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COMMENTS ON THE EXPLORATION POTENTIAL OF THE LOS DOMOS POLYMETALIC Au-Ag VEIN PROJECT, SOUTHERN CHILE

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SUMMARY

The Los Domos polymetallic Ag-Au exploration project occurs as the strike extension of veins mined at the Cerro Bayo Au-Ag mine, in southern Chile. It is located in the far NW corner of the Jurassic-Cretaceous Deseado Massif which hosts many similar low sulphidation epithermal Au-Ag deposits such as Huevos Verde and Cerro Moro in southern Argentina. The stratigraphic package youngs to the west such that Los Domos lies within the upper rhyolite-rhyodacite tuff unit of the Ibáñez Formation at the top of the regionally extensive Chon Aike felsic volcanic unit. Competency for vein formation is provided by welded units in the Chon Aike and andesites of the underlying Bajo Pobre formation.

Los Domos is characterised by a significant colour anomaly derived from oxidation of pyrite within argillic alteration which has spread laterally within the highly permeable host rocks and indicative of a well developed hydrothermal system, possibly associated with quality Au-Ag mineralisation.

Other low sulphidation polymetallic Ag-Au veins host best mineralisation within ore shoots localised by the coincidence of several factors, including:
<u>Style of mineralisation</u> as the evolving ore fluid responsible for polymetallic Ag-Au mineralisation grades in time and partly elevation as:

- The initial quartz-pyrite-chalcopyrite component of low sulphidation quartz-sulphide Au $\pm$ Cu style mineralisation.
- Higher temperature polymetallic mineralisation dominated by red sphalerite recognised at target T7.
- Typical polymetallic Ag-Au mineralisation hosts the bulk of the ore as mainly quartz, pyrite, yellow sphalerite, galena tennantite-tetrahedrite and rhodochrosite.
- A low temperature epithermal end member hosts high Ag-Au grades with white low temperature sphalerite and argentite-acanthite recognised in specimens from Cerro Bayo.
- At a late stage and elevated crustal setting the influx of circulating meteoric waters promotes the development of banded quartz veins recognised in target T1 locally with pyrite or in some instances mineralised ginguro sulphidic bands.

<u>Competent host rocks</u>, required to fracture well as hosts for throughgoing veins, would be provided at Los Domos by welded and locally silicified tuff and phreatic breccia units hosted within the less competent, locally argillic altered, felsic tuff.
<u>Dilatant structures</u> focus mineralised fluid flow as well as mineralised sites of fluid mixing at structural intersections. In the Deseado Massif NW conjugate fractures host mineralised veins within more dilatant WNW vein portions, also apparent at Cerro Bayo. However Cerro Bayo, where the above styles of overprinting mineralisation are recognised, also hosts NS trending mineralised veins, herein interpreted to have formed in response to later transient EW extension. Application of the same model to Los Domos would provide targets within the NS portions of NNW sigmoids.
<u>Efficient mechanisms</u> of Au deposition provide elevated precious metal grades such as the 78.8 g/t Au in association with FeMn carbonate in Los Domos DDH031. Continued exploration should seek to identify bicarbonate waters, evidenced at the surface by MnO, and hypogene kaolin as indicators that fluid mixing mechanisms account for the development of elevated Au-Ag grade mineralisation.

A possible setting for attractive polymetallic Au-Ag mineralisation might therefore lie within the NS portion of the NNW flexure to the east of target T6, (termed target T6B) midway between the crustal levels recognised at the deep T7 and shallow T1, although the competency of the host rocks remains unknown.

The extensive colour anomaly and favourable comparisons with other polymetallic Au-Ag systems provide Los Domos with a <u>priority A</u> for continued exploration. Further geological mapping should better define the stratigraphy and structure as an aid to exploration, possibly with continued comparison to Cerro Bayo.

INTRODUCITON

In late January 2019, 3 days were spent for Equus Mining at Chile Chico, southern Chile, in a field review of the Los Domos project. The assistance in this work of is greatly appreciated from Damien Koerber, John Braham Guillermo Chacon and Luis Olivares Leal.

Priority

Exploration projects are rated with priorities to proceed with the planned work program to take them to the next decision point. Any such a grading might include a number of projects at widely differing stages of evaluation, some with substantial data bases, while others might be unexplored, but may display considerable untested potential. Priorities are based upon the data to hand at the time of inspection, and are subject to change as increased exploration provides improved and additional data. Projects are categorised as:
A – Of highest interest such that the proposed exploration program should be carried out immediately. However, early stage projects with untested potential might be rapidly down graded from this stage by completion of the planned work program.
B – Of some interest and should be subject to further work if funds are available, often with smaller components of continued exploration expenditure than higher priority targets.
C – Of only little interest and subject to further work at a low priority if funds are available, but not to be relinquished at this stage.
D – Of no further interest and can be offered for joint venture or relinquished.

GEOLOGICAL SETTING

The Los Domos project lies in southern Chile 14 km west of the settlement of Chile Chico on the southern shores of Laguna Buenos Aires and 70 km south of the regional centre and airport of Balmaceda. Importantly, the Los Domos veins represent the S-SE strike continuation for some 25 km of the veins worked at the Cerro Bayo mine (figure 1) which produced about 0.5 M oz Au and 28 M oz Ag to 2012 (Poblete et al., 2014). These low sulphidation epithermal Au-Ag occurrences are located at what might be the NW tip of the Deseado Massif, which hosts many other low sulphidation polymetallic epithermal Au-Ag occurrences and producing mines to the east and SE in Argentina (Cerro Vanguadia, >12 M oz Au & 250 M oz Ag; Cerro Moro, >1 M oz Au & 70 M oz Ag; Cerro Negro, 5.7 M oz Au & 49 M oz Ag; Huevos Verde [San Jose] 2 M oz Au & 130 M oz Ag).

The Deseado Massif of the Santa Cruz Provence, southern Argentina, developed as a competent block of Mesozoic rocks with a rock sequence which is generally categorised as:

- Uppermost Bajo Grande Formation Lower Cretaceous continental sediments,
- La Matilde Formation Upper Jurassic ash fall tuffs and volcaniclastic sediments,
- Chon Aike Formation middle to upper Jurassic rhyolitic to dacitic continental volcanic rocks developed for many hundreds of km on the western side of the Andes during EW extension related to continental break up,
- Bajo Pobre middle Jurassic andesitic flows and local tuffs of 200-600m thick,
- Roca Blanco Formation local basement Lower Jurassic sandstone and tuff.

Epithermal mineralisation of the Deseado Massif is best developed within the most competent Bajo Pobre andesite (Huevos Verde and Cerro Negro) and locally within the overlying Chon Aike Formation (Cerro Moro and Cerro Bajo) especially where tuffs are welded (Cerro Vanguadia). La Matilde and Bajo Grande Formation rocks are considered as post-mineral cover and may constitute the cover at Los Domos. There could be an age overlap between La Matilde magmatism and mineralisation (below). Chon Aike rocks in the western portion of the Deseado Massif display an increased subduction component as the uppermost rhyolitic Ibáñez Formation which hosts the Cerro

Bayo veins. Poblete (2011 in Poblete et al., 2014) divided the Cerro Bayo host stratigraphy into 4 units as:

- Uppermost unit 4 welded rhyolitic to rhyodacite pyroclastic rocks with a minimum thickness of 300 m which hosts the non-economic Mallines and Bahía Jara veins.
- Unit 3 volcanosedimentary unit of only 60 m thickness which hosts the Lucero veins.
- Unit 2 welded rhyolite fragmental rocks of about 150 m thick which comprises crystals and fiamme and hosts the Laguna Verde veins.
- Basal unit 1 comprises andesitic to dacitic coherent lavas with volcaniclastic rocks with a minimum thickness of 112 m which host the Brillantes veins.

The NS Cerro Bayo fault hosts several felsic domes and adjacent veins (Poblete et al., 2014), and those workers describe dominant NS and NNW vein trends and show additional NE veins while citing NE-SW as well as EW extension. The dominance of NS veins and the Cerro Bayo fault are consistent with EW extension during mineralisation. Poblete et al. (2014) suggest mineralisation at Cerro Bayo was emplaced over a 33 m.y. period from 144 – 111 m.y., taking it well into the Lower Cretaceous age. Lecuyer, and Cárdenas Barzola (2017) provide a 114 m.y. age for the Laguna Verde veins at Cerro Bayo, and a 128 m.y. age for the Cerro Bayo veins, which they suggest pre-date the Cerro Bayo dome. The latter workers also proved a staged model for mineralisation in which an early deeper crustal level Pb-Zn event is overprinted by an epithermal Ag-Au dominant event consistent with the model outlined herein derived from studies of other low sulphidation vein occurrences of this type. Such a protracted history of mineralisation at varying crustal levels, possibly during uplift and erosion, could be of interest in a geological model for Los Domos.

