W,NDY-CRAGGY

Good Potential 889660

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Introduction

The author was engaged by Geddes Resources Ltd. to carry out a study of drill core from the Windy Craggy deposit during the summer of 1986. The objectives of the program were to:

- re-log the core in a reconnaissance fashion,
- chemically analyze any mineralized core not previously sampled,
- sample selected sulphidic material for spectral analysis and for metallurgical testing, and to
- re-interpret the core and other relevant data as necessary in order to better understand the deposit, particularly with respect to its potential for additional gold mineralization.

This report summarizes the results of observations made on drill core from DDHs 5b-81, 7-81, 9-82, 10-82, 11-82, 12-82, 13-83, 14-83, 15-83, 16-83, 17-83, 19-83, 20-83 and 21-83. During the course of the program, 11 kg of core from DDH 14 (440.0 to 470.0 m) were sent to the Canada Centre for Mineral and Energy Technology (CANMET) for mineralogical and metallurgical testing; this report also summarizes the initial findings of this work.

Previous work

The Windy Craggy property occurs in the St-Elias mountain range of northwestern British Columbia, 60 km west of the Haines Road and 10 km east of the Alsek River. Mineralization on the properly was discovered by aircraft reconnaissance in 1958 by J.McDougall, then of Falconbridge Nickel Mines Ltd. Intensive exploration was carried out on the property by Falconbridge and Geddes Resources Ltd. between 1981 and 1983, during which time 22 holes, for a total of 8049.5 m, were drilled.

The Falconbridge-Geddes Resources exploration program outlined a deposit with a minimum strike length of 1800 m. Approximately 1300 m of this was tested by diamond drilling, as a result of which apparant true widths of massive sulphides of up to 200 m were encountered (eg., DDH 11-82). A "world class" sulphide body was revealed, containing reserves variously reported as 350 M tonnes of 1.5% Cu, 0.08% Co (the Financial Post, Dec. 10, 1983), 317.4 M tonnes grading 1.5% Cu, 0.9 kg Co (Schroeter and MacIntyre 1985) and 100 M tonnes of 2.4% Cu, including 26 M tonnes of 3.29% Cu (McDougall, 1984). A major gold discovery (9.2 g/t Au, 9.6 g/t Ag and 1.21% Cu over a true width of 45 m, in DDH 14-83) was also made during the course of this program.

Au!

Geological Setting

The Windy Craggy deposit is contained within the Alexander lithostructural domain of the Insular Tectonic Belt. Specifically, it occurs in a weakly metamorphosed, laterally extensive Triassic volcano-sedimentary sequence, that is now believed to constitute an important base and precious metal metallogenic province (Berg and Grybeck, 1980).

Two other important occurences are known in this belt within 10 km of Windy Craggy - the Tats showing (up to 13.5% Cu, 0.12% Co in grab samples) and the Rime/St-Joe prospect (up to 89 g/t Au in grab samples). Several others have recently been discovered along the B.C.- Alaska border, 75 km to the south, eg. Glacier Creek (3 to 4 M tonnes of up to 76% Ba, 3.6Zn), Mount Henry Clay (up to 33% Zn, 2.5% Cu, and 5% Ba/6' in glacial erratics) and Herbert Mouth (up to 15.6 g/t Au in grab samples --MacIntyre and Schroeter, 1985; MacIntyre, 1984). These are all considered to be stratabound, volcanogenic and stratigraphically equivalent to the Windy Craggy deposit.

Mineralization at Windy Craggy occurs in MacIntyres's (1985) middle Tats Group, and specifically at the contact between the thick argillites which occur at the top of this unit and underlying basalt. The middle Tats Group is underlain by the basaltic flows and argillites of the lower Tats Group and by Devonian sedimentary basement; it is overlain by 2000 m of upper Tats Group pillowed basalt. Both host rocks and ore have been deformed by isoclinal northwest-plunging F_1 folds and by open, northeast-plunging F_2 folds. Both have also been offset by high angle faults coaxial to F_1 and by a later, northeast-trending fault set (Gammon and Chandler, 1985).

