New Observations on the Bolivar district

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Executive Summary

The Bolivar district has excellent potential for delineation and expansion of reserves beyond what is currently being mined. Comparison with similar deposits in Mexico, USA, and Chile suggests the possibility of 10-20 million tons. Existing drilling in the Bolivar Sur zone should be continued and several other targets are outlined.

As recommended previously, it is important to have a better understanding of igneous systematics in the Bolivar district, including dating and major/minor element compositional analysis. The 3D database needs to be completed so that accurate maps and cross sections can be drawn to help visualize the Bolivar system. Preliminary plots of surface geochemical analyses indicate a strong Mo and W geochem anomaly that is coincident with the hypothesized center of skarn alteration in the Bolivar Sur zone. This should be drilled. The 3D database should also be used to plot the distribution of the two main stratigraphic zones which host ore, the upper calcic carbonate horizon which predominantly hosts Zn-rich ore and the lower dolomitic horizon which predominantly hosts Cu-rich ore. It is particularly important to drill these horizons where they are intersected by structures or breccia pipes/zones. In addition, the topography of the Bolivar Granodiorite in the subsurface is an important control on ore distribution.

It is clear that skarn alteration and mineralization extends underneath the volcanic rocks to the east and probably to the west of the Bolivar pluton. Locally, this is evidenced by quartz-epidote veins which should be mapped on the surface both in outcrop and in float due to the resistant weathering characteristics of euhedral quartz and to a lesser extent epidote. Zones such as the gentle slope east of La Montoya should be examined for evidence of quartz-epidote float. All such zones identified should be drilled, including the west side volcanic-skarnoid-granodiorite contact.

Breccia zones such as La Increible and Breccia Linda have characteristics similar to major breccia pipes such as Pilares near La Caridad and Democrata at Cananea. Where such pipes encounter limestone they tend to have a low-grade calcite-flooded core surrounded by a high grade annulus, which itself is zoned from proximal Cu to distal Zn. These zones should be targeted and drilled. Planar faults/cleavage may be related to major unexposed faults that could have significance in terms of localizing or offsetting mineralization. The distribution of such planar/fault/cleavage zones should be examined to see if they point to larger controlling structures.

Bornite is locally abundant in the Bolivar district but is not always recorded on drill logs. The bornite intercepts are always high grade (bornite = 66% Cu), usually do not have significant Zn, and locally have high Au (over 6 g/t Au in DDH 61). To better understand the mineralogy of the bornite zones the drill core pulps from these zones should be re-analyzed with the Chemex multi-element package. In addition a brief petrographic study of the bornite zones is proposed.

Introduction

The following report of observations and recommendations is based upon a five day field visit, Dec. 15-19, 2005, which included examination of underground and surface exposures along with logging of 6 core holes drilled on the property. The locations of the 14 drill holes examined to date are shown in Figure 1. As required by Canadian Investment Regulations, Dia Bras has my permission to use this report for their own purposes, for their website, and for release to the public. Features described in this report are illustrated in a PowerPoint presentation that can be downloaded at:

http://www.science.smith.edu/~lmeinert/MeinertPubs/MeinertBolivarPhotos2.ppt

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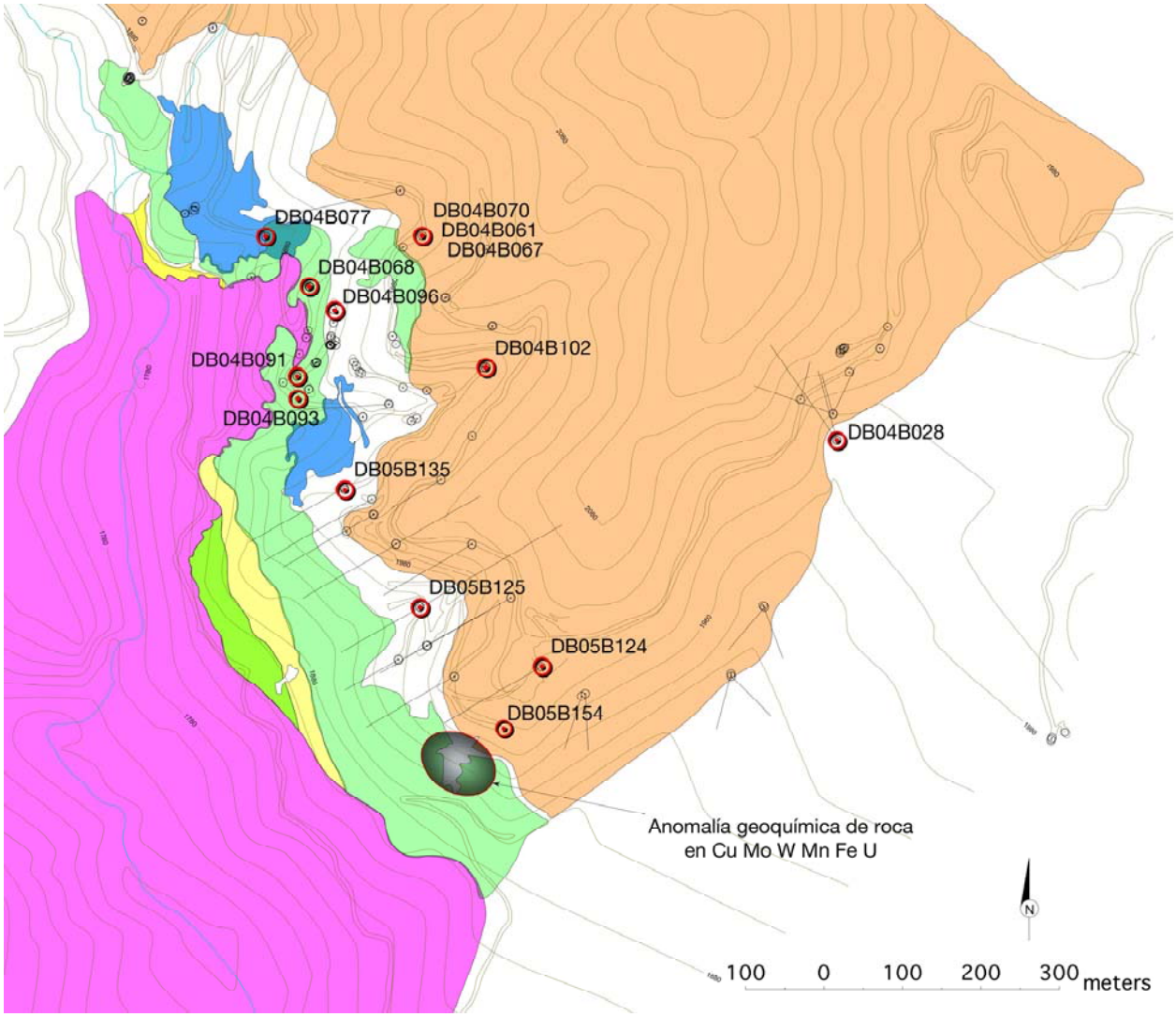

Figure 1 Geology and Drill hole locations in the Bolivar District discussed in this report.

Observations based upon underground visit to Bolivar Mine

Stop 1 Level 1 Breccia Linda East – a strongly endoskarned (epidote) porphyritic granodiorite is in contact with brown garnet skarn. Both granodiorite and skarn are cut by a fine-grained felsic dike with strong flow foliation along the margins (Fig. 2).

Stop 2 Breccia Linda East –Pale brown garnet-pyroxene skarn cut by chalcopyrite-sphalerite veins with clots and envelopes of dark brown garnet (Fig. 3). Main sulfide vein is parallel to bedding but roughly perpendicular to planar faults/cleavage developed locally throughout the Bolivar district (Fig. 4). These planar faults/cleavage are the result of brittle shattering of competent, shallow rocks. This shattering could be due to hydrofracturing or could be due to proximity to major faults. There are no major faults known in the Bolivar district but there could be in the basement rocks under the surrounding volcanics. Offshoot sulfide veins locally follow the planar cleavage/faults but also crosscut them. Whereas early skarn replacement is massive, later skarn associated with the introduction of sulfide mineralization is structurally controlled by bedding planes and faults/cleavage. Thus, ore shoots can be planar zones within otherwise low-grade or barren skarn.

Stop 3 Breccia Linda Central Pod – Coarse-grained massive sphalerite>chalcopyrite on margin of calcite-cemented breccia with fragments of sulfide and skarn (Fig. 5). Late vuggy calcite crystals fluoresce red, which likely is due to elevated Mn content.