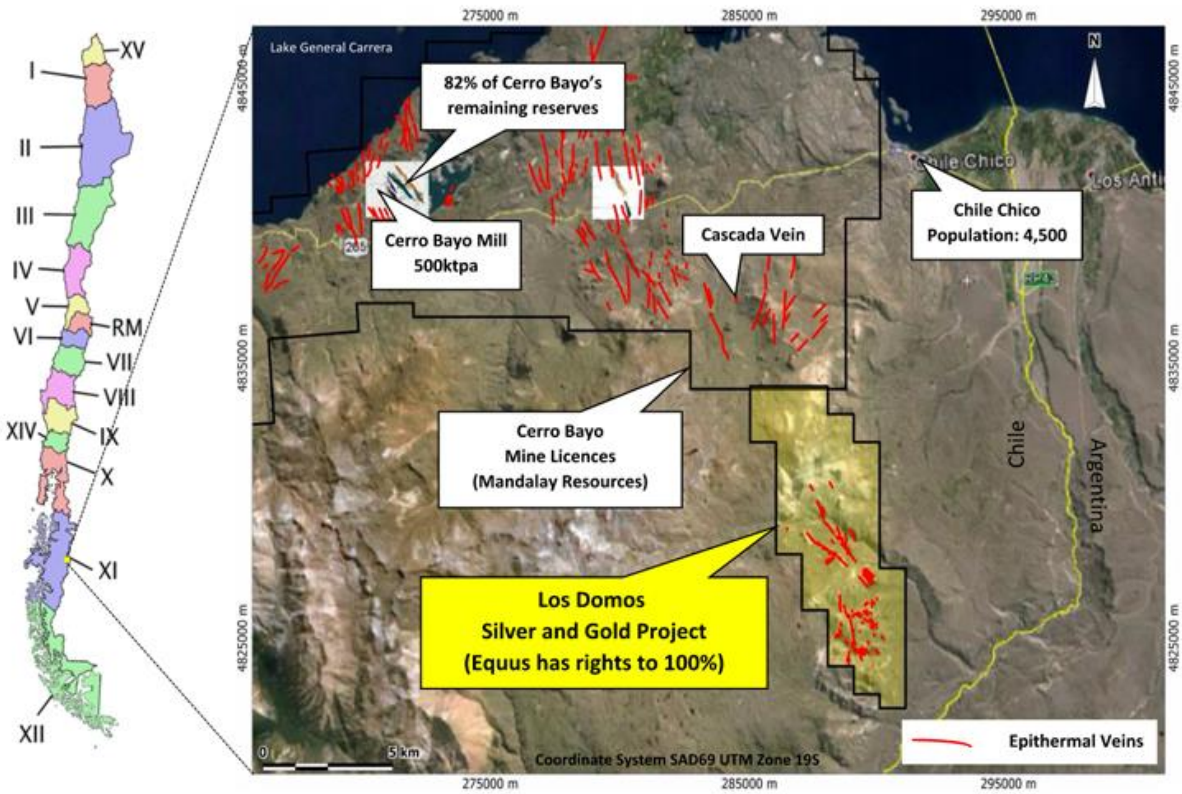

Figure 1 Relationship between the Cerro Bayo veins and Los Domos project.

HYDROTHERMAL ALTERATION

Los Domos is distinguished by the extensive colour anomaly derived from the weathering of pyrite within the strong argillic alteration characterised as silica-illite-pyrite (photo 1). The extensive alteration at Los Domos has resulted from fluid flow lateral within the highly permeable tuffaceous host rocks. The upper units of the stratigraphy in the vicinity of target T7 appear to have been more permeable and so the more extensive alteration there has provided a strong colour anomaly.

Silicification could augment the welded tuffs by provision of competency and so aid vein formation.

The Los Domos alteration extends well beyond the typical vein selvages expected for low sulphidation epithermal veins and so could be taken as indicative of a strong hydrothermal system.

CONTROLS TO MINERALISATION

Mineralisation at Los Domos is of a low sulphidation polymetallic Au-Ag epithermal style (figure 2; Corbett, 2002, 2013, 2017) developed as a Ag-rich equivalent of the common carbonate-base metal Au low sulphidation epithermal style (Leach and Corbett, 1995; Corbett and Leach, 1998), and placed by some workers in the problematic intermediate sulphidation class (Einaudi et al., 2003; Sillitoe and Hedenquist, 2003). The intermediate sulphidation class would be better restricted to the original setting (Enaudi et al., 2003) as the transition from high to low sulphidation (Corbett, 2017).

Low sulphidation epithermal polymetallic Ag deposits host most Au-Ag mineralisation within ore shoots characterised as wider and higher metal grade vein portions, which develop by the coincidence of several factors defined as:

Style of mineralisation

Three fluid flow paths associated with low sulphidation epithermal Au-Ag mineralisation (figure 2) are described (Corbett, 2017 and references therein) as:
A – Within magmatic arcs ore fluids grade from initial deposition of quartz-sulphide Au $\pm$ Cu mineralisation, to carbonate-base metal Au, and finally late stage epithermal Au mineralisation which commonly hosts bonanza grade high fineness Au.
B – In extensional settings including back arcs (Deseado Massif, Sierra Madre of Mexico or southern Peru) the quartz-sulphide Au $\pm$ Cu mineralisation (photo 2) passes to the polymetallic Au-Ag mineralisation (photos 3 - 5), as the Ag-rich end member of carbonate-base metal Au mineralisation, and then at high crustal levels to banded chalcedony-ginguro epithermal Au-Ag veins, as substantial quantities of circulating meteoric waters which deposit banded quartz with local adularia and quartz pseudomorphing platy calcite as the sulphides evolve into the precious metal rich ginguro bands.
C – The fluid responsible for high sulphidation epithermal Au deposits may become sufficiently cooled and neutralised by wall rock alteration to evolve lower sulphidation (carbonate-base metal Au passing to epithermal quartz Au) as a legitimate setting for intermediate sulphidation.

The polymetallic Ag-Au mineralisation displays a vertical zonation from early and deep:

- Initial high temperature mineralisation commonly comprises early quartz-sulphide Au mineralisation (photo 2) which passes to high temperature polymetallic mineralisation comprising pyrite, black to red Fe-rich sphalerite, lesser galena and chalcopyrite (photo 3). Carbonate and local barite are also recognised.
- Most common mineralisation includes quartz with pyrite, yellow moderate-low Fe sphalerite, lesser galena, tennantite-tetrahedrite as the main Ag-sulphosalt host for Ag (photos 4 & 5). Better Au-Ag mineralisation occurs with Mn carbonates such as rhodochrosite rising in the presence of Fe carbonate (below).
- The low temperature polymetallic Ag-Au mineralisation epithermal end member is recognised (at Huevos Verde, Cerro Moro and Cerro Bayo) as lesser chalcedony, cubic pyrite, white low-Fe sphalerite and argentite-acanthite as the main Ag sulphosalt, although others such as ruby silver and proustite may be present (photo 6).

- This sulphide ore fluid then evolves at a higher crustal level into the black sulphidic ginguro bands which become combined with a component derived from meteoric-dominate waters (photo 8) to form banded-chalcedony ginguro style mineralisation (see Corbett, 2017).

