

CASE HISTORY OF FARO-VANGORDA AREAYUKON TERRITORYGeneral:

Insofar as the Faro-Vangorda area is a relatively isolated one, the history of its development as a mining area affords an unusually clear and well documented example of the evolution of an important mining camp. The effects of corporate decision-making, exploration efforts and techniques, and engineering expertise are demonstrated. Within this historical framework, we find the usual ingredients of exploration success, which include inspiration, determination, and to a certain degree, just plain luck.

For this reason, I have decided to enlarge this paper to the scope of a Case History on the Faro-Vangorda area with emphasis on the Grum deposit. The Kerr Addison-AEX Grum deposit is in this context one link in a chain of discoveries in this area, which we hope will be continued.

At this point, I would like to mention politics briefly, and will promise not to bring it up again. For our purposes, it will be sufficient to observe that in the Yukon Territory,

we are faced with only one governmental authority, thereby avoiding the morass of conflicting policies in ownership and taxation which is severely damaging our mining industry in Canada. There are, for example, three Provinces in Canada in which, at this time, the development of the Grum deposit would be economically unfeasible. It used to be that the finding and mining of a mineral deposit were the major problems.

Location, Topography:

The Vangorda Area is located 120 miles northeast of Whitehorse in the Yukon Territory. It lies close to the Pelly River which is tributary to the famous Yukon River. The area is mountainous, forming part of the Anvil Range. In the immediate area, Mount Nye, with an elevation of 6,763 feet, is the highest peak, rising from the Pelly River elevation of approximately 2,500 feet. Local relief in the deposit areas is about 1,000 feet, and the topography tends to be rolling. The area is well wooded to an elevation of about 4,000 feet.

The area is presently accessible by road from Whitehorse via Carmacks, and from Ross River. The all-weather road through Carmacks is used to haul concentrates from the Anvil Mine at Faro to the White Pass Railway at Whitehorse, a distance of about 200 miles.

The town of Faro, built to house employees at the Anvil Mine, has a population of about 1,800. The Anvil Mine lies

about 6 miles north of the town, and the Vangorda-Grum deposits about 4 miles east.

Geology of the Area:

The oldest rocks in the vicinity of Faro are identified as Cambrian to early Ordovician in age. They include calcareous phyllites, sericitic phyllites, chloritic phyllites, and carbonaceous phyllites and all combinations thereof. They strike north westerly in the general sense, but have been highly folded and contorted by thrusting from the northeast and by lateral movement related to northwesterly faulting of considerable magnitude. These rocks are host to the Anvil-Vangorda lead-zinc deposits.

Overlying these rocks to the southwest, and probably largely in fault contact with them are argillaceous and tuffaceous cherts and basalts of Pennsylvanian age.

Intrusive into the Cambrian series on the northeast is the Anvil batholith. This is a Cretaceous intrusive mass ranging from a granodiorite to a quartz monzonite. It is sometimes porphyritic in character.

Structurally, the Anvil batholith occupies the Anvil arch or dome to the northeast. The deposit area is bounded on the southwest by the Tintina Trench, which forms the bed of the Pelly River. The Tintina Trench is a large and complex fault system which can be traced in a northwesterly direction for over 600 miles. Two hundred and fifty (250) miles of

right lateral displacement has been postulated, and movement has taken place from Cretaceous to Tertiary times. Subsidiary faulting parallel to and at right angles to the Tintina system is common in the area.

Mineralization in the Anvil-Vangorda area consists of stratiform zones of pyrite, galena, sphalerite and chalcopyrite generally situated in the broad contact zone between sericite phyllite and graphitic phyllite in the Cambrian rocks close to the Anvil batholith.

Without wishing to elaborate on the genetic implications, we can refer to these deposits as the large replacement type. It is interesting to note that in similar Cambrian rocks lying south of the Tintina fault system, lead and zinc are indeed present, but only in veins or fracture zones.

Historical Summary:

- 1953: A. Kulan, prospector from Ross River, located the outcrop of the Vangorda deposit on Vangorda Creek. He was shown the outcrop of high-grade zinc by an Indian and staked it. The property was optioned that year to Prospectors Airways Ltd.
- 1954-56: Additional staking, prospecting, magnetic and electromagnetic surveying by Prospectors Airways Ltd. Diamond drilling and X-Ray drilling during period outlined the Vangorda deposit, estimated to contain 9.4 million tons of sulphide material grading 3.16% Pb; 4.69% Zn; 0.27% Cu; 1.76 oz. Ag; 0.02 oz. Au. An additional 12 million tons of low-grade pyritic sulphide material is present. Dr. E. O. Chisholm directed this operation.

In 1955, A. Kulan, working for Prospectors Airways Ltd., staked the Gal Group, 9 miles northwest of the Vangorda deposit on a transported gossan with some copper-silver float in the vicinity. Geophysical and geochemical surveys were completed on this group; 3 packsack drill holes were attempted, none of which reached bedrock. The claims were allowed to lapse, and were acquired later by Dynasty Explorations, which subsequently located the Faro #2 deposit on them.

