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Mining District File Summary Sheet

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DIST_NO	4010
COUNTY If different from written on document	Pershing
TITLE If not obvious	Field examination and review of North Equinox and Degerstrom target areas, Rosebud Mine, Pershing County, Nevada, February 2000
AUTHOR	Allen K; Byington C.
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MULTI_DIST Y / (N?) Additional Dist_Nos:	
QUAD_NAME	Sulphur 7½'
P_M_C_NAME (mine, claim & company names)	Rosebud Mine, Hecla Mining Co.; North Equinox; Degerstrom; Lucky Boy; Dreamland
COMMODITY If not obvious	gold; silver
NOTES	Deposit report; geology; photographs 17p.

Keep docs at about 250 pages if no oversized maps attached (for every 1 oversized page (>11x17) with text reduce the amount of pages by ~25)

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Field Examination and Review of North Equinox and Degerstrom Target Areas

Rosebud Mine
Pershing County, Nevada

Report for:

Hecla Mining Company

Kurt Allen, Chief Mine Geologist

February 2000

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Executive Summary

Modeling of the Rosebud ore deposit was completed by the author in May of 1999. This was completed to expedite the discovery of additional reserves. One of the important findings of that study was stated as follows in the final report. "As a result of this study it is apparent that much of the past drilling has not effectively targeted the primary ore conduits, particularly at their intersection with favorable host horizons. Geochemical or geophysical anomalies were targeted in the past drilling campaigns often without clearly defining the primary ore fluid conduits and the controlling structural features. As a result, often the best targets were missed with past drill testing or possibly the results of the drill tests were not correctly interpreted."

Chief Mine Geologist, Kurt Allen asked that the author review the results of the target areas with the goal of identifying and prioritizing additional high-quality targets that were missed by earlier workers. The focus of this current effort included the North Equinox and Degerstrom target areas.

A review of the North Equinox target area quickly revealed that earlier drill holes had not tested the intersection of the Equinox vein (renamed the 212 vein by Newmont's staff) with the "YK" fault recognized by K. Allen and mapped by M. Brady (1997). As a result of this follow-up study, this intersection was targeted and drill results of the first hole were positive with visual pyrargyrite and considerable white clays present in the drill cuttings (assays pending). Follow-up drilling is currently underway.

The Degerstrom target area was mapped by C. Walck in 1991 and C. Stiles in late 1999. Although both of these geologic maps agreed in all important aspects, the author believed that a very significant ore-control fault had not been included in either of the earlier maps. This belief was based upon observations made during a brief visit to the key area at the request of C. Stiles in August 1999. Consequently the author remapped the area and the locations and orientations of three very significant, but previously unknown, ore conduits were recognized. The current proposed drilling will target one of these faults, herein referred to as the Saddle fault, within the most favorable host rocks.

One very important fact came to light during mapping of the Degerstrom area. It became evident that a number of previously unrecognized, NNE-oriented faults are primary ore controls for the western part of the district. This finding is based on their close association with ore-, and gangue-mineralization and alteration. The Saddle fault is believed to be responsible for mineralization in the Lucky Boy and Dreamland areas, the Brown Palace fault is related to the mineralization at Brown palace and anomalies to the south, and a third fault is related to the White Alps/North Equinox/Gator system. This important revelation may prove to be a key element to future successful ore targeting within the district. The possibility exists that other faults of this type and orientation may explain mineralization elsewhere in the district.

In addition to the identification of valid untested targets in the areas of interest, several observations are included regarding certain aspects of the volcanic setting of the district. These interpretations were not the intended goal of the current study and therefore an exhaustive study is not presented here. However, they may indirectly aid future workers in understanding the geological setting of mineralization at Rosebud and ultimately aid in the successful search for new reserves.

Introduction

The Rosebud mine and database were utilized as a working laboratory to model the features of mineralization in the district. This work, begun in 1995 and completed in 1999, was designed to define the main ore controls and build a list of characteristics that could be extrapolated to surface exploration settings. The techniques and conclusions of that work are reported in two reports by the author in 1996 and in 1999.