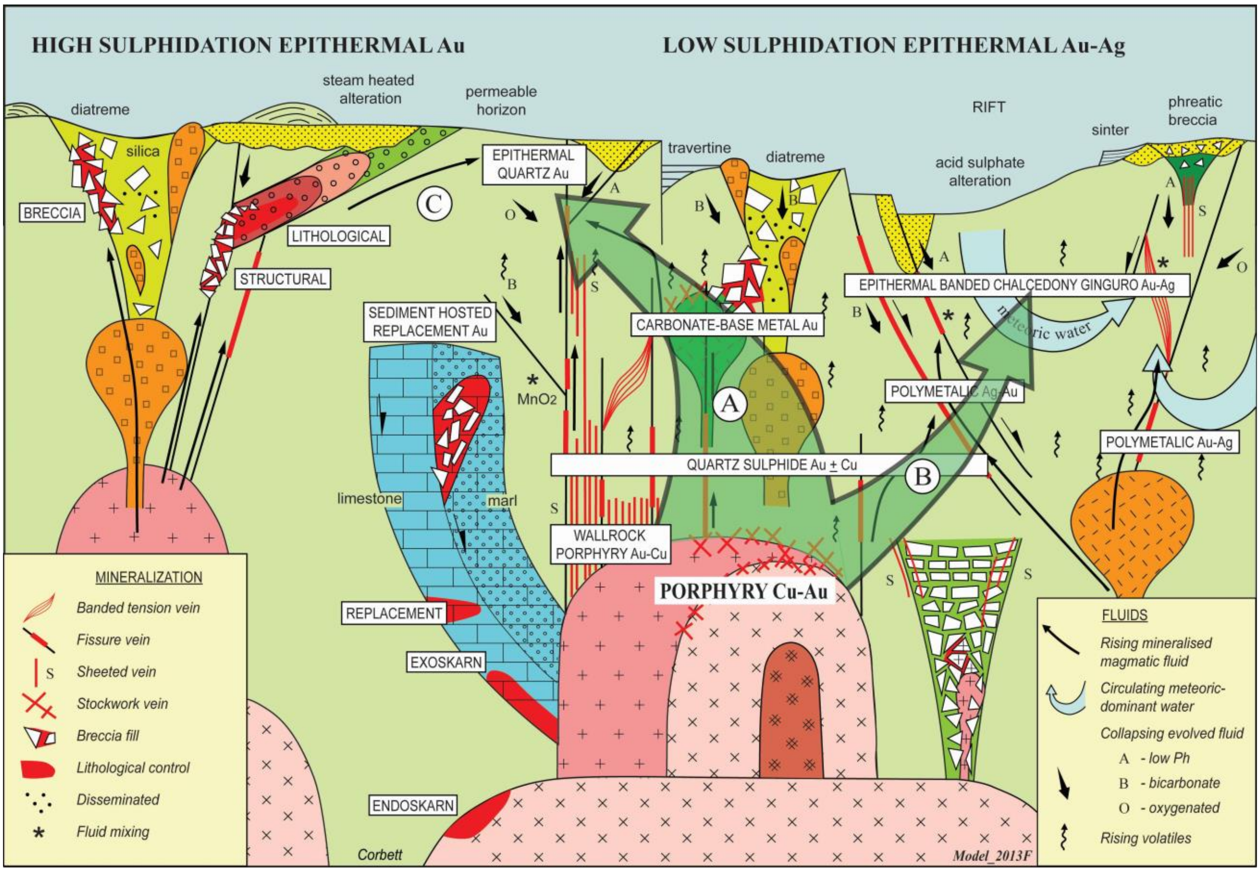

Figure 2 Styles of epithermal-porphyry mineralisation, from Corbett (2017).

Consequently, there are two low sulphidation end members which host bonanza Au, as high fineness Ag-poor epithermal quartz Au style, within magmatic arcs, and Ag-rich banded chalcedony-ginguro epithermal Au-Ag deposits, within extensional settings.

The interaction of deposition from mineralised magmatic fluids and essentially barren circulating meteoric-dominated waters also influences Au-Ag grade within veins (Corbett, 2008), and so many banded quartz veins deposited from exclusively meteoric waters are essentially barren, as Au-Ag mineralisation is interpreted to lie mostly in the magmatic sulphide component.

<u>Application to Los Domos</u>

The zonation in styles of Au-Ag mineralisation described above can be applied to Los Domos-Cerro Bayo as an exploration tool. For Cerro Bayo Lecuyer, and Cárdenas Barzola (2017) describe overprinting mineralisation in which an early deeper crustal level Pb-Zn event is overprinted by an epithermal Ag-Au dominant event, consistent with the model outlined above, derived from other low sulphidation vein occurrences of this type. Specimens of ore from Cerro Bayo examined in this review (photo 6) are coincident with the epithermal end member described above and of Lecuyer, and Cárdenas Barzola (2017) as, low temperature quartz with pyrite, white sphalerite and dark Ag sulphosalts taken to be argentite-acanthite, along with ruby silver. This ore is similar to high precious metal grade material at other mines (Huevos Verde and Cerro Moro in the Deseado Massif; Palmarejo, Mexico; Chatree, Thailand; Kupol, Russia) and should be targeted at Los Domos.

The T7 target at the southern end of Los Domos contains red sphalerite locally rimmed by yellow sphalerite developed by cooling an early higher temperature portion of the ore types described above (photos 3 & 4). The drill intercepts at T7 of red-black, red and only yellow sphalerite (photo 4) may be attributed to the polyphasal nature of mineralisation introduced at varying temperatures. Intercepts of coarse grained galena are also typical of such a deep crustal level ore type, interpreted as developed early (photos 3 & 8). Some specimens with better precious metal grades are akin to fluidised breccias with high proportions of tennantite-tetrahedrite evidenced optically and by the elevated Sb contents, and so correspond to the more typical polymetallic ores which are generally developed later and at higher crustal levels (photo 5). Therefore, mineralisation intersected in the T7 drill core to date is typical of the early, deeper crustal level, style of mineralisation recognised in many other low sulphidation epithermal polymetallic Ag-Au vein systems including Cerro Bayo. While this event may locally contain the bulk of the ore in many polymetallic vein systems, it commonly does not account for the higher precious metal grade ores such as that in photo 6.

By contrast drill intercepts of veins at the Los Domos northern targets (T1, T2, T3 & T4) are dominated by generally banded fine grained chalcedony with fine disseminated pyrite and possible rare dark ginguro-like spots, some of which has been submitted for petrology (appendix 1). At target T1, DDH021 intercepted locally banded low temperature quartz-pyrite veins hosted by rhyolite tuff at 114 m down hole (photo 9) interpreted as a mix of quartz deposited form meteoric waters with a magmatic sulphide component. This target has been traced to the north at the surface, with a reported 80 g/t Au float sample, with an anomalous drill test (DDH018, 99.8 m, 0.25 g/t Au; photo 10). Similarly, at target T2, DDH004 intersected well mineralised (30.4 m, 1.08 g/t Au & 318 g/t Ag and 43.6 m, 2.38 g/t Au & 231 g/t Ag) banded quartz veins hosted by rhyolite tuff at shallw levels (photos 11 & 12). The deeper drill test yielded lower precious metal anomalism up to 0.52 g/t Au and 31 g/t Ag (see also photo 13) in association with a phreatic breccia (photo 14). Drill holes DDH005 and006 were bored along strike to the south. DDH006 examined in this review intersected quartz-pyrite breccias with anomalous precious metals associated with quartz-pyrite breccias (photo 15) to 2.86 g/t Au and 126 g/t Ag and discernible kaolin. At target 4, DDH022 possibly bored from the footwall, intersected a finely banded quartz vein with spots of sulphide with anomalous precious metals (0.73 g/t Au & 44.7 g/t; photo 16).

These quartz-pyrite veins intersected in drill holes bored at the Los Domos northern targets (T1, T2, T3 & T4) are typical of those formed elsewhere at an elevated crustal setting by a mixture of essentially barren quartz deposited form circulating meteoric waters and a lesser mineralised sulphides derived from a magmatic-dominated fluid. Precious metal values rising to 2.86 g/t Au and 231 g/t Ag in narrow drill intercepts are most encouraging for these veins hosted within relatively incompetent host rocks.

It is recommended continued analysis, mainly geological mapping, supplemented by the planned petrology (appendix 1), should seek to better define the geometry of these vein intercepts at target T7 and the northern targets, which might then be placed in the developing geological model for Los Domos. Current thinking that target T7 is deep and the northern targets rather shallow, suggests further exploration might proceed in the central region between these targets, in order to identify Au-Ag mineralisation similar to the epithermal end member of low sulphidation polymetallic Ag-Au mineralisation such as that extracted at Cerro Bayo (photo 6) and other mines described above.

Host rocks

Competent host rocks are required to fracture well in order to host throughgoing veins. Many polymetallic Ag-Au veins occur in sequences dominated by interlayered andesite lava and tuffs such that the lavas or welded tuff host well developed veins, whereas the incompetent lapilli-crystal tuffs host only very poorly developed veins, at best. Furthermore, in some instances permeable tuffs may undergo argillic alteration to become even less competent and so become more unfavourable vein hosts (e.g., Arcata, Peru; Mastra, Turkey), or elsewhere host anomalous geochemistry but not veins. Alternatively, silicification may enhance the competency of some stratigraphic elements which host mineralised veins (e.g., sandstones at Chatree, Thailand). However, permeable and locally incompetent host rocks may play a role in ore formation by transport of ground waters to sites of fluid mixing within underlying competent host rocks (e.g., at Hishikari, Japan, barren altered volcanic breccias overlie mineralised veins within basement phyllite).

Consequently, exploration programs should attempt to define competent units within stratigraphic successions that are likely to host mineralised veins where transected by mineralised structures. Many volcanic successions feature growth faults active as dilatant normal faults during volcanism and also during mineralisation. Faults which define significant changes in stratigraphy can therefore be prospective. Exploration targets also emerge within known stratigraphic sequences, where metal anomalism is recognised within incompetent rocks which overlie competent stratigraphic units.

Application to Los Domos

The host rock stratigraphy at Los Domos, is dominated by outcropping felsic domes and rhyolite tuffs which may belong to the upper unit 4 of the Ibáñez Formation at the top of the Jurassic Chon Aike Formation, and which are locally overlain by altered Cretaceous sedimentary rocks. The presence of silicified wood clasts suggests a Jurassic palaeosurface has locally been exposed by uplift and erosion, consistent with the interpreted shallow level of formation for some veins.