Also in 1955, Vangorda Mines Ltd. was formed to acquire the Vangorda deposit and surrounding claims. Prospectors Airways Ltd. remained in a control position.

1957-61:

Little additional work in area and on the Vangorda deposit. Size and metallurgical difficulties with the ore coupled with access problems precluded development.

1962:

Kerr Addison Mines Ltd., in cooperation with Prospectors Airways Ltd., reinstated exploration in the area. Mr. W. M. Sirola of Kerr suggested insofar as the Vangorda deposit was magnetically active that an aeromagnetic survey should be carried out. This was done using a small Elsec magnetometer in a light aircraft. Claims were staked in the Swim Lake area, 6 miles southeast of the Vangorda deposit to cover an aeromagnetic anomaly, and additional claims were acquired by Kerr in the Vangorda area at this time. The north end of the aerosurvey area reached the south end of the Faro deposit.

1963:

A. Kulan restaked the Gal claims in the Faro deposit area, and optioned the claims to Kerr Addison. All undertakings of Prospectors Airways were assumed by Kerr Addison Mines Ltd. during that year, and the company became dormant. Primary drilling on the Swim Lake magnetic anomaly gave only small encouragement.

1964:

Test drilling located the Swim deposit, estimated as containing approximately 6 million tons of sulphide material grading 9.5% combined lead-zinc and 1.5 oz. Ag/ton. Actual location was on basis of gravity survey.

The Dynasty Exploration Syndicate acquired the Gal claims and added ground. In the fall, their last scheduled hole, on a geochemical anomaly, intersected strong lead-zinc mineralization in what later became the Faro #1 deposit. Dr. A. Aho guided operations for the Dynasty Syndicate.

Gravity surveys were instituted in the area that year, and proved highly significant.

1965:

The Dynasty Syndicate, backed financially by Cyprus Mines Corporation on a joint venture basis located the Faro #2 deposit and proceeded with development drilling.

1966-68:

Anvil Mining Corporation (60% Cyprus and 40% Dynasty) was formed to develop the Anvil mine. The deposit was estimated to contain 67,400,000 tons of open pittable sulphide ore grading 3.4% Pb, 5.7% Zn, and 1.2 oz. Ag/ton. Development and construction work on the Anvil mine and town of Faro during this period.

1969:

Anvil mine production at about 5,500 tons/day realized; town of Faro completed. Costs total approximately \$91 million. Metallurgical difficulties were experienced at startup, and these have been continually worked on over the producing life of the mine. Marketing of concentrate largely to Japanese.

1970-72:

Exploration in area by Anvil Mining Corporation and, to some extent, Kerr Addison. No significant discoveries.

Note that little deeper drilling was done, even in known deposit areas because it was felt that only near surface open pittable deposits would be of economic interest.

1973:

Option of Vangorda and Kerr Addison claims exclusive of known deposits to the AEX Syndicate headed by Dr. A. Aho. One hole drilled on a weak residual gravity anomaly on Kerr claims intersected 19 feet of good grade lead-zinc mineralization at 656 feet. This was the Grum zone.

1974:

Drilling by Kerr Addison and AEX, now on a 60% Kerr, 40% AEX basis, outlined a large zone of

sulphide mineralization plunging northwesterly at an average depth of about 500 feet. It has been intersected as deep as 1,800 feet.

1975: Programme of underground test work and development drilling on Grum deposit. \$6 million programme with estimated pre-production cost of \$80 million at 3,000 tons per day.

Tonnages in the 30 million range grading +10% combined lead-zinc have been reported in the press. This is probably conservative in terms of total sulphide mineralization, but may be radically decreased depending on limitations imposed by underground mining. Feasibility studies are now in progress.

The reason for this sketchy historical review is to highlight the salient features of the development of the area over a 22-year period. It is very interesting to note that, in effect, each of the major deposits in the area was found by a different method. To elaborate: --

Vangorda Deposit - prospecting, visual discovery;

Anvil Mine (Faro Deposits) - geochemical anomaly test;

Swim Deposit - aeromagnetic anomaly test;

Grum Deposit - gravity anomaly test.

Discussion of Geophysical/Geochemical
Characteristics of Vangorda Area:

Obviously, all the various exploration methods embodied under the general heading of Geophysics have merit in this area; however, some comments as to their effectiveness would be worthwhile.

Magnetics: Magnetite concentrations in argillitic phyllites are common and do not seem to bear any direct relation

to sulphide mineralization. In the broad sense, however, areas of sulphide deposition do show recognizable magnetic activity. Pyrrhotite is present in the deposits, especially in peripheral areas. Unfortunately the response to pyrrhotite seems to lie in a range subordinate to that of the magnetite zones.

Electromagnetics: Needless to say, the sulphide deposits of the area, where close to surface, do give an excellent electromagnetic response. Induced potential surveys are also effective. However, the ubiquitous presence of graphitic phyllites complicates the picture to the point that such surveys are of very doubtful value as an exploration tool.

