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Dromedary Mountain Property Update

Attached is an excerpt from a paper by Dr. A.E. Aho on Exploration in Yukon with Special Reference to the Anvil - Vangorda District. It was printed in the Western Miner in April 1966.

The exploration history is particularly relevant to the Dromedary Mountain property, since the early history at Anvil is very similar to the current status at Dromedary. Initial showings were discontinuous Pb - Zn sulphide lenses and initial drilling encountered massive pyrite - pyrrhotite with low base metal values.

At Dromedary, the geochemistry and most of the geophysics has been done. There is perhaps room for additional gravity where terrain conditions permit. What is needed now is a systematic testing of the geophysical anomalies, with emphasis on geology and gravity and not necessarily the strongest EM - mag signatures.

G. Carlson
April 3, 1991

METHODS IN ANVIL DISTRICT

Background

Massive flat-lying sulfide replacement deposits of pyrite, pyrrhotite and associated lead-zinc and copper with silver values were first found in conventional prospecting of the Vangorda area by Alan Kulan in 1953. The main Vangorda deposit was drilled by Prospectors Airways Company between 1953 and 1955 and proven to contain 9.4 million tons grading 3.16% lead, 4.96% zinc, 0.27% copper, 1.76 oz./ton silver and .02 oz./ton gold.

Beyond the main discovery two smaller deposits, the Champ and Firth, were also discovered and other indications were found in several areas. However, lack of transportation and poorer metal price futures resulted in curtailment of exploration until 1961 and 1962 when Kerr Addison Mines, who had taken over Prospectors Airways, resumed prospecting in the area, then flew a local aeromagnetic survey at Swim Lakes in 1963 and staked 82 claims on magnetic anomalies.

Dickson Yukon syndicate staked 200 claims in the fall of 1963. In the spring of 1964 principals of Dynasty Explorations staked several adjoining properties, incorporated the company April 23, 1964, and carried out aggressive exploration. In 1965 Dynasty entered into a joint venture with Cyprus Mines Corporation of Los Angeles, and the main Faro lead-zinc deposits were discovered by drilling a geochemical, magnetic and EM anomaly area 12 miles NW of Vangorda creek in June 1965. In December 1965 Anvil Mining Corporation was formed on the joint venture. Further exploration and development for production is being carried out by Anvil, and their present holdings total about 2,500 claims.

In 1964 Kerr Addison discovered uneconomic sulfides by drilling under Swim Lake, and in 1965 discovered what appears to be a sizeable lead-zinc deposit by drilling a magnetic, EM and gravity anomaly zone west of Swim Lakes. Staking by other companies and individuals in the area has now brought the total of claims held in the area to about 7,500 scattered over an area some 70 miles long and 30 miles wide.

The main known deposits occur as massive or near-massive sulfide replacements in phyllite or schist which occur around parts of a broad but complex antiform uplift some 60 miles long and 30 miles wide, here called the "Anvil district." This uplift is cut by a pattern of faults typical of vertical uplifts and bounded on the southwest by the regional Tintina fault trench along Pelly River. The deposits appear to be localized by the following factors:

(1) Favourable horizons, usually graphitic, in schist (no known depth limitations).
(2) Possible NW faults subsidiary to the main regional Tintina fault zone.
(3) N-S to NNW fault and porphyry dike zones.
(4) Proximity to NE-striking fault zones.
(5) General association with granitic porphyry, and perhaps the Anvil batholith (granitic).

Although light to moderate overburden covers much of the district the main known deposits consist of massive to near-massive sulfide usually with associated pyrrhotite or magnetite and are therefore susceptible to discovery by a combination of geochemical, magnetic, electromagnetic and gravity surveys; also by induced polarization. Vein-type silver-lead deposits and disseminated lead-zinc or copper deposits also occur. The above characteristics have determined the following exploration approach used by Dynasty Explorations.

Dynasty Approach

Initially it was realized by the writer that the potentially mineralized district was much larger than the immediate vicinity of the existing properties and known mineral occurrences, probably the entire southwest schist belt shown as Unit 7 on GSC map 13-1961. It was this initial district approach that governed the scope of the program but the structural limits of the district were not defined until the 1965 reconnaissance was completed by the writer.

Early in 1964 Dynasty carried out

ing claims, accompanied by soil sampling, geological surveys and general prospecting of the schist belt. This resulted in discovery of mineralized outcrops and a geochemical, magnetic and gravity anomaly on the SEA property. The anomaly zone was diamond drilled late in 1964, further tested with rotary holes in March 1965, and shown to be caused by a zone of pyrrhotite lenses with submarginal lead-zinc and copper values.

