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REPORT
ON THE
NORTH STAR AND STEMWINDER MINES AND INTERVENING CLAIMS
KIMBERLEY, B. C.

FOR THE
PORCUPINE GOLDFIELDS DEVELOPMENT AND FINANCE CO.

MR. FREDERICK R. WEEKS, MANAGER.

BY

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INTRODUCTION:

The claims included in this examination are as follows:-
the North Star Group, consisting of the North Star, Dreadnaught,
C. K., Buckhorn, Daffodil, Daffodil Fr., and Maple Leaf Fr.,
and the following claims which are under various ownership, -
Midnight, Greenhorn Fr., Derval, Morning Fr., Maverick, Good
Luck, Gold Bug Fr., Dean, All Over, Big Chief, Quantrell,
Utopia No. 2, Algith Fr., Eureka, Stenwinder, and Ontario.

Nearly five weeks were spent in sampling, surveying,
and studying the geology.

The samples were carefully cut with a hammer and
moil, and were shipped to E. W. Widdowson, of Nelson, B. C.
for assay.

Maps of the Stenwinder workings were not entirely
satisfactory, and those of the North Star had been destroyed
by fire some years ago, so it was necessary to make new maps.

These are drawn from my own survey with compass and tape,
or stadia, except that the claim boundaries were taken from a
tracing in the possession of Mr. Louis Johnson.

In general, claim corners have been destroyed by
fire, but a few old corners were found which correspond
reasonably well with the corners as platted.

On account of caving, only a small part of the
original workings on the North Star are now accessible.

The Geological study made was quite local in
character, and the regional geology given has been taken from
Government publications.

Considerable general information was furnished by
Messrs. C. C. Thompson and Louis Johnson.

LOCATION:

The properties are located in the Fort Steele Mining Division of British Columbia, near the south end of the Purcell Range of mountains, and two or three miles west of the town of Kimberley.

Kimberley is a town of about 1500 population, connected by a branch railway with Cranbrook which is on the Crowsnest branch of the Canadian Pacific Ry; the latter town is the main distributing point of the district.

TOPOGRAPHY:

The mines are situated on the north and east slopes of a small rounded mountain, at an elevation of 3900 feet at the Stenwinder, to 5160 feet at the North Star.

The surface is one of steep debris covered slopes.

CLIMATE:

At Cranbrook, twenty miles distant, the yearly precipitation varies from ten to twenty inches, of which about two thirds is rain. At the elevation of the mines the precipitation will be somewhat greater, and a considerable part in the form of snow. Six feet of snow has been reported at the North Star.

The temperatures in the winter are not usually excessively low except for short periods; the summers are generally fine. At the elevation of the North Star winter conditions will probably exist for six months of the year.

WOOD and WATER:

Except for a small amount of jack-pine all of the timber in the immediate vicinity of the mines has been destroyed by fire, or used, and only a very limited amount of timber suitable for mine use can be obtained without a considerable haul.

Fire wood, excluding such near by timber as can be used in the mine, is scarce and may likely cost around \$10 per cord; nothing but various varieties of pine is available.

There is only a small amount of water near the North Star mine, part of which is unfit for domestic purposes; the supply barely sufficed for camp use during the operation of the mine.

The only water within several miles sufficient for milling purposes is that of Mark Creek, which flows along the north end of the Stenwinder.

The Sullivan mine is said to have a right to all but one second-foot of this water at the mine, but, below this there is a considerable addition to the creek from small springs along the banks, and it is probable that at Kimberley there is sufficient additional water in the creek to furnish an ample supply for a large mill.

ROADS:

The Stenwinder workings lie on Mark Creek about a half mile above the end of the railroad at the Sullivan mine.

There is no road connecting them, but a grade for a narrow gauge track has been cut from a point some eighty feet above the railroad at the lower terminal of the North Star tramway, to the main workings of the Stenwinder. There is also a steep trail leading to the workings from a branch of the North Star road.

The North Star is connected with Kimberley with a fair though in places steep, wagon road about four miles in length, rising 1500 feet; snow is said to drift across it badly in the winter.

There is also an aerial tramway about 6000 feet long which connects the mine with the railroad near the Sullivan mine.

OTHER MINES:

The largest and at present the only producing mine in the district is the Sullivan, which belongs to the Consolidated Mining and Smelting Co. The upper workings are situated about a mile north from the Stenwinder, and produce ore almost identical in character. The present production is about 3000 tons daily, which is concentrated by flotation at a plant a mile and a half below Kimberley.

HISTORY:

The North Star was discovered in 1892 by Beurgeois, who bonded the claims to Woods Bros., who, in turn, transferred four fifths of their interest in 1905 to D. P. Mann, who, later, organized the North Star Mining Co.

In 1900 the railway from Cranbrook was completed and the aerial tram was installed.

