MARCH, 21st, 1969.

# RE-ASSESSMENT OF

# MOUNT NANSEN MINES LIMITED

# (INCLUDING PERFORMANCE FOR FEBRUARY, 1969)

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## INTRODUCTION AND TERMS OF REFERENCE.

On December 19th, 1968, the writer was engaged by Messrs. F. L. Croteau and E. W. Blessing on behalf of Moneta Porcupine Mines Limited to examine and report on the Mount Nansen mining operation near Carmacks, Y. T., with particular attention to economic viability and the wisdom of advancing funds. Accordingly, several meetings were held in Vancouver with executive personnel January 5th to 8th and a visit was made to the mine from January 9th to 15th. The writer's conclusions were then reported. However, since it was the view of Mount Nansen executives that the period of examination was not representative of ordinary performance, a decision was made to continue operations for January and at least part of February, after which time the economic performance could be better assessed. The writer was requested to return later on to assist in the re-assessment. In the meantime, pertinent assays and operating data were accumulated.

Upon return to Vancouver on February 10th, a review of all pertinent data was made and the resulting conclusions outlined in a series of meetings with executives and management of Mount Nansen Mines Limited. At this time, and at the initiation of Mr. H. Willi, the terms of reference were changed to include investigations regarding solution of problems, avenues for improvement, and possibilities of bringing the venture to the profit-making stage. This report covers these investigations and supersedes all previous reporting and estimates by the writer.

## SCOPE

In accordance with the terms of the initial assignment the Mount Nansen Mine, the plant, operating procedures, payroll, engineering records and milling techniques were examined in detail. The economic output was checked along with the smelter contract, marketing invoices and freight charges to reflect the cash return at the mine. Operating costs were studied, estimated where relevant figures were unavailable, and reviewed in relation to tonnage possibilities. Avenues for improvement were sought, measured for feasibility, and converted to dollar value where possible. No study was made of geological structure, drill core, mineralogy or ore reserve calculations in detail. Where ore potential was considered or measured in the light of economics, only the broadest intuitive estimates were made and these were dependent on mapping, surveys and calculations made by others.

Current metallurgical processes were reviewed with the objective of getting better performance and improving the present high freight and smelter charges. In this regard, results were compared with the experience of other operators faced with similar problems. However, there was no attempt made to re-design flowsheet, buildings or equipment nor were existing facilities checked for capacity or engineering soundness. Also, the test work done by the Department of Mines and other laboratories was accepted at face value notwithstanding the fact that there was no reinforcement by bulk tests.

It should be re-stated that, due to the tune-up stage of the operation and the lack of assays for some periods, exact

performance was difficult to establish and in some instances the available figures appeared to be awry. Specifically the milled tonnage figure appeared to be reported 25 - 30% high. Revisions have been made and new data have been worked out by Mount Nansen staff which are balanced metallurgically and which have been forwarded to the writer in order to provide the most accurate basis possible for estimates and projections. The revised figures are used in this report.

## CONCLUSIONS.

1. The Mount Nansen operation is losing money in the order of $150,000. per month and is not economically viable as it now exists.

2. Due to the presence of both oxide and sulphide ores and the necessity to treat them simultaneously, it is unlikely that the present straight flotation plant (or a straight cyanide plant) alone will ever be adequate. A combination of both is necessary.

3. Proven and prepared ore reserves are insufficient to support a profitable operation on a sustained basis.

4. Grade of ore delivered to the mill as well as observation of the mining process would indicate that dilution experience is in excess of feasibility concepts. Ore reserve grade may be unattainable.

5. Two changes are required to give the venture a chance at making a profit. First, a major mine exploration and development program and second, alterations and/or additions to the mill which would bring recoveries above 90% and reduce the freight and smelter charges.

6. In regard to priority, it should be kept firmly in mind that the key to the problem is ore and the only cure is to find, develop and prepare enough of it to allow correction of the economics by way of higher tonnage rate and improved metallurgy. The first step therefore in any corrective action is to carry out sufficient exploration and development to assure reserves to the point where further capital outlays are justified and wise. Anything less or anything different will be financially hazardous.

