804384

DAM

INFORMAL NOTES ON A VISIT TO NORTHAIR, 23-25th. JULY, 1980

INTRODUCTION

The writer was asked by Mr. M.P. Dickson, Vice President - Operations of Northair Mines to visit the mine area and to review the geology, with particular emphasis on exploration. To this end the area was visited on July 23 to 25th, inclusive. These notes first record and then discuss the impressions obtained. It is proposed to dispense with the conventional "Location", "Access", etc., since those to whom these notes are directed know more about such matters than the writer.

The work carried out to date has been conducted in a competent and professional manner and, frankly, so far as Northair is concerned (Brandy is a separate problem), I do not see any simple solutions (comparable, say, to "Drill the flanks of the mineralized zone. Period"). The following comments represent a free inquiry, a casting about, in hopes of finding something like the proverbial unturned stone, some lead worth following.

At the risk of seeming excessively simple I would like to enumerate the basic elements of the problem - namely, that of maintaining the continued existence of Northair - and either propose solutions or suggest where and how they might be sought. Exploration is by its very nature a highly disorganized, almost random business, and attempts to analyse procedures inevitably seem strained or artificial.

Exploration may be considered in terms of the time available. At Northair time might be viewed as short- and long-term - "short" meaning, roughly, up to six months, and "long" meaning from six months to as far ahead as one can reasonably project, or about two years. I gather it is understood by all involved that if exploration in the short term does not pay off, the opportunity to operate long-term may not come about.

Exploration can be conducted at several levels or scales. One level or scale, the broadest, involves the search for areas believed for one reason or another to be favourable for mineral occurrence. Once an area(s) has been identified and "ground" acquired, the detailed search for an economic deposit(s) begins. This is in itself a multi-stage process, but assuming a mineral deposit is found (or a property containing an identified deposit acquired) exploration of the deposit grades into development, ie., preparation for mining. Generally organizations engaged in exploration simultaneously conduct all these levels of effort.

The definition of what constitutes a favourable area and how they are sought is not of concern here because Northair is beyond that stage, obviously being such an area itself.

Within such an area, the search for a minable deposit, or for repetitions if one has been found - is a three stage process which might be characterized as consisting of target identification, selection or rating, and testing. Target identification involves geology, geochemistry or geophysics or a combination of these techniques. (Target identification has a good deal in common with the selection of favourable areas: the difference is essentially a matter of scale.) Typically more targets are found than can be tested in the time or with the money and personnel available, and the targets must be rated in order to decide which deserve to be tested. The rating or selection process also involves some combination of geology, geophysics and geochemistry, but logically it should not rely on the techniques used for target identification. Those targets given the highest priority are then tested by a suitable means, such as trenching, drilling and finally mining. As implied above, this procedure is in principle the same whether seeking a new deposit or extensions and/or repetitions of a developed ore body, although the practice is liable to vary in these situations.

No doubt the reader has noted a general correspondence between various phases of these three ways of looking at exploration involving time, scale and procedure. Exploration which stands any chance of success in as short a period as six months inevitably refers to an established property, almost certainly one with reserves (whether or not they are being mined). Probably the explorer has in mind seeking extensions or repetitions of known ore and most likely the hope is that identified targets (existing geochemical and/or geophysical anomalies, etc.) can be "up-rated" and shown to merit testing. The correspondence is not exact, however. The geological study which was begun recently (and is essentially a long-term measure) has the potential to aid the exploration of the known orebodies and/or improve the rating of already identified geochem or geophysical anomalies (ie, could assist short-term).

I propose to review the Northair area in terms of time scale and target-handling only (since the subject matter of what I have called levels of exploration can either be covered under these two headings or is precluded by confining the discussion to the Northair property).

The writer would like to acknowledge the generous assistance of all who worked to make this review possible. These include Messers Dickson, John Michel, Al Boon, Dave Brace, Wayne Ash, Roy Wares and Mr. Jim McLeod who briefed the writer in Vancouver. Without their unstinting help it would not have been possible to conduct this review. Nothing which follows should be construed as criticism of the mine personnel. One of the - perhaps the only - strength(s) which an "outsider" brings to a study of this nature is the objectivity or detachment which non-involvement can provide. This situation also has its pitfalls. The writer cannot know what was, or what was not, done and, more importantly, why. What now seems to have been an error of omission or commission may not have so appeared a month or a year ago. Circumstances change, and so should responses. Before leaving this subject the writer would like to repeat what was written above, namely, that a very favourable impression of the standards of the work performed to date was obtained; it will not be easy to improve on.

