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Exploration report; property report; property maps; geology; drill hole summaries; reserves; resources; production

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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)

Revised: 1/22/08
1998 Annual Exploration Report
Rosebud Mining Company LLC
Pershing and Humboldt Counties, Nevada

by

Randall B. Vance

Newmont Mining Corporation
Winnemucca, NV

August 18, 1999
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INTRODUCTION

The Rosebud mine, located 55 miles west of Winnemucca in Pershing County, Nevada, is a Newmont/Hecla joint venture (50:50). The Rosebud deposits are Miocene(?)-age, volcanic-hosted epithermal gold-silver deposits of the low-sulfidation type. Free-milling sulfide stockworks are associated with illitic and kaolinitic clays in the South zone, and silica and illite-dickite clay in the East zone. The dominant ore minerals are marcasite, ruby silvers (pyrargyrite >> proustite), electrum, naumannite, and argentite. The primary control on the deposits is structure. The North and South zones occur in the hanging wall of the South Ridge fault, and the East zone occurs within and in the footwall of the South Ridge fault. Lithology is an important secondary control in the South zone. The deposits are surrounded by a broad halo of argillized volcanic rock.

Newmont Gold acquired its ownership in the venture in May 1997, as part of the Santa Fe Pacific Gold Co. merger. The joint venture is established as Rosebud Mining Company LLC. Hecla Mining is the mine operator, and Newmont Gold is the operator for milling and exploration. All exploration expenditures are shared 2/3 Newmont and 1/3 Hecla. The property consists of 843 unpatented claims and three patented claims.

During 1998 the Rosebud mine produced 130,992 ounces gold at a grade of 0.400 oz/st gold and 556,580 ounces of silver at a grade of 3.06 oz/st silver. Gold recoveries were 97.0%, and silver recoveries were 54.4%. Total cash costs were $176/ounce, and total production costs were $274/oz (Hecla, 1999). Mining costs were $26.88/ton, milling costs were $14.66/ton, and ore trucking costs were $0.15/ton-mile. At the end of 1998, using a cutoff of 0.18 oz/st gold, the proven and probable reserve was 0.484 million tons at 0.392 oz/st gold and 1.8 oz/st silver, containing 189,615 ounces gold and 872,503 ounces silver (Allen, Clayton, and Moore, 1999). At the current production rate, the mine life will expire in the fourth quarter of 2000.

This report relies on background information presented in the 1997 Annual Exploration Report (Vance, 1998a), and refers to other sources where appropriate. In many cases, specifics from the cited references are omitted in the interest of brevity. For general background information, the reader is referred to the Rosebud Mining Co LLC monthly reports (Vance, 1998c), the near-mine exploration target report (Rogowski, 1998), and site reports by Steve Turner (1997a, 1997b).
1998 PROGRAM

The exploration program during 1998 was staffed with two full-time Newmont geologists (Langstaff, Vance) who were joined in March by a third (Mitchell). A geologic consultant (Rogowski) supplemented this effort at Vertex and Near-Mine targets. Deep targets at Dreamland, Lucky Boy, Brown Palace, and White Alps were the primary emphasis for the year (Figure 1). Surface work (mapping and minor geochemical sampling) and data review were completed at South Ridge, South Kamma, Vertex, Valley, and northeast of the mine. Additionally, several exploration holes were drilled from the mine to test near-mine targets.

Folio development continued from 1997. A variety of geology, geochemistry, geophysical and drill maps were plotted at 1:24,000, 1:6000, and 1:2400 scales. The 24,000 folio is essentially complete, except for needed updates and edits of the rock and soil geochemical database. The 6000 folio is also complete for Sheets 1 and 3 (Figure 2). Sheet 2, which covers the extreme south end of the property, has little data. The names of Lac's 2400 folio were modified to better reflect the target locations (Figure 3). The current inventory of folio maps is shown in Table 1.

Geology


The Rosebud deposits are best classified as epithermal deposits of the low-sulfidation type (see Hedenquist and others, 1996; White and Hedenquist, 1995). Rosebud includes similarities to several other Tertiary volcanic-hosted deposits in northwestern Nevada, such as Sleeper, Comstock, Mule Canyon, Hollister, and Midas (see Wallace and John, 1998). One of Rosebud's major differences, particularly to Midas and Sleeper, is the lack of steeply dipping banded veins. Also, in contrast to Midas and Mule Canyon but similar to Sleeper, the wallrock surrounding the Rosebud deposits is commonly argillized and pyritized for hundreds of feet. Lastly, the alteration is strongly influenced by low- to moderate-angle dipping faults. Core, RC holes, and surface outcrops display alteration that is asymmetric around the primary structure: it occurs either in the hanging wall or footwall, but generally is not symmetric. This seems to reflect what is seen in the deposits: the South and North Zones are in the hanging wall of the South Ridge fault and the East Zone is in the footwall. The hanging wall portion of this occurrence model was described by Brewer (1991, p. 9).