## DESCRIPTION OF MINE AND PLANT

The Mount Nansen mining operation is located approximately 40 miles west of Carmacks, Y. T., by road and is based on a series of silver-gold-lead veins on four major claim groups comprising some 400 claims. Considerable exploration in the way of drilling, bulldozer trenching, geochemical sampling and adit drives has been done by Mount Nansen and others with three mine systems developed and strong possibilities for the discovery of more. Underground work has been concentrated in the three areas serviced by adit and the ore reserves as calculated by Dolmage-Campbell are shown on the following page under the relevant mine heading with gold and silver grades.

| Huestis Mine: | Tons | Ounces Gold | Ounces Silver |
|---|---|---|---|
| Proven | 41,425 | 0.52 | 11.5 |
| Probable | 49,650 | 0.47 | 10.1 |
| Sub-Total | 91,075 | 0.50 | 10.8 |
| Possible | 71,445 | | |
| Total | 162,520 | | |
| **Webber Mine;** | | | |
| Proven | 33,700 | 0.42 | 23.8 |
| Probable | 41,500 | 0.39 | 22.3 |
| Sub-Total | 75,200 | 0.40 | 23.0 |
| Possible | 50,000 | | |
| Total | 125,200 | | |
| **Total Huestis and Webber;** | | | |
| Proven | 75,125 | 0.474 | 16.98 |
| Probable | 102,050 | 0.429 | 16.37 |
| Sub-Total | 177,125 | 0.45 | 16.6 |
| Possible | 127,270 | | |
| Total | 304,445 | | |
| **Brown - McDade Mine;** | | | |
| Proven | 16,380 | 0.50 | 6.6 |
| Probable | 26,720 | 0.51 | 6.1 |
| Sub-Total | 43,100 | 0.51 | 6.3 |
| Possible | 11,440 | | |
| Total | 54,540 | | |

All mill feed at the present time comes from Huestis Mine which consists of a simple shrinkage operation with one stope in the pulling stage and several others in the mining and preparation stages. There is little development being done although plans exist to get at least one heading going on two shifts. Observations of the actual drilling and blasting cycles in the stopes indicate some difficulty in following the vein

shift-by-shift as well as in retaining continuity, which causes extra dilution and cuts efficiency. This is a common problem in narrow vein mines and will always constitute a major hurdle at Mount Nansen in delivering economic heads to the mill.

The mill is a compact crushing, grinding and flotation plant with no frills. It is currently operating at a reported rate of about 150 tons per day but, due to past problems in maintaining continuous feed and establishing accurate tonnage, ultimate capacity is difficult to judge. There is still a fair amount of work to be done to finish off certain facilities such as dust collection, although most of these can be done over a period of time and without interruption of schedules. The cyanide plant enclosure is virtually completed but no foundations have been poured or machinery installed.

With the present straight flotation process a bulk concentrate is produced which is shipped by truck, boat and rail to the East Helena smelter. Recoveries are running at 72% for gold and 90% for silver with an indicated concentration ratio of 9.4/1. Costs of marketing the concentrate are high - freight, smelter charges and penalties amounting to $89.00 per ton of concentrate.

Service facilities appear reasonably adequate and consist of the usual powerhouse, garage, assay office, administration office, dryhouse, warehouse, water supply, mechanical - electrical shops, mine office, cookery, sleeping accommodation and a small townsite at Carmacks. There are still tail-ends of construction going on which result in some disarray and difficulty in tightening up the operation. Completion of this activity along

with organization and control will improve the physical situation as well as reduce the operating costs.

## OPERATING PERFORMANCE - JANUARY, 1969.

During the month, 3,270 tons of ore were milled to produce 273 tons of concentrate. Revenue from production along with overall expenditures were available at Mount Nansen Head Office and these show costs and cash outflow to be as follows:-

| | Amount | Per ton of Ore |
|---|---|---|
| Revenue: | | |
| Tons ore milled | 3,270 | |
| Tons Concentrate Produced | 273 | 12/1 |
| Revenue from production | $ 41,096 | $12.53 |
| Less Operating Costs: | | |
| Exploration and Development | 5,734 | 1.75 |
| Mining | 114,688 | 35.10 |
| Milling | 49,573 | 15.15 |
| Administration and General | 28,800 | 8.80 |
| Total Operating Costs | $ 198,795 | $ 60.80 |
| Operating Loss at Mine: | $ 157,699 | $ 48.27 |
| Also Deduct; | | |
| Bank Charges | 3,113 | .95 |
| Interest on loans | 79,158 | 24.25 |
| Sub-Total | $ 82,271 | $ 25.20 |
| Net Cash Loss in January | $ 239,970 | $ 73.47 |