The North Star Co. ceased operations in 1909 and the mine lay idle until 1918, when it was leased to Thompson and Brander. It was operated under this lease until 1921, when it was again closed down and has not been operated since. In 1919 a forest fire destroyed the office, bunk-house, storehouse, etc., together with most of the maps and records.

The total production was *about 75,000 tons.*

The Stenwinder was located in 1897, and in the following year a half interest was sold to D. P. Mann.

Most of the underground work was done in 1906 and 1907, as well as part of the diamond-drilling.

In 1917 and again in 1920, the property was under option to the Federal Mining & Smelting Co. who did considerable diamond drilling under both options.

There has been no production.

EQUIPMENT:

NORTH STAR:

Most of the North Star equipment was destroyed in the fire of 1919; that part remaining is generally in poor condition, but usable after a few repairs have been made.

Buildings - 1 frame blacksmith shop, 36 x 25 feet.

1 " compressor house, 34 x 30 "

1 " ore bin, 14 x 24, and tramway terminal.

1 log ore house, 50 x 20 feet.

1 " barn, 30 x 20 feet.

1 frame house, 38 x 30 feet; 4 rooms 1st floor, unfinished 2nd floor; lean-to kitchen, storehouse.

2 frame cabins, about 14 x 18 feet.

1 log assay office.

Machinery - 2 16' x 36" locomotive type boilers, Jas. Cooper Mfg.Co., No. 10.

1 14(?) x 18 inch steam driven air compressor, single stage, Ingersoll- Sergeant, Class A.

1 No. 2 (6") Buffalo blower

1 Aerial tramway 6000 feet long, with terminals and ore bins.

1 small drill press

4 small ore cars

STEMWINDER:

Buildings - None

Machinery - 1 8" or 10" x 12" geared steam hoist (not set up)
1000 feet 5/8" steel cable
1 3½ x 9 feet air receiver.

The other claims have no equipment whatever.

DEVELOPMENT: (See Maps).

NORTH STAR MINE.

It is claimed that there has been a total of 27 miles of work done on the North Star Group, but at present there is only a very small part that is accessible on account of caving.

The principal workings are entered through the "60" Level Adit, which is open, except for perhaps a thousand feet of drifts and crosscuts to the south.

There are also several crosscuts into the footwall which are not caved and which may be entered from the Glory hole. Small portions of a number of the stopes are still open, but little can be seen in them. Probably most of the shafts and tunnels are in good condition except for water, and caving at the collars and portals.

According to all accounts, very little work was done below the "110" Level, and most of the drifts, crosscuts, and shafts, were above the "60" Level, - some of them even in the overlying gravel.

The accessible workings total as follows:-

Shafts	100 ft.	Drifts	2215 ft.
Raises	300	N. Incline	785
Crosscuts	1150	Total	4550

Considerable diamond drilling is said to have been done of which there is apparently no record. In the bottom of the winze, said to be 200 feet deep, 260 feet S-W from the portal of the "60" Adit, it is said that holes were drilled N., S., E. and W., some of which cut stringers of galena.

A short hole is said to have been drilled westerly from the bottom of the "110" Shaft at a depth of 150 feet, and to have encountered broken ground with some iron and zinc.

Toward the north end of the claim, the Kellogg shaft (two compartment and in good condition at the collar, but full of water) was sunk to a depth of 200 feet, and a crosscut run to the westward.

Several hundred feet to the west of the shaft, the Kellogg Tunnel has been driven, containing 450 feet of drifts and 135 feet of crosscuts.

MIDNIGHT:

The development consists of one shaft of unknown, but considerable, depth, with levels, caved at the collar, and a number of shallow tunnels and cuts, all caved.

Some diamond drilling was also done, both from the surface and from the Midnight Shaft workings, but no records are available.

QUANTRELL:

Development consists of a drift tunnel 225 feet long, a caved tunnel, and trenching.

DEAN, ALL OVER, UTOPIA No. 2.

There are numerous shallow shafts, cuts, and trenches.

STEMWINDER:

All the workings of the claim are open for inspection except the shaft, which was unwatered for sampling; they are in good condition. The total footage is as follows:

Shaft (2 compart. timbered)	55 feet.
Drifts (from Adits)	495
Crosscuts (from adits)	210
Total	758 feet.

Approximately 5245 feet of diamond drilling has been done.

ONTARIO:

Development is limited to one 15 foot tunnel.

(A small part of the drilling included on the Stemwinder is actually over the line of the Ontario.)

OTHER CLAIMS: Shallow cuts and shafts.

GEOLOGY:

GENERAL: (from Geological Survey, Memoir 76, "Geology of Cranbrook Map-Area, B. C.", by Schofield.)

Nearly the whole of the district is in rocks of the Purcell Series, of Pre-Cambrian age, and of sedimentary origin.