Geochemistry: Rock and soil geochemistry are obviously effective exploration tools in the area, but the wide distribution of mineralization of minor nature limits the value of such surveys in the detailed sense. Mercury, present in considerable quantities in all of the known deposits, is again so widespread in distribution as to seriously limit its use as an indicator.

Gravity: The most dependable geophysical exploration method, having given recognizable response over all known deposits. The variations in topography with attendant overburden conditions can cause interpretive problems particularly in relation to deeper deposits such as the Grum. The half milligal residual anomaly over the Grum can, in fact, be theoretically explained by overburden conditions. The wisdom

of drilling a doubtful gravity situation has been well demonstrated.

The Geology of the Grum Deposit:

The Grum deposit lies in the contact area between underlying sericitic phyllite and overlying graphitic phyllite. Intercalated with these two basic types is a chloritic sericite phyllite which has been used as a marker horizon in structural considerations. It will be appreciated that the contact zone is likely an ancient sedimentary interface area in which alternating or interfingering bands of graphite-rich and sericite-rich material occur.

Overlying this sequence, and in evidence in the northernmost portion of the deposit area is a calcareous chlorite-sericite phyllite. This formation is also present at the Anvil mine, but has not been recognized in the vicinity of the Vangorda and Swim deposits.

To the northeast of the deposit area the Anvil granodiorite occurs. The south contact of the intrusive appears to dip to the southwest, and underlies the formations described. The development of biotite, staurolite and garnet is noted in the phyllitic rocks in proximity to the intrusive. Notably these metamorphic derivatives occur below the central part of the Grum ore zone at a depth of about 1,000 feet.

The ore-bearing structure appears to be a northwesterly striking overturned fold system along which pyrite, sphalerite,

and galena occur in a grossly cigar-shaped configuration. Tabular sulphide zones occur on what may be termed fold limbs. Generally strong silicification is present along with barite, minor pyrrhotite, chalcopyrite, magnetite, and rarely arsenopyrite.

Strike faulting is present both parallel to the plane of folding and with a steep dip to the southeast. Steeply dipping cross-faulting is also present, but there does not seem to be any major offset involved.

Broad open cross-folding with axes trending southwesterly is present, but this feature is not well documented in the Grum deposit area as yet.

In the general sense, mineralization occurs in both the F-1 (bedding) planes and in the F-2 (main fold cleavage) planes. Again, in the general sense, it can be said that the higher grade ore occurs in tabular masses up to 50 feet thick in areas where the F-1 and F-2 planes coincide. Lower grade, high pyritic zones are developed in the nose of folds where the F-1 and F-2 planes are developed at right angles to each other. The latter ore type tends to be associated with strong silicification and may be expected to exhibit greater thicknesses and good continuity.

Comments on Economic Evaluation
of the Grum Deposit:

I have referred to the Grum tonnage and grade estimates which have appeared in the press, most recently in The Northern

Miner of November 13, 1975. These estimates are based on drilling results from 120 holes at 200-foot intervals over a length of 2,800 feet and a width of 1,000 feet more or less. The figures are reasonable in rough fashion, but please note that they are not referred to as "ore."

As you will appreciate from the description of the Grum mineralized zone, it is a highly complex one. An accurate estimate of ore reserves will not be possible until we have completed our exploratory underground drive, and considerable underground drilling. Through data so obtained, we will be able to establish continuity of the mineralized zones, develop a mining system for the most efficient extraction, and carry out more extensive metallurgical testing. We will then be able to calculate tonnage and grade and estimate mining and milling costs at a recognized confidence level, and proceed with a rate-of-return estimate. In this regard, we generally like to see a reasonably assured rate of return on capital of about 15% before committing to production.

It will be appreciated that the rate-of-return is calculated by estimating profit per ton of ore less operating costs on an annual basis at the most favourable rate of production. Provision is made for repayment of capital and preproduction costs plus interest, taxes, and royalties, if any, on the same basis. It can be seen that this calculation is a very delicate fabrication and very sensitive to many potential variables not the least of which are metal prices and taxation.

It would be well to point out in this context that there is one popular misconception in the evaluation of orebodies which is the source of much misunderstanding. That is, the value of the recoverable metal in a ton of ore is not calculated on the basis of quoted market price, but rather what you can get for it. Thus, a net smelter return value must be used in evaluation, which involves deductions for treating, handling and marketing. For example, at the current price of zinc, which is around 31¢/pound, an approximate net smelter return value would lie in the range of 16¢ to 16½¢/pound. Thus, in the case of the Grum, where zinc is the most important constituent, the basic real value is approximately one half of the apparent value.

In conclusion, I would like to apologize for dwelling inordinately on factors other than geological relevant to the Faro-Vangorda area and the Grum deposit. However, I feel that they provide insight into the field of mineral exploration generally, and are well worth bringing to your attention.

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Toronto, Ontario

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References:

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