Atlas Copco" rock drill and blasting material began rock cuts at the northern extremity of the 'Q' showing.

There were at this time seven men at the West camp, and nine at the Main camp, employed as follows:

<u>West Camp</u>

Rock drilling and blasting, camp building	-	Rod MacPhee
Helper	-	Doug Randall
Diamond driller	-	Phillip Lang
Helper	-	Warren Fisher
Assistant geologist	-	Tom Richards
Survey Helper	-	Bob McKitrick
Cook	-	Nick Howich

<u>Main Camp</u>

Mining geologist in charge	-	Hans Morris
Geologist	-	Nicholas Close
Canadian Longyear crew	-	Ed Hagen (foreman) and five others
Cook	-	John Gigliotti

Surveyor Donald Highe and helper Paul Lawrence came to Ruddock Creek early in July, and McKitrick and Howich left late the same month, but the remainder of the crew stayed through the season, to late September.

Buildings and crew of the West camp were transferred to the new Cirque campsite in a somewhat piecemeal move between August 12 and

and August 22nd. The Cirque camp provided a base for "Packsack" drilling of the nearby 'U' showing, as well as for surveying and geological mapping of the area. Deep drilling was planned here later in the year, but was not in fact carried out, and by September 14th this camp was closed down. Three tent-frames and the wash-house were left intact. At the completion of the last deep borehole (ED-8) on September 23, the remaining crew and drilling equipment were moved, in good weather, from the Main camp to the Columbia base by the Falconbridge Hiller 12-E helicopter, with the assistance of an Okanagan Co. charter helicopter. The camp was closed down on September 27. Weather in 1963 stayed good to the end of the field-work period, unlike previous years when snowstorms forced withdrawal in late September.

Visitors to the property during the summer included Mr. E. Muraro of C. M. & S., Dr. Matt Hedley of B. C. Department of Mines, and Dr. J. O. Wheeler of G.S.C. and some of his crew working in the area. Mr. H. S. McGowan and Dr. Alex Smith spent a few hours at the main camp at the end of August.

COMMUNICATIONS

Arrangements were made with Mr. Toby Belinski of City Transfer Co., Revelstoke, to take radio-telephone orders for bulk supplies, to be delivered to the 64-mile base campsite on the Columbia Big Bend highway. The Okanagan Helicopter Co.'s Hiller 12-E aircraft, based in Revelstoke with Mr. Mike McDonagh as pilot, made weekly supply trips to the camps on the property, bringing mail and small items direct, and ferrying bulk supplies from the base at 64-mile. A two-week supply interval was tried during August, but did not prove successful, as by the time the aircraft arrived at the camp it was seldom possible to ferry up two weeks' supply of food and fuel without running short of time to do intercamp personnel movements, drill moves or other small jobs on the same day. First call on the Okanagan Co.'s helicopters in Revelstoke and Nelson was in the hands of forestry agencies during July and August, the months of high forest fire danger, so that for periods of up to ten days neither of these machines was available. Some camp and drill movements planned to take place during these months were delayed as a result, but the cost of such delays must be counted as part of the price to be paid for having a charter helicopter available at all in the Revelstoke area, and was in any case no more than the cost of bringing our own Hiller in from the coast.

Contact with the Okanagan Telephone Co.'s exchange in Revelstoke was made early in June by means of the Spilsbury and Tyndall crystal-controlled shortwave transceiver used in previous years. Because of its relatively old design this set uses a heavy battery current, and was found hard to keep at full output power: it was frequently impossible to call Revelstoke with any likelihood of making contact. A modern higher-powered Marconi transistor set, the "Marconi IV" with 65 watt output, was rented in early August, gave better results, although the mountainous terrain surrounding the Ruddock camp seems to obviate a completely reliable radio connection with Revelstoke. The telephone exchange at Kelowna was at times more easily raised.

Between-camp communication was maintained by voice-powered Japanese-made "Nobel-phones", which paid their cost many times over in helicopter hours saved, as well as keeping the geologist in charge at the main camp in touch with work at other camps and at drill-sites. They also provided assurance in the event of accident of contact between outlying work-places and the radio-tebphone at the main camp. These phones operate through thin plastic-insulated twin conductors, large sections of which have had to be laid afresh each year. About five miles of line was in use in 1963, laid wherever possible along an easily passable route between camps, to simplify the location of breaks caused by windfalls, rock slides, gnawing animals or badly made connections. On a year-to-year basis the use of cheap ($5.00 per thousand feet) thin wire may have been justified, but it now seems that heavier wire at two to three times the initial cost, if laid on the ground through the under-brush, with slide and creek crossings well-marked for easy replacement of swept-out sections each spring, would be more economic. A saving of relaying and maintenance, plus time and trouble, would accrue where more than one year's occupancy is contemplated of camps in difficult terrain such as this.

In surveying some use was made of short-range "walkie-talkie" sets. These also provided a safety link between a base camp and a man covering rough country alone, although their value was limited by their line-of-sight range.

PROGRESS OF ED DRILLING

The AX wire-line equipment used on the job in 1963 had a nominal capacity of 1800 to 2000 feet. The depth limit was found to depend more on the strength of the thin-walled wire-line rods which were from time to time available on the job, than on any other factor. With new equipment the depth limit was put by the drill foreman at 2200-2300 feet. Heavy wear in broken ground in the first three drill-holes resulted later in frequent rod breakage which could not always be made good immediately because of temporary lack of drill-rods in the Revelstoke area, or of a helicopter to bring them in. The rate of drilling was of course higher than would have been obtained with standard rod equipment: including time consumed in moving, cementing, and waiting for the helicopter, it averaged 2600 feet per month. Working three shifts per day, the crews drilled eight holes totalling 10,593 feet. Six between-hole moves were made.

	May 25-31	June	July	August	Sept. 1-25		
Feet drilled	111	2187	2903	2957	2436	Total,	10,593
Average/day	16	73	94	96	97		

The strong fault zone penetrated by holes ED-1, 2 and 3 accounted for nearly all the nine days lost cementing, and also for most of the 38 feet of lost core.

It had been hoped that some of the shorter drill moves might be made by winching the machine over the ground, but the bare rocky slopes made such a method uneconomic and even dangerous, and all moves but the first were made by helicopter. Each required about four hours flying time on the job. The heaviest part of the drill was the frame, weighing about 750 pounds, but the largest and heaviest items moved were the drill tripod legs, of timber initially brought up from the Columbia valley, and weighing not much less than 1000 pounds before drying out. The size of timber capable of being moved at 7000 to 8000 feet by the available helicopter is therefore likely to be the factor limiting both the maximum drilling depth and the speed of operation. The total weight of rods which can be raised in the hole, and the length of the pull (20, 30 or 40 ft. at a time) are governed by the strength and length of the tripod legs.

RESULTS OF ED DRILLING

Sections RD64-5 and RD64-18 present a simplified view of the rocks penetrated by holes ED 1, 2, 3, 4, 7 and 8, while the map on a scale of 1" - 100', RD64-19, illustrates the probable structure of the 'E' zone to the depth drilled.

ED 1 was drilled to cut ore at 800 feet. At this depth mineralized rock was indeed found, but of a grade and form which suggested an intersection had been made beyond the nose or apex of the main ore fold. The mineralized rocks occurred below a strong fault zone. ED 2 was sited 200 feet south, so as to hit the main ore, but instead found the fault zone containing sheared ore material, some of which was interpreted as being from the main ore layer. The third hole was then collared 200 feet in the down-plunge direction, to avoid the fault, but gave results similar to ED 2.

A step-out of 800 feet was then made, to a distance of 2000 feet from ore outcrop. At this location ED 4 was drilled to a depth of 1955 feet, meeting mineralized strata at 1900 feet. These strata were interpreted as being on the upper limb of the recumbent fold, the intersection apparently being in a position analogous to that of E 12 or E 16, that is, at a distance of 600 feet or more from the main ore fold apex. A further intersection was therefore planned about 400 feet northeast (i.e. across plunge) and hole ED 7 and ED 8 eventually directed to this target. The first of these holes, ED 7, collared vertically and drilled to 2004 feet, found two thin mineralized zones, or groups of layers, generally low-grade, over a core length of 75 feet. Fifty feet of barren rock, mainly pegmatite, separated the mineralized sections, which were interpreted as being equivalent to those cut by E 10. (This borehole, drilled at the east end of the 'E' showing in 1961, met the fold formed by the outer thin mineralized layer, near the apex, but missed the higher-grade ore.)

At this point in the season, September 8, 1963, drilling footage and expenditure had already exceeded original plans; but, in an attempt to gain a positive intersection on the main ore, ED 8 was started, with barely time (given the normal delays) to complete the expected drilling before the usual late September snowstorms. This hole was aimed steeply southwest, to give an intersection 200 feet southwest of ED 7. Excessive deviation was soon detected, but as time did not permit keeping the hole straight by wedging and the use of standard (not wireline) rods, the intersections finally made were not more than fifty feet from those of ED 7. However, new information was obtained in that the hole cut a third thin but high-grade ore section, which appears to represent the tip of the main ore fold.

The structural map illustrates this interpretation, but the following possibilities have also to be considered: 1) that the grade of the mineralization has as a whole deteriorated at this distance from outcrop, and that the 'main fold' no longer forms an ore unit west of the fault; 2) that the mineralized layers are so spread over a vertical distance that the three deeper holes did not go deep enough to find the main layer, and the mineralization found in all of them is the outer (generally low-grade) part of the sulphide-bearing structure. The capacity of the drill used in 1963 was such that the deeper holes had generally to be stopped when no more than a few feet of the supposed foot-wall marker rock - a dark quartz-mica schist labelled "MQ" on the sections - had been drilled. As small thicknesses of a similar rock have been logged in a few holes within the mineralized zone, on the more open parts of the fold area drilled off, a thickness of 30 feet of MQ is desirable for positive identification.

However, I believe the interpretation put on the intersections to be the most likely one, and that the information obtained is sufficiently encouraging to justify continued drilling down this axis in the following areas: (a) At about 2000 feet from outcrop, to find the centre of the folded ore shoot, and (b) at 8 to 10 thousand feet from outcrop (in the cirque), to pick up the mineralized layer. At the greater distance the chances of hitting the "E" zone fold apex, if it exists, cannot be rated very highly (having in mind the difficulty experienced much closer to outcrop) but an intersection on the limbs of the fold would itself be encouraging and add greatly to our knowledge of the structural position, persistence and grade of the mineralized layers.

RESULTS OF GEOLOGICAL MAPPING

An interpretation of importance for economic assessment of the property, brought out by the 1963 mapping, is the correlation of the group of limestone-rich strata in the cirque, north of the 'U' showing, with the limestone series which exists 300 - 500 feet above the mineralized 'E' zone layers. If this correlation is correct, no more than 1500 feet of drilling should be required to penetrate the mineralized horizon from a site near the 1963 Cirque camp, at an elevation of about 6500 feet. The inferred relationship is illustrated by the 1" - 400' longitudinal section.

Mapping also showed that several thrust faults may be traced through the property; no doubt more exist than have been seen. The mineralized calcareous layer of the 'G' and 'M' zones are now believed to have been followed by planes along which thrusting and mylonitization occurred. Mylonitic thrust-planes are seen to split and reunite, and to transect outcrops of pegmatite and quartz-mica schist at dip angles from zero to 60^{o}. The finely banded mylonites frequently show a striation or mineral streaking in a direction which is most often westerly; that is, roughly parallel to the linear structures presumed to be related to the major folding which forms our ore control. Mineral streaking on thrust surfaces and mineral lineation due to folding are in many instances not distinguishable, and some of the features mapped with a view to determining changes in fold plunge may in fact be due to thrust movement.

While mapping around the cirque, it was intended to examine the 'M' layer as it occurs along the steep eastern wall. Near station 68A, 2000 feet north of the cirque glacier, are four thin mineralized layers, amounting to 2 or 3 feet in a total stratigraphic thickness of about 50 feet. Each layer consists of a few inches of generally coarse grained sphalerite with a gangue of quartz grains and "pebbles", similar to 'E' zone ore. The intervening rocks are calcareous quartzites carrying small amounts of pyrite, pyrrhotite, sphalerite and mica. Above the uppermost sphalerite-rich layer is a thin quartzitic limestone, while sills of pegmatite up to 5 feet thick occur within the section. (Pegmatites of 50 to 150 feet are seen elsewhere on this cliff.) The extremely fine "colloidal" texture, mylonitic banding, and minor folding, characteristic of the "M" and "G" showings (and evidence of the thrust zones outcropping along those showings) are not seen here. The steep ground prevented me from following the mineralized layers across the cirque wall, or reaching them by climbing along the northern rim, but the layers may be traced by eye on both the west-facing and north-facing precipitous sides of the snow-topped 9400 ft. mountain, until the outcrop at station 3 is reached, near the M showing.