The Windy Craggy sulphides appear to be contained in an F_1 synform, and are considered by others to be enveloped by extensively altered and sulphide-veined basalt. Two mineralized zones are recognized within the synform-- a northern copper-rich pyritic mass, and a southern Co-rich pyrrhotitic body. The deposit is considered to have formed in a back-arc, or Guaymas-type epicontinental rifting environment (MacIntyre, 1986).

Drill Core Geology

Although a variety of geologists had evidently examined the Windy Craggy core during the course of the 1981-83 drilling program, the Falconbridge logs were found to be precise and consistent. Moreover, the interpretations illustrated in the Falconbridge plans and sections were found to be plausible, although a more conservative approach to geological extrapolation is employed in drawings P-86-02-1 to-9.

Most of the sulphide-bearing intersections were found to have been split. As a result, re-analysis for Au was carried out only on selected core from the holes drilled in 1981 and on carbonate-sulphide material thought to be similar to that hosting gold mineralization in DDH 14-83. Although rapidly oxidizing pyrrhotite had previously been reported, only a small amount of sulphide was found to have decrepitated.

Some re-interpretation of the drill logs was found to be necessary. For example, little evidence was found for the pervasive stockwork alteration reported in the logs, and described by other geologists (eg., MacIntyre, 1985). The sulphide "stringer zones" and "silicified volcanics" thought to be present between 284.9 m and 293.3 m in DDH 20-83, between 291.3 m and 390.1 m in DDH 12-82, and in much of the core from the southern part of the deposit was found to consist of interbedded semi-massive sulphides, chert and tuff. The "pyritic quartz veins" and "chloritic alteration" described between 120.4 m and 122.8 m in DDH 9-82 and elsewhere, was re-interpreted as basalt flow-top material (one such zone, between 583.0m and 586.0m in DDH 13-83, grades 5 g/t Au). The "silicified rock" logged between 231.8 m and 252.8 m in DDH 13-83 was found to be grey cherty argillite. Most important, evidence was not found for significant pre-tectonic hydrothermal alteration, implied by the description of abundant "siliceous intervals" and "stringer sulphides", in the gold-rich zone present between 419.7 m and 480.6 m in DDH 14-83.

Few useful stratigraphic markers were found in the core. An attempt was therefore made to use younging indicators (flow top features, disposition of intraflow microgabbro, various sedimentary textures) and bedding-foliation relationships as a means of defining the morphology of the deposit. Nevertheless, the structural complexity of the deposit and the low drill hole density allows for only a rough geological interpretation.

The following lithological units were recognized:

1) Limestone

Mappable light grey argillaceous limestone was noted only in DDH 5b. However, similar material is relatively abundant as fine interbeds in calcareous argillite west of the south zone in DDHs 11-82,13-83 and 14-83, and these usually contain disseminated barren pyrite. The siltstone noted in the Falconbridge logs appears to correspond to these thin argillaceous limestone beds. Thin, irregular beds of limestone, often containing significant chert, pyrite, pyrrhotite and chalcopyrite, separate basaltic flows near the ore zones, and are occasionally auriferous.

2) Argillite

Argillite is the most voluminous unit logged and, from younging evidence, constitutes the immediate footwall of the southern sulphide zone. Basalt separates argillite and massive sulphide in the north zone.

A variety of textures and compositions are represented in this unit. Weakly bedded, black cherty argillite, often containing heavily disseminated pyrhotite, chert and minor chloritic tuff, envelopes semi-massive to massive sulphide in the south zone. Well-bedded, medium-grey calcareous argillite, often containing late gypsum-infilled fractures, is found stratigraphically down section from cherty argillite on both limbs of the south zone synform. Younging features are moderately abundant in the latter, but not in the former. "Nodular" medium-grey calcareous argillite, containing granule-to cobble-sized ankerite-calcite spherules (concretions ? soft sedimentary fragments ?) occurs roughly between calcareous and cherty argillite in the south zone, and seems to signal proximity to mineralization in some of the north zone drill holes (eg. DDH 12-83, 14-83, 16-83, 17-83). Conductive graphitic argillite was not found to be common.

Reduced copper sulphides in argillite are reported in surface samples from the Geddes Resources property. However, no such mineralization was observed in drill core.