The current study is an outgrowth of the earlier work recognizing that many of the earlier targets were often poorly tested or the results were incorrectly interpreted. In particular this study focused on the North Equinox area, located approximately 5000 feet N20W of the Rosebud ore bodies, and the Degerstrom area, located approximately 2700 feet N70W of the Rosebud ore bodies. Both areas have received considerable attention from past workers especially LAC, Sante Fe, and Newmont.

North Equinox Area

The North Equinox vein target was defined by mapping completed by S. Maynard (1990) and C. Walck (1992), both of LAC. Follow-up geochemical soil and rock-chip surveys and a large-scale geophysical survey were conducted by LAC over the area to better define the targets. Five holes were drilled by LAC, all of which focused on penetrating the Equinox vein. Follow-up drilling by Sante Fe in 1997 and Newmont in 1998 also targeted the Equinox vein within the resistivity and chargeability anomalies defined by LAC.

All holes, especially Newmont's RS-473 were at least somewhat anomalous in gold and pathfinder elements. This hole returned seven different significant gold intervals of 175' @ 219ppb Au, 120' @ 132ppb Au, 15' @ 1073ppb Au, 20' @ 374ppb Au, 90' @ 150ppb Au, 80' @ 173ppb Au, and 70' @ 126ppb Au. However, if Newmont's staff recognized the significance of the drill results, they did not champion their results with the conviction of another drill hole.

Late in 1999, K. Allen recognized a likely singular relationship with the "YK" fault, and the Gator fault. A projection of the "YK" fault from near the mine aligned with the recently-mapped Gator fault and closer inspection revealed that M. Brady had also mapped a fault in the same area. The prospect of a low-angle South-Ridge-type feeder fault such as the "YK" that close to the surface put the N. Equinox target in a new light and offered strong encouragement for additional drilling (see attached map and section).

A review of the existing database followed by a surface walk-over by the author suggested that there were a number of mineralized fracture trends that had not been factored into the previous drill targeting. For example, the intersection of the Equinox vein with the "YK" fault seemed to explain the elevated gold geochemistry encountered in hole RS-473. Given the weak feeder context of the targeted Equinox vein, these intervals suggested a strong underlying geochemical cell to both the author and K. Allen.

However the other holes in the target were angled and for the most part penetrated no more than 500-feet below the surface. As such they were much too short to have tested the intersection of the faults located 1000 to 1500 feet below the surface. In effect the most likely target had not been tested by any of the previous drilling.

Drill hole RS-486 was designed to test the projected intersection. As 486 was underway, mapping in the Degerstrom area aided recognition that three main feeder faults, one associated with the White Alps, another associated with the Brown Palace, and yet a third associated with the Degerstrom area projected very close to the North Equinox target area. This new concept added encouragement for success.

At the time of this writing strong positive results in the form of abundant white clays and visible pyrargyrite prompted an immediate follow-up hole designed to penetrate the zone at an even greater depth than had hole 486.

Degerstrom Area

The Degerstrom target area was mapped by C. Walck in 1991 (LAC) and C. Stiles in late 1999 (Newmont). Where crossing a ravine Walck interpreted the Degerstrom vein as inflecting over 120-degrees in strike and/or over 30-degrees in dip within 50 feet and then inflecting back again to the original orientation within about the same distance. This interpretation was reconfirmed with Stile's map but seemed highly unlikely to the author based on past experience in similar settings. Observations during a brief visit to the area strongly suggested an alternate and much more plausible explanation for the apparent offset and the vein breccia occurrence exposed in outcrop to the south of the Degerstrom vein. Consequently at the request of K. Allen, the entire area was remapped to determine the correct interpretation and the likelihood of additional targets.

Remapping confirmed the fact that the Degerstrom vein had been offset by a NNE-oriented crossing fault system herein referred to as the Saddle fault. In addition two other strong faults of approximately the same orientation were noted in the mapping, one associated with the mineralization and alteration at the Brown Palace outcrop and another projecting toward the White Alps outcrops. All three of these similarly-oriented faults were directly associated with silica flooding, quartz in-filling, white clay occurrences, bleaching, strong brecciation, and geochemical anomalies including gold and pathfinder elements. The Degerstrom vein, and other faults of similar orientations were mineralized only near their intersection with one of the NNE fault sets. Elsewhere these faults were never significantly altered of mineralized. This indicates that the NNE faults acted as primary feeders with mineralizing fluids bleeding out into the surrounding rock and secondary structures only near the intersections. This interpretation appears to explain the Lucky Boy and Dreamland mineralization as both are adjacent to the Saddle fault.