In September 1964 Dynasty flew an aeromagnetic survey over most of the favourable schist belt, a 220-square-mile area, and defined a number of magnetic anomalies which were staked, bringing the total number of claims to 805. Although it was recognized that an airborne electromagnetic survey should also be conducted to qualify the magnetic anomalies and that most of the area should be susceptible to airborne EM, considering probable ance, this survey was deferred until the 1965 season due to additional and equipment availability.

The 1965 program was started by running ground magnetic, EM and gravity surveys over the aeromagnetic anomaly zones and testing the most promising targets by rotary drilling. Limitations of the rotary drilling are discussed later. After breakup, geochemistry, geologic mapping and standard prospecting were added to the program.

In June 1965 an airborne EM survey was flown over the original aeromagnetic survey coverage, and in August and September the entire district was covered by helicopter-supported geologic and geochemical reconnaissance done by the writer, and parts of this were selected for a larger combined airborne magnetic and EM survey. Several gossan zones and geochemical onnaissance, airborne geophysical anomalies were checked by semi-detailed geologic and geochemical reconnaissance, and the promising targets were staked to bring the total number of claims up to about 2,500.

The past program was dictated partly by available capital and partly by search for the best approach, and the most logical exploration sequence developed for the area was as follows:

(1) Initial regional considerations of probable district extent, which determined how large an area should be covered.

(2) Helicopter supported geologic, geochemical and standard prospecting reconnaissance to select the areas over which airborne magnetic and EM surveys should be flown.
High areas of abundant rock outcrop above timberline were largely eliminated by spot checks, aerial inspection and some geologic and geochemical traverses. Overburden areas and areas below timberline were covered in a similar manner but with closer traverse density, taking stream silts and contour soil samples from all downslope migration areas. Results of this work determined the areas to be flown.
All gossans, rusty areas, alteration zones, and rust seepages on stream banks were noted and checked. Several were found to give high geochemical results in lead, zinc or copper; but most such rust areas, especially those on gravel bars, showed no anomalous metal content, being merely accumulations at the ground water table.

(3) Airborne magnetic and EM surveys, using a Hiller 12E helicopter at 1,000-foot spacing and minimum ground clearance with flight lines across the expected trend of mineralized zones.
For the Lockwood Survey system used, a stripped-down Hiller 12E or Bell B-1 helicopter was barely able to carry the equipment and had little or no safety factor. In fact, it was not possible to hover and lift the equipment off the ground without a wind at elevations over 3,000 feet, so the equipment had to be based on the Pelly

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River. A larger helicopter is thus necessary for such combined magnetic and EM work.

(4) Detailed follow-up soil sampling, prospecting and geologic inspection of all areas where geochemical anomalies occurred, or where they generally coincided with either airborne magnetic or electromagnetic anomalies, followed by staking of the promising anomaly areas.

(5) Soil sampling, electromagnetic, magnetic, and gravity surveys on grid lines cut at 400- and, if necessary, 200-foot spacing with 100-foot stations on specific targets to define possible drill targets; and further semi-detailed work on general targets to establish the areas on which to carry out such detailed ground surveys.
Where overburden cover was moderate or light, geochemistry determined the approximate position of a mineralized zone and electromagnetic and magnetic surveys defined specific drill targets. However, targets should be narrowed down further with gravity surveys, especially if overburden is too deep and extensive for geochemistry to be effective.
Induced polarization should be used to test for disseminated lead-zinc deposits which may be of economic grade but do not have enough associated pyrite, pyrrhotite or magnetite to give sufficient electromagnetic, magnetic or gravity indications.

(6) On the basis of the above procedure, drilling of top priority targets should be done with possible elimination of the poorest.
As exploration and development progresses in the district more guides to discovery will be developed.

Facets of the Dynasty program which contributed to its success were knowledge of the region and its mineral possibilities, a major district outlook, adequate and capable financing, great flexibility and ability to make and carry out decisions quickly, a close-knit group of competent personnel each with personal incentive, careful attention to detail, extreme persistence, and aggressive optimism. Aside from other personnel, each director of the company not only helped finance the project but worked intensively on it; one on overall administration, exploration, camp management and reconnaissance; one on target preparation and drilling; one on expediting and transportation; and one on office administration and financing.

LIMITATIONS OF METHODS IN ANVIL DISTRICT

Conventional Prospecting Limitations

Except in the more rugged higher elevations, conventional prospecting in the district is greatly hindered by extensive cover of glacial overburden, volcanic ash, and organic accumulations with permafrost. These materials mantle most of the gentler topography where ore deposits are most apt to occur. Except for the fortuitously exposed showing in the bank of Vangorda creek, not a single outcrop of massive sulfides is known in the district; only erratic disseminations and minor vein type mineralization has been found in a few places. However, residual and transported gossans and altered wall rock are good indicators, if accompanied by geochemical anomalies.