3) **Basalt**

Basalt is moderately abundant in the vicinity of massive sulphides although, as indicated, it consitutes the direct footwall only in the north zone. Although evidence of strong hydrothermal alteration reported in basalt by others was not seen, weak chloritic alteration is common. Only erratic Mg-Fe-LOI enrichment and Ca depletion is evident from available major element analyses (Gregory, 1983; MacIntyre, 1986). There is, however, a trend towards greater chloritization and increasing thickness of footwall basalt from the south to north in the area drilled.

Basalt is present mostly as flows, often with recognizable ropey calcareous and sulphidic flow tops. Small calcareous amygdules are often concentrated near flow tops, whereas microgabbro is often developed at the base of thick flows. Basaltic tuff is moderately abundant, and is usually found in association with iron sulphide.

From MacIntyre's (1986) data, it seems that the unaltered middle Tats Group basalts found in the Windy Craggy footwall are chemically distinct, being more aluminous, more alkaline, relatively LREE-enriched and TiO_2-depleted with respect to the basalts of the upper Tats Group. Although minor ultramafic volcanics are present (eg., from 36.6 m to 37.8 m in DDH 12-82), the rocks of this unit generally fall in a narrow compositional range (SiO_2 in weakly altered basalt varies from 45% to 50%). No convincing intermediate or felsic volcanics were observed.

4) **Subvolcanic Andesite**

Fine-grained hypabyssal, light greenish-grey andesitic dykes and sills are common on the western side of the Windy Craggy synform, between holes 5b-81 and 21-83. These intrusive rocks are usually massive and unfoliated, although carbonate alteration, small feldspar pherocrysts and local glomeroporphyritic textures can be found. Cross-cutting relationships with surrounding lithologies and chilled margins are often evident. These dykes and sills seem to be compositionally unrelated to the other volcanic rocks in the sequence, and have an uncertain temporal and genetic relationship to them.

5) **Chert**

Chert is a major constituent of the semi-massive sulphide units and can occasionally be found as rounded fragments in massive sulphides. Units of sulphide-poor chert unrelated to thick sulphides are uncommon and, when found, still contain thin interlaminations of sulphide, chloritic schist (altered tuff ? exhalite ?) and/or carbonate. Facies change is suspected between holes 14-83, 12-82 and 21-83 involving chert, black cherty argillite and possibly carbonate-chert-sulphide rock.

6) **Weathered Core**

Heavily weathered core was observed near the collars of DDHs 12-82, 15-83, 17-83 and 21-83. Extensive weathering of massive sulphides 60 m below the inferred surface is also observed between 280 m and 320 m in DDH 11-82.

In all of these cases, weathering can be attributed to a major fault zone which extends down the centre of the Windy Craggy synform -- the "Axial Fault Zone". Goethite-healed fault gouge is locally evident in this fault zone.

Some of the weathered fault rubble sampled by the author was observed to be significantly auriferous. Among the better assays obtained were:

DDH 11-82, 1031 to 1054' (314.3 m - 321.3 m,	(approx.) approx.)	3.7 g/t Au/7.0 m
DDH 12-82, 70 to 94' (21.3 m to 28.7 m,	(approx.) approx.)	4.0 g/t Au/7.3 m
DDH 12-82, 109 to 129' (33.2 m to 39.3 m,	(approx.) approx.)	1.6 g/t Au/6.1 m
DDH 17-83, 20.0 m to 30.0 m	(approx.)	2.5 g/t Au/10.0 m
DDH 17-83, 37.0 m to 43.0 m	(approx.)	1.5 g/t Au/6.0 m
DDH 21-83, 31.0 m to 38.0 m (including 6.4 g/t/4.0 m from 34-38 m, approx.)	(approx.)	4.3 g/t Au/7.0 m
DDH 21-83, 73.0 m to 76.0 m	(approx.)	2.8 g/t Au/3.0 m

7) **Massive Sulphides**

Massive sulphide zones composed of pyrrhotite or pyrite are chemically, texturally and spatially distinct. Zones of pyrrhotitic massive sulphides are fine-grained, dense, and contain minor dark siliceous gangue. Pyritic massive sulphides are fine-to medium-grained, contain chalcopyrite in streaks and as aggregates interstitial to pyrite grains, contain gangue material which varies from silicious to sideritic/ankeritic and frequently exhibit coarse bedding. A crude relationship is evident between the carbonate content of the gangue and the copper grade of the corresponding pyritic unit.