Stop 4 Level 4 Foto Stope. Cu-rich zone with red-brown garnet (Fig. 6). Vuggy patches of calcite-quartz fluoresce yellow. Very large, late calcite crystals fluoresce red.

Stop 5 Level 6 Rosario zone green garnet-pyroxene-sphalerite. In a similar close to the granodiorite location but further south, the Rudolfo zone has brown garnet-chalcopyrite instead of pyroxene-sphalerite. This relationship suggests a South to North vector of fluid flow as well as away from the granodiorite contact. Vuggy patches of calcite-quartz fluoresce yellow.

Observations based upon surface exposures in Bolivar District

Stop 1 Adjacent outcrops of equigranular Bolivar Granodiorite, skarnoid, and overlying andesite on southwest side of pluton (Fig. 7) with 10% quartz, 8% hornblende, and plagioclase>Kspar. Sheared outcrop of equigranular Bolivar Granodiorite is cut by an aplite vein/dike (Fig. 8). Note that the aplite vein/dike has planar walls indicating that the granodiorite was solid when the aplite intruded and that the aplite vein/dike is cut and offset by numerous sub-parallel shears which thus must be younger than both the aplite and granodiorite. Similar sub-parallel shears have been noted locally throughout the mine area and cut skarn (Fig. 4) but not some dikes (Fig. 2). Thus, dating of the granodiorite and pre- and post-mineralization dikes will effectively bracket the time of mineralization and deformation. As previously noted, these planar faults/cleavage are the result of brittle shattering which could be due to proximity to major faults.

Stop 2 Skarnoid in sedimentary rocks near (<50m) granodiorite outcrop contains vuggy patches of euhedral quartz crystals (Fig. 9). Overlying andesite volcanic rock is cut by quartz veins (Fig. 10), forming incipient breccia like that at La Increible on the other side of the district. Locally the quartz breccia cement is vuggy and euhedral (Fig. 11). Such euhedral quartz veins are likely to accumulate in regolith and float so that even if outcrops are scarce, observation of quartz crystals can be used to infer brecciation and hydrothermal alteration in the underlying volcanic rocks and where these overlie carbonate rocks, possible skarn alteration and mineralization.

Stop 3 Looking east from Stop 2 the Bolivar Granodiorite crops out beneath the skarn cliffs of El Val and points south (Fig. 12). Looking farther north skarn cliffs of Bolivar Sur and El Gallo are visible across the grassy float of Bolivar granodiorite (Fig. 13). With a zoom lens the malachite stains of the lower Cu skarn horizon are visible and the La Increible breccia pipe is visible as a grassy area beyond the skarn cliffs. The approximate location of the Mo geochemical anomaly is shown, which might overlie a buried porphyritic intrusion (Fig. 14).

Stop 4 Adit into basal Cu zone of Bolivar Sur (Fig. 15). Boulders of epidote-vuggy quartz are scattered near the mouth of the adit, possible having rolled down from the overlying altered andesitic volcanics (Fig. 16).

Stop 5 La Increible Norte stockwork epidote veins in andesite (Fig. 17) similar to La Increible.

Observations based upon drill core

Bolivar Sur

DDH 154 Drilled vertically at the southern end of the Bolivar Sur zone.

0-32	Drill log lists mostly andesite.
32-128	Drill log lists mostly hornfels and pale skarn.
128-132.5	Andesite dike
132.5-134	Brown and red-brown garnet > blue-green pyroxene (Fig. 18).
134-135.7	Epidote-calcite altered hornfels
135.7-139.7	Massive magnetite-chalcopyrite with patches of phlogopite (Fig. 19), olivine, and red-brown garnet.
139.7-146	Mixed magnesian skarnoid and punky pyroxene > red-brown garnet (Fig. 20).
146-148	Andesite dike
148-155.6	Punky pyroxene > magnetite-garnet (Fig. 21).
155.6-157	Coarse-grained phlogopite-magnetite magnesian skarn (Fig. 22).
157-172	Biotite hornfels cut by veins with pyroxene envelopes that are cut and offset by sub-parallel, planar faults (Fig. 23).
172-182	Equigranular Bolivar granodiorite with disseminated veinlets of biotite-magnetite-chalcopyrite (Fig. 24).