## OPERATING PERFORMANCE - FEBRUARY, 1969.

From the revised tonnage figures along with assays sent down from the mine to Head Office, economic output for February can be calculated and from this, along with estimates on overall costs, one can approximate an operating statement.

The revised figures show that the mill averaged 146 tons per day for a total of 4083 dry tons for the month. Grade ran 0.315 gold and 7.611 silver to produce 436 tons of concentrate at 2.112 gold and 63.455 silver, balanced as follows;

### METALLURGICAL BALANCE

| AU | SDT | ASSAY AU | OZ AU | % RECOVERY | R/C |
|---|---|---|---|---|---|
| Heads | 4083 | .315 | 1284.831 | 100.00 | |
| Conc. | 436.1000 | 2.112 | 921.076 | 71.69 | 9.4/1 |
| Tails | 3646.9000 | .100 | 363.755 | 28.31 | |

| AG | SDT | ASSAY AG | OZ AG | % RECOVERY | R/C |
|---|---|---|---|---|---|
| Heads | 4083 | 7.611 | 31,075.163 | 100 | |
| Conc. | 436.1000 | 63.455 | 27,672.778 | 89.05 | 9.4/1 |
| Tails | 3646.9000 | .933 | 3,402.385 | 10.95 | |

Payable Metals in Concentrate.

| | | | | |
|---|---|---|---|---|
| Gold: | 2.11 ounces x | 96.75% | = | 2.04 ounces |
| Silver: | 63.46 ounces x | 95.0% | = | 60.29 ounces |
| Lead: | (Approximate) | | = | 140 pounds |

Value: (February 19th, 1969)

| | | | | |
|---|---|---|---|---|
| 2.04 ounces x | 42.65 | U. S. | = | 87.01 |
| 60.29 ounces x | 1.80 | U. S. | = | 108.52 |
| 140 pounds x | 0.11 | U. S. | = | 15.40 |
| | | | | $ 210.93 U. S. Funds. |

Deductions:

| | | | |
|---|---|---|---|
| Smelter Charge | $ 23.98 | | |
| Arsenic Penalty | 6.75 | | |
| Antimony Penalty | 1.50 | | |
| Lead Duty | 1.20 | | |
| Sales Commission | 1.90 | | |
| Total | $ 35.33 | 35.33 | |
| Net Value Delivered Smelter - - - - | | $ 175.60 | |
| | | $ 189.03 | Canadian |
| Less Freight and Pallets | | 49.84 | |
| Net Smelter Return at mine - - - - | | $139.19 | per ton of concentrate. |

Net Smelter Return for February = 436 x $139.19 = $ 60,686.00

Taking total costs for February at $250,000 of which freight is $44,000 and various construction items at $27,000, along with revenue as calculated above an approximate operating statement for the month looks like this:-

| | Amount | Per ton of Ore |
|---|---|---|
| Revenue. | | |
| Tons ore milled | 4083 | - |
| Tons Concentrate produced | 436 | 9.4/1 |
| Revenue from Production | 60,686 | 14.86 |
| Less Operating Costs. | | |
| Exploration and Development | 5,180. | 1.26 |
| Mining | 103,580. | 25.36 |
| Milling | 44,240. | 10.83 |
| Administration and General | 26,000. | 6.39 |
| Total Operating Costs | $ 179,000. | $ 43.84 |
| Operating Loss at Mine | $ 118,314. | $ 28.98 |
| Also Deduct. | | |
| Bank Charges | 3,000. | .73 |
| Interest on Loans | 15,000. | 3.67 |
| | $ 18,000. | $ 4.40 |
| Net Cash Loss in February | $ 136,314. | $ 33.38 |