The oldest formation of the series is the Aldridge, which forms the country rock of the mines and covers a large area in their vicinity; it consists of dark gray argillaceous quartzites weathering to a dark rusty brown and composed of fine interlocking quartz grains, cemented by argillaceous material that has been metamorphosed to sericite, garnet, etc. The thick-bedded purer quartzites are the more productive part of the formation.

The Aldridge formation is frequently intruded by sills varying in composition from gabbro to an acid granite, also belonging to the Purcell Series. Such a sill occurs at the Sullivan mine and is well exposed on Mark Creek above Kimberley.

The whole Purcell series has been much bent and folded.

The mines at Kimberley lie on the eastern limb of an anticline whose major axis is two or three miles west of the North Star, and strikes north and south.

During post-Jurassic times granite stocks, which outcrop at rare intervals, were formed.

ECONOMIC:

Lead-silver ores occur in the more quartzitic parts of the Aldridge, both in the form of replacement deposits and fissure veins. The common ore minerals are galena, pyrite, sphalerite, and pyrrhotite; the gangue is small in amount and consists of garnet, diopside, calcite, and quartz. These minerals suggest that the vein deposition was probably in the "deep vein zone", under conditions comparable to those in contact metamorphic deposits.

No igneous intrusion which could supply solutions of this kind, outcrops within several miles of the mines; the small gabbro sills in the neighborhood of the Sullivan are older than the ore-deposit.

For this and other reasons, it is concluded that the Aldridge, in the neighborhood of the mines, rests on an intrusive basement of granite which was the source of the ore intrusion. The conditions of ore deposition are very similar to those of the Coeur d'Alenes.

The quartzites in the vicinity of the mines dip gently eastward, but show many local folds; the ore bodies are replacements and in general conform to the dip and strike of the rocks, - this is not proved in the case of the Stenwinder.

There is a strong tendency for the deposits to show a zonal arrangement of minerals, thus, from a center core of galena ore, they shade outwardly through a fine mixture of galena and sphalerite, to pyrite pyrrhotite and sphalerite, and finally to chert, where the country rock is the purer quartzite and especially in the footwall.

SULLIVAN MINE:

The strike is north and south and the dip from ten to sixty degrees east. The ore is a replacement

the Dam and extend a mile or two to the southward. The

and conforms with the quartzites in strike and dip; the walls are usually poorly defined.

NORTH STAR:

The North Star lies on the east limb of an anticline with much local crumpling; the strike is generally north and south, and the dip at various angles to the east.

In contact with the ore the quartzites are bleached to a grayish white, and are locally known as "porphyry".

The sulphide ore is a clean argentiferous galena, with a small amount of zinc; the oxidised ore is a mixture of oxides and carbonates of lead, with some native silver.

The west orebody is 400 feet long, 70 feet wide, and 50 feet deep; the east orebody 180 feet long by forty feet deep; the axes are parallel and strike a little east of north.

The orebodies appear to occur in synclinal basins separated by an anticline; probably they are remnants of a once continuous orebody, now partly eroded.

STEMWINDER:

The orebody is entirely enclosed in the quartzites and resembles the Sullivan in its occurrence and mineralogy.

GENERAL: (Original)

Throughout the area examined the general strike of the strata is N. 30° W and the dip from 20° to 40° east; there is, however, much gentle crumpling which changes the strike and especially the dip quite markedly.

In many places there is no bedding discernable, so that the details of the many minor folds can not be worked out.

Near the dam on Mark Creek above the Stenwinder there is an especially strong local monocline.

A noticeable feature of the topography of the North Star hill is the succession of terraces and steep slopes, in places even a succession of ridges and troughs.

The highest of these is clearly evident extending from the Kellogg Tunnel (North Star) through the Midnight and Quantrell workings.

Such a structure is less easily seen in the case of the North Star orebody, but appears to be present in a modified form.

Another "slope" passes through the N-W corner of the All Over claim but fades out to the south.

Two more very prominent slopes occur at 100 and 400 feet east of the N-E corner of

the Dean and extend a mile or two to the southward. The Stemwinder appears to lie on the terrace between these.

The axes of these steps and terraces strike very closely north and south. Their cause seems due to differential erosion caused by weakening of the strata by fracturing and sheeting, rather than to folding or step faulting, though the latter has probably had some influence.

As a rule, on the slopes rock outcrops predominate, while on the terraces there is usually a considerable bed of wash, except near the edge of the descending step.

Most of the surface prospecting work has been done on the outer edge of the terraces, where the wash is thin, although the most favorable locus for ore would seem to be on the upper edge of the terrace underneath the wash.

There is a well marked series of north-south fractures with a nearly vertical dip which cover the whole area examined and are widespread rather than intense.

A strong shear-zone passes through the Kellogg tunnel (North Star), near the Midnight shaft, and through the Quantrell workings; it passes through the interior edge of a marked terrace; another shows in the North Star crebody and along the North Incline, and another along the east edge of the Stemwinder crebody, and, presumably, near the east edge of the Dean claim, although it was not definitely identified.