Mapping in 1963 between the 'U' and 'T' showings added to the evidence supporting the fold pattern outlined by preliminary work in 1961 and 1962. The succession of metamorphosed sediments near station S-19 (21,021 N, 17,662 E) dips steeply south, and is near the upper apex of a recumbent S-fold, of which the tight 'E' zone syncline represents the corresponding lower apex. The upper part of the S-fold is in fact compounded of a number of small steep dip reversals, which may be observed over a vertical distance of about 1000 feet on the eastern flank of the hill on which S-19 is placed. On the steeper western flank of the same hill the rocks have not been mapped. A few thousand feet to the northwest, near the 'U' showing and the cirque stream exit, steep dips and a marked dip reversal were recorded. Between the cirque exit and the 'V' showing steep dips, with tight 'concertina' folds in the mica schists, are the general rule, but as the trend of mineralization is followed northwestward to the 'R' and 'Q' showings, contortions of foliation become less, dips slacken off to less than 40°, and such folding as occurs is, on the whole, more open and of small amplitude. The whole structural picture, as well as similarities of the rock succession at each place, suggests that the 'Q' showing is in a position analogous to that of the lower 'T' showing, on the middle limb of the S-fold.

DESCRIPTION OF MAIN SHOWINGS

The 'E' showing (or Main showing) outcrops at 7600 feet elevation on an almost bare glaciated rock slope 500 feet above the Main Camp. Metamorphosed and isoclinally folded sedimentary rocks having a general southwest strike direction and a dip of 40° to the northwest occur between thick pegmatite sills, and are also transected by much thinner pegmatite dikes, and sheets. The zinc and lead sulphides, as noted in an earlier report, appear to be concentrated in particular beds in a quartzite-limestone-micaschist sequence. Some at least of these beds are of large lateral extent, parallel to the compositional layering of the sediments. Other mineralized layers seem to be lenticular, but still concordant to the general structure. What may appear at first glance to be cross-cutting or highly irregular structures are seen on closer examination to be the result of strong folding of the whole sedimentary series. The mineralized layers in this showing are exposed in the form of an irregular and elongated V, having its open limbs to the west. (See Map RD 64-6) The area of mineralization is 800 feet long and widens from 50 feet across the strike at the east end to 200 feet across the open limbs at the west. Detailed mapping has shown the V-shape to be the surface expression of a recumbent or overturned isoclinal fold of which the axial plunge is about 30° westward. Along the eastern 600 feet of the showing the mineralized fold limbs are parallel and compressed within a total true width of about

100 feet, on which has been imposed a series of small parallel fold waves. Over the western 200 feet of the showing the limbs diverge, with a number of small subsidiary folds, and each of the two branches consists of 20 to 50 feet of strata containing two or three strongly-mineralized layers along with low-grade or unmineralized material.

The mineralization is varied in composition and texture, but consists primarily of galena and dark brown to black sphalerite in a calcareous quartzite gangue, with strong mineral layering and stratigraphic control. Considered as a whole, the one body contains as gangue minerals quartz, calcite, fluorite, feldspar, white and brown micas, some calcium and iron silicates, and barite. Pyrite and pyrrhotite are common, while chalcopyrite was seen as minute specks in some drill cores.

Different types of mineralized layers may be discerned, as follows:

1) Very fine-grained medium to dark brown sphalerite, generally with some pyrrhotite (up to 40%) and containing sub-round grains or small pebbles of quartz, with rarely green silicates. In extremely fine grained form this is styled "colloidal" sphalerite. Layers of this material grade up to 35% zinc. Its texture may be the result of granulation and mylonitization of the coarser types.

2) Medium to coarse grained black sphalerite, occurring with galena in a 5 to 1 ratio, and intergrown with quartz grains to give a strong compositional layering consisting of short, roughly lenticular streaks. The streaky layered texture is similar to that of a gneissic gabbro. The proportion of quartz may be from 25 to 75%. Sections low in quartz may also show an appearance similar to that described under

1) above, with rounded aggregates or clots of quartz grains in addition to small grains and pebble-like masses. Pyrrhotite, pyrite and chalcopyrite occur in very small amounts. Clots of pyrite and pyrrhotite up to 6 inches across are seen in quartzite layers near mineralized material. Mineralization of this type assays 20 to 30% zinc in the better parts, down to 10% in poorer material, grading into type 3).

3) Slightly micaceous and calcareous quartzite in which sphalerite with very minor amounts of galena (and locally pyrite) occur as scattered grains or clots, with an assay of 2 to 10% zinc.

4) Thin-layered quartzite, the layers marked by thin granular concentrations of either galena or sphalerite, with no apparent intergrowth of the two minerals, and containing bandsin which calcite and fluorite are major constituents. The sphalerite in this rock tends to be pale in colour, from medium brown to pale honey-colour. This material assays 2 to 5% zinc and 1 to 2% lead, with some layers apparently containing more galena than sphalerite.

5) Crystalline limestone containing small scattered grains of pyrrhotite and dark sphalerite, in which a faint layer variation may be seen in part, the rock assaying no more than 2% zinc.

Interbedded with the mineralized quartzites are more or less pure crystalline limestones and quartzites containing almost no sulphides, or at most a sparse sprinkling of pyrite or pyrrhotite grains. Layers consisting almost entirely of fluorite, and apparently lenticular, are common in the western part of the showing, that is, inside the fold structure. They grade by interlaying into calcareous and quartzitic material. Fluorite grains also occur as a minor constituent of well-mineralized layers. A barite lens of 10 inches maximum thickness and about 50 feet in length occurs in the western part of the 'E' showing, concordant with the compositional (and assumed stratigraphic) layering of the metamorphosed sediments.

Other rock types, in which mineralization has not been seen, are described later in this report.

'F' Showing

One to three thin mineralized layers, similar to the medium grained material described above, occur in the gullies and cliffs 1500 to 2500 feet SW of the 'E' showing and 500 feet from the main camp. The layers are spread over a 200-ft. thickness of westerly-dipping sediments and pegmatite sills, and none appears to be more than a foot in thickness. No economic quantity or any evidence of folding has been seen on this showing, and there is little need of further work here, although some mineralization may be hidden by a pegmatite capping. A series of lines spaced at 50 feet and marked on the rock, as at the 'E' showing, has been laid out to locate "packsack" drilling which may be desirable to obtain assay samples.

The mineralized layers have been traced no further than a cliff at the 6600 ft. elevation, but with overburden stripping and pitting they may possibly be followed west towards the 'T' showing, or into the talus and heavy overburden near Light Lake. The detailed 400-scale mapping, which at present ends at the 6400 level here, should be continued southwestward for more stratigraphic and structural information. If the mineralized strata on the property are in the form of "cascade" folds rather than a single S-fold, then an apex analogous to the 'E' might exist at depth below the gully separating the 'F' and 'T' showings. There is at present, however, no reason to believe evidence of this would appear at surface, and to drill for it would be something of a "wildcat" operation.

"G" Showings

In the shallow, partly talus-filled creek beds 1600 feet west of the 'E' showing a disjointed series of small showings occur. The irregular pattern of the mineralization is due partly to intrusion of the zinc bearing sediments by pegmatite sheets cutting across the formational planes; partly to the low angle at which the present ground surface cuts the planes of bedding and intrusion; and partly to late movement and erosion on thrust fault surfaces which dip at relatively shallow angles to the west, again nearly parallel to both bedding or compositional layering and to the pegmatite sheets. Mineralized rock can be seen at intervals from 7350 to 8200 ft. elevation not far from a main thrust plane, and also in disconnected patches leading towards the 'M' showing. The mineralization appears thin and low grade at surface but where cut in hole ED 4 amounts to 56.4 ft. (true thickness about 44 ft.) assaying 6.12% Zn and 0.79% Pb (this includes 10.8 ft. of pegmatite assaying less than 0.2% Zn and several layers assaying over 20% Zn.)

The mineralization is in part in quartzitic beds similar to the medium to coarse grained 'E' variety, and partly in layers showing strong mylonitic features - fine drag folds and very thin mineral banding. The lower grade rocks, apart from pegmatite, are calcareous quartzites. Mylonitized sphalerite-bearing calcareous quartzites may be traced to the foot of the ridge north of drill hole ED 7.

The 'G' showing has not been drilled, except for the ED 4 intersection noted above. The thickness of mineralization revealed by ED 4 makes it desirable to do shallow test holes with the 'packsack' drill. A grid is already laid out over the southern part of the showing for this purpose. A minimum of four 75-ft. holes is recommended.

'M' Showings

The two mineralized areas named the Lower and Upper 'M' showings, 3200 to 4500 feet northwest of the main camp, are in fact a continuation of the series of showings just described. The lower 'M' consists of a 30-ft. thickness of mineralized quartzite in the form of a shallow synclinal fold plunging west at 10 to 20°, underlain by poorly mineralized, calcareous quartzite and pegmatite. The area of mineralization is about 150 ft. This outcrop and the upper 'M' showing 800 ft. north are bounded to the west partly by glacier and neve, and partly by more pegmatite which seems to be in the form of thick sills dipping gently west. The 'M' showings are at an elevation of 8100 to 8600 feet, and were tested in 1961 by 15 'packsack' drill holes. Eleven holes on the upper 'M' showed an average ore thickness of 10 ft., containing 8.4% Zn and 1.6% Pb. Above the highest drill hole, No. M-11 at 8566 ft., the mineralized layer is hidden by talus and neve snow, but reappears at the col overlooking the steep-sided cirque to the north. The layer may be traced by eye along the cirque wall westward from this point, but is not approachable on the ground. It is visible, but has not been examined, on the ridge near airphoto point No. 10, 2500 ft. NW of the 'M' showing, and between this point and the small showing a similar distance due west of the 'M', which was described earlier (p. 16). The mineralized layers on the 'M' showing are very similar to the 'G', and have been the locus of thrust movement on a plane dipping with the beds at a low angle westward. Very thin and highly contorted mineral banding in a thickness of fine grained material, probably mylonitized calcareous quartzite, is characteristic of the 'M' and 'G' showings.

The lower 'M' showing has not been traversed by a thrust plane and rock textures are similar to those at the 'E' showing. Two holes drilled here, M 13 and M 15, cut 10.3 ft. and 29.2 feet respectively of interlayered well-mineralized and poorly mineralized quartzites and limestones, similar to the rocks at the 'E' showing. Assay averages in M 13 were 23.60% Zn, 3.54% Pb, and in M 15, 8.61% Zn and 1.74% Pb. Both these holes were collared on the showing, and probably do not give total thickness of the mineralized rock down-dip. A further hole, M 12, was drilled 200 ft. down dip, but ran into a pegmatite sill which the packsack drill was unable to penetrate, and which probably overlies the mineralization.

<u>'T' Showings</u>

A series of small showings may be seen descending the west side and in the head of the gully between Clear Lake and the Main Camp. Eight DDH's were drilled on the western part, some of which gave encouraging results. The structure visible at the showings, and illustrated by Maps 22 and 23, is that of a relatively open fold, the axis plunging westward at 5 to 25°. The sedimentary compositional layering at the Upper 'T' dips south, while at the lower 'T', at 600 ft. lower elevation, dips are to the north. DDH intersections gave varied results. Some fine flow folding and mylonitization due to thrust movement is evident on the lower showing and in drill cores. (This is not related to the larger drag folding produced by the major fold pattern which is in a different direction.) Assay figures are shown on the Maps 22 and 23. The mid-'T' showing appears to represent a fold apex, where the metasediments are highly folded. However the fold is small, and the best intersection, in DDH T-5, gave 6.4 ft. of 23.84% Zn and 4.46% Pb. Possibly the entire mineralized thickness was not penetrated, but two other holes drilled here drew blanks. Three drill holes on the lower 'T' showing gave at least twice this thickness, but about half the grade. Excluding the small showings in the head of the gully, the 'T' showings (upper, mid and lower) extend over 2000 ft., but are separated by pegmatite sills dipping westward, cutting across the sedimentary structure but roughly parallel to the plunge of fold axes. Each of the sills is about 120 feet thick.

To date, work on these showings has not indicated ore concentrations comparable to the fold structure at the 'E'. Further close examination is desirable of the rocks between the 'T' and 'U' showings, but economic concentrations are not expected here, as the fold appears to be open with a number of small drags, rather than tightly compressed.

<u>'U' Showings</u>

These showings extend over a distance of 1600 feet along the eastern side of the glacial valley in which the Cirque Camp is sited. They are discontinuous and generally much folded, but on an axis different from the major fold axes of the 'E' and 'T' showings. Fold axis determinations on the 'U' showing (and on a belt of rock extending northwest from the showing up to the head of this cirque) are oriented 240°, whereas fold axes elsewhere on the property are generally 270° to 300°. Two or three thin ore layers are visible, which on drilling in the folded area gave the following intersections:

DDH U-1 : 27.3 ft. assaying 6.00% Zn, 0.18% Pb

U-2 : 29.6 ft. assaying 16.88% Zn, 2.16% Pb

U-3 : Entirely in pegmatite to a depth of 35 feet, the mineralized layers probably not having been reached at this depth.

Such ore as exists here is in the form of an elongated folded bundle of thin layers, as shown on the map (RD 64-25). The southwestern end of the showings, as shown on the main geological map, consists of two thin layers, totally about 3 ft., and has not yet been tested by drilling. The showings area warrants further work. It seems likely that a fault in the bed of the creek flowing out of the cirque just west of these showings has cut off their westerly extension towards the 'V'.