During 1998 progress was made in the areas of petrography (Langstaff, 1998h; 1998i; Williams, 1998), whole-rock geochemistry and rock classification
(Langstaff, 1998d, 1999m; Mahood, 1998). The stratigraphic column was refined and improved (Mitchell, 1998b).

Consultants Williams (1998) and Mahood (1998) provided petrographic descriptions. They prepared their own thin-sections; others were prepared by Vancouver Petrographics Ltd. (Langley, BC) or Idaho Petrographics (Grangeville, Idaho). A concerted effort was made to locate the several hundred thin-sections previously prepared by Lac. Many geologists formerly associated with the project were contacted, and offered suggestions, but none knew definitively the location of the thin-sections. They disappeared sometime between Hecla’s office relocation from Winnemucca to the mine and Santa Fe’s entree into the joint venture. Many of Lac’s thin-section billets were found in a weathered cardboard box. Unfortunately it was destroyed in a warehouse fire. A spreadsheet (R:\geology\reports\technicalmemos\tables\miscsamp.xls) tracks most of the samples submitted in late 1997 and 1998 for thin-section and/or whole-rock analyses (Tables 2 and 3).

The 1:6000-scale regional geologic and structure map by Moore (1991) was drafted in AutoCad to aid in tectonic and stratigraphic understanding. The north and south sheets were drafted in black and white, and cross sections were drafted on one sheet. (The interpretation overlays were not drafted in AutoCad.)

The 1998 magnetic declination, 15.7°, was determined in October, 1998, from IGRF, using Newmont software. The change is decreasing 3.9’ per year. The Sulphur (1981) 7.5 minute quadrangle shows 17°, which after adjusted for 16 years, compares closely to the IGRF estimate.

As a way to better visualize and model the geologic shapes in the Rosebud mine, particularly the South Ridge fault, digitized shapes (in Surpac) were acquired from Hecla in the spring of 1999, downloaded into Geomodel, edited, and modeled. The results of this work are stored on Newmont’s Winnemucca network at lnmt/explore/rosebud/model/feb99/.

The geometry of the South Ridge fault (in the mine) relative to the Sharkfin and Office faults (surface outcrops) received considerable attention (Langstaff, 1998f). The primary supposition was the Sharkfin is actually a high-angle structure, and that a primary feeder fault, largely untested, might lie down-dip of the Sharkfin. Eventually an exploration hole (RS-D350-99) was drilled in 1999 from the southeast part of the East Zone, but it failed to substantiate the concept. Rather, the Sharkfin “fault” may simply be a flexure in the South Ridge fault, with the flexure plunging ~ -30, N50°W. The modeling mentioned above requires a distinct concave-upward bend to connect the South Ridge fault in the mine to the surface outcrops (Sharkfin and Office fault). Why the dips in the South Ridge are similar for more than 2000 feet before dramatically curving upward as it approaches the surface outcrops seems to be more than coincidence, but is not understood.
The Hidden fault, first identified by G. Langstaff, and briefly described by Vance (1998c), was further supported by geochemical plots and reprocessed gravity during early 1999. The Hidden fault bounds the North and East Zones on their northeast sides, striking N50°W, and dipping steeply. The Hidden fault shows offset on the Auld Lang Syne basement surface, and seems to be reflected in the gravity data, which shows a modest northwest-trending high from Dozer Hill towards Dreamland.

1998 Results and Conclusions

Continuing exploration at Rosebud has led to the following geologic observations and conclusions:

- Petrographic and whole-rock analyses show that the majority of the rocks are rhyolite (including alkali rhyolite and rare high-silica rhyolite) or quartz latite. These determinations were made using TAS (total alkali versus silica) plots of whole-rock geochemical data (Figure 4), and calculated CIPW norms of chemical data plotted on IUGS classifications (Figure 5) (Langstaff, 1999m). There are a few samples that are rhyodacite, dacite and andesite. The Kamma Mountain volcanic rocks are weakly alkaline.