Along some of these planes slight faulting is evident, but it is probably limited to a very few feet.

That these fractures and faults are later than the folding of the rocks, is proven by their disregard of the folds and wrinkles; however some of the stronger fractures have bent the strata slightly immediately adjacent to the slip.

There are no strata sufficiently characteristic to allow them to be identified from place to place.

ORE OCCURRENCE;
North Star:

On account of the caving resulting from the extraction of the ore, it is impossible to study the relations of the orebody except underneath the old stopes on the "60" level, and at the few points in the Glory Hole where rock is exposed.

It does not appear from the fragmentary exposures of quartzite in the Glory Hole, that the ore was mined solely from a bed, or beds, of quartzite, but that the ore to a considerable extent crosscut the bedding, at least toward the bottom of the orebodies.

A body of primary ore several feet thick extends under the so-called No. 1 Ore Trough, with sharply defined walls which do not correspond with the bedding; the strike is north and south and the dip nearly vertical. A similar occurrence is to be seen in an old stope fifty feet south east of the North Star S-E corner, in the No. 2 Ore Trough, except that the ore is oxidised.

On the "60" edit level under the Glory Hole, numerous, more or less continuous, sulphide stringers appear, striking north and south with a nearly vertical dip; they contain the finegrained mixture of galena, sphalerite, pyrite and pyrrhotite, which is undoubtedly of primary origin, and appear to be closely connected, genetically, with the system of vertical fractures.

At several points in the mine, ore is to be seen making from one of these vertical sulphide veinlets upward along a specially favorable bedding plane, while the veinlet itself continues upward; there is often a considerable width of ore at the junction of the beds and verticals. There does not seem to be the same tendency for the ore to follow a bedding plane downward, and the ore in the bedding usually ends near the eastern edge of the veinlet, -frequently against a fracture. (See crosssections)

A highly folded and crumpled condition of the quartzites appears to have been favorable to ore; the south workings of the "60" level show such a condition, and it is reported that some splendid ore was taken from the Glory Hole above this area.

The North Carbonate drift was probably along a sulphide stringer, now oxidised.

In the North Incline there is a strong vein, to the east of which the quartzites have been leached to the so-called "porphyry"; north-south fracturing is fairly pronounced.

The top of the sulphides have been oxidised and some of it mined, along with some gravel along the bedrock contact.

Just north of the "110" Shaft the incline has apparently passed to the east of the mineralized zone.

About a hundred feet west of the Kellogg shaft there is a strong bed of gossan which strikes a few degrees east of north and dips at an unknown angle to the east.

Little data could be gathered on account of water and the caving of the workings, but that little indicates the probability that the ore is in bedding planes, and possibly that the fractures through which the ore rose are not more than a few feet away to the eastward, - such an hypothesis will explain the reported failure to find ore in the Kellogg shaft.

The Kellogg Tunnel (North Star) shows a strong system of shearing, striking a few degrees east of north, and dipping steeply eastward, with considerable leaching of the quartzite along the fractures. In places it contains several per cent lead (oxidised) with occasional lenses of quartz and a small amount of gouge.

MIDNIGHT:

The series of fractures from the Kellogg tunnel pass through the Midnight claim just west of the Midnight

shaft but is not well exposed on account of caving.

Some of the dumps show a fair amount of gossan, and rarely, a little pyrite and pyrrhotite.

QUANTRELL:

The same series of fractures is well exposed on the Quantrell claim as a narrow seam occasionally containing a few inches of galena. The tunnel was driven on this fracture-vein and a small amount of stoping done. There is no evidence of replacement along the bedding. The lower tunnels (on the Eureka) have apparently not found the fracture.

DEAN and ALL OVER:

Near the east side of the Dean and the west side of the All Over there are numerous shallow shafts and cuts which show considerable mineralization although no ore in the commercial sense. In most cases there has been considerable sluffing, and the bottoms are filled with water so that most of the information obtained has been taken from the dumps.

Some of these show strong gossan, and many of them show small amounts of the primary metallic sulphides. On some of the dumps there is a little highly metamorphosed impure quartzite, showing a large amount of mica and other secondary minerals, which often contains a considerable amount of pyrite pyrrhotite, galena and sphalerite; it is probably a thin bed of quartzite which was especially susceptible to replacement.

These holes show three sub-types of deposition, - mineralized fractures, replacement along the bedding, and dissemination through the quartzites, which are as a rule thick bedded.

The outcrop in this vicinity shows an unusually great mineralization, and a somewhat different weathering from the ordinary.

STEMWINDER:

The Main Tunnel is the only working which shows the outer limit, or wall, of the orebody; here the north-south

limiting fracture is very clear, but there is no evidence either for or against replacement along bedding planes.