DDH 135 Drilled -50° at the northern end of the Bolivar Sur zone and intersected both the upper calcic ore horizon (Zn rich) and the lower dolomitic ore horizon (Cu rich).

0-23.6	Drill log lists mostly marble and wollastonite skarnoid.
23.6-26	Pale wollastonite-tan garnet skarn.
26-38	Andesite dike with skarn along both contacts. This would be a good sample to date as it clearly is pre- or syn-skarn formation unlike other andesite dikes which cut and therefore postdate skarn. One box of core from this 12 m andesite intersection should be sufficient to yield dateable zircons (Fig. 25).
38-46	Tan garnet at contact of andesite dike (Fig. 26) with patches of sphalerite-bornite-chalcopyrite (Fig. 27) and a sharp contact of tan garnet with marble (Fig. 28).
44-53	marble
53-58	20-80% sphalerite in green-tan garnet-pyroxene skarn (Fig. 29). Contact with marble is sharp (Fig. 30).
58-63.5	Zoned skarn sequence from green-tan garnet-pyroxene sphalerite (Fig. 31) to red-brown garnet-pyroxene-chalcopyrite (Fig. 32) to green garnet-pyroxene-sphalerite (Fig. 33) to sharp contact of sphalerite with marble (Fig. 34). Zonation of skarn and associated sulfide mineralogy is fairly consistent throughout the Bolivar deposit.
63.5-69.5	Marble
69.5-71.4	Yellow-green garnet and 5-10% bornite (Fig. 35).
71.4-83	Drill log lists mostly marble.
83-163	Drill log lists marble, skarn, hornfels, and andesite dike.
163-165	Green garnet skarn
165-167	Brown garnet-chalcopyrite±magnetite (Fig. 36). Some high grade core with 5-10% visible chalcopyrite was not split (Fig. 37).
167-170	Green garnet-magnetite-chalcopyrite (Fig. 38).
170-177	Green garnet and tan magnesian skarn
177-200	Drill log lists hornfels and andesite dikes
200-218	Bolivar Granodiorite (Fig. 39).

Breccia Linda area

DDH 102 Drilled vertically, east of Breccia Linda on Section 23

0-100	Drill log lists mostly andesite and hornfels.
100-135	Drill log lists mostly marble.
135-137	Green garnet-pyroxene with sphalerite > chalcopyrite. Some highly mineralized core with 10-20% sphalerite was not split (Fig. 40).
137-147.5	Andesite porphyry dike. Where potassicly altered or silicified it looks like granodiorite porphyry. Epidote endoskarn at contact with tan garnet skarn (Fig. 41).
147.5-154	Zoned skarn sequence from brown garnet-sphalerite (Fig. 42) to red-brown garnet-chalcopyrite (Fig. 43) to green garnet-pyroxene-sphalerite to pyroxene-chlorite-sphalerite-Chalcopyrite at marble contact.
154-166.5	Drill log lists mostly marble
166.5-179	Zoned skarn sequence from brown garnet-chalcopyrite-bornite-sphalerite (Fig. 44) to green garnet-sphalerite (Fig. 45) to green pyroxene-garnet-sphalerite to green pyroxene-chlorite (Fig. 46) to pyroxene-sphalerite-yellow-green garnet (Fig. 47) to marble
179-225	Drill log lists mostly marble and skarn.

DDH 91 Drilled through Breccia Linda West on Section 13

0-20	Drill log lists mostly marble.
20-29	Brown garnet > blue-green pyroxene skarn (Fig. 48).
29-31	Tan pyroxene > garnet skarn
31-39	Tan pyroxene > green garnet-chalcopyrite-sphalerite (Fig. 49) with patches of quartz-amphibole retrograde alteration (Fig. 50).
39-41	Outer breccia pipe ring of massive chalcopyrite-sphalerite (Fig. 51).
41-46	Calcite-chlorite-amphibole retrograde overprint of skarn in breccia core (Fig. 52).
46-52	Breccia fragments of chalcopyrite-sphalerite cemented by calcite-chlorite (Fig. 53).
52-54	Calcite-chlorite-amphibole retrograde overprint of skarn in breccia core.
54-93	Drill log lists calcite-chlorite-quartz altered skarn.
93-97.5	Pale brown garnetite (Fig. 54).
97.5-116	Bolivar Granodiorite, fine-grained near margin (Fig. 55).