Although more work is required, the rock sequence at Los Domos from top to bottom, young to old, is currently recognised as:

- Cross cutting generally silicified cross-cutting phreatic breccia pipes may also vent to the surface and form tuff ring breccia deposits. Elsewhere, veins are developed within the underlying feeder structures for the phreatic breccias (McLaughlin, USA; Favona, New Zealand). The phreatic breccias at Los Domos, cut the existing stratigraphy (photos 17 & 18), and feature a variety of angular and milled rounded, and locally rebrecciated clasts, which include silicification and vein clasts, set in a rock flour matrix which is locally silicified (photos 19 - 22). Some breccia bodies host quartz veins (photos 23 & 24), particularly at the margins, which may be defined by faults and polyphasal activation is clearly discernible.
- Generally intrusive felsic domes, typically formed late to post-mineral, such as at Cerro Bayo, might be associated with nearby vein development and host veins unless excessively brecciated or clay altered (e.g. Sado & Chitose, Japan). Elsewhere breccias associated with dome margins also represent a common ore environment (Mt Rawdon & Mt Wright, Queensland; Kelian, Indonesia).
- P1 unwelded quartz crystal poor, lithic rhyodacite tuff with local unflattened fiamme is expected to be not mineralised and form a barren clay altered incompetent cap to underlying more competent rocks which may host veins. It is strongly FeO stained indicative of now weathered argillic hydrothermal alteration.
- P2 rhyolite tuff varies from fiamme-bearing to crystal rich and is locally welded to form prospective competent host rocks (photo 25). Silicification would also provide vein-hosting competency.

Although more work is required, the Los Domos rocks presently appear to be equivalent to the Cerro Bayo Unit 4, the uppermost portion of the of the Ibáñez Formation developed at the top of the Chon Aike Formation.

It is recommended continued geological mapping should seek to define a stratigraphic-structural model which could track any welded or silicified competent host rocks within this strongly faulted terrain. Intersections of competent host rocks and feeder structures are recognised as prospective.

Metal anomalism within incompetent tuffs may be indicative of underlying exploration targets if this model suggests feeder structures transect competent host rocks at depth.

The phreatic breccias should also be carefully defined as cross cutting pipe or extrusive vent facies. As phreatic pipes cap low sulphidation vein systems in other districts, regions below the cross cutting pipe-like breccia bodies might be considered as potential targets, especially if coincident with other favourable ore controls, including development as competent hosts by silicification.

Structure

Epithermal vein mineralisation is best developed within dilatant portions of structures which facilitate ore fluid flow and also at structural intersections which represent sites of fluid mixing (Corbett, 2012, 2017; Leach and Corbett, 2008). Structure controls the form and pitch of ore shoots and the overall vein distribution and spatial arrangements. In settings of orthogonal extension, best polymetallic Ag-Au vein mineralisation develops within the steeper dipping portions of listric faults and associated hanging wall splays, to provide vertically attenuated, flat pitching, ore shoots (figure 3). In settings of purely oblique kinematics, steep pitching ore shoots develop within flexures, fault jogs, step-overs, tension veins or other dilatant features (figure 3). Although not common, compressional settings host best mineralisation within flatter dipping portions of moderate dipping thrust or reverse faults, to produce flat pitching ore shoots, and also steep dipping veins within dilatant settings such as conjugate fractures (figure 3). Mixed extension or compressional deformation with oblique kinematics provides ore shoots of variable, commonly moderate pitch. Generally flat pitching ore shoots develop at structural intersections which represent sites of fluid mixing (Leach and Corbett, 2008; Corbett, 2017).

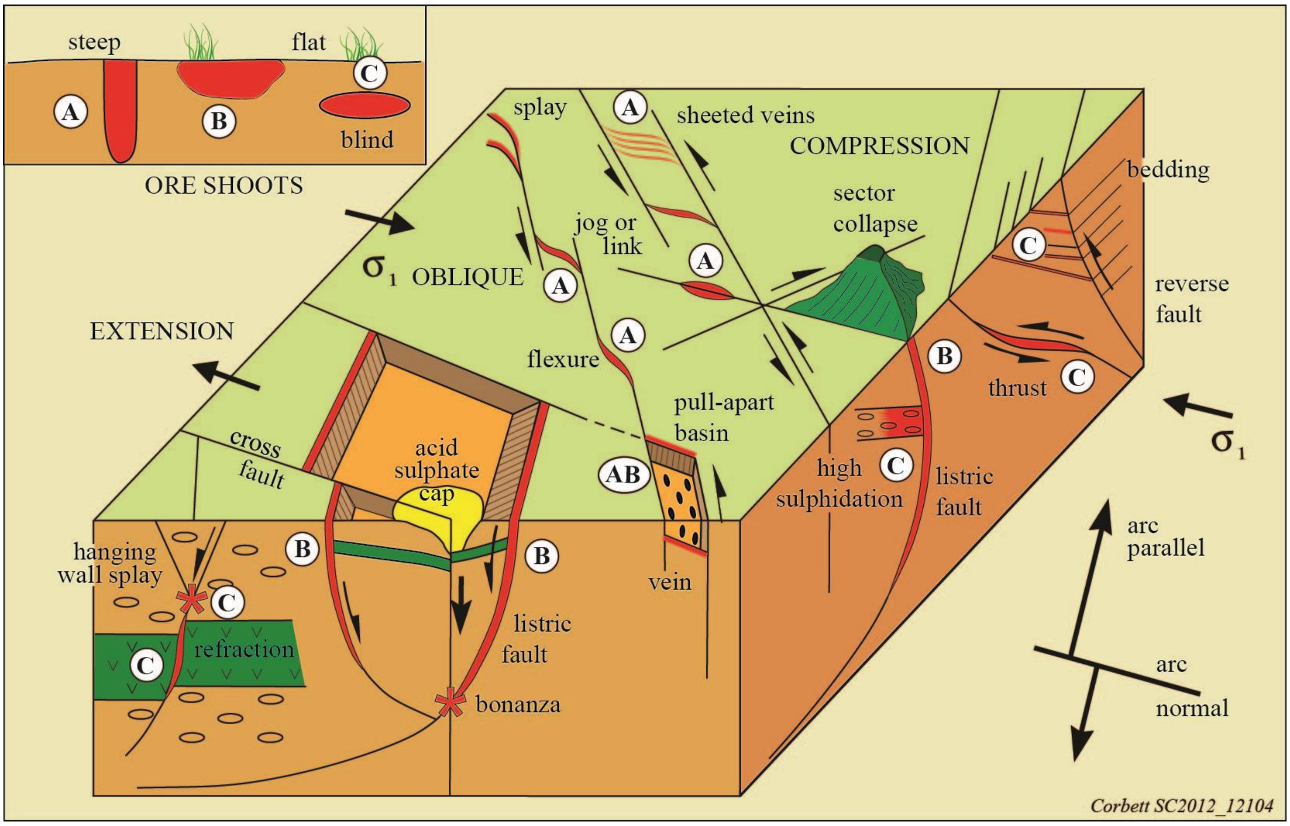

Figure 3 Orientation of ore shoots formed in different structural regimes, from Corbett (2017).

In the Deseado Massif, mineralisation is mostly related to NW and NE conjugate fractures activated during orthogonal compression such that ore shoots typically occur in steeper dipping roughly WNW-EW trending vein portions (figures 3 & 4). The NW set tends to be dominant. However, only Cerro Bayo also hosts significant NS trending vein mineralisation within structures which would be expected to be compressional in that structural model. Rather, as Cerro Bayo hosts mineralisation which is significantly younger than the ore systems in much of the Deseado Massif to the east, this later NS trending mineralisation may have developed during a late transient relaxation of convergence to facilitate EW extension and NS trending vein formation (figure 4). Elsewhere, mineral deposition triggered by transient changes from compression to extension generally leads to the development of better quality ore systems than those formed in compressional settings (Corbett, 2017).