## A NEW APPRAISAL

Considering the cash losses of $240,000 in January along with $136,000 estimated for February, one can see that the situation is critical and indicates the need for major changes - minor improvements will not do. All efforts should now be directed toward seeking a realistic solution to the problem. New concepts are required and in this regard there would appear to be several factors which might serve to change the fortunes of the venture in a favourable way. A consideration of these factors, along with the possibilities inherent in them follows:-

1. The Construction of a Nearby Smelter by Anvil, Kerr-Addison or others which could serve to treat custom concentrates for the expanding mineral industry in the Yukon. If effected, such a development could make a major difference in the economics at Mount Nansen since both freight and smelter charges might be improved upon. On the other hand it may be decades away, is not a certainty, and in the light of the general smelter tendency to charge what the traffic will bear, may not be as beneficial as expected.

2. An Increase In The Price of Gold and/or silver. One need only review the changes in the prices of these metals over the past few years and the present state of international monetary confusion to realize the very real possibility of price increases. A major change in the price of either metal would ofcourse put the economics in a new light. Such possibilities reinforce the wisdom of conserving the ore resources and providing continuity to the venture.

3. Improved Mill Heads. February mill feed was reported to be coming from the stopes alone (no stockpile) and if we take the grade for February as representative of mined grade from the Huestis zone, it becomes evident that dilution is greater than anticipated. Such a conclusion is supported by observation of mining in the stopes and a calculation of grade delivered against ore reserve grade would point to a discrepancy in the order of 50% as shown below:-

| | Gold | Silver | Average |
|---|---|---|---|
| Delivered grade | 0.315 | 7.611 | |
| Ore reserve grade (Huestis) | 0.52 | 10.8 | |
| Indicated additional dilution | 62% | 42% | 52% |

While this is flimsy evidence based on a few thousand tons from one zone, it is the only indication at hand of what is actually happening. Admittedly the limited number of developed ore sources preclude flexibility in grade control and such a situation can be improved with more development and refined techniques. However, the above experience throws grave doubt on the possibility of ever meeting ore reserve grade and would indicate that a figure within 25% of it might be a reasonable optimum..

4. Better Metallurgy. The present unsatisfactory milling recoveries and adverse concentration ratio weigh heavily against the operation. Reviewing the early test work as well as the evidence from current operations, one can conclude that the installation of a cyanide circuit to treat flotation tailings would be of major benefit and could raise recoveriesto 93% for gold and 96% for silver. The thought has also occurred that straight cyanidation would be worth

pursuing as a method of avoiding the present high freight and smelter charges. However, as both oxide and sulphide ores must be treated simultaneously, it is unlikely that either flotation alone or cyanidation alone would be satisfactory. The question of roasting with cyanidation has also been raised but this could create problems usual with the roasting of arsenic - antimony ores and results are doubtful due to the tendency of some silver minerals to fuse before oxidation. As things stand, the flotation - cyanidation process still looks the best and could, with proper grinding, bring both recoveries and concentration ratio to a satisfactory level.

5. Improved Ore Reserves. An aggressive exploration program from underground could undoubtedly change the ore reserve picture in a significant way. Past prospecting by way of trenches and drilling has been difficult, technology is improving, and the number of gold - silver veins already opened up along with the number of geochemical anomalies suggest the presence of more. The potential is undoubtedly high and the successful proving-up of a series of new veins could change the whole scope of the operation.

This aspect should be pursued with vigour and is the only real hope for the venture at present metal prices. The key to the problem is ore and the solution to the problem is to find, develop, and prepare enough of it to allow correction of the economics by way of higher tonnage rate, better grade, improved metallurgy and flexibility of operation. The first step therefore in any corrective action is to carry out sufficient exploration and development to assure reserves to the point where further capital outlays by way of improved facilities and technology are justified and wise. Anything less is financially hazardous.

6. An Increase in Production Rate. If new explorations were successful in raising the assured reserves significantly, a new milling rate in keeping with the changed reserves would be worthy of consideration and study. The effect of a larger divisor on cost per ton could be appreciable and would have the additional benefit of bringing a larger amount of vein material into the ore range.