DDH 14 Drilled roughly horizontal just above the Breccia Linda East area.

0-62	Drill log lists mostly skarn.
62-66	pale green garnet-pyroxene skarn without sulfide.
66-67	Green pyroxene>garnet skarn cut by sphalerite veins (Fig. 56).
67-71	Massive sphalerite>chalcopyrite with clots of garnet (Fig. 57).
71-73	Sharp contact of sulfides with gray marble (Fig. 58).
73-81	Massive sulfide with clots of brown garnet (Fig. 59).
81-82	Calcite-quartz vuggy cement of sulfide-skarn breccia (Fig. 60).
82-83	Massive chalcopyrite-sphalerite
83-84	Brown and red-brown garnet with clots of chalcopyrite-sphalerite (Fig. 61).
84-86	green-brown garnet
86-87	Bolivar Granodiorite (Fig. 62).

Fernandez Zone

DDH 61 Section 7

0-70	Drill log lists mostly andesite.
70-90	Drill log lists mixed marble and skarn.
90-95	Pale green garnet-wollastonite-pyroxene (Fig. 63).
95-97	Pale punky green garnet-pyroxene-sphalerite.
97-99	Green-brown garnet-chalcopyrite>sphalerite (Fig. 64).
99-105	Yellow-green garnet with bornite>chalcopyrite-sphalerite (Fig. 65, 66) and wollastonite-bornite at marble contact (Fig. 67).
105-165	Drill log says mostly marble.
165-170	Zoned skarn from green pyroxene>garnet to brown garnet-sphalerite (Fig. 68) to green garnet-sphalerite-chalcopyrite-bornite at contact with marble (Fig. 69).
170.5-216	Drill log says mostly marble.
216-248	Drill log says mostly skarn.

Discussion of Observations

The underground, surface, and drill core exposures paint a consistent story of high grade Cu-Zn mineralization in carbonate rocks near the contact with the Bolivar Granodiorite and extending for a considerable extent down dip underneath the overlying andesitic volcanic rocks. There are two main stratigraphic zones which host ore, an upper calcic carbonate horizon which predominantly hosts Zn-rich ore and a lower dolomitic horizon which predominantly hosts Cu-rich ore. In both cases the highest grade ores are developed along structures and associated breccia zones which cross the favorable horizons. This can be seen on the scale of outcrops (Figs. 4, 8, 23) and larger mineralized trends such as the Fernandez and Breccia Linda zones. In addition, the topography of the Bolivar Granodiorite in the subsurface is an important control on ore distribution. Jacques has done an excellent job in documenting this in the Bolivar Sur zone and it would be useful to extend this analysis to the entire pluton. The apparent steepness and locally overturned nature of the igneous contact in the northeastern zone is different than in Bolivar Sur and this difference needs to be better understood.

Zones of planar faults/cleavage are developed locally throughout the Bolivar district (Fig. 4, 8, 23). These planar faults/cleavage are the result of brittle shattering of competent, shallow rocks. This shattering could be due to hydrofracturing or to proximity to major faults. There are no major faults known in the Bolivar district but there could be such faults in the basement rocks under the surrounding volcanics. Such unexposed faults could have significance in terms of localizing or offsetting mineralization. The distribution of planar/fault/cleavage zones should be examined to see if they point to larger controlling structures.

It is clear that skarn alteration and mineralization extends underneath the volcanic rocks to the east and probably to the west of the Bolivar pluton. Locally, this is evidenced by quartz-epidote veins (Figs. 9, 10, 11, 16, 17) which can be mapped on the surface both in outcrop and in float due to the resistant weathering characteristics of euhedral quartz and to a lesser extent epidote. Zones such as the gentle slope east of La Montoya should be examined for evidence of quartz-epidote float.

Breccia zones such as La Increible and Breccia Linda have characteristics similar to major breccia pipes such as Pilares near La Caridad and Democrata (Meinert, 1982) at Cananea. Where such pipes encounter limestone they tend to have a low-grade calcite-flooded core surrounded by high grade annulus, which itself is zoned from proximal Cu to distal Zn.

Although the 3D database still needs to be completed, preliminary plots of surface geochemical analyses indicate a strong Mo and W geochem anomaly (Fig. 1) that is coincident with the hypothesized center of skarn alteration in the Bolivar Sur zone. Mo and W typically are associated with igneous centers and thus, this is a potential drill target for a buried pluton.