<u>'Q', 'R' and 'V' Showings</u> ("West End")

Map RD 64-24 shows the extent of detailed mapping on the 'Q' and 'R' showings, and the locations of shallow holes drilled during the last two seasons (1962-1963). This work, together with stripping and trenching of the parts suspected of being folded, showed that two mineralized calcareous quartzite layers can be traced as part of a relatively uniform rock sequence over most of the showing area, a strike length of 2800 feet. Pegmatite sheets interrupt the continuity of the metamorphic sediments and form steeper cliffs on the generally steep (45 - 55°) timbered slope. Overburden is for the most part not thick at the showing elevation of 4000 to 5000 feet, but the steep slopes and bouldery surface material severely restricted the possible sites for the drilling, especially in the 'R' to 'V' area. Water supply posed a further problem, and drilling of the 'V' showing was cut short in 1963 by the drying up of the creek. However, thirteen holes were drilled on the 'Q' and three on the 'R' showing, to depths up to 270 feet. Results in the holes which seem to have penetrated the whole mineralized sequence (9 on the 'Q', 1 on the 'R') average 29 feet of rock assaying 5.1% Zn and 0.9% Pb. Mineralization is generally confined to two or three layers, the uppermost 0.5 to 1.0 ft., the central layer 1.0 to 2.0 ft., and the lowermost 1.0 to 5.0 ft., inwhich grades reach 25% Zn, and 5% Pb, similar to the figures on the eastern showings. Details of drilling results are given on the map (RD 64-24) and in the drill logs appended to this report.

The single hole collared at the 'V' showing in a very difficult location penetrated one mineralized layer of 2.3 ft., assaying 17.03% Zn and 3.43% Pb. Three or four layers are to be seen on the showing itself, over a thickness of about 20 feet of calcareous quartzite. Further drilling here would be desirable, but would almost certainly be slow and expensive to carry out. The mineralized rock sequence steepens over the 'R' to 'V' showings to appear as nearly vertical layers with small zig-zag folds. Structurally it duplicates the section on and above the 'T' showing, and though folded, is not expected to contain tight folds of the 'E' type, on which an ore shoot might be located.

METASEDIMENTS ASSOCIATED WITH MINERALIZATION

At each of the showings the sequence of metasediments appears to have sufficient similarity to support the theory that the mineralization was confined to a few thin beds before folding, and that little or no subsequent redistribution of sulphides has occurred. The succession may be stated as follows:

Description	Symbols	Thickness	Map Colour
Biotite-quartzite schist and micaceous quartzite, garnetiferous in part	MQ(G),QM		756
Quartzitic limestone, minor biotite-quartzite schist	LQ,(MQ)	50-100 ft.	740
(Local biotite-quartzite schist and quartzite)	MQ,QM	10-100 ft.	756
Amphibolitic quartzite, hornblende-garnet-biotite schist, some tremolite - and actinolite-quartzite-calcite schists	QA,HGM,ALQ	5 - 50 ft	739
Biotite-quartzite schist, minor quartzite	MQ,(QM)	50 - 100 ft.	756
Thin mineralized quartzite, slightly calcareous, (maybe one or two well mineralized layers)	QZ,ZQL	1 - 5 ft.	736,745
Quartzite, slightly micaceous	QM	10 - 15 ft.	736
Well mineralized quartzite, main layer	ZQ	2 - 15 ft.	745
(Local barite lens on 'E' showing)			
Quartzitic limestone	LQ	1 - 15 ft.	740
(local fluoritic limestone & quartzite)	FL		742
Quartzite, slightly micaceous, locally calcareous and galena-rich layers	QM	20 ft.	736
Biotite-quartzite schist, garnetiferous	MQ		756

There are local variations, but the existence of a limestone on one side of the main mineralized layer, with quartzites on the other, followed by one or two thin mineralized layers and a section of biotite schist, amphibole schist and limestone, are characteristics of the 'E', 'G', 'T' and 'Q' showings particularly. The amphibolitic layer may be of volcanic origin.

The fact of sedimentary control at one horizon has been stressed, since the conception of the origin and control of the ore must govern the line of approach to the proving of ore on this property, as well as to the exploration for other deposits.

Fluorite is associated with the 'E' and west end mineralization but has not been noted on the 'G' or 'M', probably because of the shearing of these showings. It is more easily spotted in drill core than in outcrop except at the 'E' where it forms a conspicuous lens or layer up to 2 feet thick, and about 200 feet long, with streaks of calcite and quartz, all parallel to the adjacent bedding. The fluorine, as well as the ore, may be of contemporaneous volcanic origin.

Barite appears as a lens on the 'E' showing, but has not been identified elsewhere.

Quartzites fine to medium grained, .01 to .05" grain size but with larger grains of 0.1 to 0.25" in some sections, and in a few places small pebbles up to 1" have been recognized. Where associated with limestone and fluorite texture tends to be sugary. With increasing mica foliation and relic bedding become more evident. Calcareous quartzites may carry calcite as cement, or may contain thin (0.1 to 0.5) layers of calcite in a foliated rock carrying quartz, mica and amphibole. There seems to be every gradation between almost pure quartzite and almost pure recrystallized limestone or marble.

Limestones (more correctly crystalline limestone or marble) near the ore layers appear medium grained (0.05"), but limestones have been noted in the area with grain size up to ½". Fine, almost aphanitic, limestones where seen are generally found to be on or near the line of a thrust-plane, and are mylonitic. The calcareous and quartzitic rocks with varied compositional layering commonly contain tremolite and actinolite. Minor amounts of sphene, scapolite and possibly vesuvianite are seen locally. Some of these minerals, as well as red garnet and hornblende, are more common and of larger crystal size along the contacts of the metamorphosed sediments; but it should be noted that the thickness of the skarn zone is generally small ($\frac{1}{4}$ - $\frac{1}{2}$"), seldom over 1 inch. Even the cleanest-looking limestone is found on close examination to contain a fairly regular distribution of pale green silicate minerals, though amounting to no more than 1 or 2% of the rock, with a general concentration in layers parallel to the boundaries of the bed; that is, they are a sign of relict bedding. On a weathered bedding surface in the area near the showing a lineation is discernible, due to the arrangement of the silicates parallel to the local axes of folding.

Quartz-mica schists allow themselves to be divided fairly readily into two main types: 1) those in which the mica, being fine to medium grained, uniformly distributed through the rock and pale or medium brown, pale green or white in colour, is an inconspicuous constituent, and forms perhaps 5 to 15% of the rock; 2) those made up of varied layers of quartz grains and a dark brown, coarse flaky biotite, strongly schistose and often containing pink garnet in an eye-like texture, in which the proportion of mica appears to be from 25 to 50%, though richer lenses of almost pure biotite are seen. These types are labelled "QM" and "MQ" respectively on drill logs and maps. There seems to be little gradation between them, but the less micaceous type tends to grade into quartzite in which mica is present in very small amounts and which is indicated by "Q(M)" or "Q" on the legend.

Beds in which quartz forms the major constituent but which contain layers carrying varied amounts of calcite and fluorite, with small amounts of galena and sphalerite, are also to be seen in the centre of the 'E' showing, and can be traced around the fold.

Actinolite-quartz-calcite schists with accessory sphene, outcrop over a wide area near the 'E' showing. They have a characteristically banded or layered appearance, with grain size and composition varying from layer to layer. This rock has been mapped as "ALQ" and occurs interbedded with rocks variously labelled AQ, LAQ and QAL depending on the minerals which appeared during mapping to be dominant. Layers of each composition may be readily traced along the strike.

Also seen in this sequence is a layer of coarse grained actinolite, in which, at irregular intervals, large lenses (2 to 4 ft.) of coarse biotite occur.

Where the actinolite-bearing schists are cut by pegmatite intrusions hornblende appears along the contact. Hornblende is seen elsewhere in the form of massive medium-grained dark-green to black hornblende schists, with varied proportions of biotite or garnet.

Hornblende-biotite garnet schists also occur near the 'G', 'M' and 'T' showings.

STRUCTURE OF THE ORE-BEARING LAYERS

The general picture of an isoclinally folded sequence of sediments with axes plunging gently westward has already been described. Axial planes dip northwest or southwest at shallow angles. The 'E' fold has been termed synclinal and the 'T' to 'R' fold anticlinal, but there is in fact no direct evidence of the way up of the metamorphosed sediments in the property area. (J. R. Wheeler of the Geological Survey of Canada has found evidence of a basement dome to the southwest, suggesting the likelihood of axial planes of folds being overturned to the northeast in the Ruddock area; this would make the 'E' fold an anticline.) It is possible that a determination of the way up of the sedimentary sequence would have a bearing on the search for further orebodies in the Ruddock area.

A study of the 1" - 400' geological map (RD 64-3 and -4) shows a belt of 240° axes generally following the centre line of the cirque in a northeasterly direction through the 'U' showing. On either side of this belt drag fold axes and related lineation are generally the direction 270 to 290°. The shear lineation visible on the 'G', 'M' and 'T' showings may be related to the 240° cross-fold system. To predict the position of the mineralized layers extending from the 'E' showing beneath the cirque is therefore not a straight-forward matter.

Hans R. Morris

Vancouver, B. C.
March 12, 1965.

H. R. Morris,
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82-M-15
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RUDDOCK CREEK ZINC-LEAD

SUMMARY FOR 1963 AND PROPOSALS FOR 1965

A. SUMMARY OF 1963 WORK AND EXPENDITURES

Sixteen men worked on the property for 4½ months. Expenditures charged to the project for the whole year were $150,500. This figure and those quoted below include supervisory and administrative costs. The subdivision of costs among the phases of the work is to some extent arbitrary.

I 'E' Deep Drilling ('ED' holes) — 1963 Cost: $91,000

Work: 9243 ft. in six holes (max. 2039) drilled at 1200 to 2200 ft. from outcrop on presumed downward (westerly) extension of 'E' showing.

Results: Thin mineralized layers at 2000 ft. depth identified as marginal to ore shoot; intersections 600-800 ft. deeper than expected due to movement on major normal fault, downthrow to west.

Proposed for '65: To continue deep drilling (see below).

II 'E' Showing Drilling — 1963 Cost: $12,000

Work: 1350 ft. in two holes drilled to define location of fold hinge or apex, the northern limit of ore shoot.

Results: Hinge line defined within 50 ft. horizontally, at 600 ft. from outcrop indicating plunge direction of 290°T, at minus 37°.

Proposed for '65: Two 750 ft. holes.

III 'West End' Drilling on Small Showings — 1963 Cost: $12,000

Work: 1500 ft. in 17 holes.

Results: General uniformity of mineralization confirmed over 2000 ft. strike length in Q, R and V showings, as two layers 1 ft. to 5 ft. thick, carrying 12 to 25% combined zinc and lead; three holes drew a blank; two (on R and U drag folds) cut 10 ft. of 25-30% combined zinc and lead.

Proposed for '65: No further work on Q, R and V; four 'packsack' holes on U.

IV 'West End' Stripping and Trenching — 1963 Cost: $11,000

Work: 23,300 cu.ft. of rock and overburden shifted by hand labour, using gasoline rock drill and explosives. (Cost also includes some removal of moraine gravel from 'E' showing by ground sluicing.)

Results: Seven small showings in 'O' to 'R' area exposed or extended; exposures improved on 'E' showing.

Proposed for '65: Similar work on 'U' and 'T' showings.

V 'West End' Detailed Mapping **1963 Cost: $6,000**

Work: 'Q' and 'R' showings and stripped areas surveyed and mapped at 1" - 20' over strike length of 2000 ft.

Results: Continuity of mineralization, structure and relation to enclosing rocks made clearer.

Proposed for '65: No further work on this scale.

VI Area Geological Mapping 1963 Cost: $7,000

Work: Mapping at 1" - 400' extended or filled in over area of about 24 claims in centre of property.

Results: General structure of area and behaviour of mineralized layers further elucidated.

Proposed for '65: Similar work on edges of property.

VII Topo Survey 1963 Cost: $11,500

Work: Network of triangulation points laid out, surveyed and related to air photos; most claim posts surveyed; boreholes and showings located.

Results: Controlled contour map produced at 1" - 400' scale, 50 ft. contour interval, covering property and surrounding area (9½ sq. miles).

Proposed for '65: Surveying limited to borehole location.

B. PROPOSALS FOR 1965 WORK

While there is a possibility that the 'E' ore shoot fades out in depth, evidence of mapping and shallow drilling on the property on a whole does not support the idea of a deterioration, and the 1963 ED drilling indicated no positive change in the plunging fold structure beyond the existence of the major normal fault. The three deeper holes drilled beyond the fault (ED4, 7 and 8) hit thin ore layers which are, I believe, marginal to the central ore fold structure (see map).

Secondly, areal mapping indicates that near the U showing (cirque area) the mineralized 290° fold structure may be at 1500 to 2000 feet from surface. This relatively shallow depth (in contrast to the depth calculated from a constant 35° plunge from outcrop) may be due to cross folding on a 200-240° axis, to which the U-showing drag folds are related (see longitudinal section).

Between the cirque and the area of 1963 ED drilling the ore structure may be present at 2200 to 3200 feet from surface, if the mineralization persists and the plunge parallels surface determinations.

