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EXPLORATION METHODS AND DISCOVERY HISTORIES

ANVIL DISTRICT, YUKON TERRITORY

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Abstract

Five lower Paleozoic, stratiform, sediment-hosted, pyritic, Pb-Zn-Ag-(Ba), massive sulfide deposits have been discovered in the polydeformed Anvil District over the last thirty years. A geological summary of the district provides a background for a chronologic review of deposit discovery histories. These histories follow a classical pattern of evolving exploration methods as a function of deposit depth from prospecting (Vangorda, 1952) through saturation geophysics and geochemistry (Swim, 1964; Faro, 1965; Grum, 1973) to geological modelling (DY, 1976). Ongoing exploration is guided by an evolving understanding of district structure and stratigraphy, coupled with a synsedimentary exhalative model of deposit origin.

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INTRODUCTION

Over a thirty-year period from 1952 to the present, five stratiform, stratabound, pyritic, massive lead-zinc-silver deposits have been discovered in upper Proterozoic to lowest Paleozoic pelitic metasediments of Anvil Range, Yukon Territory (Figure 1). Numerous papers have described methodologies and discovery histories of individual deposits (Chisholm, 1957; Brock, 1973; Sirola, 1975) but a comprehensive review of evolving exploration strategies leading to more recent discoveries in Anvil District has not been given. This paper capsulizes the geology of the district as a setting for a systematic review of deposit discovery methods emphasizing prospecting in the initial discovery of Vangorda; saturation geophysics in the discoveries of Swim, Faro and Grum and geological modelling in the discovery of the blind, deeply buried DY deposit. This evolution of principal deposit discovery methods predictably follows a time and depth of deposit sequence involving initial prospecting for outcropping deposits followed by indirect geophysical and geochemical prospecting for intermediate depth deposits (to approximately 150 meters) followed by testing of geological models for deeply buried deposits (to 1,000± meters).

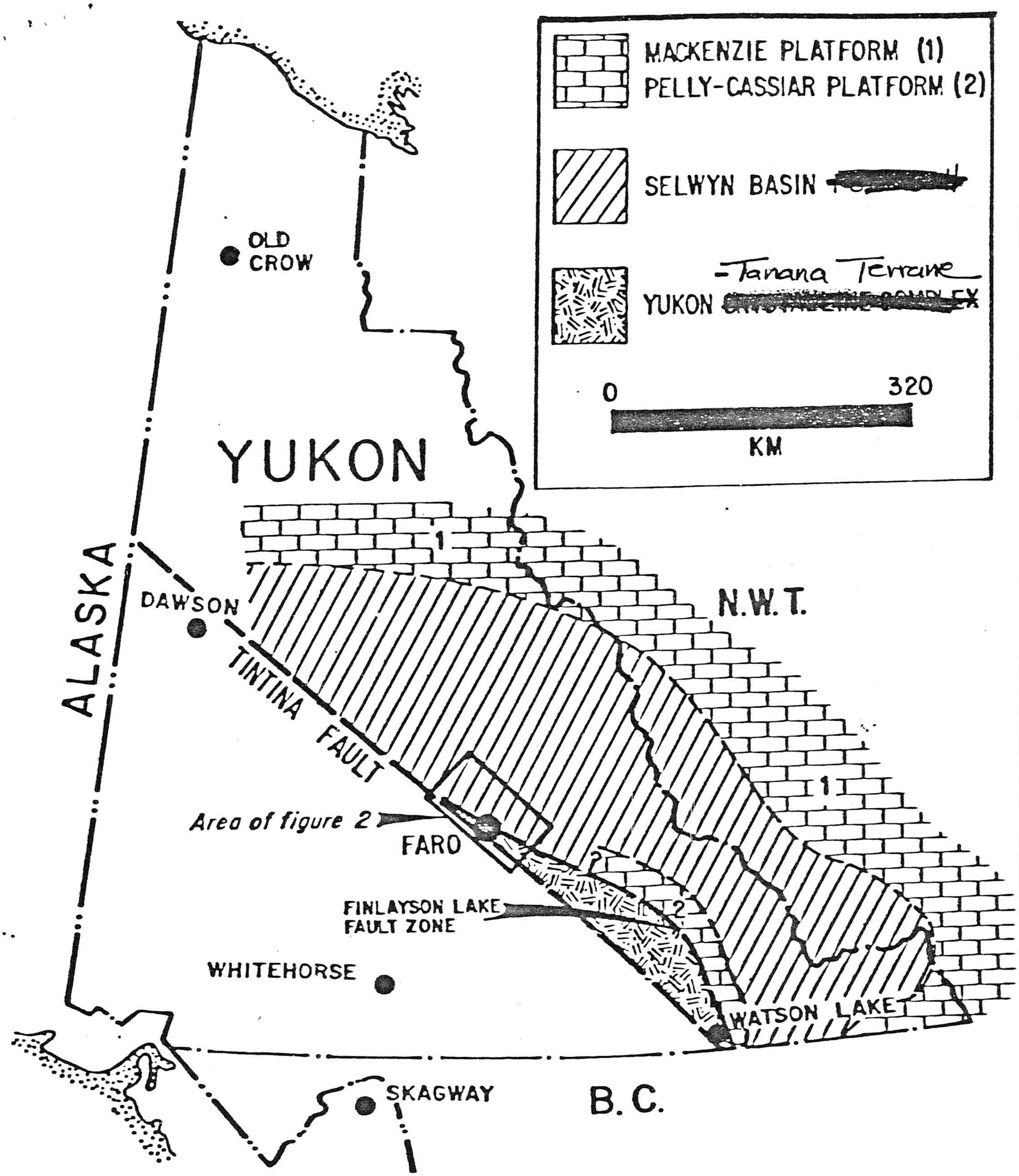

Figure 1: Location Map Showing Anvil District in Relation to Selected ~~Major~~ Tectonic Features

GEOLOGY OF THE ANVIL DISTRICT

Tectonically, Anvil District lies along the extreme southwestern margin of present day Selwyn Basin immediately northeast of two major Mesozoic transcurrent faults, near the imperfectly defined northwestern terminus of Pelly-Cassiar Platform (Figure 1). The detailed geology of this belt and its ore deposits is the subject of a recent paper (Jennings and Jilson, in press); only aspects relevant to the present paper will be summarized.

The stratigraphic section of Anvil District is divided into a lower and upper division, aggregating approximately 5 kilometers in thickness and ranging in age from latest Precambrian to Permian. The lower division of about 4 kilometers thickness is dominantly metapelites of varying carbonate and carbon content with lesser basaltic, metavolcanic rocks. These Upper Proterozoic to Silurian rocks host all known sulfide deposits and are comfortably North American. The upper division is dominated by varicolored phyllitic cherts capped by a monotonous sequence of massive, alkali basalt. At least part of this division is considered allochthonous and therefore suspect.

The Anvil District ore deposits lie entirely within the lower division, which is divisible into three regionally mappable formations or units. A monotonous package of variably metamorphosed, non-calcareous, pelitic rocks at least 2 kilometers thick named Mt. Mye Formation is the oldest sequence in Anvil District. It is thought to represent relatively deep water, basinal turbidites correlative with lowermost Cambrian strata of MacKenzie Platform and the shaley, upper portion of the Upper Proterozoic Grit Unit (Jennings and Jilson, op cit.). The base of Mt. Mye Formation is not exposed in Anvil District and coarse, siliceous clastic rocks typical of Grit Unit are not seen. The uppermost 500 meters of the formation appears more heterogeneous with prominant graphitic phyllite units, a reasonably well-developed calc-silicate phyllite horizon, lesser finely to medium crystalline, light gray, calcitic marble and minor metabasite interleaved with the dominant, non-calcareous, rusty gray-brown weathering, medium to dark gray fresh muscovite-chlorite phyllites typical of the formation. A variable, regional metamorphic overprint coarsens these phyllites locally to amphibolite facies schists with quartz-biotite-muscovite-andalusite±staurolite±garnet as the characteristic phase assemblage(s).