7. Improved Operating Costs. It is generally agreed that the present operating performance will be improved upon when all construction aspects are phased out and the operation settles down. However, the mine operating cost of $43.84 per ton of ore for February underlines the fact that the elimination of these extras is not enough and some new production concepts as well as major changes in technique and execution are required. Some very useful work could be done on the study of trackless equipment for drifting and ore handling. Lacking a major improvement along such lines one is faced with an increased production rate as the only way of effecting a real improvement in unit operating costs.

In order to determine the order of such improvement at various tonnages, a study was made of ten Ontario mines with nearly similar mining conditions. Costs were adjusted to shrinkage method and re-calculated in the light of labour and material costs at Mount Nansen. A study of the results shows the changes which one might expect from higher milling rate and also provides estimates for operating performance, indicating a cost for Mount Nansen of $34.00 at 250 tons and $30.00 per ton at 400 tons.

COMPARATIVE OPERATING COSTS - SOME ONTARIO MINES.

| Mine | Method | Tons/Day | Mining Width | Operating Cost | Adjust to Shrinkage | Adjust to Mount Nansen |
|---|---|---|---|---|---|---|
| A | Shrink C. & F. | 750 | 12 | 10.70 | 10.00 | 20.90 |
| B | Shrink | 250 | 20 | 16.30 | 16.30 | 34.10 |
| C | Shrink C. & F. | 470 | 7 | 17.80 | 15.80 | 33.00 |
| D | C.& F. | 840 | 12 | 10.50 | 8.50 | 17.80 |
| E | Shrink Open | 470 | 50 | 9.85 | 10.85 | 22.70 |
| F | Shrink | 120 | 8 | 24.20 | 24.20 | 50.60 |
| G | C. & F. | 364 | 7 | 16.60 | 13.30 | 27.80 |
| H | Shrink | 86 | 4 | 19.60 | 19.60 | 41.00 |
| I | Shrink Open | 165 | 7 | 17.80 | 19.80 | 41.40 |
| J | Open | 1500 | 13 | 6.50 | 8.50 | 17.80 |

## A CONSIDERATION OF ALTERNATIVES.

With the above factors and costs in mind one is led to a search for some practical alternative which might bring the Mount Nansen operation to a paying basis. In studying such alternatives, exact estimates are not possible due to the number of unknowns regarding new ore and the lack of detailed design plans for enlarged or new facilities. However, assuming that a mill head within 25% of present ore reserve grade is attainable, one can approximate what expenditures might be required and what performance one might expect under various alternative situations. These are rough estimates but they do give an idea of what one could expect:-

ALTERNATIVE "A". Shut down completely and put the operation on a caretaker basis. Such a step would cut the present losses

and conserve resources but would ofcourse result in no revenue. Costs during a shutdown period would be:-

| | COSTS PER MONTH | |
|---|---|---|
| | First Three Months. | Continuing Months |
| Insurance | 7,000 | 7,000 |
| Interest | 18,000 | 18,000 |
| Claims Administration | 1,000 | 1,000 |
| Caretaking | 2,000 | 2,000 |
| Salvage and removal of Equipment | 10,000 | - |
| Road and Plant Maintenance | 10,000 | - |
| | $ 48,000 | $ 28,000 |

ALTERNATIVE "B". - Shut down, carry out 12,000 feet of exploration and development and assuming success in developing reserves, raise the milling rate to 250 tons per day in a revised plant. On this basis and using the average reserve grade of the Webber, Huestis and Brown - McDade Mines (factored for additional dilution), the expenditures required and the earnings expected are approximated below:-

EXPENDITURES - ALTERNATIVE "B"

| | Construction & Development | Administration and Services | Total |
|---|---|---|---|
| Mine | $ 600,000 | $ 60,000 | $ 660,000 |
| Mill | 264,000 | 36,000 | 300,000 |
| Electrical-Mechanical | 66,000 | 72,000 | 138,000 |
| Surface, yard and roads | 48,000 | 36,000 | 84,000 |
| Administration & general | - | 198,000 | 198,000 |
| Head Office and interest | - | 108,000 | 108,000 |
| Allowance for contingencies | 212,000 | - | 212,000 |
| Working capital | - | 400,000 | 400,000 |
| Total | $1,190,000 | $ 910,000 | $2,100,000 |