The fracture extending along the length of the tunnel shows weak mineralization over its whole length, and for 140 feet from the portal forms the east wall of the pyrrhotite body.

The quartzites to the east are leached and bleached and resemble the so-called porphyry of the North Star.

In the interior of the orebody the bedding planes are rather well preserved, with a general strike of N 30° W and a dip N-E of from 30° to 45°.

The two upper tunnels show massive pyrite and pyrrhotite containing (it is said) little value.

The zonal arrangement of sulphides in the orebody, noted by Schofield at the Sullivan mine, appears to be true also in the Stenwinder.

GENESIS:

These occurrences indicate very strongly that the mineralized fractures are feeders through which the ore bearing solutions have risen, penetrated and replaced favorable strata, and that not one, but several, entered into the formation of the North Star orebody, and presumably the other orebodies of the area.

The source of the solutions is probably the underlying granite intrusion, as concluded by Mr. Schofield; it also probably caused the fracturing. The gabbro sills appear to have had nothing to do with the formation of the ore.

Figure 1 illustrates the occurrence of the North Star orebody, and, except for the erosion, should apply to the remainder of the area.

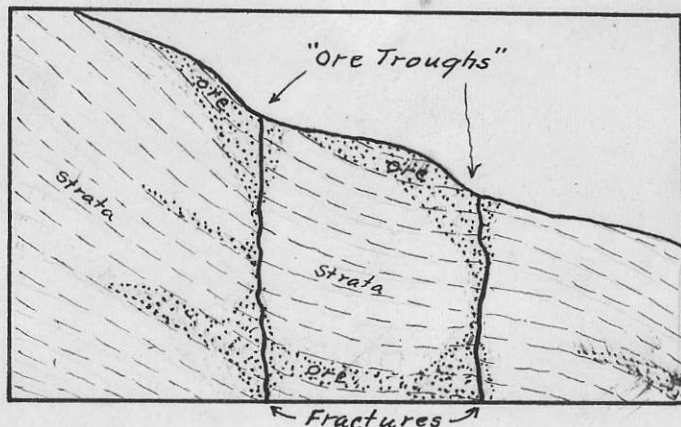


Fig. 1. Diagrammatic Cross-section of North Star "Ore Troughs", showing probable structure of orebodies.

DEDUCTIONS:

It follows from the above data and hypothesis, that the most favorable places for prospecting are (1) in unusually contorted strata, and (2) in strongly fractured zones.

This suggests that the wash covered western part of the terraces may be more favorable than the more bare eastern edges, where the greater part of the surface prospecting has been done.

The probable line of extension of the North Star orebody lies under deep wash for a long distance, ^{with no indications} unless it be the presence of strong gossan on the dumps of two shafts sunk through the wash.

Probably the Stenwinder ore zone passes near the east side of the Dean claim; this is indicated by its strike and the mineralized condition of the rocks.

SAMPLING: (see Maps)
STEMWINDER:

Samples Nos. 1 to 14, with the exception of No. 3, were cut horizontally across the back of No. 2 tunnel, and cross the bedding planes at a small angle; No. 3 was cut vertically.

Samples Nos. 15 to 22 were cut horizontally along both sides of the outer crosscut portion of No. 2 Tunnel; No. 23 was taken to the west of the ore, and

consists almost entirely of pyrite and pyrrhotite.

Samples Nos. 24 to 36, and 38 were taken from the sulphide body of the main tunnel but none of them show any ore.

Nos. 37, 39, and 40 are from the leached oxidised zone immediately east of the sulphides, and show nothing of value.

Nos. 43, 47, and 48 are from the south side of the shaft and were cut vertically from 56½ to 50½ feet depth.

Nos. 44 to 46 and 49 to 53 are cut horizontally at five foot intervals over the depth of the shaft.

Average values are as follows:-

		Ft.	Oz. Ag	% Pb.	% Zn
Main tunnel - sulphides			1.0	0.8	0.6
" " oxides			1.7	0.9	0.7
No. 2 " sulphides, drift		5.9	2.7	4.5	23.5
" " " X-0		20.0	5.3	9.4	22.0
Shaft - horizontal cuts		11.9	7.8	13.2	20.7
" vartical cuts (lower 14 feet)			10.3	17.1	23.2
Sample No. 41 East half shaft dump	200 Tons	11.9		12.5	19.2
" 54 West " "	250		8.0	13.2	22.9
" 55 West ditto - coarse only			3.2	14.8	23.3
" 56 No. 2 tunnel dump, inaccurate			7.4	4.1	22.2

No. 42 is a sample from picked pieces of diamond drill core showing zinc but little lead -- 6.7 Ag. 6.3% Pb. 18.8 Zn.

This sample indicates the possibility that cores were not assayed unless they appeared to be lead ore, which raises the question whether or not some of the so-called iron in the drill holes may not contain sufficient zinc to make it ore.