Mt. Mye Formation shows a narrowly gradational to reasonably sharp contact with overlying Vangorda Formation calcareous phyllites. The carbonate content of Vangorda Formation is its principal distinguishing feature from underlying Mt. Mye. In the greenschist facies portion of the district, Vangorda phyllites develop a characteristic light to medium bluish gray, drusy, weathered color and on fresh surfaces are silvery, light to medium, tan-gray. The dominant phase assemblage at this grade is muscovite-chlorite-quartz-plagioclase-calcite±dolomite. Color variation from numerous shades of gray to nearly black to dull, olive green is thought to be controlled mainly by variation in carbon content (Jennings and Jilson, ibid.). The base of Vangorda Formation is marked by a moderately but variably thick, laterally continuous, black, graphitic phyllite unit often interleaved with chloritic phyllites and basaltic metabasites. Normal, calcareous or carbonate-bearing phyllites occur above this basal unit and generally increase in carbonate content upward through the formation. A parallel increase is noted in the abundance of metabasites upsection. Generally, metabasites form 10% to 15% of the unit by volume but toward the top may locally form 30% to 50%. Vangorda Formation is approximately 1 kilometer in thickness as measured commonly in cross section. In higher metamorphic domains of the district, Vangorda Formation calcareous phyllites are converted to characteristically lensoidally striped, light yellowish ~~to green~~ to green and purplish brown calc-silicates. This metamorphic transition begins in upper greenschist facies with the breakdown of chlorite to biotite in pelitic layers and the formation of tremolite-actinolite±epidote or diopside assemblages in carbonate-bearing, siliceous bands. Vangorda Formation is correlated with at least the lower part of Kechika Group and with Rabbitkettle Formation (Jennings and Jilson, in press). It is presumed to represent the metamorphosed equivalent of thinly interlayered, noncalcareous pelite and calcareous siltstone bands of probable turbidite origin deposited in moderate basinal depths.

The uppermost horizons of Vangorda Formation are interleaved with subalkaline to alkaline basalts of Menzie Creek Volcanic Unit (Jennings and Jilson, ibid.). This unit, about 1 kilometer thick on average, consists of generally dull, olive-green to medium dark green, variably carbonated, pillow lavas, massive flows, homolithic breccias of diverse origins, bedded basaltic tuffs and minor volcaniclastic sediments. Medium grey to black, siliceous phyllite and slate are interleaved, principally with ~~, particularly,~~ the lower portions of the unit. Locally, these phyllites are associated with gray-brown graptolitic siltstones and orthoquartzites higher in the pile. Faunal collections from this higher sequence (Tempelman-Kluit, 1972; Gordey, 1983) imply a mid-Ordovician to lower Silurian age for Menzie Creek and commensurately older ages for Vangorda and Mt. Mye Formations in accord with their regional correlations. The distribution of original depositional units in Anvil District is shown in Figure 2 with stratigraphic summary and correlations in Figure 3.

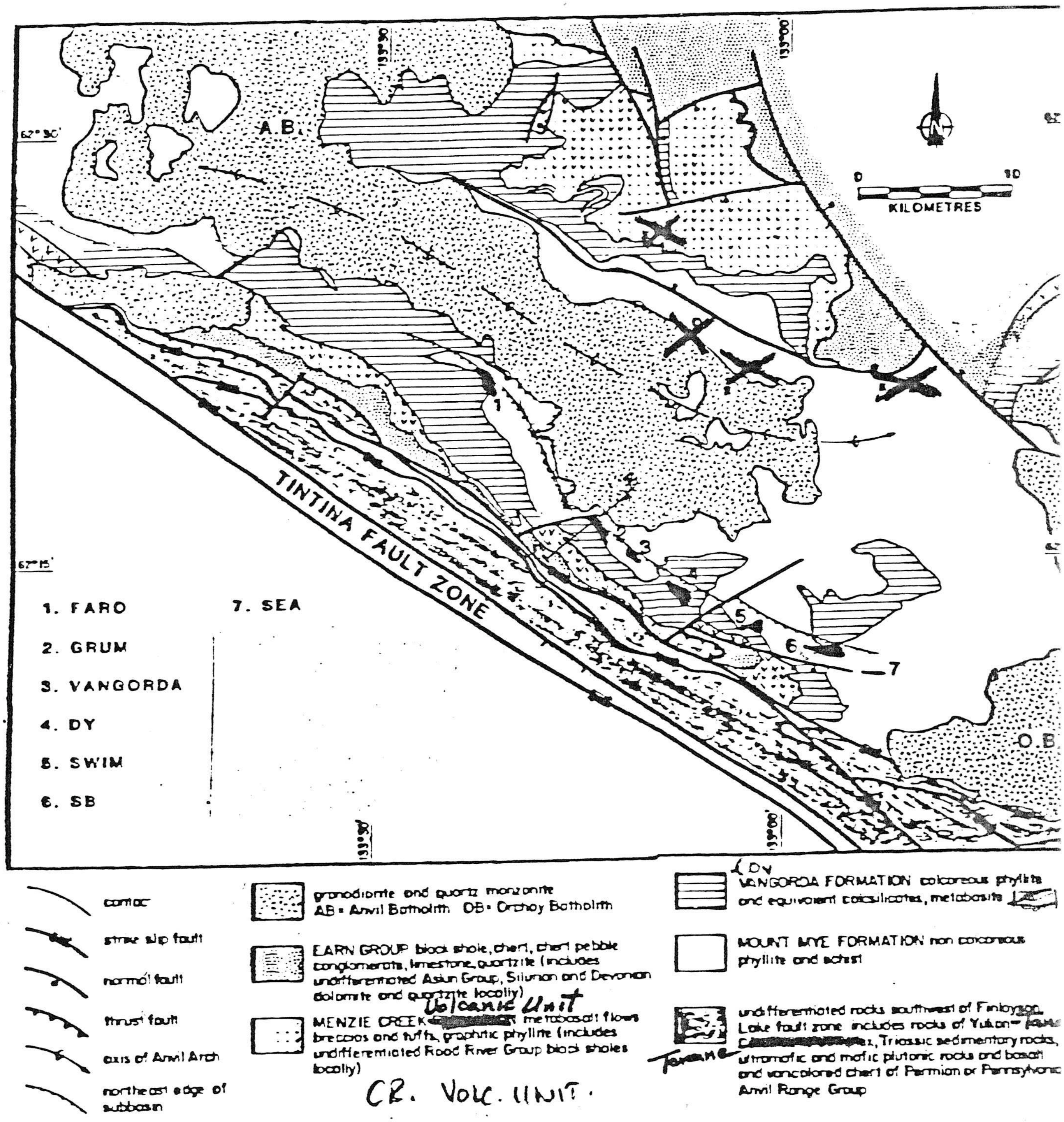

Figure 2

Geologic map of the Anvil ~~Pb Zn Ag~~ District showing location of ore deposits, ~~and~~ prospects and major stratigraphic units