The proposed program may be subdivided as follows (estimated costs based on total inclusive average for 1963 drilling):

i) Continued testing of mineralized layers between ED4 and ED6; two holes, estimated depth 2500 ft.:
inclusive cost $ 48,000

ii) Testing of ore structure beneath cirque area; four holes estimated depth 2000 ft.:
inclusive cost $ 75,000

iii) Testing location of ore structure in central part of property; three holes, estimated depth 3000 ft.:
inclusive cost $ 84,000

Total Deep Drilling: $ 20[illegible],000

iv) Additional areal mapping at 1" - 400 scale: $ 7,000

v) 'E' showing drilling, to test ore fold at 600-800 ft. from outcrop; two 750 ft. holes: $ 13,000

vi) Stripping and shallow drilling on U and T showing: $ 11,000

TOTAL: $ 238,000

Deep drilling estimates for 1965 are based on 1963 inclusive costs and on tentative estimates made by the Canadian Longyear Co., who handled the 1963 contract. Drilling to 3000 ft. necessitates a heavier drilling rig than was used in 1963, ~~and this in turn is likely to force the use of a more powerful helicopter than the Hiller 12E both for the initial and final moves and for drill movements between sites.~~

H. R. Morris.

Vancouver, B. C.
January 7, 1965

Notes on Breakdown of Ruddock Costs:

1963 Expenditures :-

Drilling -	Salaries:	$ 18,000	(6 men for season - covers supervision of ED and Q, and drilling of O) $3000 per man
	ED Contract:	$ 61,500	10,500 feet - $5.85 per foot (also 1500 drilled on Q)
	Transp.:	$ 16,000	1½ camps operating, 10 men, 1 large drill, 1 small drill
	Field Exp.:	$ 14,000	
Surveys -	Salaries:	$ 12,000	4 men for season - covers areal mapping (½) Q mapping (½), topo (2), stripping (1), $3000 per man
	Transp.:	$ 14,000	1½ camps, 4 men
	Field Exp.:	$ 6,000	4 men - $1500 per man
Assays, Admin., Taxes:		$ 9,000	
		$150,500	TOTAL

Expected Costs - 1965 :-

Drilling -	Salaries:	4 men x $3000	$ 12,000
	ED Contract:	has been estimated at 12% above 1963 average i.e. $6.55 for total of 22,000 ft.	140,000
	Transp.:	Two camps operating, 15 men, 2 drills - say 150% of 1963	24,000
	Field Exp.:	two camps, etc. - say 150% of 1963	21,000
		($9.15 per foot)	$201,000
E Showing Drilling		1500 ft. at $8.00 per foot	$ 12,000
Surveys -	Salaries:	3 men (including stripping & survey)	$ 9,000
	Transp.:	$1500 per man)	
	Field Exp.:	$1500 per man)	9,000
			$ 18,000
Assays, Admin., etc.			$ 7,000
		TOTAL	$238,000

NOTES ON LOCATION OF DRILL CORE

Drill core recovered by 1961 and 1962 drilling on the Main 'E' showing is stacked at a point 40 feet or 35° W from station S-2, which is the highest point of ground south of the small lake at the showing. Core from the 1963 ED series of holes are in the case of each hole stacked 20 to 50 feet south of the site. Part of the core above the mineralized section in holes ED 7 and ED 8 was discarded at the site. All mineralized material was split for assay, the second half remaining in the core boxes.

Core from DDH's M 4 to M11 is stacked near the helicopter landing area (a rough rubble platform) on the 'M' showing. Core from holes M 1 and M 2 is stacked near the claim posts about 100 feet north of the showing. M 2 core is stacked 50 feet northwest of the site. None of the 'M' drill core was split, and little but non-mineralized material remains in the coreboxes.

Coreboxes containing rock recovered from 'T' showing drilling are stacked at several points: T 1 to T 3 about 100 ft. east of AP-39, near the lower end of the showing; T 4 to T 6 on the mid-'T' showing, near the sites of the these holes; T 7 and T 8 on the upper-'T' showing, near the sites of the holes. Parts of the cores of holes T 4 to T 8 were removed to the campsite east of Clear Lake for logging and splitting, and are stacked there.

Location of core storage on the 'Q' showing is shown on the West End Showing map, near the heliport at the 1963 campsite. This includes core from the 'R' and 'V' drilling all of which was split for assay.

Drill core from holes U 1 to U 3 is stacked at the Cirque Camp.

TO ACCOMPANY
REPORT ON RUDDOCK CREEK
1961 - 1963

MORRIS (1965

	FLT AT	EL COLAR	EL FLT	FAULT	
				AUG 25	
ED1	745-781	7716	6935-6971		
ED2	772-794	7634	6840-6862	7600 700 6900	
ED3	1170-1240	7699	6459-6529		