NORTHAIR MINE AREA

General Statement

As time is of the essence, I propose to touch on the subject of time limitations first and then turn to target handling.

Exploration Time Scale

Short-Term

A glance at plans, longitudinal sections, etc., indicated that the amount of drilling designed to test the depth extension of the mineralized zone and/or for parallel repetitions (a hole collared some way from the zone so as to obtain depth does both) exceeds the amount of drilling performed along the strike - roughly, to the north and south. It seem to me that it would be worthwhile to even up the record, with or without specific targets (see "Targets", below).

Since writing the foregoing I have received a copy of Roy Wares's first weekly report in which he characterizes the Warman-Manifold deposits as possibly occupying "sigmoidal-dilatant" zones and he noted that, if sustained, this view suggests exploration "along strike has less validity than exploration to the south of the veins, looking for an en echelon repetitions". The point is well taken and that is of course the object of the study he is undertaking - namely, to resolve such questions. Nevertheless the general truth of the generalization made in the previous paragraph still stands and I believe it behooves those involved to review the implications. When on-strike exploration is conducted, a zone - and not just a planar surface - is inevitably covered. And there is no reason why exploration could not "lean" toward the south, to cover the possibility Roy perceives. In any event, this is an example of just the kind of wide-ranging or open minded approach which is needed.

Examination of drill cores stacked at various places on the Northair property reveals the presence of quartz veins, sulphide zones and weathered iron carbonates(?) which have not been split for assaying. (No criticism of those involved is implied here: some of these features are only visible, or are more obvious, because the core is weathered.) This state of affairs gives added emphasis to the desirability of re-organizing core in a suitable storage area (see "Miscellaneous", below). And, more to the point, "interesting" zones could be sampled while this work is in progress, the core tested with an ultra-violet light and, as Roy Wares proposed, a scintillometer.

While Dave Brace, Roy Wares and the writer were examining a longitudinal section of the mine we all more-or-less simultaneously commented on the possibility that the distribution of metal values might (probably?) bear(s) some relationship to the form of the "vein system". One of the best ways of investigating this possibility - and of laying the groundwork for identifying and testing what analysis reveals as favourable areas - is through the use of what I call Conolly Seetions" (Conolly, 1936, - see Attachment 1). It is believed that, using available information, the requisite procedures could be carried out by the mine staff in a matter of a few weeks or in the short term.

Other short term measures which could be taken (and which largely have to do with the rating and testing of identified EM, AEM and geochem targets will be discussed below in the section titled "Targets".

Long-Term

Long term exploration at the Northair Mine refers principally to the re-study being undertaken by Roy Wares in co-operation with Dave Brace, Jum McLeod, Glen White and others. Consequently it is too early to say much about the outlook. A couple of comments might be made concerning method. However pressing the demands of time, pains should be taken at the outset to organize existing data. Maps and air photos should be looked for and indexed. Extreme care should be taken over the choice of format, scales, etc., of plans and sections. In this regard the value of the old tried-and-true conventions, described in textbooks such as McKinstry's "Mining Geology" and Peter's "Exploration and Mining Geology", should not be underestimated.*

Owing to the limitations of time, care should be taken to have the requirements of short- and longer-term exploration support or re-inforce each other, where possible, eg., sample mineralized zones while organizing the drill core for the benefit of the long-term study.

Exploration "Targets"

General

In the sense explained in the Introduction this section is in some respects a restatement of the foregoing, except that it views the problem from a different standpoint. Regardless of the time factor, exploration may be defined as the finding, rating and testing of targets. Since the Northair property contains numerous untested targets - mostly geochemical and geophysical anomalies - I propose to discuss rating first, followed by "finding" (identification). Testing, which generally boils down to trenching, drilling and "mining", is fairly obvious and need not be considered at all.