The massive sulphides show no clear metal zoning, other than the lateral pyrite-Cu to pyrrhotite-Co distinction that is made between the north and south deposits. To date, only minor sphalerite has been found in either zone. The magnetite described previously as occuring throughout the massive sulphide zones was not observed by the author.

Thirty five-element quantitative spectral analyses were carried out on seven composites from a variety of massive to semi-massive sulphidic samples, in order to evaluate the potential in the deposit for economic byproducts. The following sulphide types were investigated: auriferous semi-massive pyrite in carbonate from DDH 14-83 (samples 14-440A and 14-452A), massive pyrrhotite with elevated Co content from DDHs 9-82 and 12-82 (samples 9-1420A and 12-231A), massive pyrrhotite containing unusually high Cu grade, and moderate Co values from DDH 12 (sample 12-218A), a massive pyrite sample relatively rich in Zn from DDH 12 (sample 12-527) and unusual semi-massive, coarse- grained pyrite-chalcopyrite material from DDH 11 (sample 11-1344).

The results, tabulated in Appendix A, show sample 14-440A to be weakly enriched in Ga (17 ppm), sample 14-452A to be anomalous in Mo (52 ppm), samples 12-218A, 12-231A and 9-1420A to be enriched in Sb (73-160 ppm) and sample 12-527 to contain elevated contents of Sb and Cd (51 and 87 ppm respectively).

8) **Semi-massive sulphides**

Semi-massive sulphides envelop the southern massive sulphide zone, and seem to increase in thickness as the massive sulphide decreases. This unit consist of irregularly interbedded massive pyrrhotite, occasional massive pyrite, black chert, cherty argillite and chloritic chert; it rarely contains important concentrations of economic metals. The unit is easily distinguishable from the auriferous, sulphide-bearing carbonate unit discribed below.

A similar heterogeneous semi-massive sulphide unit envelops thin massive pyrrhotite west of the north zone, towards the bottom of DDH 12-82. It may represent the distal expression of the thick massive sulphide body comprising the south zone. It is suspected that rocks of this unit may grade further into cherty argillite and chert.

Rocks of this unit have been described previously in terms of silicified and chloritic alteration and stringer sulphides. However, there is no question that they reflect chemical and clastic sedimentation.

9) **Carbonate-sulphide rock**

This unit is typified by the rocks of gold-rich zone encountered in DDH 14-83, and is compositionally distinct from all of the other units logged. It is also stratigraphically distinct; it occurs between massive sulphide and basalt in DDH 14-83, and between massive sulphide and footwall calc-argillite in a number of other holes.

The unit in DDH 14-83 is composed of fine-to medium-grained, medium brownish-grey Fe-Mg carbonate (calcite is rare), and subordinate grey cherty quartz. The former is buff-brown on the lightly weathered outer surface of the core, whereas the latter weathers white. Pyrite, subordinate pyrrhotite and moderately abundant chalcopyrite occur heavily disseminated, as semi-massive pods and bands, and occasionally as massive fragments in carbonate. In contrast, only weakly disseminated sulphides are observed in the cherty quartz. No visible gold was seen in any of the core.

Cherty quartz is present mostly in the form of poorly sorted, subangular to subrounded fragments, which are invariably enclosed by sulphide-bearing carbonate. However, bands of thinly laminated, non-fragmental cherty material can also be found occasionally. The carbonate-sulphide-chert unit in DDH 14-83 is cut by F_2-related, barren calcite veins (plate 2).

A total of 10 intersections of this unit, including the gold zone in DDH 14-83, have so far been recognized. Some of the anomalous values obtained are:

DDH 17-83	124.0 - 133.0 m	0.8 g/t Au/9.0 m
DDH 17-83	158.0 - 159.0 m	7.5 g/t Au/1.0 m
DDH 12-82	558 - 612 ft (170.1 - 186.6 m)	0.7 g/t Au/16.5 m
DDH 11-82	899 - 911 ft (274.1 - 277.7 m)	1.3 g/t Au/3.7 m
DDH 11-82	1540 - 1555 ft (469.5 - 474.1 m)	1.2 g/t Au/4.6 m
DDH 11-82	1601 - 1612 ft (448.1 - 491.5 m)	1.5 g/t Au/3.4 m
DDH 11-82	1704 - 1726 ft (519.5 - 526.2 m)	1.3 g/t Au/6.7 m
DDH 13-83	325.0 - 327.0 m	1.1 g/t Au/2.0 m