Composites of samples were made up and assayed for gold and copper as follows:-

Nos. 1 - 22	No 2 Tunnel	Tr. Gold	Tr. Copper
43 - 52	Shaft	.01	.08

NORTH STAR:

Samples Nos. 57 to 65 were taken near the north end of the Glory Hole on an exposure of sulphide ore, part of which had been mined, leaving it in poor condition for proper sampling.

Cuts of considerable length were made but they represent only a small horizontal width; there is a slight difference discernable

here in the ore of different strata, and also there is vertical banding. The width of the samples does not represent the full width of the ore. The average value is 7.4 Oz. Ag. 8.6% Pb. 13.1% Zn. over a width of 2.5 feet.

Nos. 66 to 73 were taken from the next sulphide exposure to the south in the Glory Hole; they were taken from both sides of a drift in which the bottom could not well be gotten at, and the top had been mined. The samples by no means represent the full width of the ore, which is probably ten or fifteen feet wide. The average is 8.1 Oz. Ag. 9.5% Pb. 13.3% Zn. and the width sampled 1.5 feet.

No. 120 was taken on the bottom of the Glory Hole over the "60" Level adit and assayed 6.1 Oz. Ag. 10.1% Pb. 12.9% Zn. over a width of 4½ feet. The above three exposures are undoubtedly on the same streak of ore.

Nos. 95 and 100 to 103 were taken from sulphide veinlets and replacements on the "60" level and do not represent any considerable body of ore; their average is 2.8 Oz. Ag. 5.4% Pb. 6.2% Zn. over an average width of 2.0 feet.

No. 99 was a grab sample of oxidised ore over the Parker shaft station and assayed 6.0 Oz. Ag. 3.3% Pb.

Nos. 93 and 94 were taken across oxidised material at the south end of the underhand stope at the head of the north Incline and showed ten feet of material assaying 6.7 Oz. Ag. 3.8% Pb.

Nos. 74 to 81 were taken in the flat stope of the North Incline from the sulphide body and immediately below the oxidised ore; they show a width of 10 feet assaying 9.0 Oz. Ag. 7.6% Pb. 5.4% Zn.

No. 82 came from 30 feet farther north, consisting of partly oxidised sulphides assayed 6.5 Oz. Ag. 5.0% Pb. 3.4% Zn.

Nos. 83, 84, 97, and 98 are from sulphides in the first two west crosscuts in the north Incline and showed 6.7 feet of ore assaying 5.6 Oz. Ag. 3.9% Pb. 6.4% Zn.

No. 87 from the North Incline, 25 feet south of the "110" Shaft, taken from sulphides in the west bottom of the incline showed nothing of consequence.

Nos. 85 and 86 from the N. Incline at 5 and 15 feet north of "110" Shaft showed one foot (plus) of sulphides assaying 6.1 Oz.Ag. 6.5% Pb. 13.1% Zn.

Nos. 88 to 92 and 96 are from carbonate ores along the bedrock-wash contact in the N. Incline; they show 3½ feet assaying 9.1 Oz.Ag. 3.7% Pb. and were not assayed for zinc.

Samples Nos. 104 to 109 are from oxidised material from the Kellogg tunnel and are all low; their approximate average is 2.8 feet wide, 0.6 Oz.Ag. 2.0% Pb.

Nos. 111 to 116 are from the dumps at the "60" Level adit. The dump samples were taken, a small shovel full at a time, from all around the sides of the dumps, screened over a 1 inch grizzly, mixed and quartered; the original samples probably weighed 500 to 700 lbs. The proportion of coarse (rejected) to fines is approximately as 1:6. Twenty cu. ft. is assumed to equal one ton.

DUMPS

No.	Total tons	Fine, Tons	Oz.Ag.	% Pb.	% Zn
111	3300	2800	5.7	11.2	2.1
112	1000	900	4.0	7.3	-
113	1500	1300	7.2	6.4	1.8
114	3200	2700	5.8	5.8	-
116	5500	4700	2.5	5.8	-
Avg.	<u>14500</u>	<u>12400</u>	<u>4.5</u>	<u>7.2</u>	
115	2900	2500	1.0	2.7	

Sample No. 117 is from the fine gravel and muck in the north half of the Glory Hole and assays 5.6 Oz.Ag. 5.7% Pb.

It was taken in a similar manner to the dump samples.

No. 118 is from the south half of the Glory Hole and assays 2.6 Oz.Ag. 7.5% Pb. No. 119 is from the extreme west workings in what is known as the New Discovery, it assays 5.5 Oz.Ag. 4.9% Pb.

Composite Samples No. 57 -73 .01 Gold
 " " 74 -87 .01 "

ORE RESERVES:

There is no developed ore on either the North Star or the Stemwinder, in the sense that it is exposed on three or four sides, - in fact there is very little that is opened on two sides.

