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January 29, 1992
Project Number 60619

Curragh Resources Inc.
P.O. Box 1000
Faro, Yukon
Y0B 1K6

Attention: Leo Hwozdyk

Dear Leo:

RE: REVIEW OF ROCKFALL IN SN711 AREA

The rock fall experienced in the SN711 area is depicted in plan and section in Figure 1 and as a photographic plate in Figure 2. Please note that Figure 1 is based on approximate measurements as the area was, at the time, unstable and did not allow for exact measurements.

The fall occurred slightly after the slash round in the SN711 room was detonated. There was, however, evidence that the back was working during the loading of the slash round as large (up to 3 ft long) blocks were noticed falling behind the miners.

Geologic structure was the main cause of this failure. It is a wedge bounded by a low angle geologic structure (joint or fault) on one side together with two higher angle (steeper) structures. Maximum failure depth appears to be 7 to 8 feet, with a volume in the range of 150 - 200 tons. The failure is approximately 25 foot long parallel to the SN700 drift, extending into the SN711 area approximately 14 to 17 feet. Failure occurred immediately after the slash round was detonated as the wedge, which ultimately failed, was cantilevered over the room. The slash round removed the support under the pinned end of the cantilever, allowing failure.

Rock support in the area was composed of 6 foot split sets on an average 4 ft by 4 ft pattern (Curragh personnel estimate). As this was a structurally defined wedge, it became a suspension load on the bolts. Split sets are not designed for, nor do they function well, carrying suspended loads (SRK letter 04/12/91). In addition, they were not long enough to penetrate the observed failure planes. A simplified back analysis of the failure, based on the observations made for Figure 1, indicates a safety factor of 0.2. This does not take into account intact rock which may bring the factor of safety to near 1. The bolt pattern recommended in our letter (SRK 4/12/91) gives safety factors of 1.05 and 1.44 respectively for 8 ft long, 3/4 inch and 7/8 inch grouted bolts, not including the intact rock. It is impossible to say whether grouted

bolts, as recommended, would have prevented the fall as the ground is badly fractured, however, the numbers suggest that they could only have helped.

Recommendations

The south N, G, H, and possibly other areas which I am unaware of are similar in that they have a hanging wall composed of either muscovite schist or metabasite. They are also located in a structurally complex area, quite possibly the trough of a syncline, which has been faulted in a multitude of directions. In addition, the present mining design, with a room width of 30 feet, was developed in the South B area. This area had a relatively good back, composed of either quartzite or ore, and was at a shallower depth which resulted in a lower pillar stress. A summary of these negative factors affecting stability is:

- Weak hanging wall
- Structurally complicated area, faulted and jointed
- Increase in vertical stress (800 - 900 psi) compared to the South B (400 - 500 psi)

These all combine to render the present mining practice in the above mentioned areas unsuitable. No exact solution can be given to the problem, however a series of options will be given for your action.

Remain at the same mining span, support the back

Adequately supporting the back would entail using 8 to 10 foot long grouted bolts on 4 to 5 foot centers. Split sets would be required between the grouted bolts as a fill-in support measure to support the smaller rock blocks. Mesh or strap would also be required to prevent ravelling from around the bolts as well as to protect the miners during benching operations. Pull tests would be required on the grouted bolts in order to determine if they are holding correctly in the talc and muscovite schists. Cement grouted bolts would be preferred. A motion alert system, such as tell-tales or extensometers would be required to verify if the support system is effective.

Prognosis: Uncertain. The back can be supported but will be expensive and will require continual verification.

Remain at the same span, leave ore in the back

A minimum thickness of ore, varying from 4 to 6 feet, could be left in the back. The ore could then be supported as required. This would require a good knowledge of the back before excavation so that the

hanging wall is not daylighted. It would also require a knowledge of the competency of the hanging wall as well as a knowledge of the jointing/faulting within the ore remaining in the back. Support would of necessity be adjusted to conform to the above mentioned parameters, requiring some site specific rock mechanics engineering.

Prognosis: Will work if the above criteria are followed. It would be an economic alternative if the ore is too thick to mine with the present design for your room and pillar methods or if more reserves exist than will be mined before closure.