The current mapping indicates that the Saddle fault zone is over 100 feet in width. The surface trace continues south passing between the Lucky Boy and Dreamland areas, and then continues south across the saddle and down the ravine passing through the Degerstrom vein. Before the surface trace is lost under colluvium a strong quartz vein standing in bold outcrop projects toward the Oscar prospect south of Rosebud canyon.

The Saddle fault trends N$\pm$20E overall, but inflects to N35E between the Lucky Boy and the Degerstrom vein intersection (see attached geologic map and sections). South of that intersection the fault splits into a cymoid-like loop which appears to close to the southwest and with depth. Utilizing the associated geometries of known gold occurrences such as the Lucky Boy vein and Dreamland veins as well as abundant quartz-mineralized fractures, the Saddle fault appears to have experienced a sinistral component of movement during the deposition of quartz and dextral kinematics during the deposition of ore metals. As such then the dextral inflections of the fault present the best segments for drill testing. A normal component is also suggested by the rock offsets and this would direct drilling into more competent host horizons such as the Lbt.

Where the Saddle fault crosses the saddle south of the Lucky Boy/Dreamland areas there is a very significant amount of propylitic alteration affecting all nearby host rocks. The intensity of chloritic alteration found at the surface here is duplicated only in those rocks above the Rosebud deposit. In all cases the host is part of the Chocolate formation but internally to the hanging wall and footwall strands is an intensely chloritized Bud-like section of Chocolate rocks. The surrounding Chocolate tuff is also intensely chloritized near the fault zone.

LAC's sampling defined a strong gold with selenium anomaly in the hanging wall of the Saddle fault, well into the footwall of the Degerstrom vein. At the intersection with the Degerstrom vein, a strong mercury and selenium anomaly was also delineated. Although LAC's sampling was focused on the Degerstrom vein, sporadic samples suggest that gold and pathfinder elements were found along the surface trace of the Saddle fault southward.

A review of past drill results including hole RS-474c, a hole recently drilled by Newmont, revealed that most of the drilling focused on the down-dip projection of the Degerstrom vein system. However because much of the previous mapping mixed breccia zones associated with the Degerstrom vein with breccia zones of the Saddle fault system, many of the drill holes did not encounter either structure or encountered the Degerstrom vein very high in the less favorable Chocolate formation. However some drilling did cross the Degerstrom vein without significant encouragement.

Some drilling crossed the Saddle fault apparently by accident. Hole RBW-17 was drilled for water, but crossed through the east leg of the cymoid loop, intersecting abundant quartz re-annealed breccia and clay. Hole RL-47 crossed through internal splits within the loop and hole RL-235 penetrated the western leg of the cymoid loop both with similar results to RBW-17. All three of the holes penetrated the conduit within the Chocolate formation at depths of only a few hundred feet below the surface. Unfortunately Newmont's hole RS-474c was collared over six hundred feet into the footwall of the Saddle fault, but may have unintentionally crossed a split from the White Alps fault system near the bottom.

Favorable host rock projections based on intercepts in hole RS-474c located in the footwall and RBW-17 located in the hanging wall of the Saddle fault, indicate that the favored Lbt target horizon occurs at over 1000 feet below the bottom of the earlier LAC drill holes.

Two drill holes are proposed to test the favored Lbt horizon at its intersection with the Saddle fault and near the intersection with the Cave fault as projected from drilling results to the east. These drill tests will require holes oriented N72W and inclined at 55- and 60-degrees for holes 1 and 2, repsectively (see attached cross sections). The total drill footage is 5500 feet for both holes.

Volcanic Stratigraphy and Volcanic Setting

Age Relationships of the Volcanic and Epiclastic Rocks

In the course of mapping and reconnoitering the North Equinox, Degerstrom, Oscar and surrounding areas a number of observations related to the geologic setting of the district were collected which warrant consideration. In earlier work (Byington, 1999) it was determined that the average for bedding of the epiclastic units is oriented at N10E40SE within the mine and surrounding area. This orientation was assumed to represent a regional block rotation related to some unexplained phenomena.