GAJ to provide final

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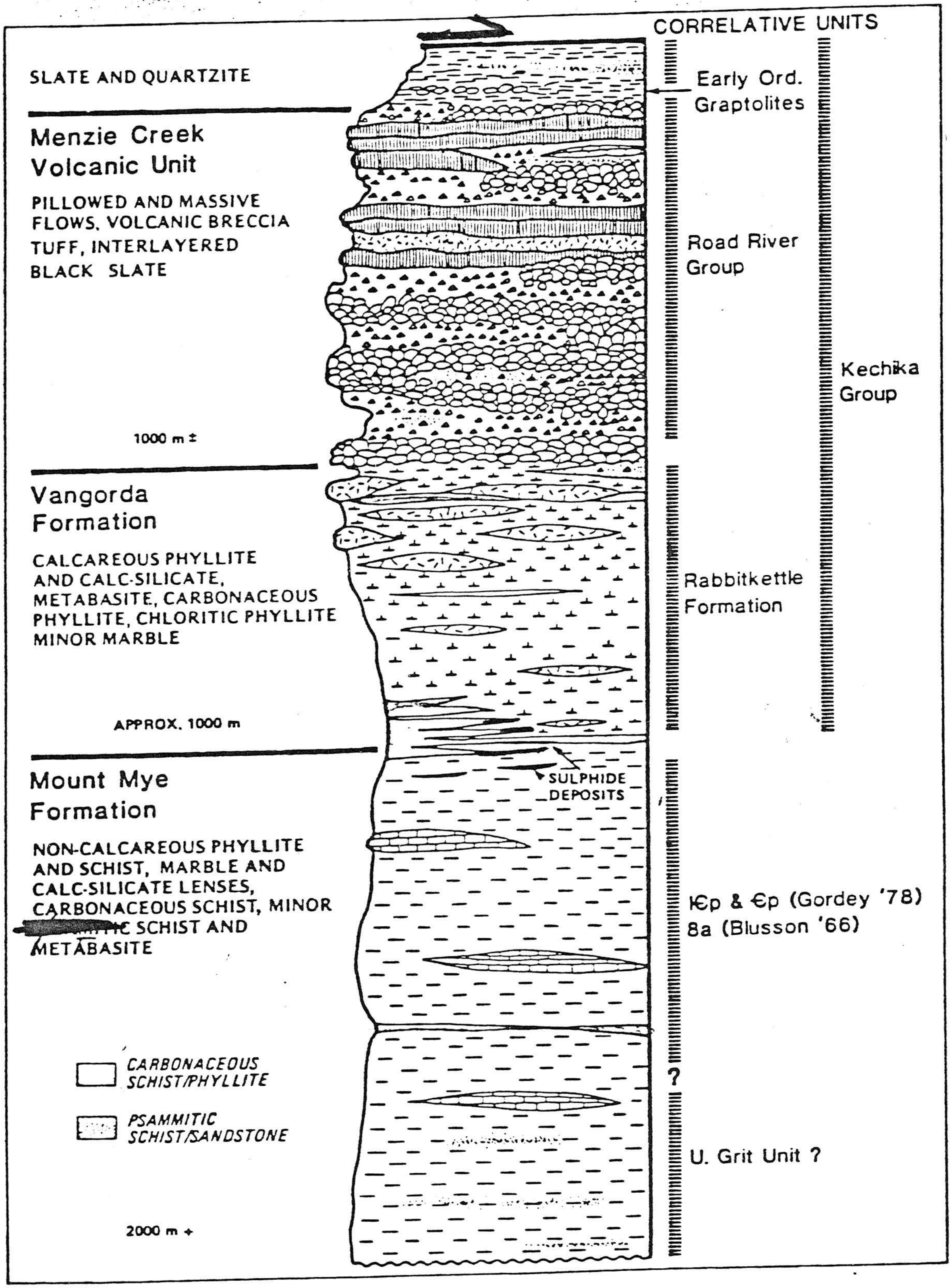

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Figure 3: Diagramatic stratigraphic section of the lower division of Anvil Range showing relation of ore deposits to stratigraphy and regional correlations.

STRUCTURE

Both stratigraphic divisions in Anvil District have experienced a complex, polydeformational, polymetamorphic history. Two overlapping, regional metamorphic events with up to five periods of folding have been recognized. The structural evolution of the belt is treated in detail by Jennings and Jilson (in press), and will be recapped here by reference to a partial cross section through Anvil Range (Figure 4). The most prominent feature is the right-side-up, lower division, stratigraphic panel forming the southwest flank of Anvil Arch; the large, open, dominant, late stage fold in the district (Figure 2). Superimposed on this panel are several first phase Z symmetry folds in bedding with amplitudes greater than 500 meters, creating map unit closures in plan (e.g. northwest of Faro). The steeply southwesterly dipping axial planar foliation of these folds is intensely crenulated by a shallow southwesterly dipping younger foliation which produces complex second phase folds, interference patterns and strong lithon structure in the rocks at all scales (Figure 4). Broad, open to locally tight folds subsequently affect this younger foliation. Anvil Arch itself is the largest example of a broad antiformal third phase flexure in this foliation. While this internal geometry relates to a macroscopic example, identical fabric relations are seen on the meso- and microscopic scale. An understanding of the structural history of the district has become essential for continued, successful exploration.

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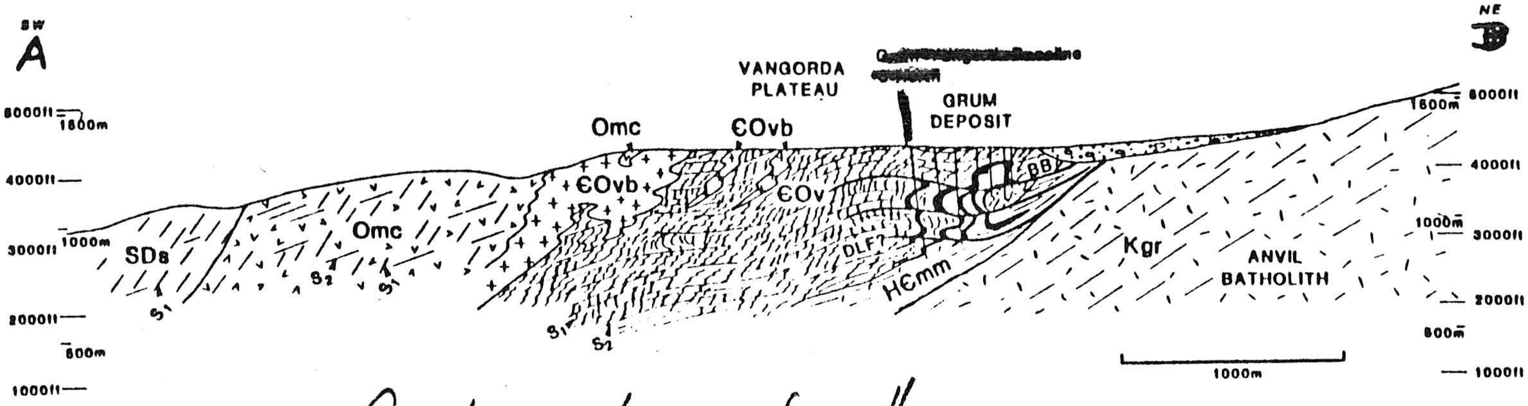


Re-draw w/ correct patterns

Figure 4: Cross section through Vangorda Plateau and Grum Deposit looking northwest illustrating effects of polyphase folding

ORE DEPOSITS

Known ore deposits of Anvil District are distributed through a 150 meter thick interval straddling the contact of Mt. Mye and Vangorda Formations. The deposits occur as single or multi-layered pyritic, quartzose, stratiform layers generally associated with regionally developed, laterally discontinuous graphitic phyllite units which are, in part, their lateral equivalents. There are presently five known deposits distributed along a curvilinear trend on the south flank of Anvil Arch (Figure 2). From northwest to southeast, they are Faro, Grum, Vangorda, DY and Swim. Two base metal poor, sulfide occurrences, SB and Sea, are also known. The bulk of the deposits, or of any given, multi-layered deposit, occurs within Mt. Mye Formation but the uppermost horizons in Grum and DY are definitely within basal Vangorda Formation. Pre-mining geological reserves of 120,000,000 tonnes of 9% combined lead-zinc with approximately 45-50 grams/tonne silver are estimated for these five deposits, remaining reserves are shown in ~~(~~Table 1~~)~~. While the bulk of basaltic, meta-igneous rocks occur up-section of the ore deposits, the first pulse of basaltic activity is approximately coincident with the ore horizons, suggesting at least a temporal connection between ore deposition and basaltic magmatism (Jennings et al, 1980). Nonetheless, the Anvil deposits are dominantly pelitic sediment hosted, associated with a "pinch out" of ore facies and equivalent reduced basinal, carbonaceous pelites ~~against~~ along a strongly developed northwest-southeast trend. It is appealing to suggest this trend represents an ancient syn-sedimentary growth fault bundle localizing the site of ore fluid exhalation, basaltic extrusion and ponding of deposit~~s~~-forming brines in reduced basinal sediments.