- Surface mapping at Short Shot, White Alps and Dreamland identified a new rock unit, named the Rosebud quartz latite (RQL) (Mitchell, 1998a), which is widely altered. The RQL has rare phenocrysts of β-quartz and sanidine. It intrudes the Wildrose northwest of White Alps as a dike, and shows sill-like contacts elsewhere. Most previous mapping lumped this with Chocolate, but it is distinctly different than typical fine-grained, biotite-hornblende-bearing Chocolate flows. The presence of quartz is definitive, but because quartz phenocrysts are relatively rare, their absence in any single specimen cannot be used as evidence against RQL. Altered rock in RC chips has a granular texture, recognizable sanidine phenocrysts, and rare quartz phenocrysts that are sometimes smoky.

- Significant progress was made understanding the Rosebud stratigraphic column and unusual nomenclature. Santa Fe’s tentative correlation of the mine’s LBT unit with Brady andesite (equal to Wildrose rhyolite) appears correct. The deep holes at Short Shot and White Alps (RS-455, -456) clearly show Bud epiclastics (including Bud volcanics) overlying Wildrose rhyolite, which in turn overlies the “mine Tos”. Another Bud-type epiclastic/volcanic breccia occurs in the Chocolate formation at White Alps.

- The roots of the Rosebud deposit are not well understood. The South Ridge fault is recognized as a primary conduit for ore fluids, yet it has not been drilled extensively down-dip from the mine workings. The evolution of the
fault and its relationship to tilted stratigraphy is critical to understanding the timing of ore, and the amount of rotation of the deposits, if any. The presence of silicified and mineralized basement with sub-ore grades suggests the deposits have not been significantly displaced from the underlying low-grade metamorphic rocks. Exploration should continue to focus on (1) identification of ore conduits along and near the unconformity, (2) epithermal alteration and Rosebud-style geochemistry in the basement rocks, and (3) faults that propagate from the basement into the overlying volcanic rocks.

- Last year the existence of the Rosebud shear, interpreted by Lac as a major left-lateral strike-slip fault, was questioned. Continuing logging, mapping, and analysis of geophysical data and structure contour maps generated additional evidence that the Rosebud shear, as defined by Lac, does not exist. Early in the year the location and significance of the Cave fault was recognized (Vance, 1998c, March), and we began to search along the valley for its possible trace. Only one outcrop (~2203100N,481200E) has been located that is believed to be the surface trace of the Cave fault. Both declines penetrated structures thought to be the Cave fault, and the fault in Decline #2 projects closely to the above surface outcrop. The Cave fault outcrop occurs near the intersection with the South Ridge fault above the southwest edge of the South Zone deposit, where the South Ridge steepens and is cut off by the Cave fault. This intersection is important, and will be evaluated more closely in 1999. About half of the surface trace of the Cave fault coincides with Lac's Rosebud shear.

- The Foundation fault, located at the base of the volcanic pile, does not appear to have large-scale, post-mineral offset in the Rosebud mine area because the ALS basement is locally silicified and mineralized (barite-marcasite-stibnite-pyrrargyrine) beneath the North zone, and there are numerous white to gray Dozer-like altered dikes or sills cutting the basement in the mine area. A slickensided, planar tectonic fabric in carbonaceous phylite earlier interpreted as evidence for the Foundation fault may be an older penetrative metamorphic fabric, possibly developed during pre-Tertiary thrusting. The Foundation fault is better defined as the narrow (0.5-5 feet) breccia and microbreccia in the hanging wall volcanic rock, as seen in many core holes. In either case, most of the drill holes that reach the basement do not have major breccias or wide alteration across the contact. Yet the geochemical expression from the ICP shows consistent increases in the epithermal elements As-Sb-Se surrounding this contact (eg., RS-401c, RS-423c, RS-425c, and RS-446c). In addition, elements commonly enriched in black shales (Mo-Ni-Zn-Cd-Co-Ag-V-Se) dramatically increase at the volcanic/phylite contact.

- Although the basement surface is generally planar, with a gentle northwest dip, there are several places where adjacent drill holes encountered the basement at distinctly different elevations. Two examples are: RBW-17,
There are a few occurrences of altered dikes or sills intruding the basement (RS-448, -449, -451, -452), local decalcification of phyllite in contact with the volcanics (RS-D331-98), and possible carbon flooding along the Foundation fault. Several drill holes on sections show limited gold in the basement (e.g., RL-106c). These holes will be evaluated for underground exploration potential.