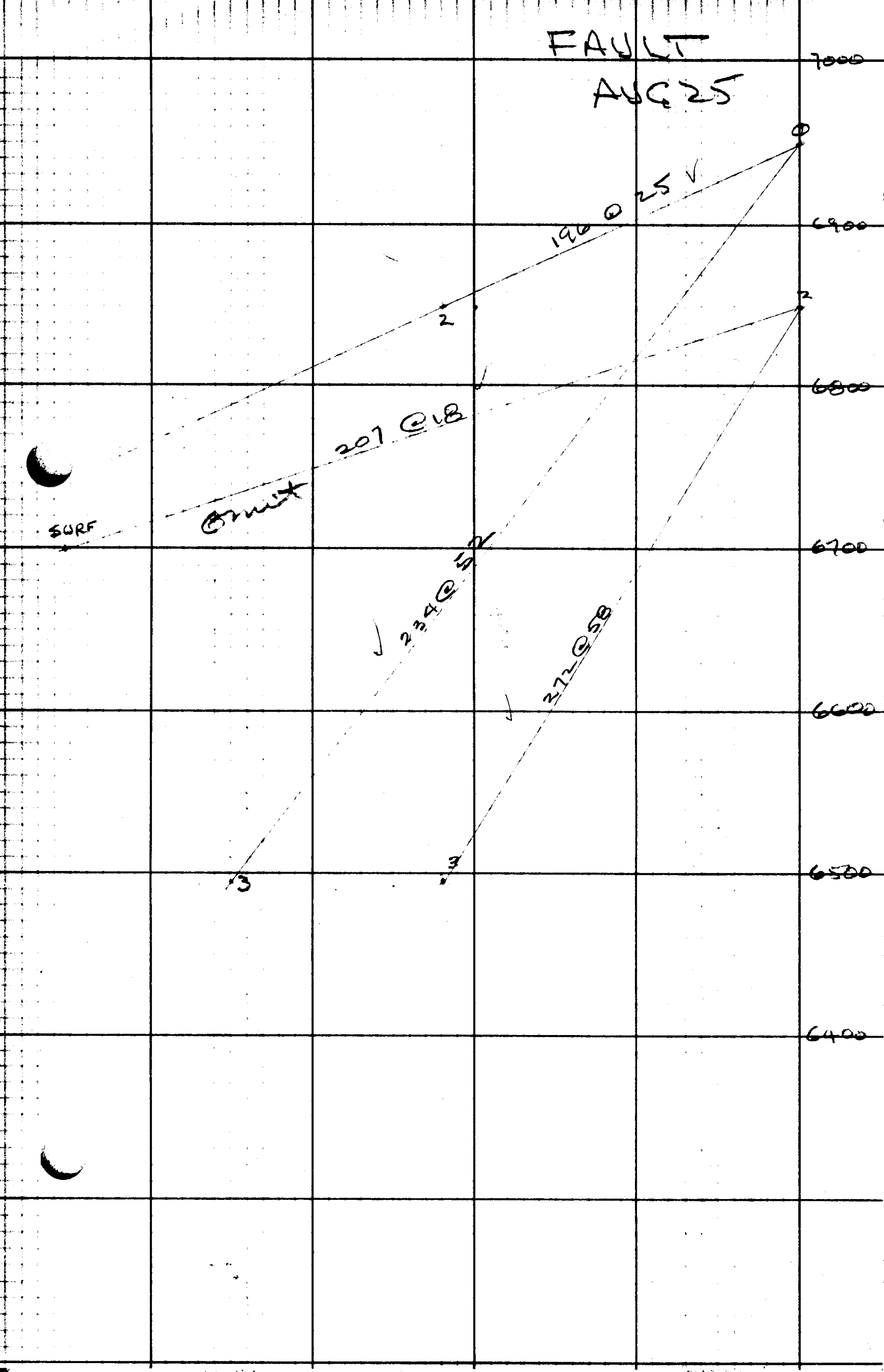
Vertical Polar

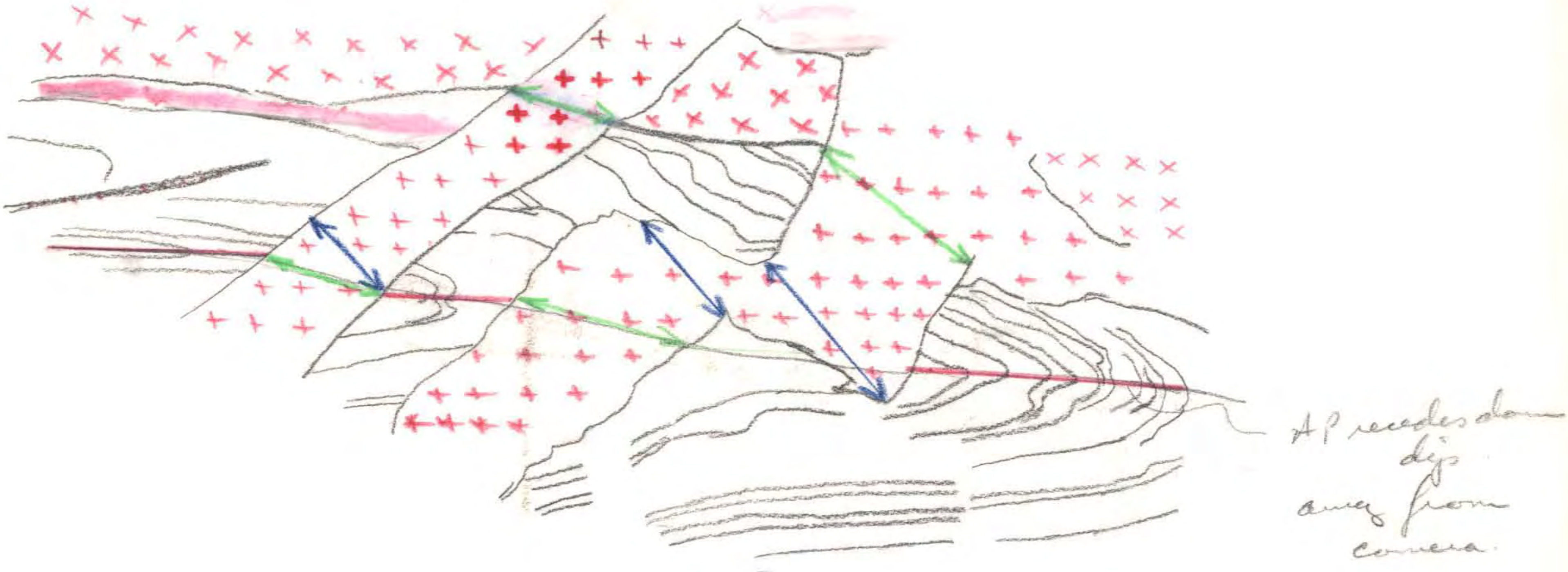
6700

6800

6900

7000


FAULT
AUG 25
7000
6900
6800
6700
6600
6500
6400
196 @ 25
207 @ 18
234 @ 52
272 @ 58
SURF
Omit

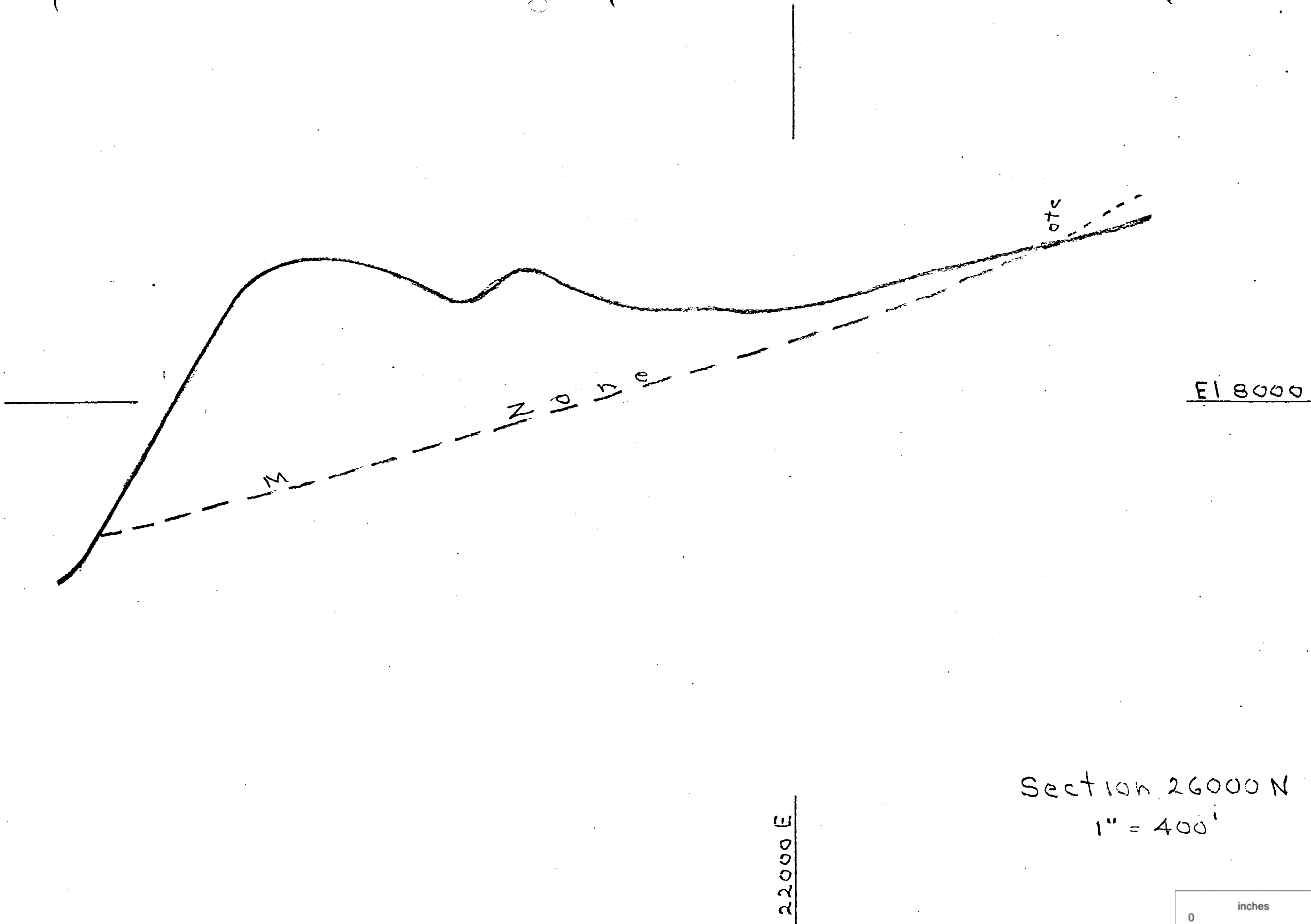


Pegmatite slide
68-29.

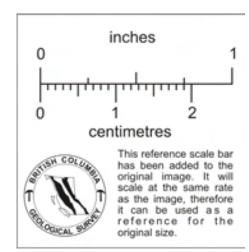
inches
0 1
0 1 2
centimetres

This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

BRITISH COLUMBIA GEOLOGICAL SURVEY



Section 26000 N
1" = 400'



FALCONBRIDGE NICKEL MINES LIMITED

CABLE ADDRESS
"FALCONBRIJ"
TELEX 02-2720

7 KING STREET EAST
TORONTO 1, CANADA

TELEPHONE
362-7292
AREA CODE 416

January 27, 1967

Dr. Alex Smith,
Falconbridge Nickel Mines Limited,
504 - 1112 W. Pender St.,
Vancouver, B.C.

Dear Alex:

Thanks for your memo on Ruddock Creek. I have no thoughts about proposing more work for the near future. However, I do think it is time for a review of our property holdings. It seems to me that all we are doing, right across the country, is maintaining properties and acquiring new properties. We never seem to bring any to a conclusion. I would like to produce a neat volume to present to the brass. This should contain a concise summary of each and every property, setting forth the potential, and what should be done to establish or disestablish said potential. I feel that the brass is somewhat confused about the objectives of our exploration policy.

I study the reports sent in from the Vancouver office, but I suspect I often draw erroneous conclusions therefrom. If you can find time to undertake some of these reviews, I will be grateful. I am thinking in terms of the end of the year for finishing the job.

Further to Ruddock Creek,-- Hans' proposals for tracing the E Zone fold by deep drill holes, west of the presumed normal fault, frighten me. In the first place what reason do we have for believing that such a tight fold will persist on the plunge extension. The ED series of holes are rather negative. If ED 8 did penetrate the extreme nose of the fold, maybe Hans is right and a deep hole between Ed 8 and ED 4 might confirm his reasoning. However, continuation of this program west to the cirque is a costly business and it might well be abortive.

This led me to wonder if relatively shallow drilling could prove up tonnage. Suppose Hans' overall fold picture is correct;-- but rather than having a consistent pattern, on plunge, we have local folds making and dying out. The concentrations of sphalerite and galena would be in the minor synclinal and anticlinal locals. I agree that any such concentrations will be diluted by pegmatite.

If we assume that the M showing, the Lower M showing, the G showings, and the ED 4 intersection, represent the same horizon, then, even allowing for thrust faults, there must be a number of local folds. M-15 on the Lower M occurrence suggests thickening of the ore horizon as the result of a tight synclinal fold.

If the M showing persists on a westerly dip under the snow field, somewhere between the main exposure and the cliffs at 20,000 E, there should be some real warping. If the snow is deep, maybe such has been eroded away. I wonder if the snow field would support a drill set-up.

Regards,

....
A. S. Dadson

ASD:PR

File Ruddock Creek Correspondence

1112 West Pender, Vancouver, B.C.

INTER-OFFICE MEMORANDUM

XF-70-106

DATE: January 30, 1967

TO: S.N. Charteris

COPIES TO: A.S. Dadson
A. Smith

FROM: E.D. Dodson

SUBJECT: Ruddock Creek

As a very much interested bystander to the recent interchange of memos on Ruddock Creek I would like to make the following comments.

First, I can sympathize 100% with Stew's desire to (a) establish on a firmer basis the fold structures controlling the ore and (b) to find a lower cost method of increasing the reserves.

In regard to (a) it appears that we should do everything in our power to encourage Dr. J.T. Fyles to proceed with his structural study. At the end of this season he will know whether the area warrants a full-scale study. Should he undertake such a study there should be few structural questions unanswered two years from now.

There are now several interesting suggestions in the hat as to possible ore controls. Unfortunately at the moment any or none would appear to be equally likely. I would tend to favour a modified version of Hans' original.

The chief characteristic of the Adams River area is the superposition of two directions ~~(?)~~ of folding. If this holds in the Ruddock area we can expect to see lenticular bodies of ore grade material along the main axis or at best a rather snake-like trace to the fold axis and any attendant thickened sulphide zone.

With regard to the fault which displaces (?) the 'E' zone axis I would say that it does appear from air-photo studies to be the continuation of a strong northerly-trending lineament. The relatively straight trace suggests to my mind that this and other similar lineaments are tensional features related to the late arching of the Monashees. The abundance of Mid-Eocene lamprophyre dykes in many of these lineaments serves to emphasize the above.

Regardless of the interpretation placed on the above fault there is a broad suggestion, particularly noticeable in the 1"=400' mapping, of an 'S' fold outlined by the crystalline limestones and schists around the 'E'zone and back up parallel to the 'G' zone. Hans and I had discussed this possibility earlier - his conclusion at that time was that the'S' was more attenuated - extending to the 'T' zone.

. . . . ./2

If the complimentary fold is in fact hidden by the pegmatite at the base of the 'G' zone we have another locus for shallow drilling in that area; the approximate location indicated by the islands of schist in the pegmatite in the vicinity of 23,000 E, 22,000 N.

As regards (b) I see no major problem in drilling from the ice to the west of the 'M' zone. The ice surface is relatively smooth and as nearly as I can remember we believed the ice to be only a few feet thick.

Our biggest problem in this area would seem to be the unknown thickness of pegmatite in the various thrust slices and its position relative to the ore horizon.

Earl D. Dodson

EDD:GK

January 24, 1967 XF-70-106

A.S. Dadson

A. Smith

S.N. Charteris

Ruddock Creek

I haven't looked at the Ruddock report since it arrived in the spring of 1965. Without funds to work there and with the assessment work in good standing for years to come, I had ignored its problems. Your memorandum resurrected them.

The possibility of developing tonnage in the G zone based on the E.D. 4 intersection looks good, however there are several difficulties. The first will be the problem of correlation of intersections since the G zone is flooded by large masses of pegmatite. From H. Morris' mapping, the pegmatite has invaded passively, assimilating the rocks without reference or disruption. Individual intersections may appear to line up, but similar to the dyke swarms at Tasu, there may be considerable barren material between them. According to the field notes, exposures in the M-G-F area are excellent so there is little reason to suspect more mineralization than is shown on the maps.

Second is the problem of the thrust fault shown on Morris' map RD. 64-5 or passing through ED. 4 at a depth of 220 feet (but not recorded in the logs). The usual irregular surface of such a fault plane could cause some very erratic offsets and "smearing" of the mineralized horizon.

This brought me to a re-evaluation of Morris' structural hypothesis and his proposal for continued deep drilling west of E.D. 4 through to the cirque north of the U zone. The concept of a pencil of ore plunging continuously westward at depth hinges on the fault west of the E zone being a normal fault. But is it a thrust? Does the E zone represent the northeast end of a canoe shaped recumbant fold and the F zone its southwest extension? Then the broad conception of an overburdened fold is correct but the thick "penul" is attenuated at a shallow depth. Also the M - G section becomes a separate fold, and is worthy of further drilling.

In support of your suggestion, I would like to see shallow drilling (less than 500 feet) done in the vicinity of the G zone to see if the structure postulated by Hans on Map R.D. 64-5 can be corroborated. This would also serve to see if the tonnage you envisage (and I say will be pegmatite diluted) can be outlined.

. . . . ./2

We hope the structure problem will be further clarified this summer when Dr. J.T. Fyles of the B.C. Department of Mines will spend a month on the Ruddock Creek property. Dr. Fyles is acknowledged as a structural expert on the highly folded structures of the Kootenay arc so we are naturally pleased to learn that another analysis will be forthcoming. I think we should await his results before planning any further work.

S.N. Charteris

SNC:GK

Ruddock Tom.

FALCONBRIDGE NICKEL MINES LIMITED

CABLE ADDRESS
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TELEX 02-2720

7 KING STREET EAST
TORONTO 1, CANADA

TELEPHONE
362-7292
AREA CODE 416

January 23, 1967

Dr. Alex Smith,
Falconbridge Nickel Mines Limited,
504 -1112 West Pender St.,
Vancouver, B.C.

Dear Alex:

RUDDOCK CREEK

After looking over Hans' reports and maps I am wondering if the next step should be on the projected extensions of the E Zone fold. I am somewhat intrigued by the possibilities in the upper layer, as represented by the M and Lower M showings, and by the intersection in E-D 4. It seems to me that there has to be some rather tight folding here which could mean some comparatively thick sections of ore. The suggested grade is comparable to that of the E Zone. (ref. accompanying sketch)

Drill exploration should be relatively quick and low cost. I don't know if the snow field to the west of the M showing could hold up a machine, or if it is thin enough to melt or dig away.

I feel it is time we had a review of all the B.C. property holdings. We are getting some embarrassing questions from above. These appear to be based on confusion more than anything. Would appreciate your comments on Ruddock and others.

Regards,

....
A. S. Dadson

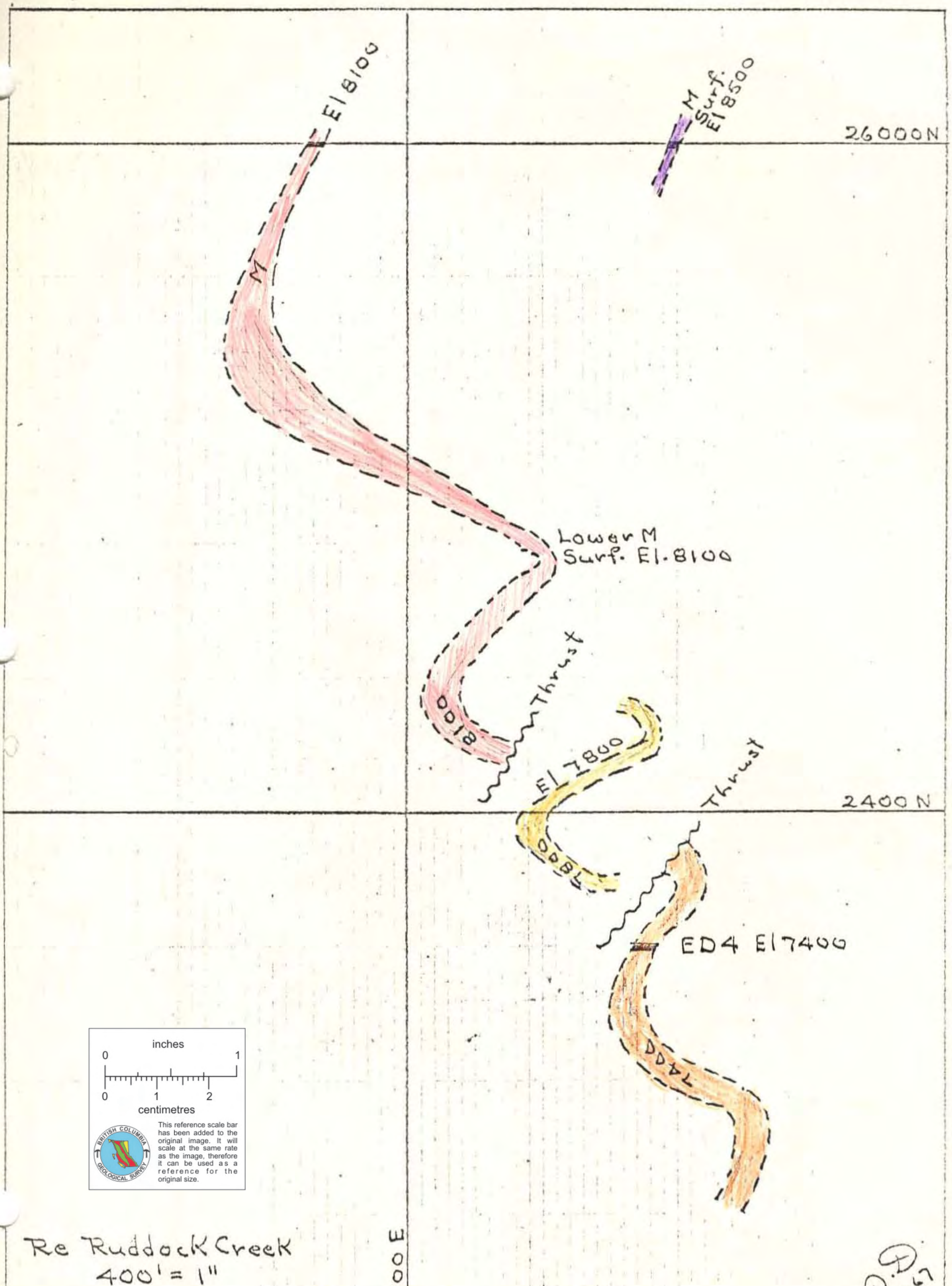
ASD:pr

c/c: S. N. Charteris
G. P. Mitchell

Ruddock Cr. 6000 Section

Generalized view down plunge of ore layer
1" = 1000 feet.