The Dozer (Td) unit has been interpreted as a lava flow related to a hypothesized, but undocumented rhyolite flow-dome complex. Because of the superposition, the overlying epiclastic rocks (Tos) have been interpreted to postdate the Td and were thought to represent broadly distributed, well-bedded, volcanic-related accumulations of sediments, which in some cases include lahars and clastic debris slides. The overlying Lbt has been interpreted to represent another younger volcanic flow uniformly covering the Tos and subsequently covered by another Tos-like epiclastic sequence called the Bud unit.

Observations made on the south side of South Ridge appear to be in direct conflict with some of these earlier interpretations. This compelling new evidence requires that the Td and probably the Lbt were injected as sills into a wet pile of epiclastics which have subsequently been grouped separately as the Tos and Bud units because of the intervening Lbt .

Photo A was taken from the south side of Rosebud canyon to illustrate the general nature of the contact of a block of Tos with the underlying Td. The contact is uncharacteristically irregular for a paleo-surface contact, and nowhere shows paleosols or other erosion-related surface features. A closer examination reveals some important clues about this contact and the relationship of the two rock types.

Point A in Photo A for example suggests an intrusive relationship and this interpretation is reconfirmed with details provided in a closer inspection. Photo B was taken along the left or west side of a near-vertical contact where the fine, well-sorted and stratified epiclastic beds are abruptly terminated by this dike-like part of the intrusive sill.

Photo. A (S. side of South Ridge). Contact of overlying Tos with Td. Green line shows actual contact.

Photo. B. Contact west of Point A showing Tos (l) with Td (r).

There is no sense of an on-lapping sedimentary contact as one would expect should this contact represent an in-filled paleo-channel. Note also the auto-intrusive breccia within the Td near the contact.

There is no indication of faulting in the relationship of this contact although the contact shows a very significant amount of brecciation in both rocks and strong hyaloclastic textures within the Td. This zone of breccia and rubble follows the contact and indisputably crosses all bedding in the Tos. The zone consists of poorly-sorted breccia and rubble and is everywhere present along the contact zone, but it is highly variable in width, composition, range of clast size and degree of disruption. This zone will be herein after referred to as the "disrupted zone" in this report.

Where the Td intrusive has forcibly penetrated the overlying and presumably water saturated epiclastics, the disrupted zone includes large blocks of Td as is shown in Photo C. The character of the disrupted zone in general is notably inconsistent with the adjacent beds of highly stratified, and well- to moderately-sorted sediments. The occurrence of table-sized blocks of Td is consistent with small dike-like cupolas that were intruded into the pile of wet sediments and then broken and brecciated during the resulting phreatomagmatic explosion. Note that the intense chlorite-dominant propylitic alteration affects all rock on both sides of the contact. It is important to note that the most intense chlorite alteration in the Tos always occurs near the contact and diminishes away from the contact regardless of the particular bed observed or the angular relationship of the contact. In local instances fluids responsible for the precipitation of hematite and chlorite follow a particular bed out from the contact, but the alteration and the disrupted characteristics always rapidly diminish away from the contact.