## EARNINGS - ALTERNATIVE "B"

| | Gold | Silver |
|---|---|---|
| Heads | 0.364 | 11.66 |
| Concentration ratio | 15 | 15 |
| Percent recovery | 92 | 95 |
| Price(Canadian) | 46.65 | 1.93 |
| Concentrate grade | 5.03 | 166 |

Payable Metals:

| | | | |
|---|---|---|---|
| Gold: | 5.03 x .9675 x 42.65 = | 207.56 | |
| Silver: | 11.66 x .95 x 1.80 = | 283.86 | |
| Lead: | 140 x 0.11 = | 15.40 | |
| | | $ 506.82 | U. S. |
| Smelter charges & penalties | - | 35.33 | |
| | | $ 471.49 | U. S. |
| | | $ 507.46 | Canadian |
| Freight & pallets | | $ 49.84 | |
| Net Smelter return at mine | | $ 457.62 | Canadian |

Revenue for month = $457.62 x 480 = $ 219,657

Operating Statement:- 250 tons per day:

Continued on following page.

Operating Statement:- 250 tons per day.

| | Amount | Per ton of ore |
|---|---|---|
| Tons ore milled | 7,200 | |
| Tons concentrate produced | 480 | 15/1 |
| Revenue from production | $ 219,657 | $ 30.51 |
| **Less Operating Costs:** | | |
| Exploration & Development | 50,400 | 7.00 |
| Mining | 100,800 | 14.00 |
| Milling | 64,800 | 9.00 |
| Administration and General | 28,800 | 4.00 |
| Total Operating Costs | $ 244,800 | $ 34.00 |
| Mine Operating Profit (Loss) | ($25,143) | ($3.49) |
| **Also Deduct:** | | |
| Bank Charges | 3,000 | .42 |
| Interest on Loans | 30,000 | 4.16 |
| | $ 33,000 | $ 4.58 |
| Operating Cash Flow (Loss) | ($ 58,143) | ($ 8.07) |

ALTERNATIVE "C" - Shut down, carry out 24,000 feet of exploration and development and, assuming good fortune in developing assured reserves, expand the mill to 400 tons per day.

EXPENDITURES - ALTERNATIVE "C"

| | Construction & Development | Administration Services | Total |
|---|---|---|---|
| Mine | $ 1,200,000 | $ 100,000 | $ 1,300,000 |
| Mill | 690,000 | 60,000 | 750,000 |
| Electrical-Mechanical | 90,000 | 100,000 | 190,000 |
| Surface, Yard & Roads | 70,000 | 50,000 | 120,000 |
| Administration & General | - | 220,000 | 220,000 |
| Head Office & Interest | - | 150,000 | 150,000 |
| Allowance for Contingencies | - | 390,000 | 390,000 |
| Working Capital | - | 600,000 | 600,000 |
| Total | $ 2,050,000 | $ 1,670,000 | $ 3,720,000 |

Operating Statement:- 400 tons per day.

| | Amount | Per ton of ore |
|---|---|---|
| Tons ore milled | 11,500 | |
| Tons Concentrate Produced | 767 | 15/1 |
| Revenue from Production | $ 350,750 | $ 30.50 |
| Less Operating Costs: | | |
| Exploration & Development | 74,750. | 6.50 |
| Mining | 138,000 | 12.00 |
| Milling | 92,000 | 8.00 |
| Administration & General | 40,250 | 3.50 |
| Total Operating Costs | $ 345,000 | $ 30.00 |
| Mine Operating Profit | $ 5,750 | $ 0.50 |
| Also Deduct: | | |
| Bank Charges | $ 5,000 | .43 |
| Interest on Loans | 39,000 | $ 3.39 |
| Sub-Total | $ 44,000 | $ 3.82 |
| Operating Cash Flow (Loss) | ($38,250) | ($ 3.32) |

The above calculations indicate that under present metal prices and economic conditions one could expect to reach a break-even point at about 400 tons per day with an improved mine and mill. However, this can only be achieved by the expenditure of over three million dollars in risk capital. It might be said that the job can be done for less and that better costs can be expected than those estimated. However no purpose can be served now by undue optimism in the face of past over-runs and present economic performance.

Respectfully submitted,

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