The 1998 report stated “Thick sections of unaltered rocks (1000-1200 ft) may overlie altered rocks (Dreamland). A major flat-lying fault occurs near the top of the lower altered zone.” This fault, which is approximately 50-70° to the core axis, possibly is the Cave fault, because it has the same stratigraphic offset as seen in the declines, i.e., Chocolate above Dozer. It completely cuts out the Bud, LBT, and Tos stratigraphy at Dreamland. As one moves towards the northwest (White Alps holes RS-445, RS-446), stratigraphy in the hanging wall of this fault moves down section (from Chocolate to Bud to LBT).

Geochemistry

Craig Olsen of Newmont’s Winnemucca office managed the geochemical and drill databases using Paradox and Stones software. Originally plans were made to convert to Newmont’s GEMS database, but a manpower shortage and jurisdictional dispute precluded the conversion. During the last half of the year a geochemical study by Robert Jackson and Adi Sjoekri brought to light some discrepancies in the rock and drill hole databases. These problems were somehow introduced when the database was converted from Lac/Hecla to Santa Fe. A major review and edit of the rock database to correct the problem was completed in early 1999.

For drill hole composites, the same 1997 partial-digestion, 31-element ICP package was used in 1998. The ICP analyses were completed by Acme of Vancouver as a subcontractor for American Assay of Reno. In general, the ICP package was run using 4-sample composites (20 feet) for the RC precollars, and multiple-sample composites for core tails which typically approximated 15-25 feet. Occasionally individual samples were analyzed if a core interval was well mineralized.

Robert Jackson, Newmont Gold geochemist, commented on the quality of the geochemical data:

The rock chip and drill hole data is of good quality. However, it needs to be noted that the drill hole data is derived from 2 different digestions. Most of the drill core from holes in and immediately adjacent to the Rosebud deposit were analyzed using a total digestion (hydrofluoric-perchloric-nitric acids). The remaining holes were analyzed using a partial digestion (hydrochloric-nitric acids). These data will be comparable for most elements, the exceptions being
the major elements Al, Na, K, Ti. Most of the Ca and Mg in these rocks are in carbonate forms that are readily extracted by both digestions.

The soil data suffers from a number of problems. The data was generated from multiple surveys that employed different analytical procedures. This has resulted in variable detection limits and relative accuracy shifts amongst surveys. Distinct differences are observed not only between adjacent surveys but also between overlapping surveys. Also, the soil fraction that was analyzed was ~80%. This fraction contains considerable wind-blown material that dilutes and obscures the geochemical signature of soil derived from local bedrock. Consequently, only the highest contrast features are recognizable, and subtle but important trends in the data are not discernable.

Robert Jackson and Adi Sjoekri completed a geochemical study of the ICP data from the Rosebud mine (1994 total digestion) and exploration drill holes (1997-98 partial digestion) (Jackson, 1998; Jackson and Sjoekri, 1998). The study generated two map sets. Plans of the mine area were generated at 1:6000-scale every 100 feet from 4300 to 5300 elevation. Plots were made for Au, Ag, As, Sb, Hg, Se, Ca, Fe, Ti, La, W, V, Zn and Zr every 100 feet (~154 maps), and for K, Cu, Mg, Mn, Mo, Na, Ni, and Sr every 300 feet from 4300 to 5200 (~32 maps). Plans of the claim block, including exploration and underground holes, were generated at 1:12,000-scale every 300 feet from 3400 to 6100 elevation. Plots were made for Au, Ag, As, Sb, Hg, Se, Ca, Fe, Mg, Zn, V, and U (~130 maps). As noted above, caution should be used comparing partial-digestion data in the exploration holes versus total-digestion data in the near-mine holes. For most elements they are not directly comparable.

The primary observations and conclusions of Jackson and Sjoekri’s study were:

- Hydrothermal alteration (argillation, silicification) results in depletion of Ca, Mn, K, Na, Sr ± P, and enrichment of Au, Ag, Se, Sb, Hg, As, W, U, Cu, Mo, Te, Pb and to a minor degree Zn, Ni, Co, and Bi.
- Looking at very low levels of gold (ten to hundreds of ppb), the Au signature over top of the deposits is weak to unfocused and does not provide a clear target. The mineralization appears to neck down with depth below 5000 ft level, toward the North Zone.
- There is a strong suggestion that the mineralization is focused at the intersection of N-NE structures with E-NE and E-SE structures that are common to the two deposits (South Zone-North Zone, and East Zone). There is not much support for a northwesterly trend to the system. The Au system appears to be open to the E-SE where there is evidence for another locus or intersection with a N-NE structure that is mineralized.
- The upper level expression of the deposit is characterized by: (a) a Hg-Ag plume above the South Zone, (b) an Sb plume above the East Zone, (c) an As-Se plume along an E-W trend over the South and East Zones, and (d) Ca-Mn-Sr-P-Na depletion over the whole of the mineral system (Rosebud mine).
- The Hg signature dissipates at about the 4800 level.
- The basement rocks are enriched in Se, As, Sb, Ag, Mo, Zn, and Ba.
- The geochemical signature of the Rosebud mine is different than Dreamland.
They identified the following targeting favorability criteria based on the Rosebud model:

- Areas of complex structural intersections involving big regional fault zones
- Areas of carbonate and potassium depletion
- Strong multi-element geochemical signatures (Au, As, Sb, Hg, Ag, Se, Cu, Mo, Pb, W, U)
- Presence of felsic volcanic host rocks in the stratigraphic section
- Proximity to the basement contact

Using these criteria, they favored the following seven priority target areas: Degerstrom, Dreamland (in particular East Dreamland), North Rosebud Peak, North Equinox (north of the 212 fault), Oscar, Chance, and Gator.

Two comments concerning their study are warranted. First, the ALS basement can be distinguished geochemically from the volcanic rocks by browsing tabulated down-hole ICP data and looking for enrichments in Mo-Ni-Zn-Cd-Co-Ag-V-Se. Secondly, hydrothermally altered and mineralized volcanic rock can be identified in the same way by closely examining Se, As, Sb, and sometimes Hg. To date the trace elements do not markedly display halos or gradients around mineralized structures or the deposits any better than very low levels of gold (tens to hundreds of ppb).

Geophysics

A geophysical index map was compiled for the 1:24,000 folio (Rosindex.dwg). It shows the locations of the various ground and airborne geophysical surveys completed to date.

Radiometric maps (potassium, uranium and thorium) were plotted for the 1:24,000 folio. Potassium and thorium data appear to correlate more closely to mapped bedrock than does uranium. Ternary cluster images identify known altered areas around the mine, and highlight several new areas that warrant field checking.

Forty line miles of IP/resistivity were processed using Newmont inversion software. About 30 lines extend from South Ridge north to White Alps and North Equinox. The quality of the surveys is excellent, but the original survey parameters allow for modeling and interpretation only to about 400 ft. The modeled sections show resistivity contacts not recognizable from bedrock mapping.

An orientation gradient array IP survey, with the ability to penetrate about 1000 feet, was completed in an array south and west of the mine (Valley target).
Completion of the survey was hampered by cultural noise. Very low resistivities were found (single digits in ohm-meters).

The gravity grid was enlarged another 520 stations. It was increased to the west, northwest and north at 800 by 800 ft spacing, and to the east at 400 by 1000 foot spacing. At White Alps, a northeast-trending gravity gradient was originally interpreted to be upthrown basement. The gravity gradient was remodeled along line 2209000 N, but the density of Auld Lang Syne could not reasonably account for the anomaly at those depths. The new interpretation is that the gradient is caused by contrasting densities of volcanic rock, such as a thick sequence of unaltered rhyolite flows (Twr=LBT) on the west, against argillized and silicified rocks on the east, rather than an uplifted basement block on the northwest. The gradient therefore delineates an alteration contact. Although deep holes RS-455 and RS-456, on the northwest edge of the gradient, did not hit the basement, they and RS-445 and RS-446, on the southeast side of the gradient, contain evidence supporting this interpretation.

As a way to select the placement of the first offset hole to RS-425 (5.8 feet of 0.84 oz/st Au), down-hole IP was attempted to identify a chargeable concentration of sulfide. Perforated PVC pipe was installed inside the drill rods, and the rods were pulled over the top of the PVC. Unfortunately, the PVC pipe hung up on the bottom of the rods and it had to be removed. The open hole was adequate for the probe to reach the bottom of the hole at 2400 feet, and the survey was completed (Phillips, 1998b). Only small anomalies were identified in the survey. Apparently the chargeability contrast between the mineralized breccia and the altered wall rock is not sufficiently large to show a strong anomaly.

**Drilling**

Newmont drilled 28,849 feet of exploration hole during the year, consisting of 16,946 ft of reverse-circulation in 12 holes, and 11,903 ft of core in 16 core and RC/core combination holes (Figure 6 and Table 4). The drill results of individual targets are described below.

All surface drill holes were assigned an RS- prefix and numbered consecutively (from RS-427 to RS-456). A "C" suffix was used to denote core holes. There were four underground exploration holes drilled in 1998: D-280-98, D-331-98, RSDU-453A, and RSDU-454.