TABLE 1

1982 Reserves for Anvil District Deposits

Deposit	Proven Geological Reserves (Million Tonnes)	Grade Lead %	 Zinc %	 Silver (gm/t)	Cutoff (Pb+Zn) %	Est.Total Sulfide Tonnage (Million Tonnes)
Faro	33.0	3.0	4.6	35.7	4.0	70*
Grum	30.8	3.1	4.9	49.0	4.0	60–80
Vangorda	7.1	3.4	4.3	48.0	5.0	15–20
DY	20.3	5.7	7.0	82.0	9.0	70–90
Swim	4.3	3.8	4.7	42.0	6.0	8–10

After Yukon Exploration and Geology (1982)

*(before mining)

The Anvil deposits are strongly zoned with respect to their sulfide lithofacies and metals distribution (Figure 5). The base of an idealized deposit is ribbon-banded, sulfide-bearing, graphitic quartzites succeeded upwards by base metal sulfide bearing pyritic quartzites, massive pyritic sulfides and massive baritic and pyritic sulfides. This cyclic lithofacies arrangement, termed the Anvil Cycle, is also repeated laterally with the lower, disseminated, quartzose facies being more distal and transitional outward into reduced basinal pelites. On the basis of limited data, metal zonation appears to crudely follow lithofacies distribution in that the lower quartzose disseminated sulfide facies are zinc enriched while the upper massive sulfide facies are lead-silver-(barite) enriched. Cyclicity occurs from a deposit scale~~, e.g.~~ to a 1 meter scale, and may be complete, interrupted or partially developed, generating sub-cycles within overall larger scale cycles. The cyclicity is suggestive of either or both repetitively occurring physiochemical factors at the site of sulfide deposition or in the reservoir site of brine evolution.

The cyclicity of ore facies has a strong effect on grade distribution. The major ore facies, graphitic, siliceous, pyritic and baritic have different milling characteristics and all display internal grade variations from less than 4% combined lead-zinc to over 15% combined lead-zinc. This, together with an overall tendancy for the more massive baritic and pyritic variants to be generally higher grade, introduces a marked grade variation, effective on scales from a few ~~feet~~ meters to an open pit mining phase. Unfortunately, initial production from Faro took the exceptionally homogeneous No. 1 orebody which de-emphasized the extreme grade variations inherent in all other Anvil deposits, including the balance of Faro. This aspect is now well documented and included in production plans for future development.

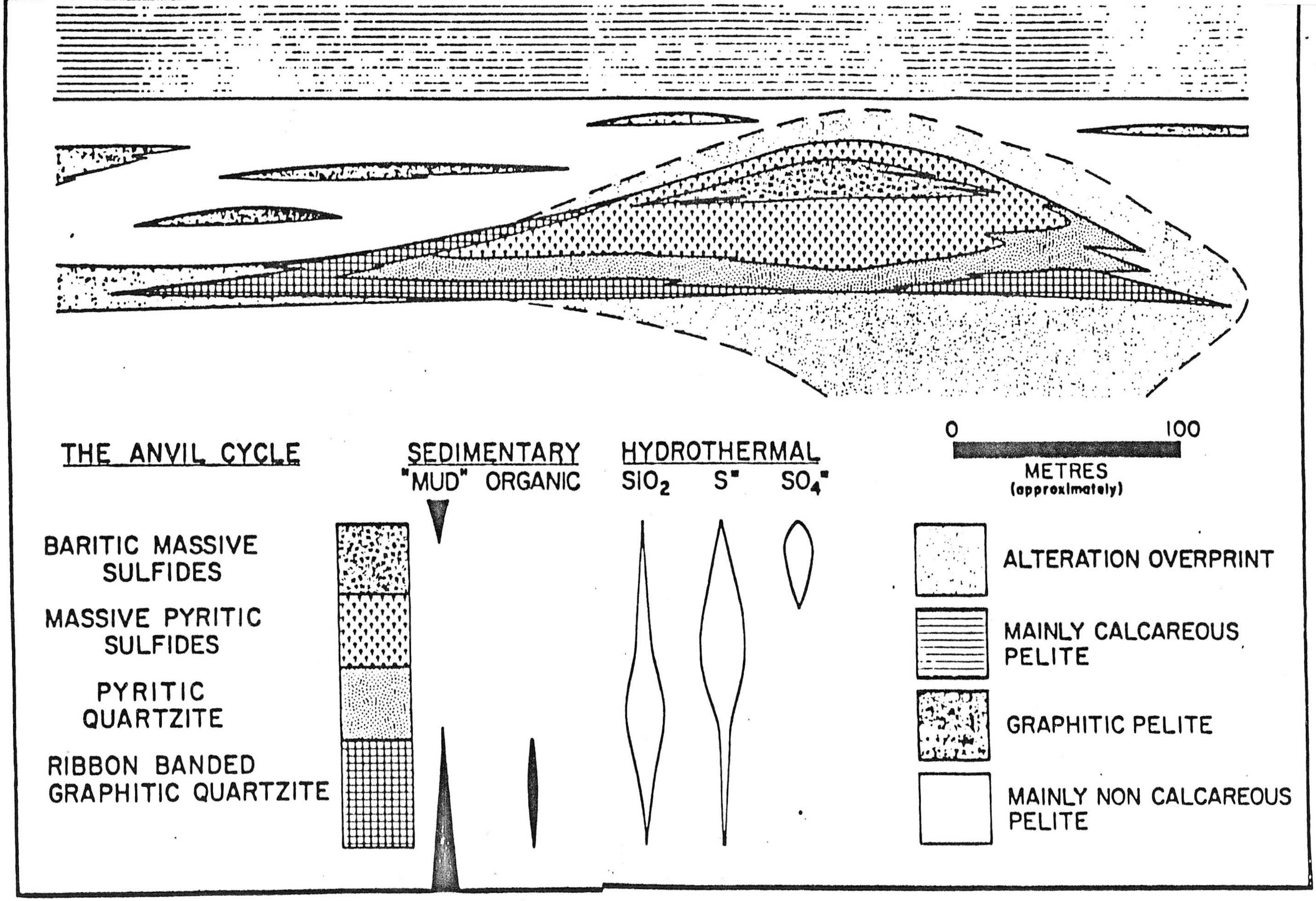


Figure 5

The Anvil Cycle: an idealized model of the distribution of sulfide lithofacies in ~~all the~~ Anvil district deposits based largely on the Faro Deposit

The cyclicity is suggestive of either or both repetitively occurring physiochemical factors at the site of sulfide deposition or in the reservoir site of brine evolution. ¶ Anvil deposits characteristically have a white mica-dominant alteration envelope (commonly footwall based) suggestive of hot fluid/wallrock interaction at time of deposition. Fluid inclusion studies (Kuo, 1976) further suggest the role of NaCl-rich brines in the formation of the deposits. The linear association of known deposits with facies changes at reduced sub-basin margins, coupled with basaltic activity, suggest a synsedimentary exhalative origin for the deposits with fumerolic loci developed along synsedimentary, basinal boundary, growth faults (Figure 6). This model is consistent with the current geologic data for the district (Jennings and Jilson, op. cit.) and guides on-going exploration of deep targets.