Float is rarely found because of the volcanic ash and vegetation or organic cover. For example the Faro area was intensively prospected by very capable men several times and until 1965 the only mineralization found was one piece of magnetite float with silver-bearing bornite and a trace of molybdenite disseminated in porphyry. In early June, 1965, sizeable pieces of float showing heavily disseminated chalcopyrite in green tuff and outcrops of calc-silicate hornfels (skarn) with traces of disseminated galena and sphalerite were found and it was thought more likely that copper rather than lead-zinc would be found. Float of massive silver-rich galena and of massive pyrite and pyrrhotite with lead and zinc was not found until much later in the season, but neither massive sulfide zone has yet been exposed.

Although severely hindered, conventional prospecting in the district is therefore valuable but must be guided and supplemented by geochemistry and other tools.

Geologic Limitations

Geologic work is largely limited to eliminating the least favourable rocks such as granite, massive volcanics, greenstone bodies and perhaps massive chert sections.

Certain linears or fault and porphyry dike trends are favourable, and the presence of altered rock, if visible, is a promising sign. Sericitization, silicification, and choritization appear to be localized to varying degrees with the sulfides, the most typical surface indication being a rusty-weathering sericite schist alteration halo. Mineralization of some type has been found in every rock unit in the district except Tertiary volcanics, so no geologic formation can yet be completely eliminated as possibly ore-bearing. Even the granite contains vein type silver-lead mineralization.

Except for the presence of graphitic material at Vangorda and in Faro No. 2 sulfide zone, graphitic members of the schist sequence are not yet recognized as being definitely favoured. Little or no graphite occurs in or near the main Faro No. 1 zone which is in barren-looking quartz-mica schist, or in the SEA sulfide zone which is in chloritic phyllite and sericite schist.

Geochemical Limitations

Geochemical limitations are varied. In reconnaissance work, stream silts of the best character cannot always be obtained. They are often too coarse, organic, or laden with volcanic ash; and the metal ion content varies with the coarseness, fineness and type of sediment so anomalous threshold can be quite variable. Soil sampling is limited in some areas of permafrost or thick organic cover, and in areas of deeper overburden where the geochemical approach is only of superficial value.

Sample density relative to drainage and downslope migration is also important. The Faro discovery could easily have been masked by overburden cover over the main rusty swamp area and only one or two reconnaissance soil samples would have shown high zinc, lead or copper. The stream silts from the vicinity showed only background values, but it is not certain if the samples were of the best character.

Although some transported gossans show high zinc content, others show less than background values with a buildup some distance downstream, probably because of low Ph near the source (as suggested by C. F. Gleeson for some rusty springs sampled by Operation Keno in the Mayo district). Therefore, even if a transported gossan is not anomalous, it should not be concluded that its source contains no economic metals until the general vicinity has been sampled.

Zinc is the most abundant and mobile metal and therefore is the best guide to lead-zinc deposits in the area. Although mobile, copper occurs in lesser amounts and is not as good an indicator since some greenstone areas also contain anomalous copper concentrations. Lead is the most certain indicator of significant mineralization but is much more immobile and therefore occurs almost exclusively in soils near the source.

Even in individual mineral soil profiles the content of zinc, copper, and lead varies considerably and generally not consistently, apparently being a result of irregular metal or float concentrations on the glacial overburden.

Geophysical Limitations

Limitations of geophysical methods are depth pentration, conductivity of sulfides, and response from other sources.

Disseminated or vein type deposits might be detected by standard prospecting or geochemistry, but not by the geophysical methods used so far. Blind deposits of either type would be missed, as would any such deposit if it were not in an area to which attention was directed by the initial reconnaissance. Geophysically, this limitation can be overcome only by using induced polarization or perhaps self potential methods.

The airborne electromagnetic equipment used is said to have a maximum depth penetration of about 350 feet which, with 150 feet of ground clearance in the wooded areas, leaves only 200 feet penertation so that overburden much in excess of 100 feet would largely, if not entirely, mask the response. However, on this basis about 70% of the area flown was considered to be susceptible to airborne EM. Ground EM methods can achieve greater penetration but the reconnaissance instrument used so far by Dynasty was limited to about 150 to 200 feet.

Interference from conductive overburden in hollows and lakes also has a marked masking effect.

Moreover, graphitic phyllite members are so abundant in the district that several belts of complex EM response have been encountered, and EM anomalies are widespread.

EM anomalies have been graded on strength and conductivity but these are still of doubtful use, because an economic sulfide zone could be either a good or poor conductor and thus cannot be sorted out from graphite.