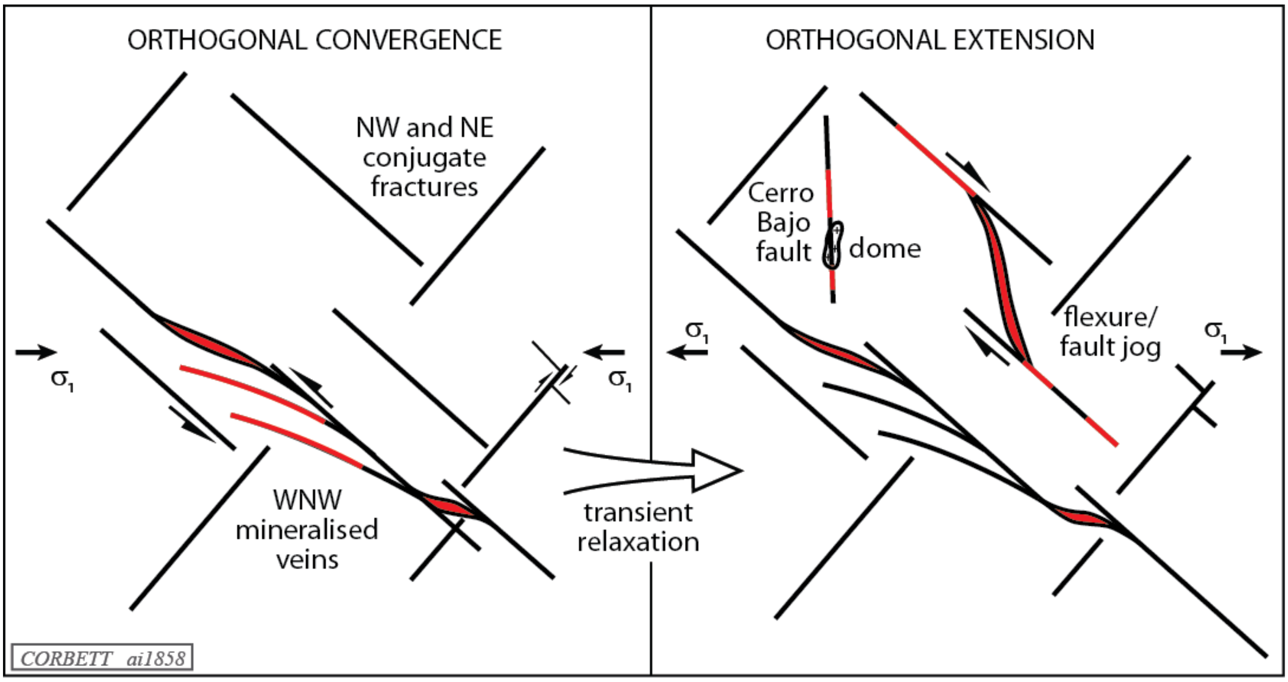

Figure 4 A model for two stage ore formation at Cerro Bayo and Los Domos mineralisation by multiple activation of conjugate fractures during a transient change from subduction-related compression, to transient extension. Mineralised veins in red.

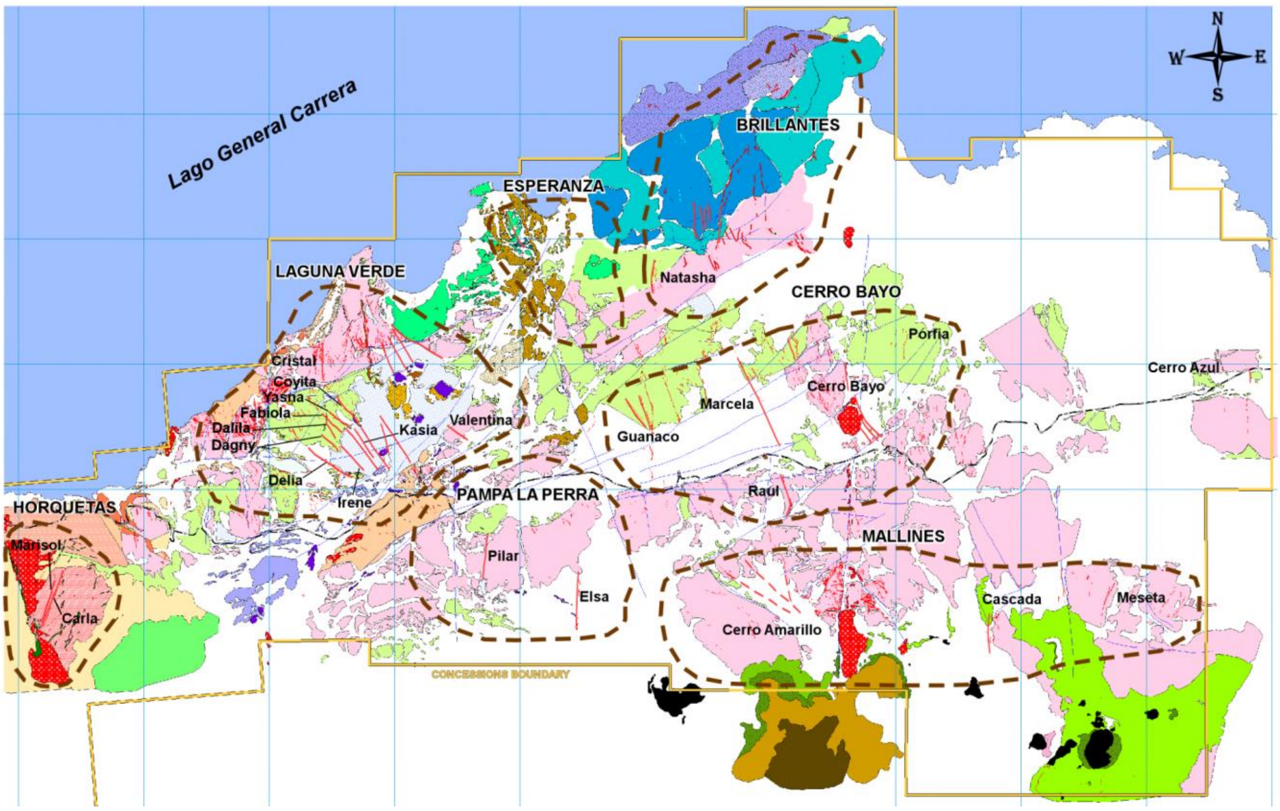

Figure 5 Vein orientations at Cerro Bayo showing the typical NW as well as NS veins.

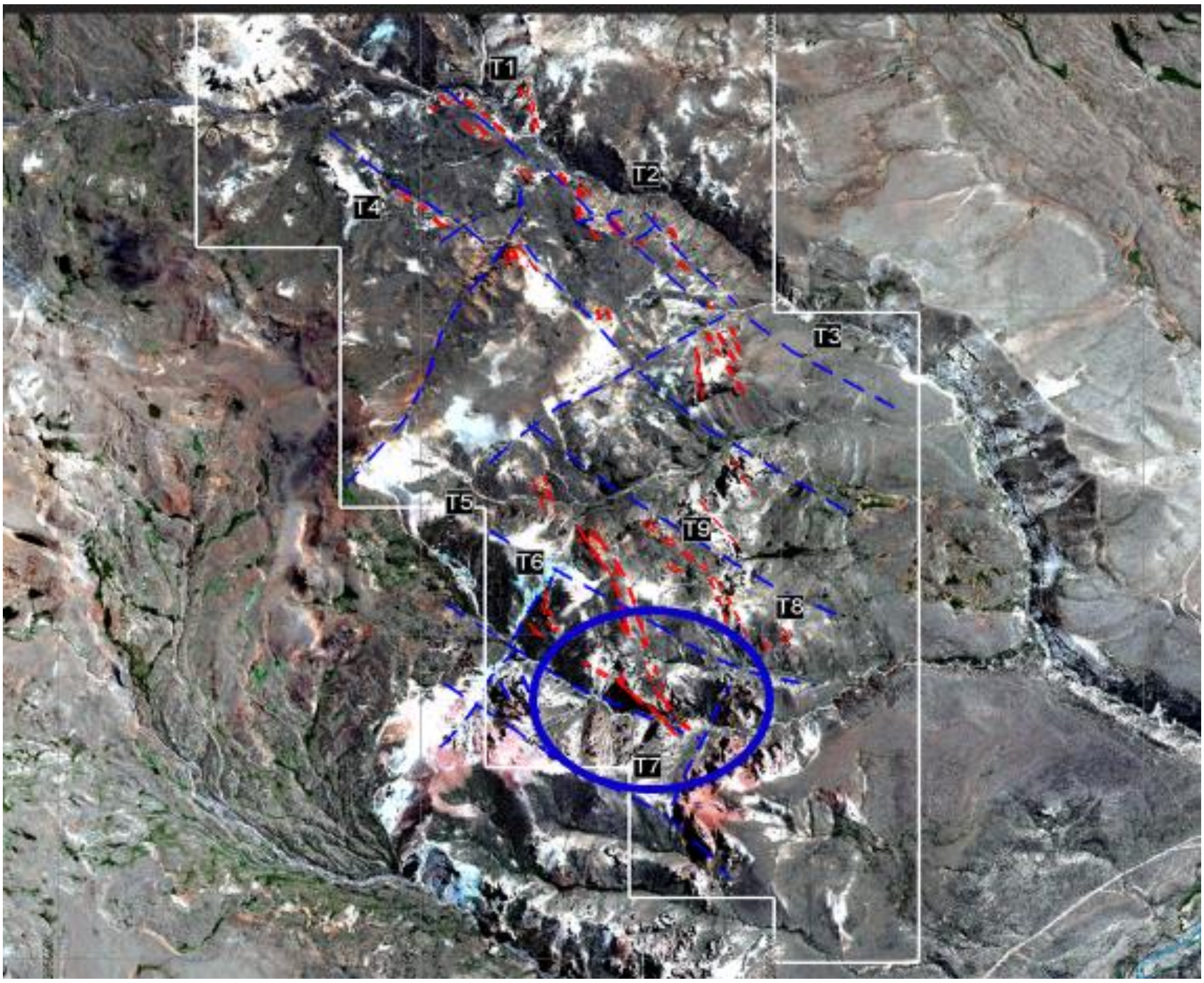

Figure 6 Los Domos structural elements from Equus Mining data.