Rating Targets

As noted in the Introduction, almost any type of exploration - prospecting, geological reconnaissance or mapping, geochemical and geophysical surveys - tend to lead to the identification of targets. Generally it is impractical to test them all and some means of rating or screening targets must be found. In many respects this is the most critical phase

---

* The experienced geologist should not feel himself above refreshing his memory about such apparently simple matters. I could cite with examples from both Canada and the U.S. cases where their neglect led to serious and expensive problems.

in all exploration. Although logically it follows the search for targets it is treated first here, because, thanks to the results of previous efforts, many targets have already been identified on the Northair ground and rating them or selecting those which seem to deserve further work is of paramount importance. (In terms of the time-scale employed above this step would probably be regarded as short term.)

Most of what in the Northair area might be regarded as known or identified targets consist of geochemical (typically, Cu, Zn, Pb, with some Au and Ag) or geophysical (EM, mag or SP) "anomalies".

In the course of conversation most of those involved expressed some dissatisfaction with the screening and selection of such features. Although the mineralization in the Northair area was originally found through the use of geochemistry, little if any of the metals employed in the initial surveys were shed by the principal ore body. Given the steepness of the slopes, thickness of cover and relative paucity of acid-forming sulphides (to leach/and permit the transport of metals) this is perhaps not surprising. In addition, owing to the low sulphide content and poorly developed banding the mineralization is liable to be an indifferent conductor, and not especially amenable to detection and hence screening by the most commonly used geophysical methods (except, perhaps, if mineralization occupies a fissure which is also a water course?). Rating the identified anomalies (plus any new examples which might be found by the pending AEM and AM surveys) therefore constitutes a problem. As a result the need to sharpen existing tools and/or find new ones seems to be indicated.

The means of rating available targets are the same as those employed to find them in the first place, namely, geology, geochemistry and geophysics. As a general principle I believe however that anomalies should not be screened in terms of the property by which they are defined. The reasoning behind this assertion is partly logical or semantic and partly practical. "Anomalous", like "unique" for example is a superlative adjective. It makes no more sense to speak of poor, moderate and good anomalies than to refer to unique, very unique and most unique (although, regrettably, both have crept into the language!). In practical terms one cannot rate EM and copper anomalies, etc., in terms of electrical conductivity or copper content because value (size and tenor) of deposits and conductivity and geochemical response do not reveal "positive correlations" - ore deposits can be excellent conductors to non-conductors and many good conductors are not ore or even mineralization*. Ditto with geochemical responses and mineralization.

So the question becomes whether some (other?) means can be found to screen the known geochem and geophysical anomalies. Since attention was first drawn to the area through the use of geochemistry, it seems reasonable to start with that method.

As noted above there seems to be general agreement that the screening of geochemical anomalies composed of precious- and/or (non-ferrous) base-metals leaves something to be desired. One solution would be to try to find an indicator of tracer metal(s) with which to improve discrimination. This might begin with semi-quantitative analyses for 30 or so metals of a few samples of ore followed of course by some experimentation. Such analyses might also reveal the presence of hitherto unsuspected economically recoverable metals. (Roy Wares has suggested that the environmental impact statement in the original feasibility report might contain the basic information required.)

From the outset the writer formed the impression that mercury might be a useful index metal and subsequently noted with interest that both Miller and White made favourable comments on mercury responses - without following through. After "calibration" in suitable areas mercury sampling could provide a method by which geochemical, geophysical and even geological targets could be rated. (This is not meant to imply that any one technique is liable to prove diagnostic.) Since it is proposed that mercury be used

---

* There is, of course, a difference between a "good conductor" and a "good anomaly".

because Cu-Zn-Pb (-Au-Ag) may not be reliable as indicators of mineralization, the use of mercury to screen anomalies consisting of one or more of these metals involves something of a "circular fallacy" and some thought should be given to the best approach to adopt.

Should surveys using mercury (or any other metal) appear to be useful, they could also be used for target identification (next section).

In light of the developing concensus about the different strikes of bedding, foliation and veins, it might be feasible to screen some of the geophysical anomalies (EM and SP) simply in terms of shape or plan-form. Anomalies which are mode up of "forked" or "angular" segments could reflect both bedding and foliation or shearing (which could house mineralization).

