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October 14, 1970  
Technical Services

RECEIVED  
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TO: R. E. Thurmond  
FROM: W. A. Hamilton  
SUBJECT: Report on Visit to Anvil Mining Corporation  
September - October 1970

ANVIL MINING CORPORATION  
LIMITED

Following are comments on certain phases of the Anvil operation during the above period. All of these comments has been discussed with your mill staff.

METALLURGY

LEAD

Recoveries of lead are presently substantially better than in the past. Recently the assay results on two or three 24 hour periods showed almost theoretical lead Metallurgy. For example on October 6, 1970 lead results on 6525 milled tons were as follows:

<u>PRODUCT</u>	<u>% Pb.</u>
Feed	5.8%
Pb. concentrate	69.9%
Zn. concentrate	2.6%
Bulk concentrate	17.1%
Plant Tailing	0.35%

Assays of the above nature indicate lead recoveries in Pb. and bulk concentrate of over 90% of the lead in the feed and these concentrates were of acceptable grades.

Improvement in lead Metallurgy is due in part to any and all of the following: Use of Aerofloat 242, higher tonnage rates with more stability and less surging and also [activation of the bulk concentrate production.] [Lime addition to the grinding ~~was~~ originally planned.] Mr. Langey of Galigher altered this addition to add lime after the grind. This I believe was a mistake. At any rate the circuit appeared more stable and easier to control after the lime addition was again changed to the grinding circuit.

ZINC

Zinc Metallurgy is still below par. comments are as follows:

REAGENTS:

Z-200 is the promoter being used. In the past some shipments of Z-200 have deteriorated in transit and/or storage and have been unusable. Furthermore this reagent is not too selective and appears to float considerable quantities of Pyrite. Also undesirable froth conditions appear to stem from this reagent and this may result in excess use of  $\text{CU SO}_4$ . Suggestions to alleviate this will follow.

CLEANING CIRCUITS

Very little actual cleaning is being done in the cleaners. I suspect this is mainly due to the Z-200 froth and non-selective effect as well as possible overuse of  $\text{CU SO}_4$ .

COPPER AND SILVER

Actually little is known of the Mineralogy and Metallurgy of the above metals. However, both the above should be concentrated in the selective Pb concentrate to best economic advantage to Anvil. At present the recoveries of both the above are relatively low in the lead concentrate. Evidence is accumulating to indicate that the copper and silver are associated.

GENERAL OBERVATIONS AND SUGGESTIONS FOR LAB TESTING

Although the lead Metallurgy appears reasonably well in hand the use of Cyanide as an iron-zinc depressant is not conducive to the recovery of copper, silver or gold in the lead concentrate.

I suggest tests be run to study effect of Sodium Sulfite and/or Calcium Sulfite in pulps made alkaline with Soda Ash and also with Lime. This to see if lead Metallurgy, can be maintained and copper and silver recoveries in the Pb concentrate be improved by eliminating the Cyanide.

I would also like to see the present use of  $\text{ZnSO}_4$  investigated. This reagent appears to be doing very little if anything at all and when some oxidation is present in the feed the  $\text{ZnSO}_4$  addition may be actually harmful.

With respect to the Zinc Metallurgy the elimination of Z-200 should be

considered. Some time ago a series of lab tests indicated both Aerofloat 208 and AF-211 gave excellent recoveries with better selectivity than Z-200. If this series were repeated and similar results were indicated I would advocate a mill test on these reagents to test out the indicated advantages. I would expect better froth conditions, better selectivity, better cleaning and lower CU SO<sub>4</sub> consumption with use of the above instead of Z-200.

AMERICAN CYANAMID REPORT - Microscopical Examination -  
Project No. 1740 dated September 15, 1970.

In brief the report highlights are as follows:

- 1- Tetrahedrite was assumed to be the copper mineral carrying the silver.
- 2- Photomicrographs  
These clearly show considerable locking of all minerals but also show considerable free mineral in the wrong products indicating milling can be improved.
- 3- Very little light colored Sphalerite was observed indicating that Marmatite was the principal Zn carrier.
- 4- Lead losses are chiefly in the the minus 10 micron size.
- 5- Zinc losses are in both free and locked mineral.

ULTIMATE GRADE OF ZINC CONCENTRATES

Little is known regarding the above and little has been done to find out.