Reduce mining spans

Reducing the mining span from 30 foot to 20 foot would dramatically decrease the size and total depth of potential failures. As such, the support requirements, in terms of length of support and support intensity would be reduced compared to the other two options. Pillar sizes can be reduced according to the design methods outlined in our previous letters to reflect the change in the area which they are supporting. Longer bolts should still be used and where suspension type loads are suspected, grouted bolts should be used. Pillars, being thinner, will be much more sensitive to damage and undercutting. As such, extra care must be taken while cutting the initial pillar and during benching. As a direct consequence, pillar bolting will become more critical to prevent pillar slabbing as well as to contain damaged rock.

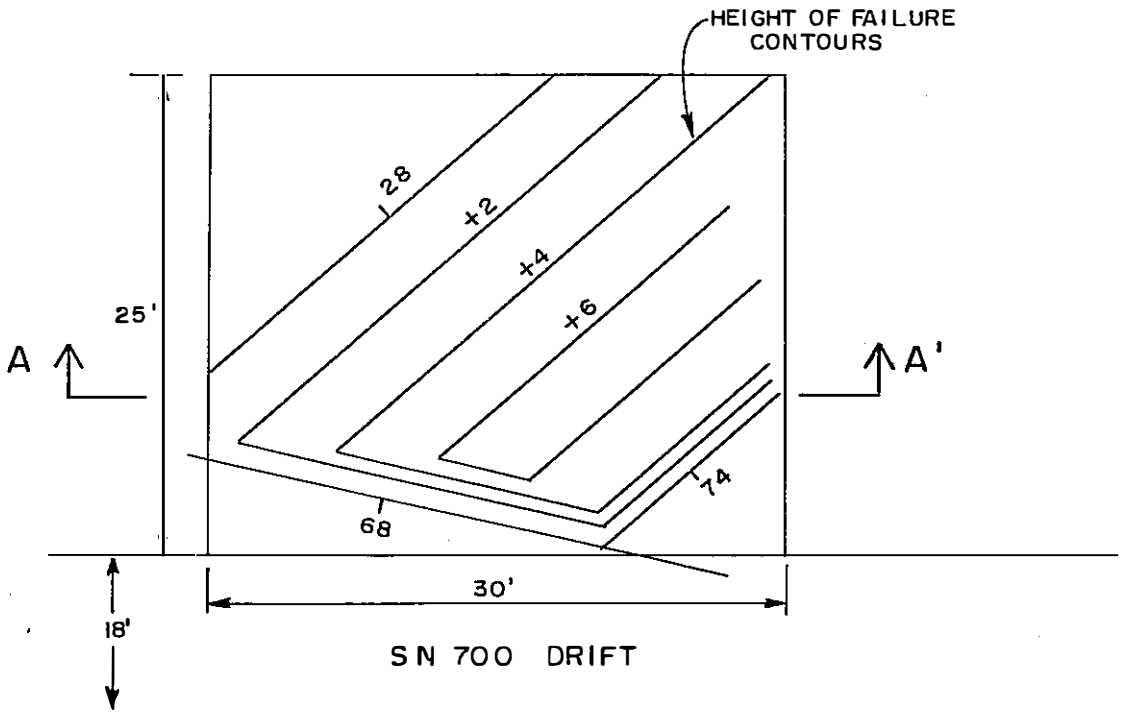
Prognosis: Area will become more stable. Will make mining slightly more difficult and reduce the total extractable resource (decreased extraction ratio). Production may suffer. It does not mean that all rock mechanics problems will be eliminated.

This concludes the assessment of the rockfall in SN711. A summary of the site visit will follow shortly.

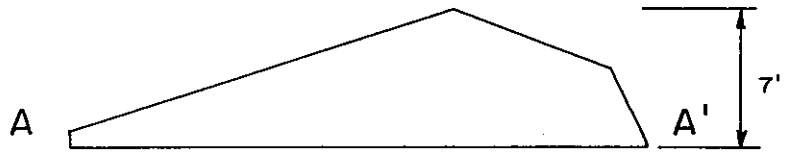
Yours truly,

STEFFEN, ROBERTSON AND KIRSTEN (B.C.) INC.

James I. Mathis
JIM/065



PLAN VIEW



SECTION

SCALE - 1" = 10'

CURRAGH RESOURCES LTD. FARO UNDERGROUND	DATE JAN. 1992
SN 711 ROCKFALL APPROXIMATE DIMENSIONS	PROJ. NO. 60619
	APPROVED
	NO. 1
STEFFEN ROBERTSON & KIRSTEN, Consulting Engineers	