Identification

Although the results of a geological study could (in the short term) influence the rating of identified targets or reveal the presence in existing cores of unsuspected mineralization, such a job is principally directed toward the identification of new targets and is therefore fairly long-term. The proposed AEM and AM survey could confirm the presence or otherwise enhance the standing of existing anomalies and detect new ones. By the same token if mercury sampling should prove useful for screening known targets, the method could also be used in an attempt to find new targets.

Before leaving the subject of target identification I would like to insert some remarks on the role of geology or the way in which geology is used. (The principles involved here also refer to the selection of favourable areas as districts. The difference, as noted above, is chiefly one of scale.)

It has become fashionable to make a great deal of "genetic models" or "conceptual models" and to assert that they provide the best or the only basis for an exploration program. In my opinion nothing could be farther from the truth. A genetic model is the poorest of all starting points for an exploration program. This point is of such fundemental importance as to justify explanation. Perhaps the easiest way to make this point is to cite a specific example.

The most recent issue of "Mining Journal" (July 25, 1980, p. 73) - the misunderstanding is so general that one could probably find examples in a recent copy of any periodical picked up at random - reported that two Canadian companies are exploring the Ogafau gold property located in South Wales. The gold is reported to be "associated with pyrite and arsenopyrite in conformable saddle reef [sic], in cross-cutting quartz veins and in a black carbonaceous pyritic shale". The report went on, "Recent investigation of the mineralization at Ogafau suggests that both the pyritic shale and the Pyritic Lode, contain gold which is not related to that of the quartz veining. If a syngenetic or diagenetic origin of the gold can be demonstrated - indicating that the auriferous sulphides form an integral part of the black shale deposits - it could have important implications so far as the future exploration of the area is concerned since the mineralization could be part of a more extensive stratiform type of deposit".

The point I wish to make of course is that ís is perfectly feasible to conduct exploration in the area without worrying about genetic theories. If the auriferous sulphides look like an integral part of the black shales, one could quite simply proceed with exploration on the assumption ("working hypothesis") that they are - especially since the notion is not exactly revolutionary. Much mineralization occurs in black (carbonaceous) shales, including gold (numerous occurrences in northern Nevada, South Africa, Western Australia), gold-uranium (parts of Witwatersrand), uranium, copper-silver-zinc, etc. (Kupferschiefer), vanadium (Mina Ragra, Peru), and so on. Geologists argued for 50 years over the origin of the gold in the Rand before reaching the present concensus and, interestingly enough, successfully conducted exploration while the "wrong" genetic theory held sway!

I could cite other examples and relate stories to emphasize this point ad infinitum, but I do not wish to flog the proverbial deceased horse and this one example will be made to serve for now.

Those engaged in exploration should attempt to characterize the target(s) of choice as accurately and as objectively as possible - looking for features which stand a chance of being recognized on the appropriate scale - and then seek areas which contain the desired empirically defined characteristics. Suitable features include both gross or overall lithological suites and specific host rocks, especially those likely to give rise to outcrops, to be mentioned in literature or to respond to regional geophysical surveys; composition and physical properties of mineralization; anticipated or demonstrable geochemical and geophysical responses; associated types of mineralization, and so on. This approach is applicable to virtually every conceivable type of metallic and non-metallic minerals deposit and to every scale, ranging from that of favourable regions or districts, through properties to individual ore bodies or targets - by which is generally meant "drill-target".

General Remarks on Geology

The assemblage of rock exposed at Northair is fairly typical of what were once called greenstones and subsequently eugeosynclinal volcanic and sedimentary rocks (which of course have been moderately deformed and regionally metamorphosed). (This was first written before Roy Wares's report of finding "banded iron formation in chloritic tuffs", a discovery which supports the comparison just made.) Today such rocks would probably be identified by many or most authors as ocean floor or island arc deposits. I prefer the non-genetic "greenstone". Experience teaches that such rocks host a large number of precious- and base-metal deposits of a wide variety of types. Precious-metal deposits found in such rocks include disseminations and "veins" (concordant and discordant) in mafic to felsic volcanics, clastic sediments such as greywacke, siltstone and shale, and iron formations, especially the carbonate facies of same. (Roy Wares's reference to a "halo of ferroan dolomite and ankerite" is intriguing in this connection.) Base metal deposits found in such rocks include iron formations (ie., mined for iron) and polymetallic massive pyritic sulphides.