All of the above occur in carbonate-sulphide intersections which are believed to be stratigraphically equivalent to the one intersected in DDH 14-83; they resemble the low-grade calcite-bearing material present towards the margins of the main zone. They differ with respect to thickness and Au grade, in the relative abundance of calcite in the gangue, and in the preponderance of pyrrhotite. Cherty fragments are rare or absent, although small chloritized volcanic or sulphidic clasts may be present.

exhalite

All of these auriferous intersections occur in the vicinity of the northern massive pyritic deposit. All are believed to represent exhalitic sediment, in which the original carbonate-chert bedding has been transposed and dislocated by tectonic brecciation and/or by soft sediment deformation. They do not appear to reflect epigenetic mineralization, as has been inferred previously.

10) Gabbro

Black, medium-to coarse-grained hornblende gabbro intersects calcareous argillite near the tops of DDHs 11-82 and 13-83. Its chilled margins were previously logged as mafic tuff.

This unit is inferred to cut the hypabyssal andesitic of unit 4, and may be the youngest lithology present.

Gold Zone Mineralogy

A petrographic examination was carried out by the author on the following six polished thin sections from the gold zone of DDH 14-83:

426.64 - 3 thin sections	(from	423.8 - 427.0 =	4.30 g/t Au)
452.50 - 1 thin section	(from	452.0 - 455.0 =	34.97 g/t Au)
456.15 - 1 thin section	(from	455.0 - 458.0 =	22.63 g/t Au)
455.35 - 1 thin section	(from	455.0 - 458.0 =	22.63 g/t Au)

A total of 15 gold grains, averaging 5 to 10 microns in size, were observed in samples 452.5, 456.15 and 455.35.

All four samples contain semi-massive sulphides, and bands or fragments of chert in abundant fine-to medium-grained carbonate. Petrographic and wet chemical analysis shows the carbonate to consist of siderite, ankerite and minor calcite. The cherty bands and fragments consist of very fine-grained, mosaic-textured quartz. The fine-grained, laminated and silica-rich nature of the latter, and the sharp contact between carbonate and unaltered basalt observed in a number of samples from this zone tends to support a sedimentary origin for this unit.

The carbonate fraction in the samples contains 10-40% of fine-to medium-grained pyrite, subordinate pyrrhotite, and minor sphalerite, pentlandite, Fe-chlorite, quartz, hematite and stilpnomelane. The sulphides occur as irregular patches, and as intergrowths between carbonate grains. The chert bands and fragments contain 5-10% of very fine-grained sulphide, in the form of weak disseminations and very thin laminae.

A direct spatial and genetic relationship between gold and carbonate is evident in these samples. Gold grains were found only with carbonate; none were apparant in chert or in silica-rich sample 426.65. Moreover, gold was observed primarily in association with the pyrite in the carbonate bands. An early, often brecciated, subidiomorphic to idiomorphic variety of pyrite, usually found in association with chalcopyrite, was found to be a particularly favourable host for free gold. Three varieties of free gold grains were recognized;

- bright yellow, very fine-grained gold (1-2 μm), found as inclusions in pyrite;
- lighter yellow, relatively coarse-grained gold (20-25 μm), found at the contacts between pyrite and gangue;
- pale yellow (argentiferous ?) fine-grained (3-6 μm) gold found in fractures in pyrite.

Gasparrini (1983) studied two samples from DDH 14-83 by means of petrography and scanning electron microscopy. Gold was observed in only one sample, as grains with an average size of less than 10 μm. The silver content of these grains was found to vary between 15 and 30%.

Based on her observations, Gasparrini obtained a textural categorization of gold identical to the above. A fine and even distribution of gold through the rocks of the gold zone was inferred, which, as pointed out in her report, is in contrast with the dense and irregular concentrations found in many other gold ores.

CANMET has used petrography and electron probe micro-analysis to study the nature and mode of occurrence of gold in samples provided by the author from 440 m, 452 m and 458 m in DDH 14-83 (Wilson , in preparation). Nineteen gold grains were observed in the 15 polished sections analyzed.