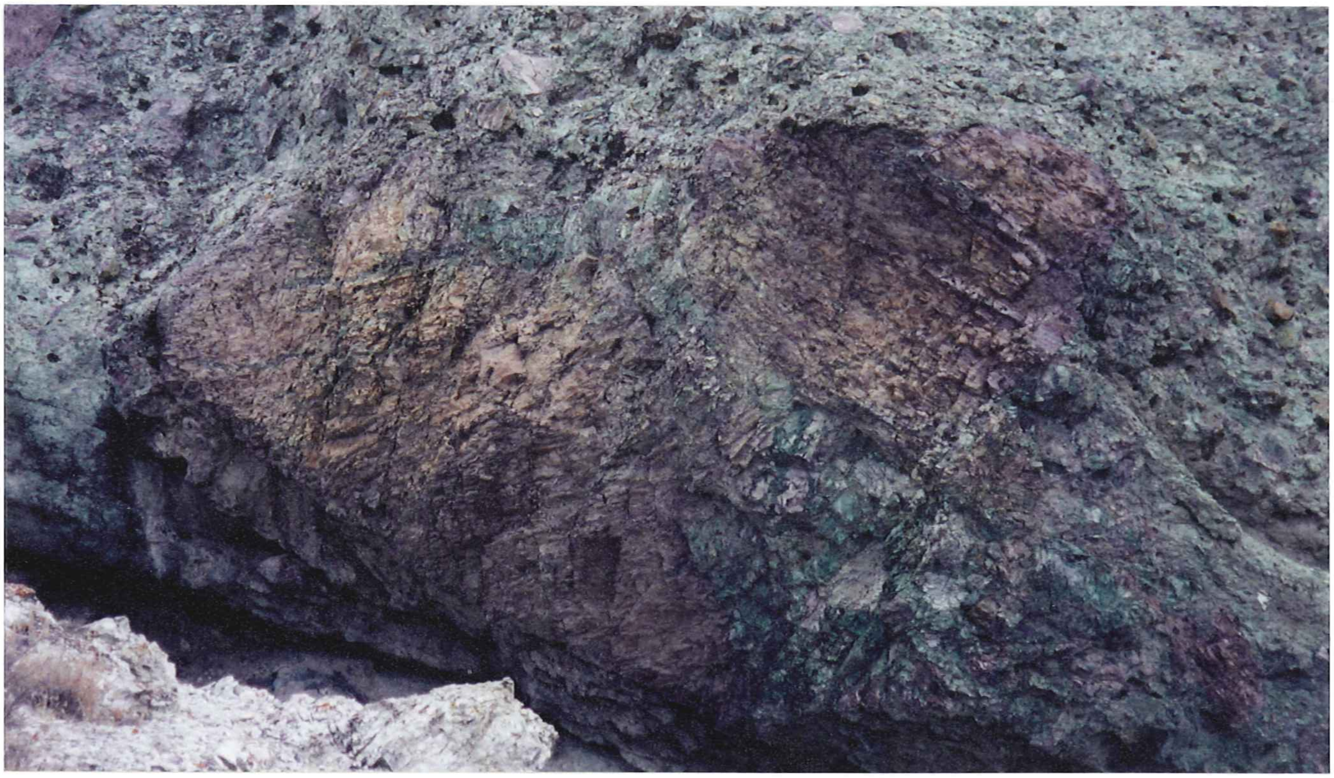

Photo. C. Disrupted zone containing remnant blocks of intruded Td (at point A).

Photo D was taken from the top of the Td cupola illustrating the disrupted zone to the east of point A. Again note the crosscutting nature of another Td dike where a large block of Td remains intact but highly altered. Note again that there is no sense of the sediments lapping onto a paleo-surface, but rather the sense that the Td has crosscut the beds at an acute angle. There is never a sense of bedding within the disrupted zone although the bedding is obviously terminated by the disrupted zone.

The near vertical white streaks within the block of Td represent botryoidal quartz coatings along zones of hydrothermally bleached, argillized and selectively removed bands. Below and to the left of that block, part of the disrupted zone widens into a lens of intense bleaching due to hydrothermal alteration. There are no hydrothermal conduits feeding this zone suggesting that this lens of alteration represents a local pocket of hot water, probably interstitial meteoric water derived from the clastic sediments.

Photo E illustrates a chill margin along the contact of the underlying Td sill with the overlying disrupted zone. The fragmental and matrix-supported nature of the autointrusive breccia is evident on a small scale along with the intimate and welded nature of the overlying clastic sediments. These matrix-supported autointrusive textures are consistent with an intrusive, but never with a surface lava flow. Such features are always present in the Td and Lbt near the contact, and as the contact is approached the intensity of the brecciation increases.

The disrupted zone is largely confined to the older Tos host, but is also locally evident in the Td intrusive as is shown in Photo F. Fragments of Td are supported in a matrix of Td and the localization of chlorite and especially hematite is restricted to the zone of disruption. In all cases both hematite and chlorite are present at the contact but rapidly decrease outward in both directions.

Photo. D. Disrupted zone and contact with Td east of point A.

Photo. E . Chill margin in Td at contact with overlying disrupted zone.

Photo. F (S. side of South Ridge). Monolithic fragmental breccia extending into the Td intrusive.