In brief the principal diluents of the zinc concentrate are Pb and Fe. The Pb may be present as very fine Pb not recovered in the Pb float and also as Pb locked with either or all Zn, Fe and gangue. At the present time it would appear that reduction of Pb in the Zn concentrate to + 1.0% appears reasonable with good operation.

The Fe dilution is another matter since the Zinc concentrate color definitely indicated Marmatite and it is also known that some quantity of Pyrite is being floated. The quantities of Fe as Pyrite and Fe contained in Marmatite are unknown at present. With very careful analysis of selected Zinc concentrates for Pb, Zn, Fe and S coupled with Microscopical work to determine minerals present a reasonably close estimate of the Marmatite

can be made and the ultimate practical Zinc grade can be determined.

### BULK CONCENTRATE

The production of bulk concentrate has now started and appears to be going well.

However, there are problems associated with the above production. The principal problems may be shown as follows:

1- Over production or underproduction:

The production of the bulk concentrate should be gauged closely. It is perfectly possible to obtain excellent mill products assays but if the metals are concentrated in the bulk concentrate instead of maximized in their respective selective concentrates then the overall economic picture is less attractive. Conversely if the bulk concentrate is underproduced then the advantage of removing middling grains is lessened and selective concentrate grades and/or metal recoveries are adversely effected.

At present a measuring weir is being used to estimate the rate of production of bulk concentrates. I would suggest that tonnage charts be made up and placed at the weir so that the operators can gauge production rates from their weir readings and density measurements. Bulk concentrate production rate should also be proportional to the mill feed tonnage rate.

A mass flow-meter has been suggested for installation in the pulp line to determine the bulk tonnage. I am inclined to approach this solution with caution as the bulk concentrate is a froth and air bubbles will cause serious errors in the flow-meter readings. I suggest full investigation of the weir idea before going on to other methods which may be costly and with not much more accuracy.

2- Selection of Middling:

Obviously the most advantageous product to put into the bulk concentrate is true Pb and Zn middling. It is also obvious from the Cyanamid Report that much of the material in the middlings are free mineral grains. For best economic advantage it is apparent that close study of the operation is required so that the objective is reached.

### FLOTATION CAPACITY

Zinc Rougher flotation appears to be short. No action toward preparing and AFE for added machines has been prepared although general agreement on the need has been established.

### THICKENING FILTERING AND DRYING

This area has been troublesome and the concentrate thickener filters and dryer systems could well be the real bottleneck on production.

### CONCENTRATE THICKENER

These have all be overfilled recently and some plant shutdōwn and lost time has been incurred to allow the filters and dryers to catch up.

None of the thickeners are being operated properly and under present conditions proper operation of the thickeners may be impossible.

In the case of all concentrate products the rate of withdrawal from the thickeners is mainly governed by the dryers capacity and the filter down time. The thickeners appear to have ample capacity and the filters are operating with only 50% of the leaves installed. Ammeters are installed on all dryers and the operators are instructed to feed the dryers at the highest safe rate indicated by the ammeters measuring the dryer power input.

In a study of the system the following comments apply:

- 1- The ammeters are not adequate and should be replaced by recording instruments.
- 2- The actual operating capacities of any of the dryers is unknown. Recently an effort to determine this was made on the lead dryer. In a 24 hour period approximately 320 wet tons of concentrate was delivered to the bins. In the above period about 7 hours of lost time was incurred on filters, dryers and other. Thus the elapsed time rate is  $\frac{320}{24}$  or 13.25 wet tons per hour and the capacity rate at 100% is almost 19 wet ton per hour. Actual operating time was 72%.  
Tests should continue and every effort to improve operating hours should be made.
- 3- The automatic rake lowering devices are not considered

good practice. It has been suggested that remote torque and rake position indicators be installed and equipped with start-stop buttons for remote manual control of lowering the rakes.