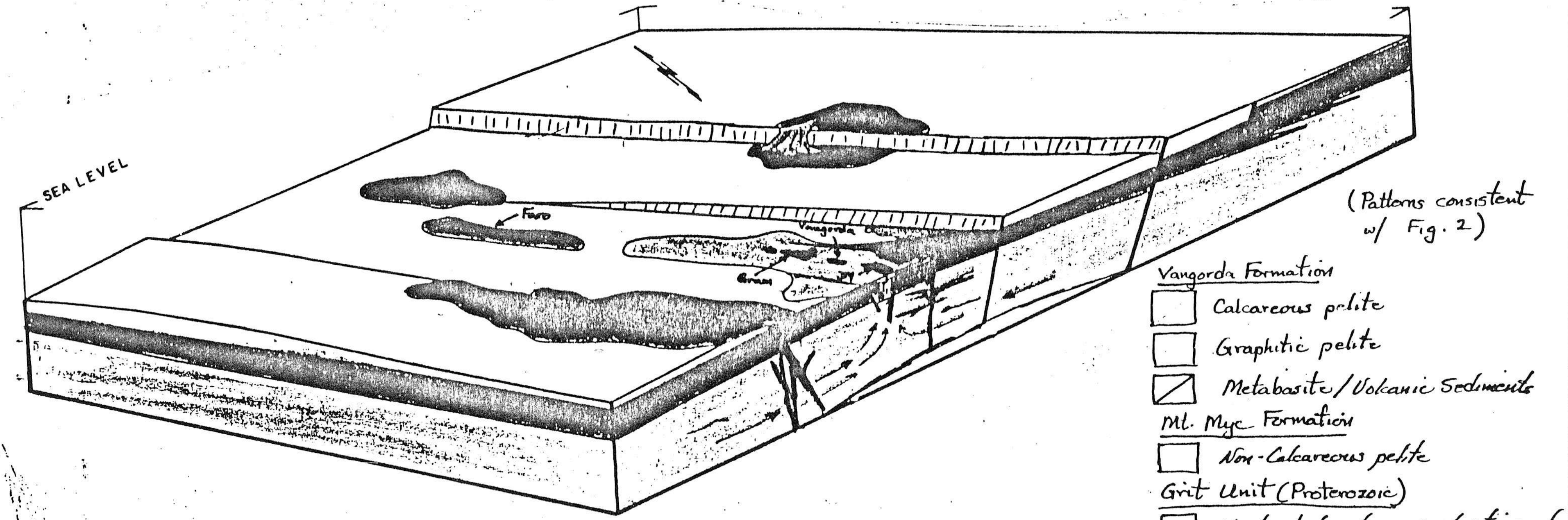


Figure 6: Suggested Synsedimentary Exhalative Model for Origin of Anvil District Deposits

DEPOSIT DISCOVERY HISTORIES

A tabulation of deposit discovery dates, principal methods used and other pertinent data for all Anvil deposits (Table 2) illustrates the evolution of discovery methods from prospecting (shallow) through saturation geophysics and geochemistry (intermediate) to geological modelling (deep). The discovery histories of the five known deposits will be chronologically reviewed emphasizing discovery method, dependence on date and depth of deposit burial. These histories form a background for a systematic review of all exploration techniques used in the district.

Vangorda Deposit

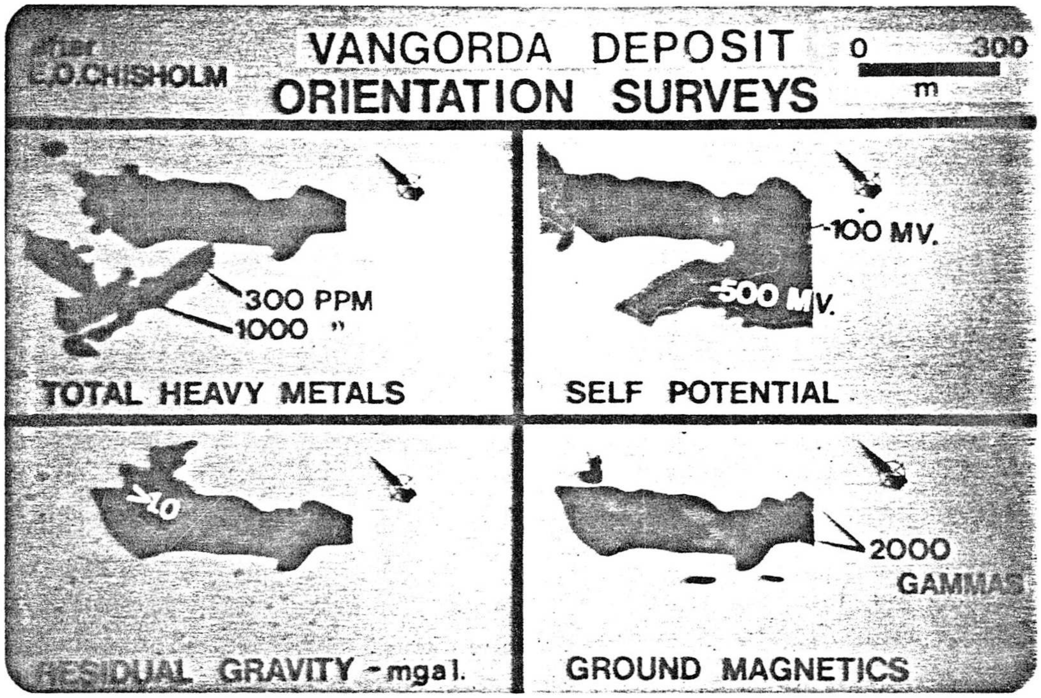
Exposures of massive sulfides on the northwest bank of Vangorda Creek were brought to the attention of Whitehorse prospector Alan Kulan by Ross River natives, George Steriah and Robert Etzel in the fall of 1952. Kulan, upon relocating the showings and realizing their significance, staked the area and optioned the claims to Prospectors' Airways the following spring (Chisholm, 1957). Extensive orientation geochemical and geophysical surveys were performed over Vangorda which became benchmark studies guiding exploration in the embryonic district for the succeeding twenty years (Chisholm, 1957). Specifically, geochemical, gravimetric and electromagnetic surveys were suggested as methods capable of targetting the deposit. Ground magnetic results were considered inconclusive and the effect of graphitic host rocks on electromagnetic and self potential results was recognized (Figure 7). Drilling results on Vangorda proved uneconomic in light of deposit size, remoteness and metal prices of the

TABLE 2

SUMMARY OF EXPLORATION METHODS AND DISCOVERY HISTORIES

Deposit	Discovery Date	Principal Discovery Method(s)	Approx. Total Sulphide Tonnage (Million Tonnes)
Vangorda	1953	CONV. PROSPECTING	20 ~~x 10^6~~
Swim	1964	AMAG	9
Faro	1965	AMAG/JEM	70
Grum	1973	GRAVITY/AMAG/GEOL.	60-80
DY	1976	GEOLOGY	70-90

c.f. Tab 1



After Chisholm (1959)

Figure 7: Orientation study over the Vangorda Deposit showing strong geochemical and gravity signatures and suggesting from self potential data that [illegible] conductivity electromagnetic methods would be more discriminating.

day. Significant work on the deposit ceased in 1957 with minor episodes of drilling largely for metallurgical testing thereafter.

Swim Deposit

Prospectors' Airway's interests in the Vangorda Deposit and Anvil area were joint ventured with and later acquired by Kerr Addison Mines Ltd. in 19~~--~~65. With some improvement in world metal prices in 1963, ~~Kerr Addison~~ ~~completed~~ an airborne magnetic survey was completed over much of the~~ir~~ holdings including a claim block at the west end of Swim Lake ~~(Figure 22)~~ which yielded a positive response similar to earlier ground magnetic surveys over Vangorda. Follow-up geochemical, ground magnetic, E.M. and gravity surveys, based on the Vangorda orientation surveys, confirmed the airborne findings and defined numerous drill targets. Drilling in 1964 outlined massive and disseminated sulfides similar to, but smaller than, Vangorda. The discovery of Swim, through application of the Vangorda orientation studies, marked the beginning of saturation, indirect geophysical and geochemical prospecting in Anvil District, which would lead to the most significant deposit discoveries, highlighting the importance of retention of a significant land package in a favourable terrane.