However, as it will be interesting to obtain an estimate of the possible ore that lies adjacent to present exposures, the following figures are given, more as an expression of personal opinion than a true estimate.

NORTH STAR:

	Tons	Oz. Ag.	% Pb.	% Zn.
Sulphide ore from the Glory Hole 260' x 20' x 4½' @ 6 cu.ft. per ton	4000	7.	9.	13.
Sulphide ore from the North Incline 120' x 20' x 5' @ 6 cu. ft. per ton	<u>2000</u>	<u>6.</u>	<u>5.</u>	<u>6.</u>
Total sulphide ore	6000	7.	8.	10.
Oxidised ore on dumps	12400	4.5	7.2	
" gravel, old fill etc in Glory H.	<u>5000</u>	<u>4.0</u>	<u>6.5</u>	
Total oxidised ore	17400	4.5	6.9	

This ore must be concentrated and a lead-zinc separation made before it is salable; also the fact that the tonnages and values are little more than guesses must be emphasized.

STEMWINDER:

A rough estimate made from the "Indicated Lead Ore Limits" on the Stemwinder cross-sections, combined with the average of the assays from the shaft and the No. 2 Tunnel gives the following figures for presumable ore:

150,000 tons 5 Oz. Ag. 9% Pb. 22% Zn.

This ore also requires treatment before it is salable, and must be further developed before its grade and quantity can really be more than guessed.

MILLING:

No milling tests have been made on the North Star and Stemwinder ores, but they are so closely similar to the Sullivan ores which are being successfully treated by flotation, that it

seems certain that they would respond to the same treatment.

At the Sullivan Mill crushing is done by gyratory crushers, rolls, and Hardinge ball mills to 200 mesh.

All concentration is by Minerals Separation flotation machines, which are so operated as to take out first the lead, and then the zinc. Both concentrates and tailings are cleaned and recleaned.

The specific gravity of the ore is reported to average 4.3. The mill feed is supposed to contain about 11% lead, 9% zinc, and 40% iron.

SUMMARY:

The North Star Mine has made a very considerable production of high grade lead-silver ore, but the known orebodies have been practically worked out. Its future depends entirely on the discovery of new bodies of ore. In the absence of such discoveries the mine is worthless, except that if a suitable milling plant should be available there are a number of tons of chiefly oxidized ore that should pay well for working.

The Stenwinder mine has a considerable tonnage of high grade zinc-lead ore indicated, but not developed, which can without much doubt be successfully treated along the same lines as that used on the Sullivan ore.

On the ground lying between the North Star and the Stenwinder, a considerable aggregate of shallow work has been done, some of which shows a well mineralized condition, and affords a favorable field for further prospecting.

The geological study indicates that the ore has been formed from rising solutions in north-south fractures which have penetrated and replaced favorable strata. The locus of the orebodies is probably influenced to a great extent by the strength of the North-south fracturing and by the folding and crumpling of the strata.

RECOMMENDATIONS:

It is recommended that the North Star and Stemwinder properties be optioned, together with the intervening claims shown on the map, if they can be obtained on favorable terms and with at least a year before any considerable payments become due.

If the properties are obtained, it will probably not be advisable to do any underground work on the North Star at first but rather to confine all operations to diamond drilling.

The first hole should be drilled about S 75° W, dip 45° from a point about 700 feet N 27° E from the S-E corner of the North Star claim. It would pass under the strong ore bearing fractures near the head of the North Incline at a depth of

about 700 feet; the total depth drilled should not be less than 1200 feet. Other holes about parallel should then

be drilled two hundred to 300 feet distant, both to the south and the north.

The best method to explore the mineralized area near the N-E corner of the Dean would probably be by a drill hole located about 300 feet east of the Dean N-E corner, pointing west at an angle of 45°.

On the Stemwinder, the shaft should be sunk to the 100 foot point and exploratory drifts run north and south.

It would also be well to continue the West cross-cuts at the 100 and 300 foot points in the main tunnel to the western limit of the pyrrhotite in order to check up the unconfirmed drill reports, and more thoroughly explore the pyrrhotite body.

CONCLUSION:

The North Star-to-Stemwinder ground is widely mineralized and offers a very attractive field for intensive prospecting.

The North Star mine has made a very considerable profit for its owners from what was probably a

remnant of the original orebody; the Stenwinder has a considerable body of good ore now exposed at several points; the Sullivan mine, which is about a mile nearly north of the Stenwinder, is reported to have enormous bodies of high grade ore which are now being mined at the rate of 3000 tons daily.

Aside from the probable extension of the Stenwinder orebody laterally and downward, there is every reason to believe there are other, undiscovered orebodies in the area examined although they may not come to the surface.

The discouraging feature of the proposition is the enormous amount of prospecting that should be done, without any proof of orebodies of commercial size, excepting the Stenwinder.