- 4- Normally, thickener rakes are operated on the bottom and any condition forcing the automatic device to raise the rakes for protection is an emergency. It is obvious that the Anvil thickeners are continually operating under emergency conditions.
- 5- The thickeners, filters and dryers are in a closely linked chain and any problem in any of the links is immediately reflected in the balance of the chain.
- 6- It seems obvious that whenever the dried concentrate production is stopped or curtailed for any reason, that the thickener must accept and store the concentrate production from the mill. Conversely the thickener, filter, dryer complex must have sufficient capacity to catch up quickly on the thickener excess to restore normalcy. Therefore, dryer capacity must be analysed and abnormal down times on filter and dryers must be curtailed in order to maintain production of dried concentrate commensurate with the mill production. It is quite possible that additional dryer capacity might be required to satisfactorily achieve a production rate commensurate with 7000 tons of 12% combined grade which is the target. Therefore, it is imperative that the true capabilities of the systems be evaluated as quickly as possible and downtime analysed and eliminated whenever possible.
- 7- Weigh scales should be installed on all dryer product belts. This is to obtain daily production data as well as to provide operating standards.

#### FAIL SAFE DEVICES

A large number of complaints from the mill staff was listened to regarding failure of electrically operated safety devices. From some of the complaints investigated these seem justified.

#### BALL MILLS

Failure of protective devices resulted in two burnt out trunnion bearings.

Much of the protection was locally designed and is inadequate and in some cases was hooked up improperly and in the instance of one bearing on the regrind mill, was not hooked up at all. The oil flow switch and valve positions are not fool proof and are inadequate. Provisions was made by Hardinge for installation of a bearing temperature measurement. Instead an oil temperature device was installed. The latter is a much less effective device.

### THICKENERS

The locally designed automatic rake lowering devices should be removed.

The bent flange on the stub shaft on the bulk thickener was caused by overload. In this case either the overload protection failed to work, the system was not properly hooked up or the protective device was jumpered.

### GENERAL

I suggest a review of all such devices be made and inspection and testing for operability on a regular schedule be instituted.

### MAINTENANCE

Maintenance has made good progress in improving the physical features of the plant. Since July all four primary grinding mills have been relined and the bulk of reline requirements in the crushing plant for this year has been achieved. Maintenance wise the plant is now in reasonably good condition for sustained operations. It is now expected that maintenance can devote more energy toward correcting the many minor items that collectively constitute a major problem and also to further implement the preventative maintenance program.

More and closer association with operations is needed to make better use of downtime.

Overtime hours are excessive and must be more closely regulated. During August some individuals worked overtime hours far in excess of human ability to function efficiently.

Recent plans to rehabilitate the Rod Mills would appear to be an excellent, permanent solution to the problem of loose liners and distorted bolt holes.

However, stringent safety rules must be enforced in the Zincing step on the liners. For much of the year the liners will be brought into the mill in sub-zero temperatures with snow and ice clinging to them. Ample time should be allowed for warming, snow and ice melting and drying of these liners before

installation and zincing.

The cost of shell repair will be quite high. Recent prices indicated \$15.00 per insert plus freight and labor and welding materials or over \$3000 per mill for materials only.

#### OPERATIONS

Recent additions to the Mill Staff should greatly strengthen supervision and provide better guidance for the operation. There seems to be some lack of establishing chain of command and individual responsibility which is not good.

Lack of skilled operators and inability, because of rapid labor turnover, to institute good training programs is hampering operations.

#### PRODUCTION

The main deterrent to satisfactory production is still excessive plant downtime. In July the physical condition of the plant did not permit sustained production without breakdowns or emergency conditions of similar nature. During September operational problems were the principal source of downtime. So far in October maintenance downtime in excess of the normal required for the work has been the culprit.

In order that production be increased to desirable levels both operation and maintenance must work more closely both to screen the jobs required most urgently and to insure minimum scheduled downtime and maximum effort from maintenance during such scheduled downtime.

#### MILL REPORTS

Some thought should be given to preparation of a conventional daily mill report. The present type of daily report does not give any operating data.

It would appear useful to both Management and operations to produce such a report. Inasmuch as almost all of the essential data is available and recorded in the Mill Log no great added effort would be required to put this data on a sheet for convenience and allow for better use of the information.

Such a report should include screen analyses of final crusher product, Rod Mill feed and Float Feed. Operating hours on principal equipment, downtime and reasons, for, along with Assays, tonnages, shipment, man hours

R. E. Thurmond

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October 14, 1970

used in both operations and maintenance and other pertinent data.

I believe such a report is essential to permit day to day control of operations.

*W. A. Hamilton*

W. A. Hamilton  
Senior Project Engineer

WAH/dt

cc: E. S. Allen