Greenstones are typically deformed and metamorphosed ("eugeosynclinal" referring to one of the two major assemblages or suites thought to have been laid down in the early stages of mountain-building and likely therefore to have gone through at last one episode of deformation, etc.). Most of the mineral deposits of this general type which have been studied have been found to exhibit metamorphic textures and, presumably, were exposed to nearly the complete range of geological processes identified with or believed to characterize orogeny - including igneous intrusion, deformation, metamorphism and "mineralization and alteration". Although the characteristics of the groups of deposits as a whole are well understood, the nature and affiliations of individual examples may be obscure. The example of iron formations, perhaps the least controversial of all the deposits cited, may be noted, numerous iron deposits in upper New York state, south-central Missouri and northern Sweden being regarded as "magmatic segregations" (from felsic magmas yet!), although they exhibit many of the features of banded iron formations. In B.C. late Palaeozoic to early Mesozoic greenstones have been intruded by a typically late-orogenic, calc-alkaline "minor granites" which host porphyry (molybdenum) mineralization and it would scarcely be surprising to find areas exhibiting characteristics of both types of mineralization (not to mention some others).*

So far as the Northair area is concerned the Warman and Manifold zones are believed to represent some variety of greenstone-type precious- and base-metal deposit - possibly modified by subsequent deformation and metamorphism. The Discovery zone is tentatively regarded as having massive sulphide

* Some mineralization in the Brandy area could have porphyry copper affiliations, for example - see below.

affiliations or affinities. The reasons for arriving at the latter conclusion are both positive or affirmative and "negative", namely:

1. - The appearance of the mineralization which loosely resembles massive sulphides (this suggestion could be tested to some extent by checking whether or not the stratigraphic zoning of metals which is typically developed in massive sulphides is present).

2. - The nature of the host rocks.

3. - "A process of elimination". The mineralization in the Discovery zone is not "carbonate-hosted" (Pb-Zn-Cu); not Cu (Ni) in a layered mafic rock; not Cu (Ag) in plateau basalts; not Cu (Ag-Zn-Pb) in a (bituminous) shale; not a "red-bed" Cu deposit not a "porphyry" Cu (Mo); etc. All that is left is strata-bound, massive, pyritic sulphides!

The reader may have noted that in keeping with the dictum previously laid down I have tried to characterize the host rocks as objectively as possible and have said nothing about the genesis of the host rocks or the mineralization except insofar as the nomenclature of geology makes this unavoidable.*

---

* When we "describe" a rock as a basalt we are making at least one and probably two inferences: one, the rock is "igneous" or "is believed to have consolidated from a melt"; and two, the rock is probably extrusive (it is of course possible to have basalt dykes and sills which is why I wrote "probably" two). This is inescapable because the threefold classification of rocks into igneous, sedimentary and metamorphic groups is derived from the inferred mode of orogin. The nomenclature of geology is permeated with examples of such "logic". The only solution is a complete revision of the vocabulary, but this is not about to happen. Indeed, the situation is getting worse instead of better with perfectly good words like greywacke being displaced by "turbidite" and chert or limestone by "exhalite".

BRANDY AREA

General

As before it is proposed to dispense with the usual conventions. If the reader is not familiar with the area, "background" can be obtained from Little (1974) and Miller (1979).

It is a good deal easier to discuss the Brandy than the Northair area - partly because less is known about the former(!) and partly because it contains a tangible target which is still being explored. I propose to begin with a brief review of this exploration and then take up the Brandy area in general.

Silver Adit

In terms of the categories employed in respect of the Northair area the work being carried out at the Silver Adit is of course short term and target testing. There appears to have been some uncertainty about the nature of the target - the mineralization exposed in the adit and revealed by drilling located nearby - and, hence, the best way to pursue it.