<u>Application to Los Domos</u>

Structures at Los Domos are discernible as upstanding zones of silicification (photos 26 & 27). On the data provided (figure 1) Los Domos is linked to Cerro Bayo by both NW (125^{o}) and NS trending structural corridors. The structural elements of Los Domos (figure 6, photo 26) include:

- Dominantly NW (125^{o}) fracture sets partly defined by drainage anomalies which may represent local elements of the Deseado Massif conjugate fractures.
- NW trending veins locally developed within the NW fractures.
- Roughly NNW trending veins which locally display sigmoidal shapes and may include NS trending central portions.

Sigmoids of this nature are expected to have developed in response to dextral strike-slip movement on the NW fracture system under conditions of NS compression or EW extension (figure 5). As also suggested for Cerro Bayo, this kinematic pattern is at odds with veins of the Deseado Massif, but may have developed later under different later transient stage kinematic conditions, in keeping with the polyphasal mineralisation suggested by Lecuyer, and Cárdenas Barzola (2017). This kinematic model would place best mineralisation within steep dipping more dilatant NS trending portions of the NNW flexures/fault jogs/tension veins.

It is <u>recommended</u> the central NS portion of the flexure east of target T6 on the existing data, herein termed target 6B (photo 27), should be considered for a drill test. An upstanding roughly NS trending silicified alteration zone was inspected in the field (photo 27).

Mechanisms of Au deposition

More efficient mechanisms for Au deposition, by the destabilisation of the bisulphide complexes that transport Au, help to account for the development of higher Au grade ore shoots and may influence Au:Ag ratios. Although fluid boiling is promoted in the geological literature as the principle mechanism for Au deposition, it is not readily apparent in hand specimen, particularly for the development of higher Au grade mineralisation (Leach and Corbett, 2008; Corbett, 2017). Rather, some other mechanisms might be considered:

- Cooling of ore fluids accounts for the deposition of coarse grained sulphides which host interstitial Au-Ag as an important source of mineralisation in many polymetallic Ag-Au deposits and also finely banded quartz veins (photo 16).
- Rapid cooling, generally characterised by fine grained and locally fluidised textures, also accounts high precious metal grades, although fine ore textures and Au associated with As may display problematic metallurgy (photo 5). Finely banded quartz (chalcedony) veins are also deposited from rapidly cooling fluids, commonly meteoric-dominated waters.
- The mixing of rising pregnant ore fluids with oxidising ground waters provides the highest Au grades (Corbett and Leach, 1998) as:
  - Bicarbonate waters, derived from the entrainment within ground waters of CO_2 exsolved from cooling felsic domes, reside as blankets in the upper portions of low sulphidation epithermal hydrothermal systems. Mixing of rising ore fluids with these oxidising waters promotes Au deposition. Consequently, Mn carbonates such as rhodochrosite is common within polymetallic Ag-Au and carbonate-base metal Au deposits. Lowest pH fluids deposit siderite with highest Au grades whereas less acidic fluids deposit low Au with mixed MgCa carbonates.
  - Oxygenated near surficial ground waters may be drawn into the ore environment and mix the ore fluids to promote Au deposition by oxidation of the bisulphide complexes in association with formation of hypogene haematite.
  - Mixing of low pH waters, associated with the formation of acid sulphate caps, with pregnant ore fluids, represents the most efficient mechanisms of Au deposition and so many low sulphidation epithermal Au deposits host best Au in association with kaolin deposited as evidence of this process.

<u>Application to Los Domos</u>

Many mineralised polymetallic Au-Ag drill intercepts are associated with elevated Mn contents as an indication of Au deposition by mixing with bicarbonate waters, typical of these deposits. The highest Au drill intercept of 78.8 g/t Au and 94.7 g/t Ag (DDH031, 114-114.4 m) is associated with siderite discernible in hand specimen, along with elevated Fe and Mn in the assay data (photo 28). Elsewhere in other carbonate-base metal Au and polymetallic Ag-Au deposits, highest Au are associated with siderite rather than the typical rhodochrosite, as the former is deposited by the mixing with ore fluids with lowest pH bicarbonate waters (Leach and Corbett, 2008; Corbett, 2017). The unusual Au:Ag ratio in the DDH031 drill intercept, which approaches 1, results from the more efficient mechanism of Au deposition than Ag.

Elevated Au-Ag grades recognised within fine grained banded quartz-pyrite veins from drill intercepts at the northern targets were also deposited from rapidly cooling fluids.

Hypogene kaolin, elsewhere deposited by low pH fluids derived from acid sulphate caps, has been recognised at Cerro Bayo (Poblete et al., 2014), and may be associated with high Au grades there. Some kaolin was recognised in this inspection of Los Domos and continued investigations should be mindful of its association with high grade Au in low sulphidation epithermal Au deposits.

Conclusion

At Los Domos ore shoots could host best Au mineralisation at the coincidence of:

- The epithermal end member of polymetallic Ag-Au deposits, which in specimens from the Cerro Bayo mine formed at low temperatures, as evidenced by white low Fe sphalerite and low temperature Ag-sulphosalts. Drill tests at the northern targets have intersected precious metal anomalous banded quartz-sulphide veins, typical of elevated settings interpreted to occur elsewhere above the targeted level in polymetallic Ag-Ag systems. The T7 area displays mineralogy typical of deep crustal levels. Consequently, the portion of Los Domos between T7 and the northern targets should be prospected for targeted mineralisation interpreted to have developed at a crustal level between those occurrences.
- Competent welded or silicified tuffs and phreatic breccias are required for quality vein formation. Although some competent welded tuff was inspected as float boulders much of the rhyolite tuff intersected in drilling to date does not represent entirely favourable host rocks.
- Dilatant structures may include NS segments of generally NNW trending sigmoids developed between NW conjugate fractures by a component of transient dextral strike-slip deformation as well as WNW trending portions of NW fractures. The two stage structural model is interpreted for Cerro Bayo and Los Domos suggests these occurrences might host a later event of NS vein development than the WNW veins which host most mineralisation throughout the Deseado Massif.
- Higher Ag grades are associated with effective mechanisms of Au deposition by mixing of rising pregnant ore fluids with bicarbonate waters, evidenced by Fe (siderite) or Mn (rhodochrosite) carbonate, or low pH acid sulphate waters apparent from the presence of hypogene kaolin.

Higher temperature deeper crustal level polymetallic Au-Ag mineralisation is recognised at target T7 and low temperature quartz veins are intercepted in the northern targets (T1-3), and so continued exploration should target the upper portion of polymetallic Ag-Au mineralisation, the region between these occurrences, such as the NS portion of the sigmoid east of target T6, termed target T6B.

RECOMMENDATIONS

Continued exploration should seek to prepare a geological model of the stratigraphic succession and structure in order to identify settings of the coincidence of competent host rocks and dilatant feeder structures.

The NS portion of the sigmoid east of target T6, target T6B, hosts the NS structural setting for mineralisation suggested in this review and so might be considered as a high priority target. However, competent host rocks will also be required for quality vein formation.

If competent host rocks an be identified, depth extensions of the mineralised banded quartz veins intercepted in drill tests of the northern targets (T1, T2, T3 and T4) to date, might also be prospective.

The regions below cross-cutting phreatic breccia pipes may also be prospective in competent host rocks, such as silicified breccias, can be identified.

Los Domos is currently provided with a <u>priority A</u> for completion of the work program suggested here. The significant colour anomaly is derived from weathering of extensive argillic alteration which is derived from a possible large hydrothermal system.

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Photo 1 Bedded tuffs immediately south of T7 showing red FeO stain of derived form weathering of pyrite in argillic alteration.