AS


El 8100
M
Surf.
El 8500
26000N
M
Lower M
Surf. El. 8100
Thrust
8100
El 7800
7800
2400 N
Thrust
ED4 El 7400
7400
22000 E
Re Ruddock Creek
400' = 1"
Jan. 1967
inches
0
1
0
1
2
centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.
BRITISH COLUMBIA
GEOLOGICAL SURVEY

PLOTTED AUG 23

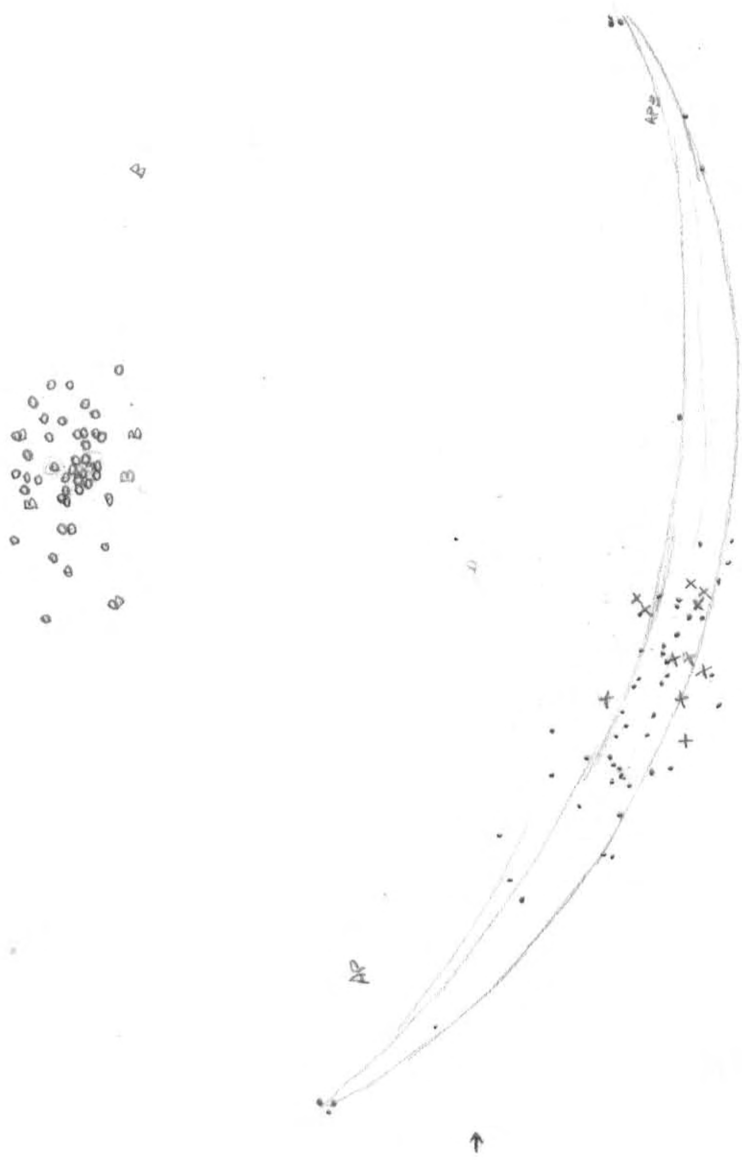
E ZONE Δ 100-110

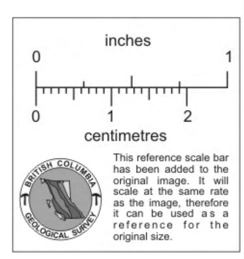
+ AUG 23 MORRIS MAP

B. CALC 285/30

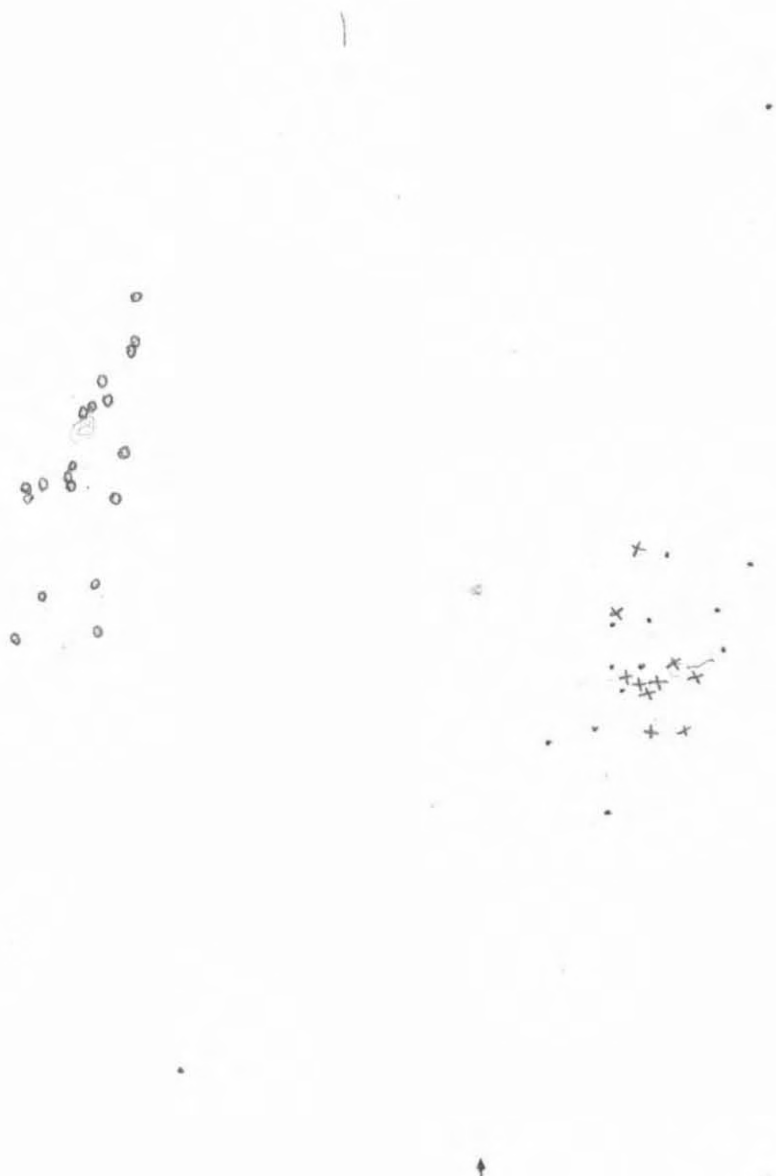
B AVERAGE 283/28

AP AVERAGE 25/32W





Δ 1-17



B. SCATTERED IN PLANE 15/25W

B. AV. 292/25

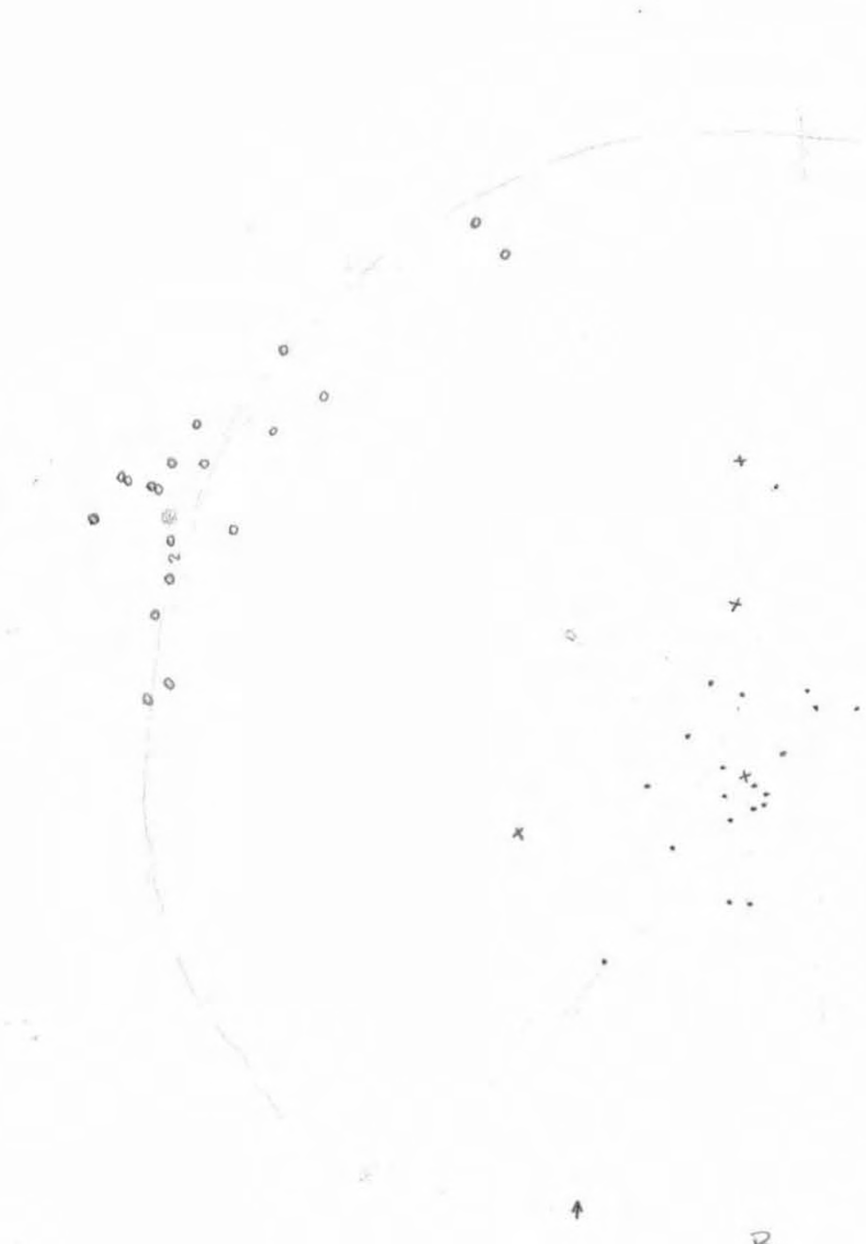
AP. 25/28W

1sDAY A/C

+ OBS S/C

△ M-37

1st DAY A/C
PASS & SLOPE TO NE



B1

B1 ON PLANE 30/32W

AV B1 286/25
292/26

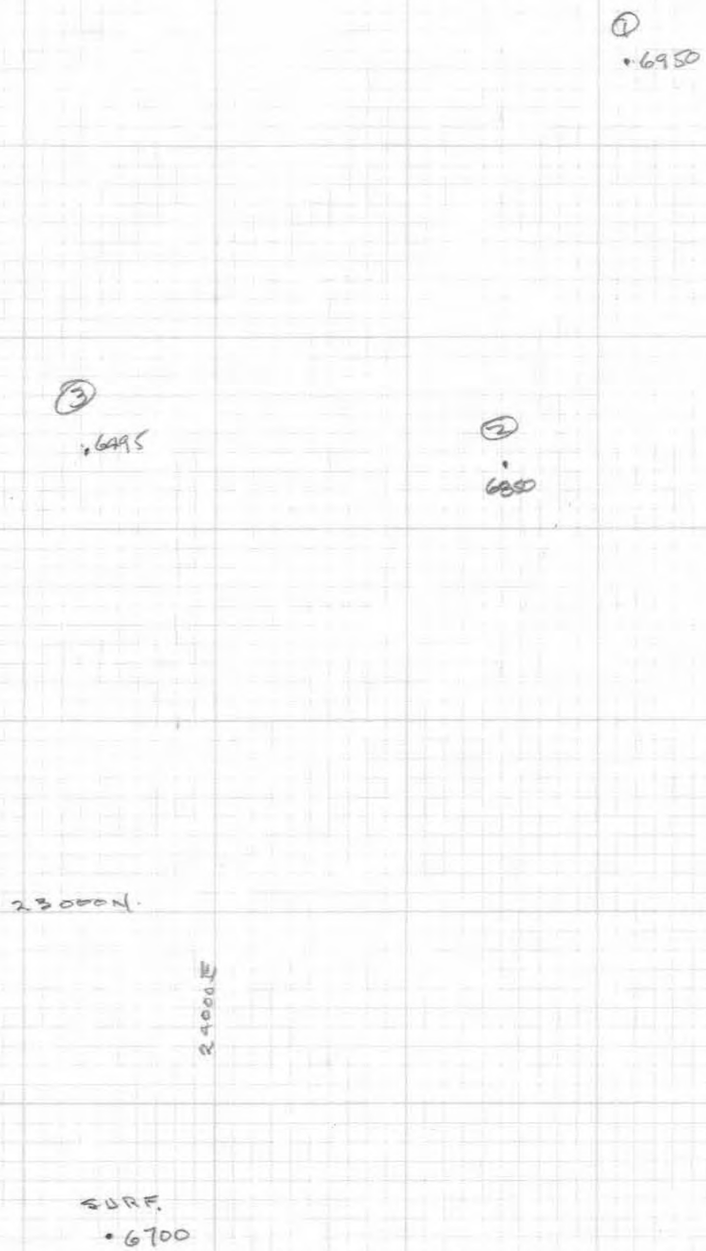
B1 —

PLOTTED AUG 15

100 – 116
E ZONE A/C

AV B, 286/30
π B, CALC 286/30
AP, 25/30W

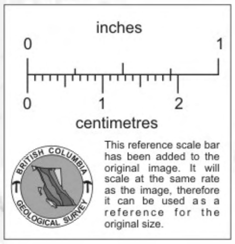
surface 6900



FAULT
AUG 25

FAULT
AUG 25

0 @ 58W
Direction of slip 290


inches
0
1
0
1
2
centimetres
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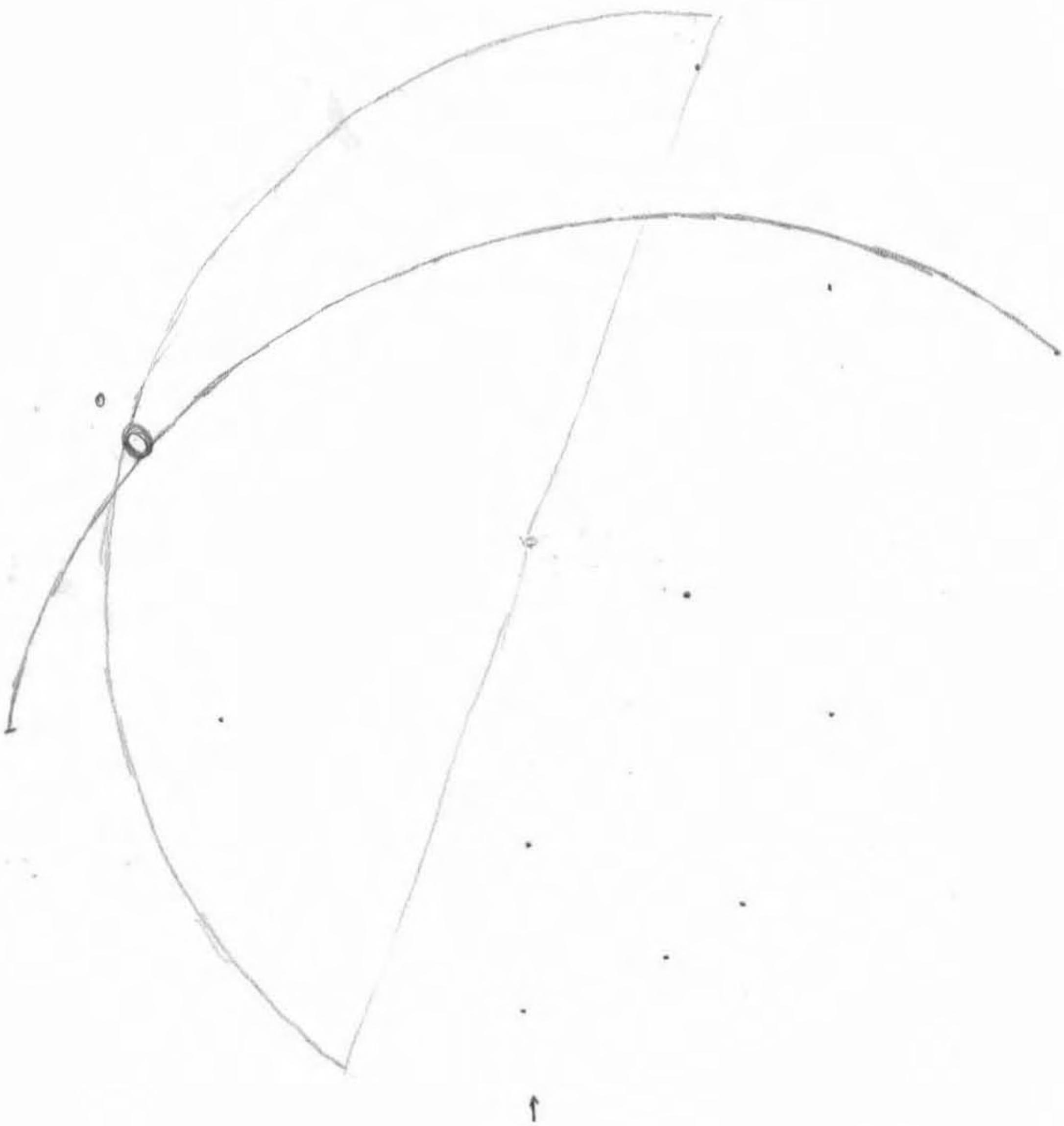
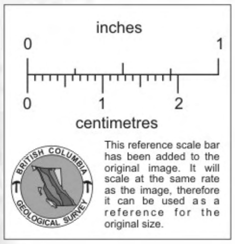




Δ 85 - 99
Δ 38 - 44.
F-G SYNCLINE
119 120 121

AP1 10/25W FOLDED ON B1
π axis 288/20 30
Av B1 288/22
Av C1 280/25

AP, AV 0/10-30°W.
FOLDED ON N-S AXIS
{B. ≡ l. 270/25
245/20} 2 CLUSTERS
OR AV 264/20
π circle 260/20

Δ 146-165
V ZONE

inches
0 1
0 1 2
centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

A1 81-201
QRV SHOWINGS

B_2 AV 260/20

AVAP. 20/25W
B. 288/25

T ZONE ORE LAYER
Δ 68-~~72~~ 75

44-68
CLEAR CREEK
BASIN
G ZONE - T ZONE

Q = 38°

AP↓ CALC 6/28W
B↑ CALC 294/25
B1 AV 278/24

inches 0 1
0 1 2
centimetres

This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