Faro Deposit

Recognizing the Anvil area as a major, potential lead-zinc-silver district, Dynasty Explorations Ltd. of Vancouver expanded on the airborne geophysical approach to exploration beginning in the spring of 1964. After acquiring a modest land package tied on to and infilling the Kerr Addison holdings, Dynasty completed ground magnetometer, soil geochemical and geological surveys over this land package, then undertook a large scale, airborne magnetic survey over similar Paleozoic strata hosting the Vangorda and Swim deposits as mapped by Roddick and Green (1961) of the Geological Survey of Canada (Brock, 1973). Magnetic anomalies were staked for later evaluation. One such anomaly had been the subject of earlier geophysical and geochemical surveys, as well as shallow drilling by Prospectors' Airways in 1957 and by Dickson-Yukon Syndicate again in 1964 (Brock, op. cit.). A follow-up ground magnetic survey after restaking in 1964 by Dynasty confirmed the airborne results while a J.E.M. survey defined a strong conductor near ~~the same~~ a small stream with anomalous lead-zinc ~~stream of previous~~ response from previous geochemical surveys. Rotary drilling of this E.M. "bullseye" with supporting geochemical and magnetic results led to the discovery of the fault offset, southeast portion of Faro deposit in June, 1965. This discovery resulted in Yukon's largest staking rush and entrenched saturation geophysical and geochemical exploration methods in the district until the mid-1970's.

Grum Deposit

By 1973, A.E.X. (73) Syndicate optioned a land package from Kerr-Addison surrounding the Vangorda deposit and extending to the northwest. A. E. Aho, founder and president of the syndicate and successor companies, was intrigued by the apparent northwest plunge of the Vangorda Deposit into an area of newly mapped graphitic pelites associates with the previously known Champ sulfide showing discovered northwest of Vangorda by Prospectors' Airways in 1957. Erratic electromagnetic and soil geochemical responses on the Grum claims between the Vangorda and Champ deposits, coupled with an isolated 1,000 foot mean terrain clearance Federal aeromagnetic anomaly, prompted an evaluation including re-interpreted gravity data on which a series of diamond drillholes were based. Of four holes drilled in late 1973, two cut significant sulfide and base metal mineralization. Additional drilling from 1974 to 1976 outlined the Grum Deposit.

DY Deposit

Through regional geological mapping carried out in 1972-75, it became apparent that a primary, doubly plunging antiform/synform ~~fold~~ couple between the Vangorda and Swim Deposits provided a large, blind, untested volume of Vangorda/Mt. Mye Transition Zone rocks at depths of 300 to 1,000 meters on the Grum-Vangorda-Swim deposit trend. An ambitious deep drilling project by Cyprus Anvil proved successful in locating massive sulfides in late 1976. Progressive drilling through 1977-81 defined the deeply buried DY deposit. A core zone of approximately twenty million tons of greater than 12 percent combined lead-zinc may be available for underground development.

EVOLUTION OF EXPLORATION METHODS

After the discovery of Faro, saturation geophysics and geochemistry guided the continued search for additional deposits. The strong association of deposits, graphitic pelites and EM signatures was clearly established (Figure 8a). By virtue of varying pyrrhotite and magnetite contents, the Vangorda, Swim and Faro deposits had definable magnetic (ground and airborne) anomalies (Figure 8b); positive, residual gravity anomalies in excess of 1 milligal (Figure 9); and base metal soil geochemical responses (Figure 10).

Combinations and permutations of these parameters formed the basis of exploration programs in the Anvil camp through the late sixties and early seventies, often without critical regard to the many pitfalls of the saturation approach. Once a coherent geological framework was established throughout the district, it was apparent both ground and airborne electromagnetic highs were principally, if not exclusively, related to graphitic pelites (Figure 11a). While this was previously known or suspected for local cases, (Chisholm, 1957; Brock, 1973), the integration of district-wide geological mapping, drilling and coincident electromagnetic data clearly shows it to be the regional case as well, (even for most isolated "bullseye" responses). In this regard, electromagnetic data has been successfully used as a mapping tool through areas of poor exposure and overburden cover.

Disseminated pyrrhotite gives rise to broad, high amplitude magnetic responses over greenschist facies graphitic phyllites of the Vangorda/Mt. Mye Transition Zone (Figure 11b). These responses are too broad to

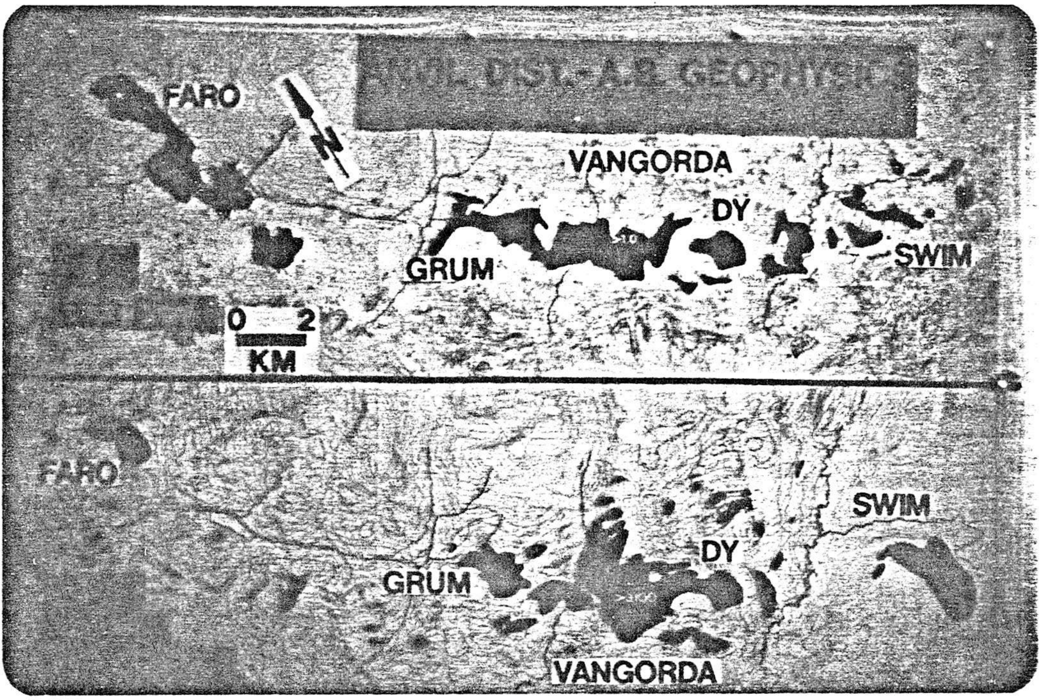


Figure 8a: Airborne EM, main deposit area, showing crude [illegible] of Vangorda, Swim, Faro and Grum deposits with anomalous conductivity; note absence of distinct magnetic signature over DY deposit due to depth of burial

Figure 8b: Airborne MAG, main deposit area, showing strong but vague MAG signatures for Vangorda and Swim; a weak to non-existent signature over Faro; a discrete fingerprint for Grum and [illegible] over DY