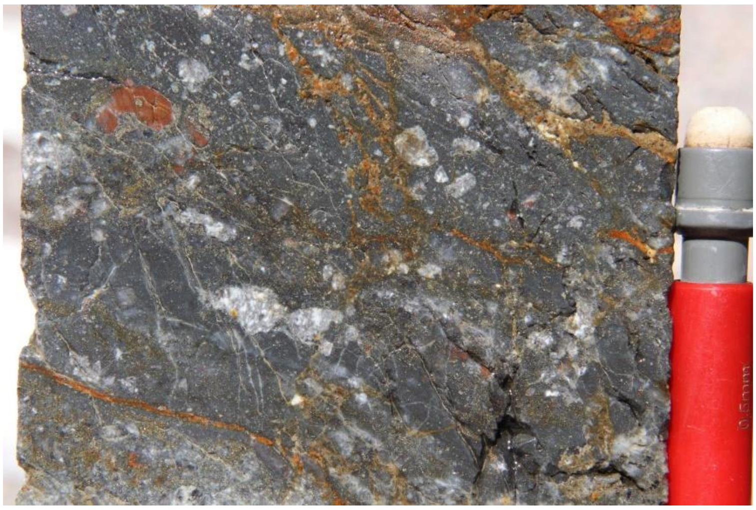

Photo 2 Early quartz-sulphide stage of polymetallic Ag-Au mineralisation – DDH001, 36.3 m, 1.41 g/t Au & 27 g/t Ag.

Photo 3 High temperature polymetallic Ag-Au mineralisation characterised by deep red to black sphalerite – DDH001, 46.3 m, 2.5 g/t Au & 178 g/t Ag.

Photo 4 Typical moderate temperature polymetallic Ag-Au mineralisation characterised by yellow sphalerite and galena but without carbonate and so with low Au-Ag grades – DDH001, 36.2 m, 1.41 g/t & Au g/t 27Ag.

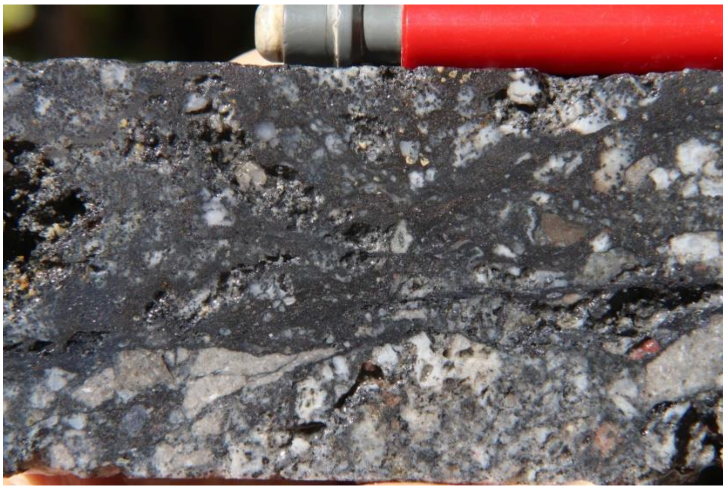

Photo 5 Fluidised breccia characterised by fine sulphides including tennantite-tetrahedrite – DDH035, 154.5 m, 2.3 g/t Au, 202 g/t Ag & 14.5% Zn.

Photo 6 Cerro Bayo sent for petrology and characterised by quartz, pyrite, white low temperature sphalerite, grey Ag sulphosalts and ruby silver.

Photo 7 Banded quartz, deposited from circulating meteoric-dominant interlayered with, and overprinting red sphalerite, deposited from dominantly magmatic fluids – DDH001, 47.5 m, 0.92 g/t Au & 59 g/t Ag.

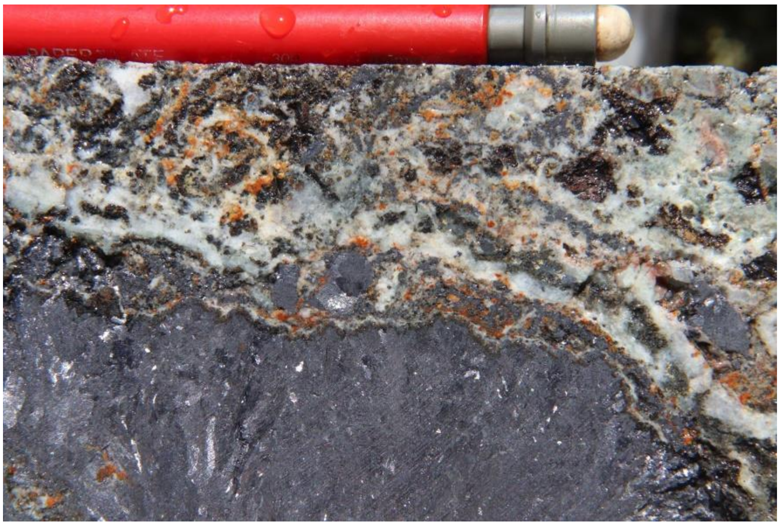

Photo 8 Coarse galena overprinted by banded quartz interlayered with an overprinting red sphalerite similar to the material in photo 7– DDH001, 51.5 m, 0.17 g/t Au & 1010 g/t Ag.

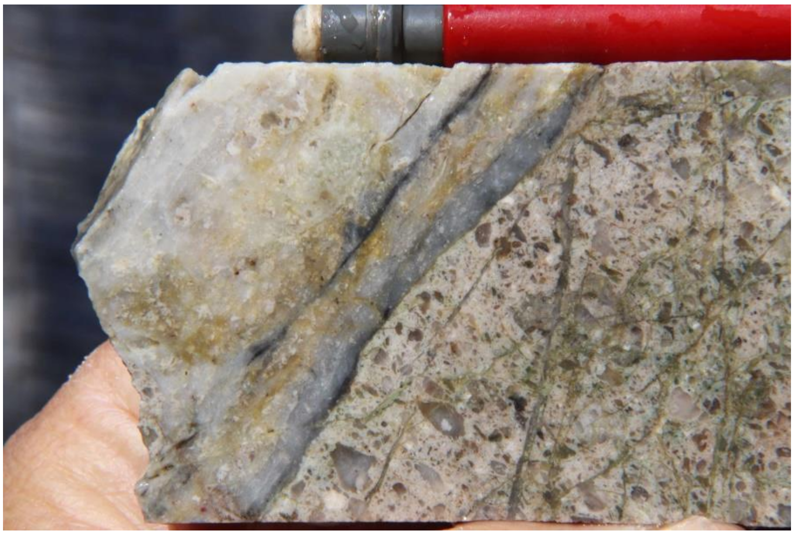

Photo 9 Banded quartz-pyrite veins cut rhyolite tuff – DDH021, 114.9 m, 0.5 g/t Au & 82 g/t Ag.


Photo 10 Quartz-pyrite vein breccia – DDH018, 99.8 m, 0.25 g/t Au.

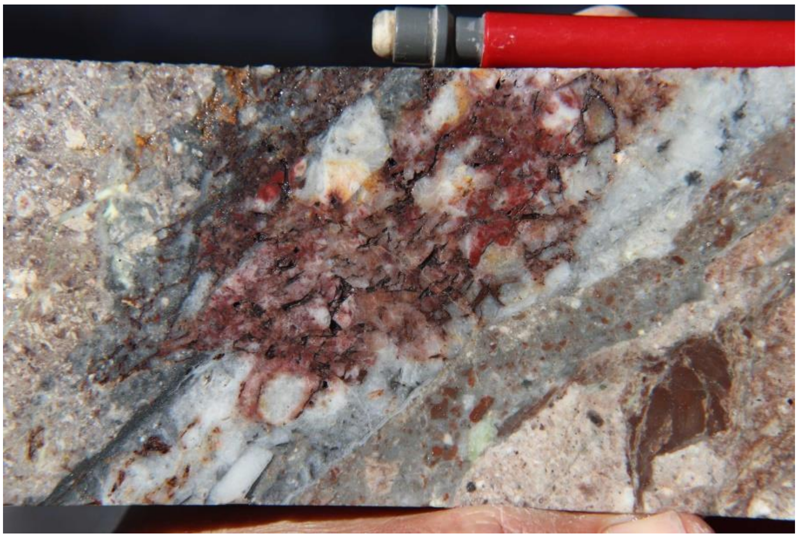
Photo 11 Quartz-pyrite vein cuts rhyolite tuff – DDH004, 43.6 m, 2.38 g/t Au & 231 g/t Ag.


Photo 12 Quartz-pyrite vein breccia – DDH004, 30.4 m, 1.08 g/t Au & 318 g/t Ag.

Photo 13 Banded quartz vein with minor sulphide cuts rhyolite tuff – DDH008, 80.5 m, 0.11 g/t Au & 13 g/t Ag.