< CW OF T ZONE
Δ166-180

M ZONE
+ RIDGE TOW & SLOPES
NEARBY

ED1 C 122 – 144
AP1 FOLDED ON LOW
N PLUNGING AXIS

Letter H.R.M to A.S.D. - KUDDOCK CREEK (with 1"=1000' cross sections) DEC 10. 62

M-FILE

3A

File #7167

December 10, 1962.

Dr. A. S. Dadson,
Falconbridge Nickel Mines Limited,
2200 - 25 King Street West,
Toronto 1, Ontario.

Dear Stew: **Ruddock Creek**

In response to your letter to Alex, dated December 5th, I enclose four rather hurriedly-drawn sections, showing what the structural picture might be at 2000-foot intervals in the direction of the fold plunge. They are at right angles to the 1"-1000' "Inferred Cross-Section on Plunge" attached to my report dated October 18, 1962. The position of the "E" fold and other parts of the structure are projected at minus 15° in the N60°W plunge direction. 300

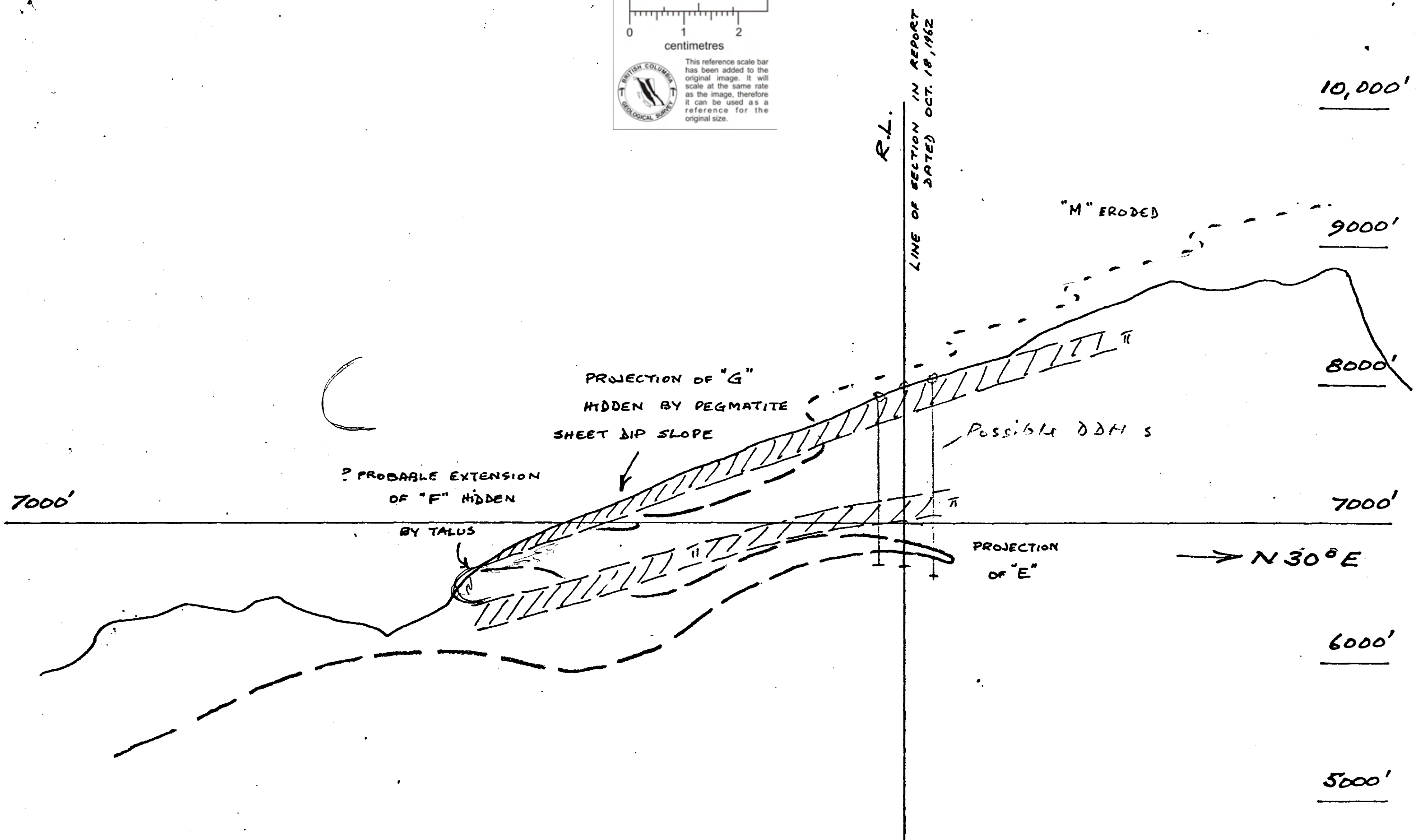
When one attempts to fit the outcrops located on my 1"-1000' map of the showings (attached to the report mentioned above) into a simple structural cross-section, a number of irregular folds appear. These I believe are not so much folds as off-sets of the ore horizon brought about by the intrusion of thick pegmatite sheets dipping westward at a shallow angle. The greater width of the anticlinal "T" fold as compared to the synclinal "E" fold may in part be similarly explained. I have shown the position of some of these sheets on the sections: some have been mapped, some have not.

As to the plan for further exploratory drilling: I agree with the idea expressed in your letter, and intended that the first paragraph under "Further Work" in my report should suggest the same thing. I will send you a tentative plan and estimates before long.