Respectfully submitted,

Chas. C. Starr

APPENDIX

STEMWINDER - Drill Hole Data:

From Curran's progress letters to MacKenzie Mann & Co.
1906 & 7.

- No. 1 at Face 1st west crosscut in main tunnel;
Due west; Flat.
0 - 69 ft Iron with a little yellow copper galena and zinc shot through it.
69 - 122 Iron body
122 - 144 Lime slightly mineralized.
- No. 2 13 feet from end of 1st crosscut in main tunnel.
0 - 10 ft. Iron and zinc.
10 - 39 Seamed and mineralized
39 - 90½ " "
- No. 3 at 100 ft. point in Main Tunnel; dip 68 degrees westerly.
0 - 10 ft Cased, broken
12 - 79½ very hard rock
79½ - 192 Lime carrying yellow iron.
192 - 239 Unsatisfactory, very soft rock in last part
- No 4 300 feet from entrance of main Tunnel; runs S-W, flat.
0 - 58 feet broken, several small seams of iron and galena
58 - 75 fairly solid and mineralized
75 - 109½ iron ore
109½ - 168½ fairly well mineralized, hard, traces of yellow copper
168½ - 189½ hard, fairly mineralized
189½ - 191½ mineralized quartz
- No. 5 300 feet from entrance to Main Tunnel; runs easterly, flat.
0 - 60½ ft mineralized porphyry.
60½ - 99½ " "
- No. 6 at end of crosscut at 300 ft. point in main tunnel.
Runs westerly flat.
0 - 16 ft. slightly mineralized
16 - 139 the iron composing the ledge
139 - 144 country rock
- No. 7 at 40 feet west of No. 2 tunnel. Strike about N 75 W and dip 55 degrees (Thompson)
0 - 8 ft wash
8 - 93 lead ore with zinc; lead decreasing and zinc increasing toward bottom
93 - 147 Iron composing the ledge
Assays:
0 - 30 feet 8.6 oz silver, 13.3 lead, 17.2 zinc
30 - 60 8.3 17.1 22.3
60 - 93 7.3 10.4 22.8
93 - 199 .8 - 1.1
199 - 293 .7 - 11.2
- No. 8
0 - 9 ft wash.
9 - 19½ hard rock
- No. 9 at 50 feet west of No 7 hole and runs westerly
Baering S 40 E, dip 55 or 60 degrees (by Thompson)
0 - 38 ft. Wash X 60 E
38 - 50 Ore similar to that in No. 7 hole
50 - 60 " " " " "
60 - 119½ the iron forming the ledge.

Diamond Drilling from brief notes by Louis Johnson, 1917.& 1920

- No. 1 Runs due west, dip 80 degrees.
1st 400 feet pyrrhotite, then 100 feet of quartzite.
- No. 2 Same set-up as No. 1; runs due west, dip 60 degrees.
0 - 180 feet pyrrhotite
180- 200 " quartzite
- No. 3 Runs south, dip 70 degrees.
0 -342 feet pyrrhotite
342- 402 " chert
- No. 4 Runs S 85 W, dip 80 degrees.
Depth 200 feet, shows slight mineralization only.
- No. 5 Same set-up as No. 4; dip 60 degrees west.
Depth 200 feet; mostly barren.
- No. 6 Same set-up as No. 4; points about to the shaft, dip 45 south.
0 -100 feet seamed and mixed pyrrhotite and quartzite.
100-300 " barren.
Total depth 400 feet.
- No. 7 Same set-up as No. 4; runs N 20 E, dips 45 degrees.
Depth 258 feet; barren quartzite.
- No. 8 Runs S 65 E, dip 50 degrees.
0 - 10 feet wash
10 -200 " pyrrhotite
Depth 239 feet. Showed a little copper and seams of lead in places.
- No. 9 Same set up as No. 8.; Runs S 85 E, dip 50 degrees.
Depth 212 feet; pyrrhotite 189 feet.
- No 10 Runs S 70 E, dips 45 degrees.
Depth 189 feet; 168 feet of pyrrhotite.
- No. 11 Runs S 75 E, dip 45 degrees.
0 - 165 feet in pyrrhotite
165-200 " in quartzite
- No. 12 Runs N 70 E, dip 45 degrees.
0 - 150 feet pyrrhotite
150-270 " chert
270-354 " quartzite
- No. 13 Runs N 40 E, dip 45 degrees.
0 -40 feet pyrrhotite
40 -196 quartzite with no chert.
- No. 14 Points to 50 feet south of shaft, dip 30 degrees.
0 - 240 feet quartzite
240- 272 " ore sulphides
272- 460 " pyrrhotite
460- 468 " pyrrhotite and quartzite
- No. 15 Bears 20 degrees to the left of No. 14, dip 30 degrees.
0 - 224 feet quartzite
224- 228 " pyrrhotite
228- 257 " zinc lead ore
257- 271 " pyrrhotite