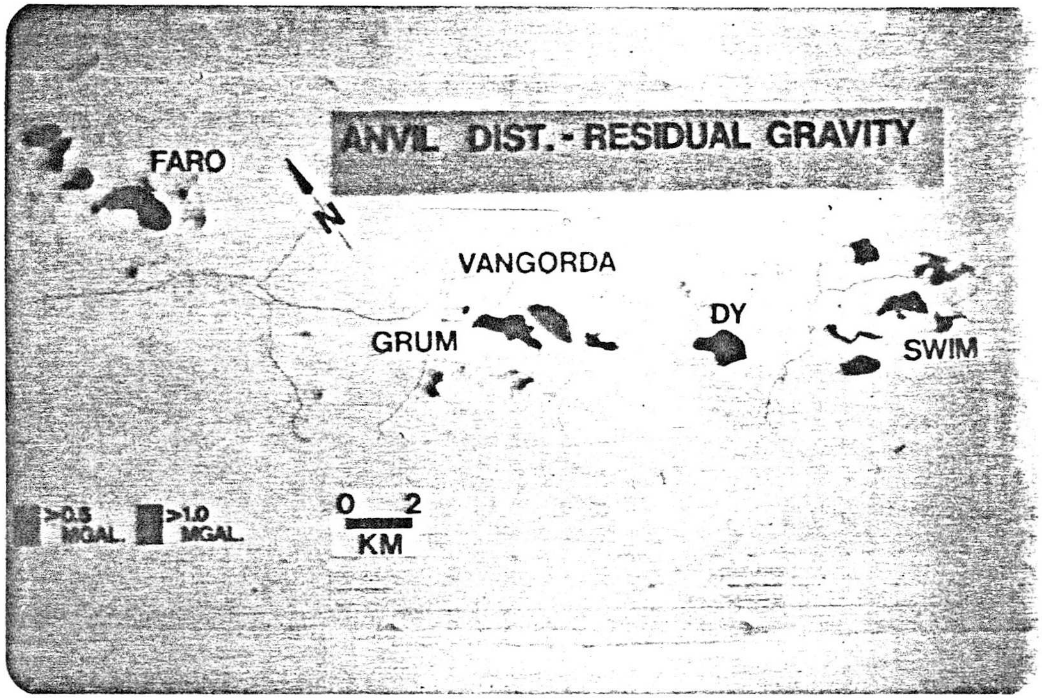


Figure 9: Residual gravity, Anvil district, showing positive anomalies over Vangorda, Swim, Faro and Grum; note absence of signature at DY due to depth of mineral and many drilled spurious gravity [illegible]

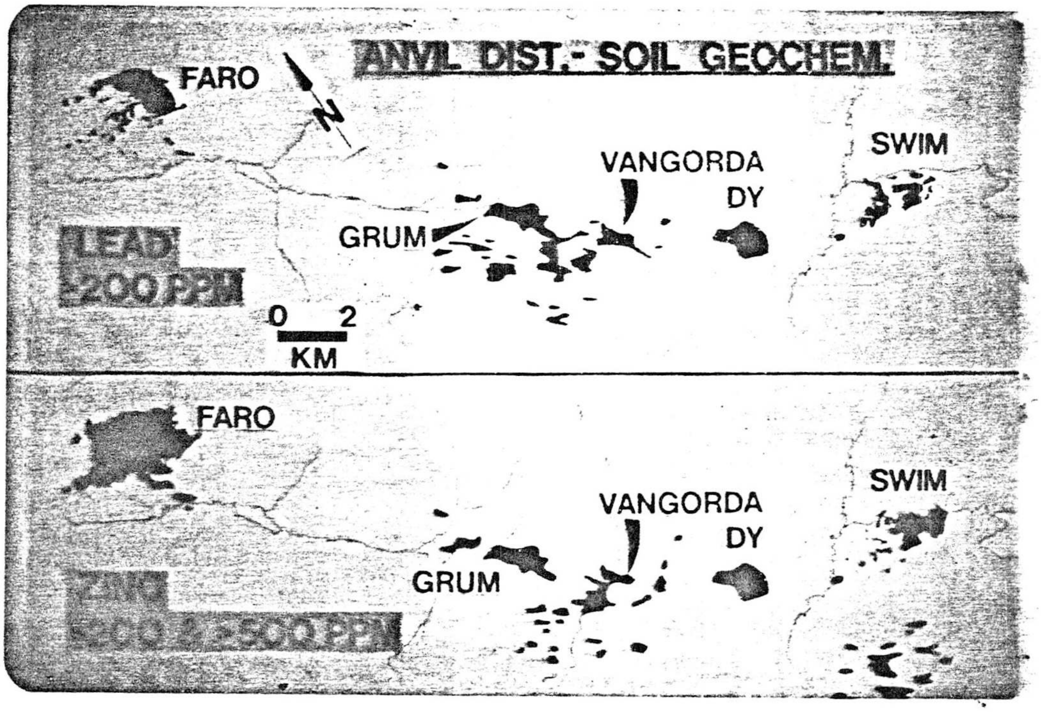


Figure 10: Soil geochemistry (Pb and Zn), Anvil district area, showing positive responses for Vangorda, Swim and Faro; note only the northwest fault-offset portion of the Grum deposit is identified and that DY is not detected due to burial depth. Geochemistry is accordingly [illegible] [illegible] any occurrence.

pinpoint deposits within this stratigraphic interval as a general rule. Additional confusion in the magnetic data also arises from many isolated "bullseye" ~~or~~ and linear signatures related to metabasites (and a magnetite-chalcopyrite skarn in one case) containing ferromagnetic oxides and/or sulfides (Figure 11b).

Spurious gravimetric responses are caused by at least three factors:

(a) bedrock topography,

(b) surficial topography, and

(c) specific gravity contrasts between rock types.

Specific cases of spurious responses are shown in Figure 12. One particularly confusing gravity residual in excess of 1.0 milligal~~s~~ immediately southeast of Grum deposit appears, from limited drill testing and outcrop distribution, to be caused by incised glacial drainages infilled by overburden concealing the bedrock high coincident with the anomaly. Specific gravity contrasts between metabasites and their host rocks, coupled with the more resistant nature of the metabasites, combine to create many spurious gravity signatures involving a combination of specific gravity and bedrock topographic effects. A prominent residual anomaly is seen immediately northwest of Faro deposit overlapping a sharp outcrop pinnacle. This obvious surficial topographic enhancement to the gravity signature can be easily spotted and corrected. Clearly, depth of deposit burial is another limitation to gravimetric interpretation. While modelling studies have shown a Faro-sized deposit could theoretically be "seen" at a depth of 500 meters, a more practical limit is 150 - 200 meters, given the above uncertainties.