The pale cream to white, weakly mineralized "felsite"(?) exposed in the addit and drill cores resembles nothing so much as thoroughly weathered mineralization.* (The oxidation, fracturing, and so on, which are common at shallow depths, tend to obscure details.) The rocks seem to have been sheared and crushed - possibly more than once? - and largely altered to bleached clays, presumably by acid produced through the oxidation of acid-producing sulphides (typically pyrite, pyrrhotite and chalcopyrite). If so, the presence of some pyrite is "anomalous". Sphalerite and galena on the other hand are relatively stable and their preservation is not at variance

---

* The existence of deeply weathered material suggests that the immediate area was probably not glaciated. How the near-surface rocks excaped glaciation is a matter for speculation, which need not concern us here. Examples in Canada of deposits with preserved leached cappings and secondary chalcocite blankets include the Casino porphyry copper in the Yukon and the B orebodies at the Heath Steel (massive sulphide" property in the Bathurst-Newcastle district.

with the suggestion made here.*

A brief examination of portions of two of the holes drilled in the vicinity of the Silver Adit revealed the presence of the following succession (from top to bottom of the drill holes):

greenstone
mottled pink and green rock
haematitic greenstone
oxidized mineralization(?)("felsite")
"quartz porphyry"

The quartz porphyry is light brown to tan in colour, laminated or foliated(?), and contains lenticular quartz "eyes" which measure 2 or 3 mm long and tend to be elongated parallel to the layering. This is identical to the quartz (feldspar) crystal (lithic) tuff which is the most typical rock type in many massive sulphide districts (eg., Bathurst, N.B.; Shasta, Calif.; Jerome, Ariz.; Central Sweden; Rio Tinto, Spain; to name only a few in a very large group).

The position of the leached zone(?) suggests it is (a) conformable - at least in these two holes and (b) in keeping with the common, but by no means universal, location of mineralization in relation to a felsic volcanic unit, ie., at or near the top. The noticable amount of haematite in the "greenstone" overlying the leached(?) zone accords with the characteristic association with massive sulphides of exceptional amounts of silica, iron and manganese (oxides, carbonates, etc.). The mottled rock consists of "knots" (aggregates) of chlorite 5 to 10 mm across set in a pale pink matrix but it was not otherwise examined closely. Since the unit has a very singular appearance, it could be a useful "marker". One receives the impression that the succession is normal - "right-way-up" - or, in other words, that the succession "youngs" or "faces" to the west.

---

* An up-to date review of the effects of oxidation and weathering on mineral deposits with suggestions for farther reading may be found in the text by Peters already cited ("Exploration and Mining Geology", Chap. 3, p. 85-120. —

See Appendix 2

Taken in sum, all these observations suggest the existence of a layer or bed of stratiform mineralization which strikes N-S and dips to the west at about 55 degrees, the near-surface expression of the zone being thoroughly weathered to a depth which is so far unknown.

Some of the units in this succession could be magnetic (eg., the haematitic greenstone or the mottled rock) and the results of the proposed AM survey might provide a means of tracing them to the north and south of the Silver Adit. The area of the Silver Adit might be a good place to experiment with mercury geochemistry by sampling the "trace" of the mineralization. (Of course, even if this mineralization contains mercury, it does not follow that the dissimilar material at Northair does so too.)

If the Silver Adit "felsite" is a weathered and oxidized sulphide deposit, it could contain a zone of secondary or supergene mineralization at the interface of oxidized material and the primary sulphides. One of the objectives of exploration should be to investigate this possibility. And needless to say, the mineralized zone - whether it is a concordant bed or a discordant vein - is not likely to be uniform in width and grade. Finding shoots (chutes) of better width and grade should be one of the major objectives of exploration in the area. This, of course, is where aids such as EM and geochem come in handy.

Brandy Area in General

Dave Bruce and others (eg., Miller, 1979) have reported that the area lying at least as far to the north of the Silver Adit as the Tedi Pit contains scattered mineralization. Exploring this area obviously constitutes a larger and/or "longer" term objective for work in the Brandy area. Suitable methods would seem to include AEM and AM (for geology, if not mineralization), geochemistry, and geology. In any event, it seems prudent to try to learn from the Silver Adit area and then to proceed accordingly.