Rare pockets of hematite are found within the Td such as is evident in Photo G. Note the textbook examples of hyaloclastic brecciation in the Td.

Photo. G (S. side of South Ridge). Monolithic fragmental breccia extending into the Td intrusive.

Photo. H. Fragment of Tos probably plucked from the disrupted zone floating in Td.

The contact of this once-viscous sill and the overlying clastic rocks characteristically is brecciated due to the friction imposed by the dynamics of emplacement. Occasionally it is possible to find fragments of Tos emplaced within the Td intrusive, an impossibility if the Tos were younger than the Td. Although the occurrences are rare, fragments of Tos become engulfed within the Td such as is shown in Photo. H.

Photo. I. Disruption zone of Lbt 20 feet below contact with Bud.

Photo. J Heterolithic Lbt autobreccia directly below contact with chloritized Bud.

Much more commonly the fragments of Tos are of considerable size and occur as pendants floated within the Td. Several such pendants were found floating in a Td host on the south side of South Ridge and along the south wall of Rosebud canyon. In addition there is a large outcrop exposure on the south side of Rosebud canyon where the epiclastic beds are cut by a wide Td dike.

A similar relationship is shown where the Lbt is exposed in contact with the overlying Bud unit. The occurrence of an autointrusive breccia selvage just below the contact in the Lbt is similar to the one described for the Td. Photo. I illustrates the autobrecciated nature of the Lbt in outcrop 20 feet below the contact with the Bud epiclastics. Note the fragment near the hammer point for example which shows strong flow banding. As the contact is approached the fragment composition changes from monolithic to polylithic suggesting that the Lbt stoped, milled and incorporated fragments from the overlying epiclastics. That feature is shown in Photo. J where polylithic fragments are entrained within the Lbt autointrusive breccia.

The data presented here and available in outcrop exposure to any open-minded field observer brave enough to venture to the outcrop are consistent with only one interpretation and that is that the Td and Lbt units were intruded in a sill-like fashion into an older pile of wet epiclastics.

Contributions to the Understanding of the Geological Setting of Rosebud District

Aside from the relationship of the Td, Tos, Lbt and Bud units the author collected several observations that may aid in understanding the geologic setting of the district. For example, local variations of foliation within the Chocolate formation (Tc) and the occurrence of megabreccia and other slide features locally suggest the location of a structural margin typical of a maar (or caldera) setting. The west wall of the maar appears to occur along the ridge separating School Bus canyon from the Degerstrom area and the east wall might occur near the blocks shown in Photo. A. The southeast wall would be south of Rosebud canyon and north of the Oscar target area. The Rosebud mine would lie just outside of the northern structural margin of the maar.

Features such as reattached slide blocks with highly variable compaction foliation were noted along the canyon south of the Degerstrom area. Photo. K illustrates a modest sized slide block that apparently became detached while it was still ductile and rolled or slid down the crater wall into its present reattached position. In the process the compaction foliation was bent at nearly 90 degrees within the block and is discordant to the surrounding foliation (not shown). Several additional megabreccia blocks were noted in this area including a block that appears to be the size of a large parking lot.

Photo. K. Compaction foliation fold in Tc slide block.

All of the foliation in the Tc appears to be dominantly compaction foliation because true flow characteristics are rarely present. The high variability of compaction foliation orientations in that area, and the megabreccia suggest a very close proximity to the structural margin of a eruptive center.

South of Rosebud canyon are excellent exposures of basal surge deposits. Typically these surge beds are located within 800 meters of an eruptive center (Wohletz and Sheridan, 1979) and occur outside of the structural margin. These basal surges occur along the south wall of Rosebud canyon and again south of the Oscar target area.

Proximity to the eastern margin may be indicated by the rapid change in bedding within the epiclastic units shown in Photo. L. The lower contact shown on the left side of the photograph is the same as was discussed regarding the Td and Tos contact. Bedding at that point is inclined at approximately 15 to 20 degrees. However similar epiclastics shown on the right side of the photograph are inclined at over 50 degrees. This exceeds the angle of repose for these clastic units and is about 20 degrees steeper than similar Bud epiclastics directly to the east (outside of the view). Perhaps these represent slide blocks that have moved downward into the crater along the eastern structural margin. Outside of this area to the east the epiclastics are all conformable and exhibit well developed and persistent bedding.