Bornite is locally abundant in the Bolivar district (Figs. 27, 35, 44, 65, 66, 67, 69) but is not always recorded on drill logs. The bornite intercepts are always high grade (bornite = 66% Cu), usually do not have significant Zn, and locally have high Au (over 6 g/t Au in DDH 61). The mineralogy of the bornite zones is not well understood and as a first step I asked Jacques Marchand to re-analyze drill core pulps from these zones with the Chemex multi-element package. This can be followed by petrographic study to better understand the mineralogy.

During my logging of selected drill core intercepts, several examples of strongly mineralized but unsplit and unanalyzed core were noted (Figs. 37, 40). This should not happen.

Comparison of Bolivar with similar Cu-Zn skarn deposits

Dia Bras (DIB) acquired the Bolivar mine and surrounding land package in October 2004. Previously, the mine was operated by a private Mexican company, Sr. Fernandez, for about 20 years and for the last eight years Dia Bras' project geologist, Roberto Banda, was the mine geologist. During those eight years the mine shipped 60,000 tonnes at 30% Zn and 6% Cu. The open stopes indicate that 200,000-300,000 tonnes was mined by Fernandez. Visual examination of the underground workings and surface drill core indicate a likely total of about 1 million tons but no reserve or resource has yet been calculated. Since the deposit is open in several directions, the total resource likely is larger than 1 million tons. To better constrain this will require more drilling, but some indications are provided by looking at comparable deposits.

There are several Cu-Zn skarns in Mexico that are broadly similar to the Bolivar deposit, including Tecolote, Sonora (Meinert, unpublished data), and San Martín in the Velardeña district, Chihuahua (Correa-Perez, 1988; Gilmer et al., 1988; Rubin and Kyle, 1988). The Tecolote mine in Sonora has historical production of 850,000 tons of skarn ore with average grades of 7.6% Zn, 2% Cu, and 60 g/t Ag. This is slightly larger, but otherwise comparable to Bolivar production. Continued exploration by Peñoles has defined a larger resource. San Martín is associated with a composite quartz monzonite stock which has intruded the Cretaceous Cuesta del Cura limestone and the district includes the equally important Sabinas skarn deposit. San Martín has produced approximately 20 million tons of ore averaging 5% Zn, 1% Cu, and 150 g/t Ag.

Outside of Mexico, other Cu-Zn skarns that are important analogs for Bolivar include the Empire Mine, Mackay District, Idaho, USA and El Sauce and La Campana in Chile. From 1884 when it was discovered until 1982, the Empire mine intermittently produced 899,517 tons of ore yielding 30,730 tons of copper, 456 tons of zinc, 41,159 ounces of gold, and 1,293,208 ounces of silver from garnet-dominant skarn (Wilson, et al., 1995; Chang and Meinert, 2004). The low Zn production is not due to low Zn grades (many zones are in the 5-10% Zn range) but because the bulk of mining occurred in the early 1900s when Zn was not an economic quantity. El Sauce in the Cabilda district of central Chile has produced about 10 million tons at 1.5% Cu and approximately the same Zn (no longer produced) (Tidy, 1970, Camus, 1985). La Campana in the Til Til area of central Chile has produced 500,000 tons at 1.75% Cu, 3% Zn, and 20 g/t Ag (Moya, 1980, Camus, 1985).

Based upon these analogs, it appears that there is excellent potential for small to moderate size Cu-Zn deposits in the Bolivar region with 10-20 million tons being a possible target.

Recommendations for future work

1) As recommended previously, it is important to have a better understanding of igneous systematics in the Bolivar district. To help with this zircons should be dated from the various igneous rocks, including the main Bolivar stock, an andesite dike with associated skarn (DDH 135 26-38m) and one that cuts skarn, a felsic dike, the andesitic volcanic rocks, and the overlying rhyolitic rocks. Such dating can be done through commercial labs such as Chemex. Zircons are preferable over techniques such as Ar-Ar which date alteration events. We know that alteration postdates most or all of the dikes and it is the chronology of the dikes and igneous events in general that needs to be understood. If igneous rock samples are collected for dating they should also be analyzed for major and trace elements for normal petrologic study. This would also form the foundation for a scientific publication on the Bolivar mine in a journal such as Economic Geology or Mineralium Deposita.