Many magnetic anomalies or anomaly belts in the district are caused by greenstone and probably magnetite-bearing schist members so that magnetic anomalies are also numerous and often coincide with graphitic conductors which give EM response.

The use of gravity is therefore advisable to narrow down possible targets, but the method is slow and costly so smaller areas must be covered. Unless a gravity anomaly is strong, or supported by other strong evidence from the other methods, it may also be caused by differing rock and overburden densities such as basic rocks or a buried bedrock knob or ridge.

Limitations of Faro Property

On the Faro No. 2 zone, massive sulfides within 20 to 50 feet of surface gave a strong soil geochemical anomaly, a strong ground EM response, and also showed up as a minor high conductivity anomaly on the airborne survey. However, this sulfide zone contains no visible pyrrhotite and gives no magnetic response on either airborne or ground instruments.

In contrast to No. 2 zone, the main Faro No. 1 zone contains much pyrrhotite and shows up as a well-defined magnetic anomaly on both ground and airborne magnetic surveys. This sulfide body, mostly at a depth of 100 to 250 feet, barely showed up as a 3° deflection on the ground EM, but a part of the orebody closer to surface showed up as a faint broad high conductivity anomaly on the airborne survey. It also shows a marked geochemical anomaly where overburden cover is light to moderate. At one point rust occurring in a small stream had given a strong geochemical anomaly on a previous reconnaissance.

Although the airborne magnetic survey of the Faro area shows an eastwest string of similar magnetic anomalies, with No. 1 ore zone in the middle, the easternmost and westernmost parts of this anomaly zone are caused by dioritic and gabbroic intrusives respectively, not by sulfides. Without these fortuitous magnetic anomalies, neither the airborne nor ground magnetic or electromagnetic anomalies over the Faro deposits showed any real coincidence except in a very general way, certainly not enough to have caused much interest without supporting geochemical results.

Moreover, although attention was directed to the general anomalies in the Faro vicinity by a single float occurrence, a transported gossan, and strong reconnaissance soil geochemical results, all of these indications could have been completely masked by a slightly greater cover of glacial overburden.

However, a gravity survey over the Faro property outlined No. 1 orebody very well and gave a rough estimate of its tonnage when drill hole intersections were introduced into calculations. No. 2 zone, being much thinner, barely showed up, but a sulfide body at the gossan swamp north of No. 2 zone showed a definite although a slight anomaly and several other gravity anomalies were defined. A properly conducted gravity survey therefore appears to be the best tool for defining position of massive sulfides.

Drilling Limitations

Several rapid methods of drilling the anomaly targets were considered and a detailed comparison was made between an Atlas Copco overburden drill versus a Nodwell-mounted Mayhew 1000 rotary drill. Mainly because of the depth limitations and possible attendant drilling problems with the Atlas Copco, it was decided to use the rotary and to drill with air. This method proved satisfactory during the entire 1965 season; however, in sufficient air capacity made it impossible to drill with air except in dry ground or permafrost even though various bits and a down-the-hole hammer were tried. Drilling with water proved to be slower and therefore more costly than anticipated, resulting in a total of about $6.00-$7.00 per foot direct costs for this type of drilling. In all, some 18,000 feet were drilled at this average cost, the holes averaging about 300 feet in depth, maximum depth being 790 feet. Rotary drilling with water therefore proved to be comparable in cost to diamond drilling but the rotary had greater mobility.

Rotary drilling with air did not present any problems of reliable sampling, being similar to the Atlas Copco which checked out well at Mt. Nansen. All cuttings were panned so that no trace of mineralization was missed; massive sulfide cuttings were assayed as obtained; and cuttings, pannings and magnetics were pasted onto typical sample boards showing footage, a standard practice.

However, with water drilling and recirculation of the drilling mud it was found that soft minerals were ground up and lost to a considerable degree in the mud. Diamond core drilling on the Faro Nos. 1 and 2 zones later showed that the true lead-zinc grade was up to 50% higher than shown by the wet rotary drilling in which interstitial galena and sphalerite were ground up in the presence of coarser and harder pyrite, pyrrhotite and quartz.

It appears that rotary drilling with sufficient air would still be faster and cheaper than diamond drilling and would be suitable for initial testing of anomalies provided the contract footage is large enough to justify setting up properly. However, diamond drills are being used on the present phase by Anvil Mining Corporation because of (a) the necessity for maximum information from development drilling on the Faro deposit, and (b) greater flexibility in contract footage, logistics, and tie-in with existing equipment and contractor.

Conclusion

In conclusion, it is certain that the present approach or modifications of it will reveal other deposits in the Vangorda district, but it is equally certain that because of the extent of the mineralized district and limitations of any combination of methods, it will not find all deposits, so the district should remain a fertile field for exploration for a long time, limited only by justifiability and cost.