Photo. L. Unconformable contact of epiclastic units on S. side of South Ridge

Conclusions

The lack of past drill penetrations in the North Equinox and Degerstrom areas targeting zones of favorable structural preparation and favorable host horizons provided the encouragement for additional drilling in both areas.

Past drilling at N. Equinox targeted geochemical and geophysical anomalies defined by LAC's work in the early 1990's, but all of these holes were shallow penetrations in less favorable host rocks. One recent drill hole by Newmont encountered very significant intervals of anomalous gold concentrations but the significance of this apparently was not fully appreciated and no follow-up drilling was proposed by Newmont's staff. The intersection of the N. Equinox vein and the YK fault was identified as a valid and untested target in this work, and RS-486 was completed to test this target.

At the time of this report this initial deep hole in the North Equinox area had penetrated abundant white clays and visible pyrargyrite. A second follow-up hole is currently underway to test the mineralized zone at a greater depth.

Mapping within the Degerstrom area resulted in recognition of three district-scale ore feeder conduits. These conduits appear to control mineralization in surrounding crosscutting structures like the Degerstrom fault. One of the conduits, the Saddle fault, is believed to explain mineralization in the Lucky Boy and Dreamland areas. Another conduit explains mineralization in the Brown Palace outcrop and a third seems to be related to a system feeding the White Alps, North Equinox and Gator targets. The possibility of a similar feeder structure near the Rosebud mine has not yet been investigated.

Two holes in the Degerstrom area are herein proposed in light of the recognition of three major ore conduits crossing through the area. Past drilling was shallow and tested only the less desirable Chocolate formation near the main feeder conduits.

All past drilling was completed without recognizing the significance of these ore conduits, and consequently many of the holes were drilled distal to or into the footwall of these major ore controls. The three holes that crossed the Saddle fault did so in one of the least favorable rock types, but in all cases these ore-conduit intercepts reflected strong brecciation and strong gangue mineralization.

The ore conduits are dominated by strike-slip faulting based on their geometries with surrounding conjugate fractures. Using the geometrical relationships of the quartz-mineralized and gold-metallized fractures with the main conduit, it appears that the early quartz event occurred during sinistral movement while the subsequent gold event occurred during a later dextral deformation event. A significant but poorly quantified amount of normal movement also occurred along these structures.

Given dextral/normal kinematics during the gold event the best targets would predictably lie within the more competent hosts (Lbt) along legs of clockwise inflection. The two proposed drill holes for the Degerstrom area are designed to target the Lbt along sections of favorable strike inflection. In addition, this is an area with very encouraging alteration and geochemistry.

In the course of mapping and reconnoitering additional surrounding target areas, observations were collected that justify a revision of some of the currently-accepted geological and timing concepts. These are observations regarding the Td, Tos, Lbt, and Bud units. These data validate a new interpretation where the Td and Lbt are rhyolite sills that intruded a pile of wet epiclastic rocks. The Td and Lbt are therefore younger than the rocks that overly them. The timing and genetic relationship of the Td with the overlying Lbt is unknown.

Observations concerning the geologic setting of the district suggest that the area southwest of the mine site may represent a volcanic maar. Features present at various locations suggest a proximity of the structural margin on the southeast, south and southwest sides. These observations may prove useful in understanding the host rock characteristics, and ultimately in understanding where new reserves may be found.

REFERENCES

Byington, C.B., 1999, Target identification, mineralization and ore controls at the Rosebud Mine, Pershing County, Nevada, Hecla in-house report, June 1999.

Byington, C.B., 1996, Rosebud Mine area structural analysis, final report, in-house report January 1996.

Walck, C.M., Bennett, R.E., Kuhl, T.O., Kenner, K.L., 1993, Discovery and geology of gold mineralization at the Rosebud Project, Pershing County, Nevada, Preprint no. 93-175, *for* Society of Mining Engineers Annual Meeting, 1993.

Wohlet, K.H., and Sheridan, M.F., 1979, A model of pyroclastic surge, Geological Society of America, Special Paper 180, pp. 177-204.