General Remarks on Geology

While the nature and affiliations of the "felsite" exposed in the Silver Adit may be in doubt, the lithology of the Brandy area is generally suggestive of a massive sulphide environment. Miller and others noted the presence of limestone - in places altered to skarn - in the Brandy area. Although limestones are uncommon (not unknown) in massive sulphide host rocks of Precambrian age, they do occur widely in Palaeozoic and younger hosts. For this and other reasons the writer drew attention to deposits and host rocks which exhibit some of the characteristics of both pyritic massive sulphides and carbonate-hosted lead-zinc mineralization (Gilmour, 1976). Examples include Montauban-les-Mines, Quebec, and Balmat and Edwards, New York (both Grenville or Precambrian); the lead-zinc deposits of the Central Pyrenees (Ord.-Sil.); Meggen and Rammelsberg in West Germany (Devonian); Tynagh, Ireland (Carboniferous); Campo Morado, Guerrero, Mexico; and the Balabac Islands, Philippines (Cretaceous). In short, the existence of carbonate rocks, marls, etc., is not particularly at variance with a Mesozoic massive sulphide setting.

Miller drew attention to mineralization, in the Millsite area for example, which is reminiscent in some respects to that of porphyry copper deposits (1979, p. 103). This need not be a matter for surprise. I have already remarked that in B.C. and the U.S. Northwest porphyry coppers are associated with plutons which intrude "eugeosynclinal" (greenstone) belts. The Sam Goosly deposit, for example, seems to exhibit features of both massive sulphide and porphyry copper-molybdenum deposits. The mineralization consists of scattered fine-grained sulphides in tuffaceous greywacke, siltstone and shale of the "eugeosynclinal" Takla-Hazelton Group thought to be Jurassic in age. The layered rocks are intruded by monzonite and gabbro-monzonite stocks which have been dated as early Tertiary and are believed to have porphyry affinities. The Heracles silver prospect, located in the Cuddy Mountains about 100 miles northwest of Boise, Idaho - likewise has both massive sulphide and porphyry features. And, no doubt, there are others. It seems to me quite conceivable - even probable, given the local geology - the the Brandy (and Northair) districts could contain two or more superimposed rock assemblages and their associated mineralization. This suggestion could "account for" some of the features which appear to have puzzled a few previous workers.

MISCELLANEOUS

It is proposed in this section to note in passing what might be called "Organizational and Administrative" matters. It was obvious from the conversations that these subjects had already been discussed and most resolved by those involved. They are merely mentioned for the "record.

Arrangements were made at the time of the writer's visit to have the Northair-Brandy area flown with air photos on a scale of 1 in. to 800 ft. It was also proposed that readily accessible survey stations, the base line, claim corners, etc., be "panelled" (marked so that the locations will be visible on the photos). Roy Wares suggested this might be a useful job for the new surveyors to perform as it would also serve to introduce them to the area. The desirability of gathering core to a central location, providing protection, and so on, was briefly discussed, and it is understood that plans to conduct this vital task are already on hand. The need to provide Roy Wares with a vehicle and the desirability of finding a well-rounded helper were also briefly noted. These proposals too seemed to meet with the approval of those in authority.

13th August, 1980
Tucson, Arizona.

Signed:

REFERENCES

Conolly, H.J.C., 1936. A contour method of revealing some ore structures: Econ. Geol., v. 31, p. 259-271

Gilmour, P., 1976. Some transitional types of mineral deposits, Chap. 4, p. 111-160 in Wolf, L.H. (editor), Handbook of Stratabound and Stratiform Ore Deposits. Part I - Principles and General Studies, Volume 1 - Classifications and Historical Studies: Elsevier Sci. Publ. Co., Amsterdam, 338 p.

Little, L. 1974. A mineralography study of the Brandywine property lead-zinc-gold-silver deposit, Brandywine map area, Southwestern B.C.: Unpubl. B. Sc. Thesis, Dept. Geol. Sci., Univ. B.C., Vancouver, B.C.

Miller, J.H.L., 1979. Geology of the central part of the Callaghan Creek Pendant, Southwestern B.C.: Unpubl. M. App. Sc. Thesis, Dept. Geol. Sci., Univ. B.C., Vancouver, B.C., 174 p.