Yours very truly,

H. R. Morris.

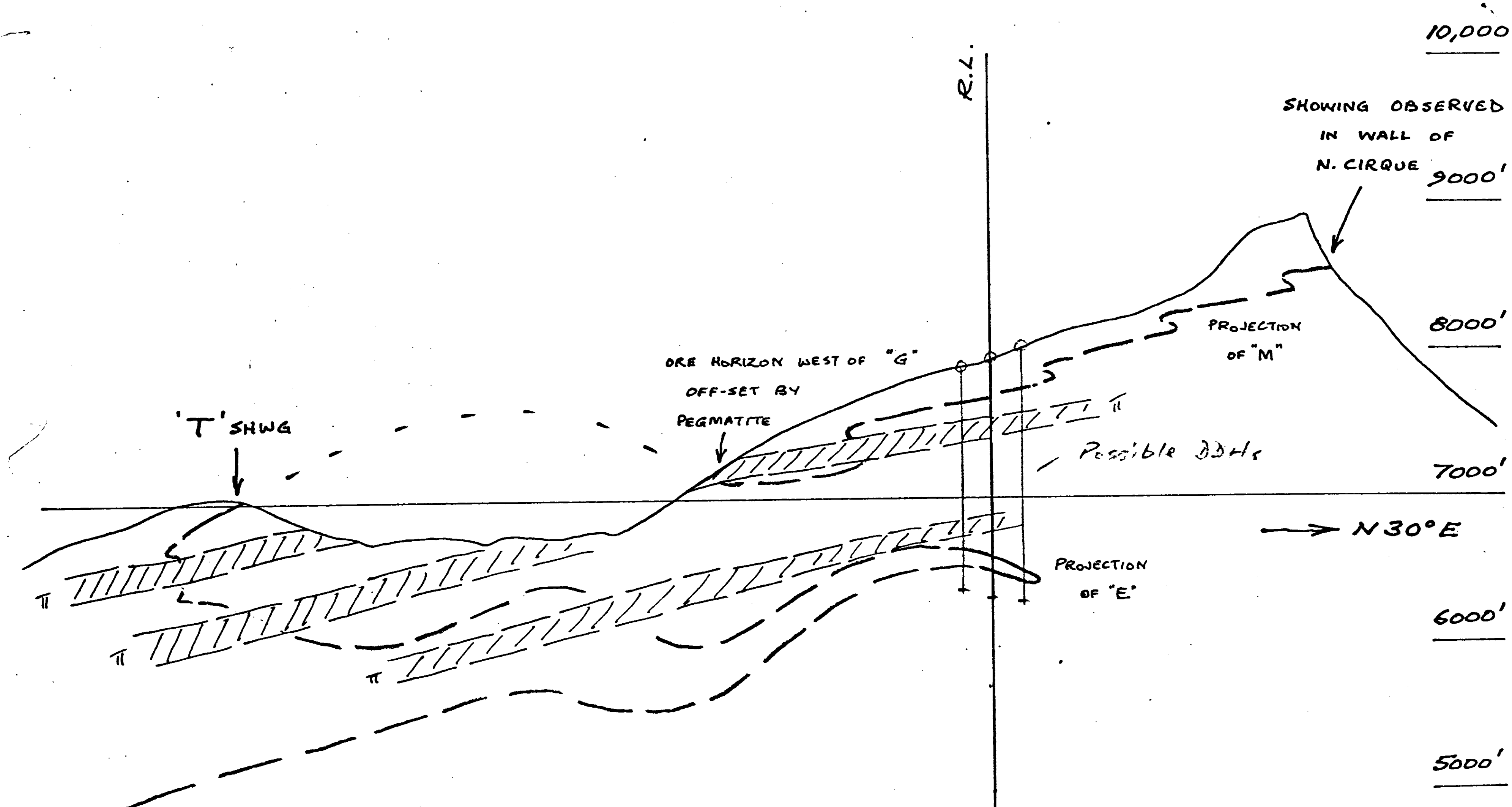
HRM:MH
Encl.
c.c. A. Smith



π = PEGMATITE SHEETS, APPROXIMATELY PARALLEL TO FOLD PLUNGE

RUDDOCK CREEK Pb-Zn
CROSS-SECTION
ON POSSIBLE ORE STRUCTURE
2000 FT NW OF "E"

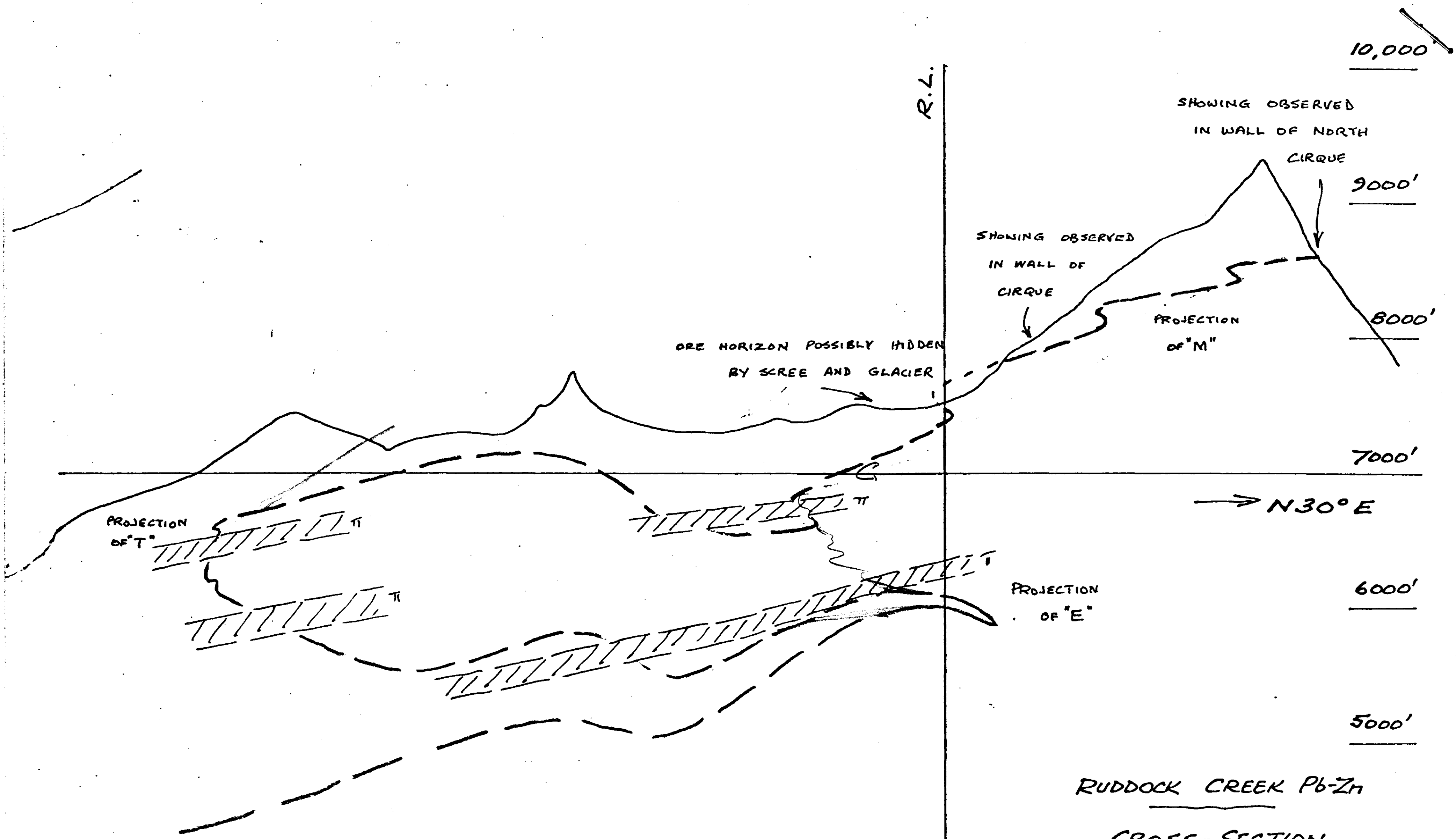
SCALE: 1" - 1000'



RUDDOCK CREEK Pb-Zn
CROSS-SECTION
ON POSSIBLE ORE-STRUCTURE
4000FT NW OF "E"

SCALE: 1"–1000'

M 12/62



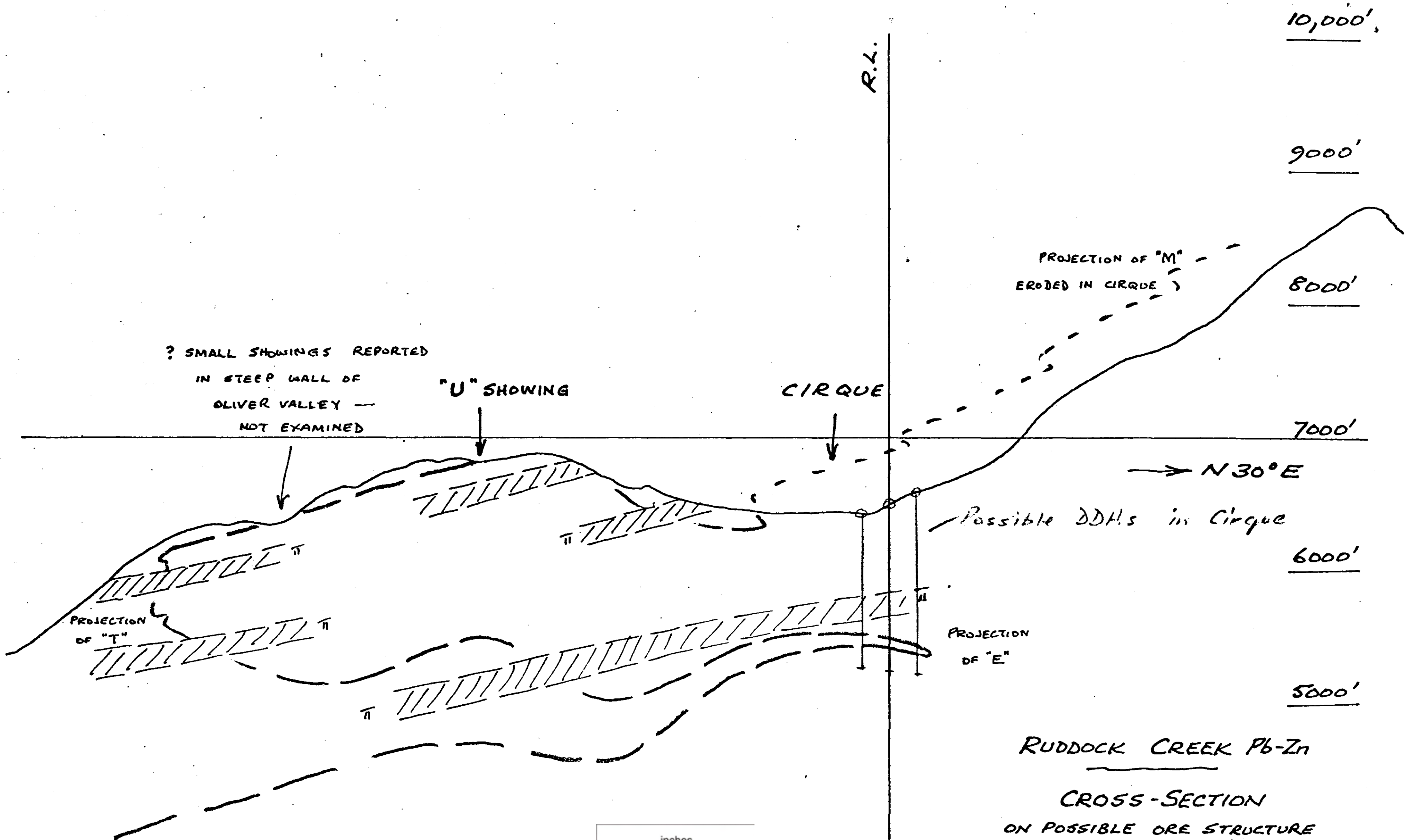
RUDDOCK CREEK Pb-Zn

CROSS-SECTION ON POSSIBLE ORE STRUCTURE

6000FT NW OF "E"

SCALE: 1"–1000'

m 12/62



RUDDOCK CREEK Pb-Zn

CROSS-SECTION
ON POSSIBLE ORE STRUCTURE
8000 FT NW OF "E"

SCALE: 1" — 1000'

REPORT ON
RUDDOCK CREEK LEAD-ZINC PROPERTY
1961 to 1963

INTRODUCTION

The description of the 1963 summer field work contained in these pages is intended to supplement my earlier progress reports on the property. Where appropriate a summing-up is made of data gathered since 1960 on each of the lead-zinc showings, and on the general area. An account is also given of methods of work and some of the difficulties encountered, as an aid to future planning.

SUMMARY OF 1963 RESULTS

Seventeen men drilled, trenched, surveyed and mapped geology during the four-month season. Over 12,000 feet of drilling were completed in this time, at three camps, supported by a helicopter chartered from Okanagan Helicopters Ltd. in Revelstoke. Total cost (for the full year) was about $140,000.

The attempt to prove the down-plunge continuation of the 'E' Zone ore, at a distance of 1000 to 4000 feet from outcrop was on the whole unsuccessful. Six diamond-drill holes averaging 1530 feet in depth were drilled to this end. A post-ore fault (named the No. 1 fault) cutting across the plunge of the ore structure at 600 to 1000 feet from ore outcrop, was found to have moved the down-plunge block 600-800 feet deeper than anticipated. Lowgrade mineralization in the down-thrown block was found at a depth near the limit of the drilling apparatus used, in three boreholes collared at an elevation of 7800 feet a.s.l. The high-grade ore of the ore-bearing fold structure is believed to have missed by three drillholes, due partly to unexpectedly great dev