2) The 3D database needs to be completed so that accurate maps and cross sections can be drawn to help visualize the Bolivar system. Roberto's existing hand drawn mine maps are excellent but their utility is limited by not being able to integrate them with other scale and location maps. Preliminary plots of surface geochemical analyses indicate a strong Mo and W geochem anomaly (Fig. 1) that is coincident with the hypothesized center of skarn alteration in the Bolivar Sur zone. Mo and W typically are associated with igneous centers and thus, this is a potential drill target for a buried pluton. The 3D database can also be used to plot the distribution of the two main stratigraphic zones which host ore, the upper calcic carbonate horizon which predominantly hosts Zn-rich ore and the lower dolomitic horizon which predominantly hosts Cu-rich ore. It is particularly important to drill these horizons where they are intersected by structures or breccia pipes/zones. In addition, the topography of the Bolivar Granodiorite in the subsurface is an important control on ore distribution. Jacques has done an excellent job in documenting this in the Bolivar Sur zone and it would be useful to extend this analysis to the entire pluton. The apparent steepness and locally overturned nature of the igneous contact in the northeastern zone is different than in Bolivar Sur and this difference needs to be better understood.

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6) Bornite is locally abundant in the Bolivar district but is not always recorded on drill logs. The bornite intercepts are always high grade (bornite = 66% Cu), usually do not have significant Zn, and locally have high Au (over 6 g/t Au in DDH 61). The mineralogy of the bornite zones is not well understood and as a first step I asked Jacques Marchand to re-analyze drill core pulps from these zones with the Chemex multi-element package. This will give some idea of what other minerals and elements are present. I have also collected a suite of samples that I will have made into polished thin sections and write a short report on their mineralogical characteristics, similar to what was done previously for Bolivar skarn mineralogy. The cost of this is $3000 and the work will proceed as soon as possible once authorized.

References:

Camus, F., 1985, Los yacimientos estratoligados de Cu, Pb-Zn y Ag de Chile: in Frutos, J., Oyarzún, R., and Pincheira, M. (eds.), Geología y recursos minerales de Chile, Editorial de la Universidad de Concepción, Concepción, Chile, Tomo II, p. 547-635.

Cano, J., 1994, Geología y evaluación del área Sauce oriental, yacimiento de cobre tipo skarn El Sauce, comuna de Cabildo, V Región, Chile: B.Sc. Thesis, Departamento de Geología, Universidad de Chile, 66 p.

Chang, Z., and Meinert, L., 2004, Vermicular Textures of Quartz Phenocrysts, Endoskarn, and Implications for Late Stage Evolution of Granitic Magma: Chemical Geology, v. 210, p 149-171.

Correa-Perez, Jaime, 1988, Mining and concentrating practice at the San Martin Unit of I. M. M. S. A.; production of copper and zinc concentrates from complex sulphide ores: In: Silver; exploration, mining and treatment: Inst. Min. and Metall. London, pp 175-181.

Gilmer, A.L., Clark, K.F., Hernandez C., I., Conde C., and Figueroa S., J.I., 1988, Geological and mineralogical summary of the metalliferous deposits in the Santa Maria Dome, Velardeña, Durango: in Clark, K.F., Megaw, P.K.M., and Ruiz, J., eds., Lead-zinc-silver carbonate hosted deposits of northern Mexico: El Paso, Texas, University of Texas El Paso, Society of Economic Geologists Guidebook, p. 143-153.

Meinert, L.D., 1982, Skarn, manto, and breccia pipe formation in sedimentary rocks of the Cananea mining district, Sonora, Mexico, Economic Geology, v. 77, p. 919-949.

Moya, V., 1980, Zonación mineralógica y química yacimiento de cobre tipo skarn mina Sauce, Cabildo, V Región: B.Sc. Thesis, Departamento de Geología, Universidad de Chile, Santiago, 123 p.

Rubin-Jeffrey-N; Kyle-J-Richard, 1988, Mineralogy and geochemistry of the San Martin skarn deposit, Zacatecas: Economic Geologyv. 83; 8, pp 1782-1801.

Tidy, E., 1970, Geología del distrito minero La Campana, Provincia de Valparaíso: B.Sc. Thesis, Departamento de Geología, Universidad de Chile, Santiago, 286 p.