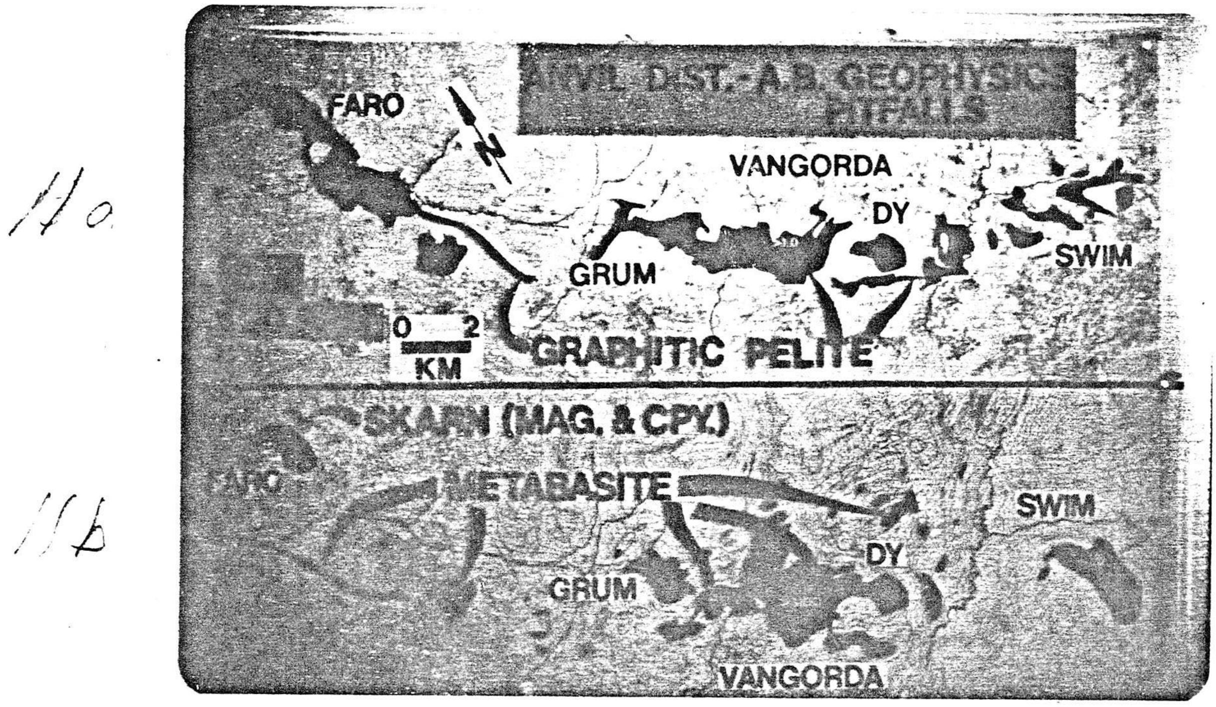


Figure 11a: Airborne EM, Pitfalls main deposit area, showing relationships of EM signature to mapped and drilled distribution of graphitic pelites

Figure 11b: Airborne MAG, Pitfalls main deposit area, showing broad, high amplitude responses to disseminated pyrrhotite in graphitic pelites and "bullseye" or linear responses related to mapped metabasites and skarns.

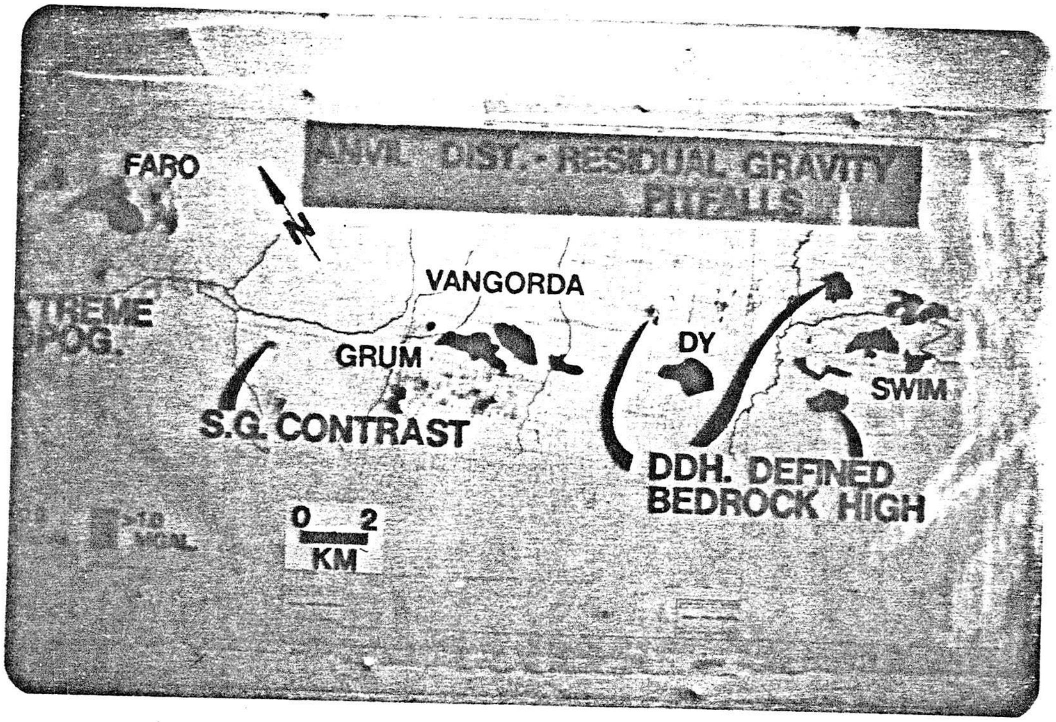


Figure 12: Residual Gravity Pitfalls, main deposit area, note spurious anomalous signatures caused by a) bedrock topography b) surficial topography and c) specific gravity contrasts

Despite the many pitfalls of uncritically applied saturation or blanket geophysical techniques, their valuable role in the discovery of near surface and intermediate depth deposits in Anvil Range cannot be denied. Perhaps the lesson to be learned is that the geophysical approach might have reached earlier successful conclusions had there been an adequate geological framework to "screen" the geophysical data. This would have been particularly cost effective for gravity surveys had they been restricted largely to the Mt. Mye/Vangorda Transition Zone after compilation of critical geological and airborne geophysical data.

Only depth of deposit burial (30 meters) seems to restrict the effectiveness of surface geochemical surveys. Vangorda, Swim, Faro and the northwestern extent of Grum (Firth prospect) are clearly delineated by conventional soil geochemistry on 400 meter line spacings. Additionally, heavy mineral stream~~s~~ geochemical surveys ~~carried out on a 1:50,000 scale~~ showed Anvil District anomalous in lead, zinc, copper and barium (as barite) on a regional scale. These results provide a basis for regional exploration using major stratigraphic and geochemical parameters.

As near surface to intermediate depth geophysical and geochemical targets were sequentially exhausted in Anvil District from the late sixties through early seventies, it became increasingly evident deeper targets, based on geological modelling, would be the focus of continued exploration.

In 1974, Anvil Mining Corp. instigated a detailed remapping of the immediate Faro deposit area and regional mapping of the district in an effort to understand the regional setting and depositional and structural history of the deposits to aid the search for more deeply buried or masked deposits. Perhaps the single most important feature fully recognized at this time was the dominantly calcareous nature of Vangorda Formation as opposed to the largely non-calcareous character of Mye Formation, thus allowing otherwise poorly exposed and relatively featureless phyllites to be subdivided and the location of the productive Transition Zone to be interpolated. At the same time, detailed deep drilling was carried out on selected sections across the Faro orebody to determine the anatomy of the deposit and to test structural continuations of the ore horizons outside the existing drill limits. While indicating some additional ore extensions, this work unraveled the polyphase deformational history and ore zoning parameters that proved invaluable in modelling the remainder of the district for on-going drill testing of geological targets.

CONCLUSIONS

The history and development of the Anvil camp portrays a classical exploration pattern of discovery methods as a function of deposit burial depth. The initial discovery of the outcropping Vangorda deposit by prospecting in 1952 was followed by the subsequent discoveries of Swim and Faro between 1963 and 1965 by saturation exploration methods developed from orientation studies on Vangorda. An eight year period of further exploration refinement and geological understanding was required before the largely geophysical discovery of the intermediate depth (300 meters) Grum deposit was made. The discovery of the DY deposit in 1976 at depths in excess of 600 to 1,000 meters was, in some ways, the most sophisticated application of the total knowledge of the Anvil District, combined with deep drilling of a geologically inferred target. It is almost a certainty, given the untested volume of favourable stratigraphy remaining in the Anvil camp, that further exploration and drilling will result in additional finds. If the ten to twelve year pattern holds true and the price of base metals and general economic outlook improves, then 1986 to 1988 might be a reasonable expectation for the next discovery in the camp. Sadly, current low metal prices and general economic trends have caused an extended interruption of production in Anvil District. Future planning to take better advantage of grade and distribution of ore types within both the Faro and other deposits could maintain production even through low price cycles. Certainly the Anvil District ranks as a world class repository of lead, zinc and silver which will continue to provide a valuable source of new wealth to the economy of Yukon and western Canada.

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