Gold was observed by CANMET to range in size from 3 to 60 μm, and to average 13 μm. However, on a weight basis, 70% of the gold was found in grains greater than 30 μm in size, and 87% in grains larger than 20 μm. In contrast with previous studies, most of the free gold was observed to occur in gangue.

In view of the association observed in at least some samples between gold and an early phase of pyrite, and particularly since gold is often found as inclusions in such pyrite, the gold mineralization in DDH 14-83 is assumed to have occured early in the history of the deposit. Since a sedimentary origin is evident for the carbonate unit and its associated sulphides, a syngenetic origin for the gold is also inferred. Note that only one gold-bearing veinlet-- an 8 mm long, 1mm wide quartz-filled tension fracture in sample 440 -- was observed in all of the sections examined by the author and by CANMET (plate 1b).

Its occurence in the free state, and in an acceptable size range suggest good metallurgical properties for the gold zone around DDH 14-83. On the basis of textural evidence, Gasperrini (1983) concluded that a gold recovery greater than 60% could be expected, although some loss might occur in relation to very fine-grained, unliberated particles totally enclosed in pyrite.

Metallurgical Tests

Metallurgical tests on composite samples from the gold zone at Windy Craggy were carried out in 1986 by Coastech Research Inc. (Summers and Marchant, 1986) and by Mr. A. Stemerowicz of CANMET.

The Coastech results indicate that a copper concentrate with a copper recovery of 82% and a grade of 20% Cu can be achieved by means of floatation. Gold recovery of 83% to a bulk floatation concentrate was obtained. Additional testwork was recommended to improve concentrate cleaning efficiency; cleaning will improve the concentrate gold grade, although recovery might decrease due to loss of unliberated gold in pyrite/pyrrhotite.

Selective floatation at a 90% -325 mesh grind was carried out by CANMET on material provided by the author from the gold zone. A concentrate with a Cu recovery of 85% and a grade of 27% Cu was obtained, with a gold recovery of 69%. Cyanidation of the floatation tailings resulted in a total gold recovery of 97%, although high cyanide and lime consumption was reported.

Preliminary gravity concentration tests were also carried out by CANMET. Jigging at -14 mesh and tabling of the reground (90% -325 mesh) jig tailing resulted in a gold recovery of 56%. Gold recoveries of 70% or better may be obtainable with further testing (A. Stemerowicz, pers. comm., 1986). Further gravity concentration study, and mercury amalgamation trials on both floatation and gravity concentrates is recommended by CANMET.

Summary and Conclusions

An interpretation of the Wind Craggy geology is presented in dwg. P86-02-1. The presence of two sulphide bodies, separated by a 100 m "gap" of basalt, can be confirmed at the 1600 m level. Both bodies occupy the core of what is probably the same F_1 (?) synform, and both have been affected by a major fault system (the "Axial Fault Zone") which extends through the centre of the southern sulphide body. The two sulphide zones appear to have an overall northwesterly plunge. The limbs of the north and south zone synformal folds extend to the northeast and northwest, which indicates that mineralization is open along strike in these directions, as well as down plunge and at depth. The presence in the south zone of supergene-enriched covellite-bearing material (11.1% Cu, 0.20% Co/9.1 m, in DDH 11-82), suggests local potential for high grade base metal mineralization additional to that evident in the unaltered sulphides.

Evidence for two foliations, two corresponding fold phases and at least as many generations of faulting is evident in the drill core, which supports the multiphase deformation style for the Windy Craggy area suggested by Falconbridge. The superposition of these structural events may explain the complexity of the deposit. Thus the two sulphide zones probably represent segments of the same body, with the gap between the two probably being the result of major F_1-F_2 cross-folding. Structural mapping at surface in the vicinity of the gap will determine if F_2 is synformal here, and if the two bodies are likely to join at depth.

The rocks enclosing the deposit do not appear to be strongly altered, as has been suggested by others. Instead, the semi-massive sulphides surrounding the main areas of mineralization are now considered to consist of interbedded sulphide, chert, cherty argillite and chloritic tuff exhalite. However, increasing chloritization of footwall basalt, as well as possible basalt thickening, is noted in the vicinity of the north sulphide zone. The possibility therefore exists that the major focus of hydrothermal alteration and footwall basalt doming lies down plunge and/or along strike to the northwest of the area drilled.