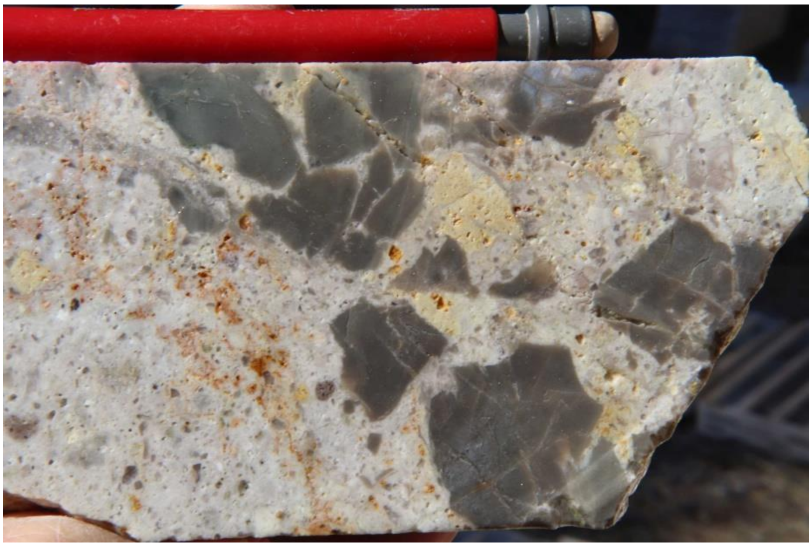

Photo 14 Phreatic breccia with chert clasts – DDH008, 80.7 m.

Photo 15 Quartz vein breccia – DDH006, 32.2 m 0.78 g/t Au & 58 g/t Ag.

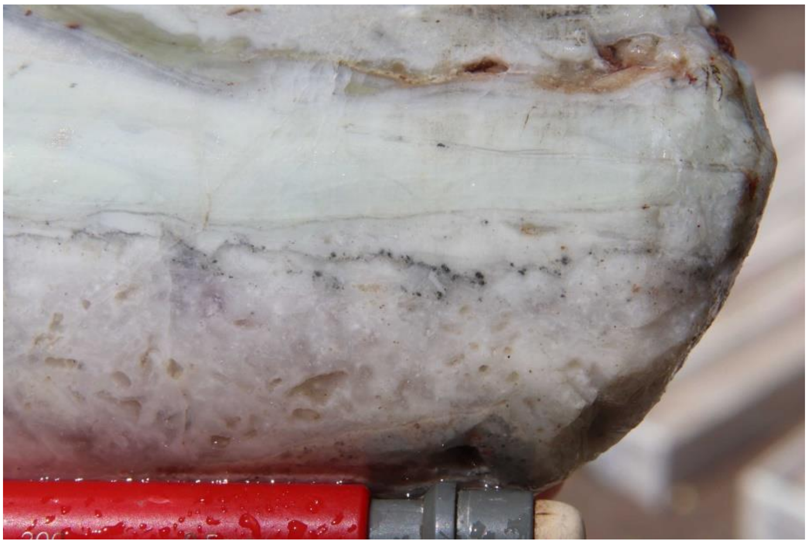
Photo 16 Banded chalcedony with sulphide spots – DDH022, 175.6 m, 0.73 g/t Au & 44.7 g/t Ag.


Photo 17 Cross-cutting phreatic breccia pipe.


Photo 18 Close up view of the cross-cutting phreatic breccia pipe in photo 17.


Photo 19 Phreatic breccia characterised by milled clasts in a rock flour matrix from the exposure in photo 18.

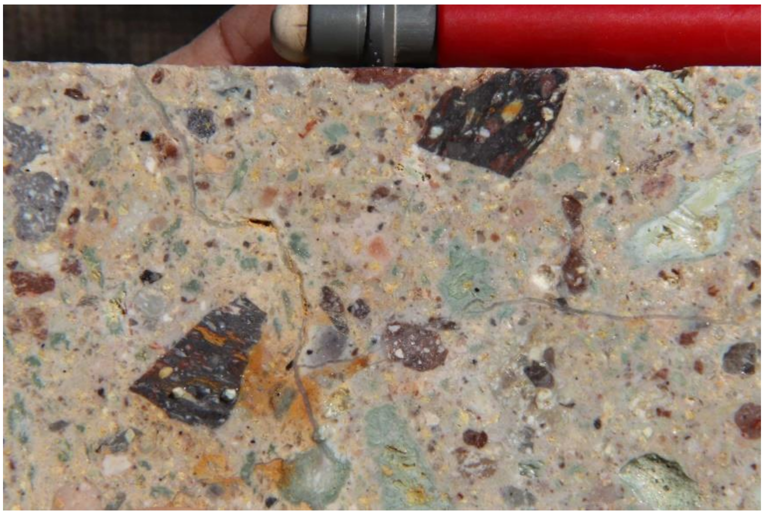
Photo 20 Phreatic breccia characterised by angular clasts in a silicified rock flour matrix. – DDH026, 114.5 m, 0.02 g/t Au & 0.66 g/t Ag.


Photo 21 Phreatic breccia with milled silicified clast from the exposure in photo 18.

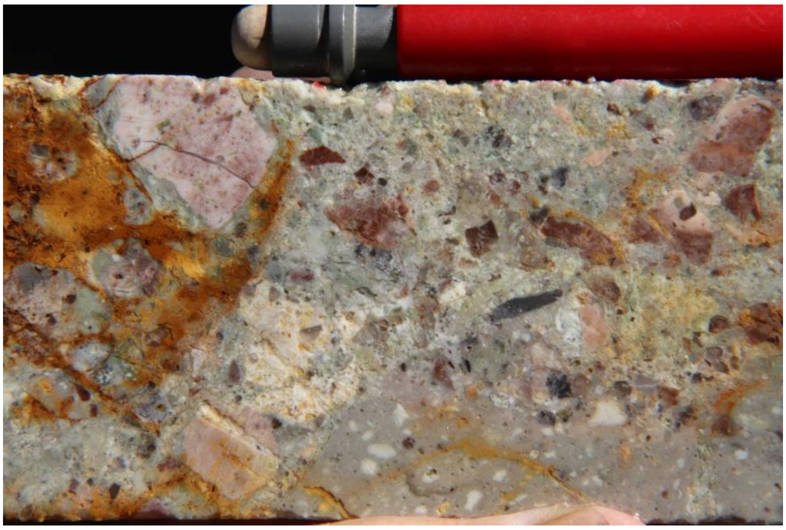
Photo 22 Silicified phreatic breccia – DDH027, 90.7 m.


Photo 23 Phreatic cut by silicification from the exposure in photo 18.


Photo 24 Phreatic breccia from the exposure in photo 18 cut by quartz veins.

Photo 25 Fiamme-rich rhyollite tuff – DDH04, 56.7 m.

Photo 26 View looking south towards the north side of T7 with the site of DDH42 to the left of the support vehicles. The central silicified structures strike NS whereas those to the right strike NNW.

Photo 27 Silicified structure defined as Target T6B which displayed a strike trend of 353^{o}.

Photo 28 Irregular pyrite-chalcopyrite set in a FeMn carbonate matrix deposited by fluid mixing – DDH031, 114.3 m, 78.8 g/t Au & 94.7 g/t Ag.

APPENDIX 1

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8 Feb 2019

Re: Los Domos petrology samples

Paul

Find enclosed 8 samples from the Los Domos project passed on for Damien Koerber, and one from the Cerro Bayo mine. I have a model which places these rocks at different crustal levels within a fluid flow sequence, and generates a target. I will keep working on that while the sections are being prepared.

If you have not received it by then shoot me a note and I get it to you ASAP.

Regards
Greg Corbett

1. DDH4, 30.5m, 1.08 Au & 318 Ag – quartz pyrite vein-breccia
2. DDH18, 99.6 m, 0.32 Au – quartz-pyrite vein-breccia
3. DDH22, 115,2 m, 0.01 Au & 0.85 Ag – banded quartz with possible spots of ginguro
4. DDH26, 120.5 m, 2.63 Au & 25.7 Ag – banded quartz-pyrite vein-breccia with possible ginguro
5. DDH28, 197.4m, 0.8 Au & 5.6 Ag – low temperature quartz with pyrite and FeMn carbonate
6. DDH29, 344.3m, 4.22 Au, 40.5 Ag, 692 Sb – low temperature quartz with intergrown pyrite and tennantite-tetrahedrite and illite alteration of clasts
7. DDH 31, 114.3m, 78.8 Au, 94.7 Ag, 0.47% Cu, 381 Sb – pyrite, chaclopyrite in siderite and evidence of Au deposition by fluid mixing. Can you comment on my identification of the carbonate as mixed FeMn.
8. DDH35, 153m, 9.6 Au, 243 Ag, 1.89% Cu, 77 Bi, 5860 As, 80.2 Hg, 1530 Mn, 3660 Sb – rapidly cooled sulphide fluidised breccia with red is rimmed by yellow sphalerite with minor galena tennantite-tetraedrite and other grey Ag sulphosalts
9. Cerro Bayo ore – fine grained rock with low temperature open quartz, crystalline pyrite, white sphalerite, grey-black Ag sulphosalts taken to be argentite-acanthite and local ruby Ag