The gold intersection in DDH 14-83 is compositionally and texturally distinct with respect to all of the other sulphidic units encountered, and occurs at a distinct stratigraphic level near the base of the massive sulphides. The interection in hole 14-83 is not unique; analogous, but less well mineralized carbonate-sulphide intersections were encountered at similar stratigraphic levels in a number of other drill holes. In particular, the thin, folded (?) weakly auriferous carbonate zones intersected near the end of DDH 11-82 may represent the eastern strike limit of the main gold zone.

The carbonate-sulphide units in DDHs 12-82, 13-83, 15-83 and 17-83 are inferred to be the folded, distal equivalents of the gold-bearing unit interected in DDH 14-83.

Petrographic study suggests that gold in this carbonate-sulphide rock exists in the free state, in association with pyrite and with carbonate gangue. Observed grains vary in diameter from 1μm to 70μm. A mean size of between 5μ and 13 μm is apparant, although work by CANMET suggests that by weight most of the gold occurs in grains larger in size than the mean.

Metallurgical testing of material from the DDH 14-83 gold zone by CANMET and by Coastech Research Inc. indicates good gold recovery (69 to 83%) to a copper floatation concentrate. Of particular interest from the point of view of capital cost is the possibility, suggested by CANMET, for acceptable gold recoveries by gravitational methods.

Evidence exists in weathered core for significant epigenetic (?) gold mineralization along the "Axial Fault Zone" (eg., 4.0g/t Au/7.3 m in DDH 12-82, 6.4g/t Au/4.0 m in DDH 21-83), which is distinct from the syngenetic mineralization found in carbonate-sulphide rock. It is therefore concluded that the fault zone constitutes an important new gold exploration target.

Existing tonnage and grade estimates indicate that Windy Craggy may be among the word's largest known base metal deposits. From the present study, it is concluded that excellent potential exists for base metal reserves additional to those already outlined down plunge and along strike of the north sulphide zone to the northwest, in the direction of increasing alteration and footwall basalt thickening.

It is also concluded that the gold-rich carbonate-sulphide zone intersected by DDH 14-83 is stratabound, and that its contained mineralization is syngenetic in origin. Potential is therefore believed to exist for stratigraphic continuity of this zone, and hence for significant additional gold mineralization of this type on the property. Reserve calculations cannot be made on the basis of a single drill hole, but sufficient confidence can be placed on the continuity of this zone to support speculation on the presence of a gold-bearing resource of several million tonnes (eg., Fox 1986; McDougall, 1984). The metallurgical properties of this resource are likely to be good.

Recommendations

Additional exploration at Windy Craggy is clearly warranted. It is recommended that a program be designed to meet the following objectives:

- The detailed definition of base and precious metal reserves in the area of previous drilling. Because of anticipated structural complexity and the limitation on surface drill sites, McDougall's (1984) recommendation for an underground exploration program is supported.

- The reconnaissance evaluation of the "Axial Fault Zone", of the area to the northwest of the north sulphide zone, and of the high grade supergene Cu-Co zone intersected by DDH 11-82. Drilling in the Axial Fault Zone should be initiated in the "gap" between the north and south sulphide bodies, where it intersects the base of the massive sulphides. Drilling should be done both in the zone of weathering and below it to determine if gold enrichment is primary, or due to the oxidation of sulphides, as is the case for Canamax's Ketza River deposit, Y.T.

- Detailed structural mapping and reconnaissance drilling in the "gap" between the two sulphides zones, to test the hypothesis that the two zones join at depth.

- Additional metallurgical testing of material from both the gold and massive sulphide zones. In particular, tests should be continued on gravity methods of gold beneficiation.

The commercial feasibility of the Great Central Mines chloride-based hydrometallurgical process (eg., Craigen and Beattie, 1985; Beattie, Craigen and Sarkar, 1984) should also be evaluated, This process could result in the extraction of all of the potential product at Windy Craggy, including Cu, Ag, Au, Co and S, is more suitable for the deposit than acid pressure leaching methods, and is potentially an economically attractive option to conventional pyrometallurgical methods. Metallurgy

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