Similar to the fall of 1997, Newmont's Drill Services Group completed one phase of infill delineation drilling of the East Zone using RC precollars and core tails (RS-427 through RS-442). At the time of drilling, there was no underground access in the East Zone that could easily reach the area needing holes.
Drill hole monumentation and plugging procedures were the same as 1997 (Vance, 1998a, p. 4). Drill hole collars were surveyed in groups of 5 or 10 after completion. Because the pads were larger than in the past (with a deeper cut), the collar generally becomes buried under 1-5 feet of fill after reclamation. The respective core or RC driller completed the abandonment of drill holes. The core drillers abandoned the holes from T.D. to the base of the precollar, and the RC driller abandoned the hole to the collar when pulling the casing. In several instances in the deep holes, the level of the abantonite would drop significantly if the hole was left for a long period, in which case more was added. A cement plug and aluminum monument was placed in the top of the hole.

RC and core drilling contractors and earthwork contractors filled out daily drill reports using Newmont’s standard form. Newmont’s Drill Services personnel and Rosebud geologists monitored their progress on a daily basis, but the geologists did not sit the rigs. The daily reports were entered into Newmont’s DrillCost tracking system, which provided monthly reports detailing drill progress and all associated costs.

Assay procedures established in 1997 continued during 1998 with one exception. In RC drill holes that intersected maroon to red, hematitic and unaltered rock, gold-silver intervals were increased from typical 5-foot samples to every fourth or fifth sample as a way to economize. Pulps were made for every sample in a drill hole. Core tails that lacked alteration were not sampled from top to bottom; rather spot samples of possible altered rock were taken to insure no surprises. For down hole geochemistry, American Assay of Reno provided a 30-element ICP + Se package using partial digestion (aqua regia). This analysis was run on 20-foot composites in RC holes. Core samples were composited into approximate 20-foot intervals, unless strongly mineralized rock was present, in which every sample was analyzed without compositing.

Exploration Targets

Exploration during the first half of 1998 was focussed on discovery of new deposits away from the Rosebud mine. Primary emphasis was placed on the Rosebud-Dreamland-White Alps trend, plus a single hole drilled at North Equinox. As the value of Rosebud’s low-cost ounce production became more pronounced with falling gold prices, plans were made to begin exploration around the mine in an effort to extend the short mine life.
Deep Dreamland

Several deep holes drilled in the Dreamland target in 1997 intersected long intervals of altered rock, gold-silver mineralization with encouraging trace elements, and significant low- to moderate-angle mineralized structures. RS-425, drilled in late 1997, intersected 5.8 feet of 0.856 oz/st gold in a sulfidic breccia within altered rhyolite (Dozer) in the footwall of a fault (Cave fault?). The Au:Ag ratio was 1:1. Three offset holes (RS-443, -444, -450) were drilled around RS-425, but failed to intersect gold greater than 0.095 oz/st. In fact, all three holes show distinctive geologic differences from the first hole. RS-443 may have crossed a steep east-west fault contact and gone into the footwall of the south side of the Dreamland block. RS-444 wandered south and intersected an unusual amount of intrusive rock, indicating proximity to a feeder zone. RS-450 intersected numerous steeply dipping white clay veinlets cutting weakly altered wall rock. Detailed analysis of the data is needed prior to drilling another hole.

Brown Palace & Lucky Boy

RS-422 was drilled in late 1997 as a step-out hole north of Lac's RL-290, and intersected 3.5 oz/st silver in the last 15 feet of the RC hole. A core tail was added in early 1998, and intersected vugs lined with pyrargyrite in the top of the core tail. Gold values were low. Strong alteration and low levels of gold and silver persisted at depth. The amount and intensity of argillization, pyrite, and structure are impressive.

RS-445 was collared near the base of a high-resistivity anomaly as seen in the Lac IP/resistivity. The target was to test the lower mineralized zone as seen at Lucky Boy and Dreamland. The hole intersected long intervals of strongly altered rock, including porphyritic rhyolite, planar laminated rhyolite (LBT), and sanidine-bearing rhyolite. Much of the hole showed clay alteration. The highest gold values were 0.023 oz/st, and the highest silver was 1.23 oz/st.

White Alps

White Alps knob is a bold outcrop of massive silica. The true dip of the White Alps fault has been debated in light of several Lac RC holes that seemingly missed the silicification. Some geologists thought the bold silica outcrops dipped north, whereas others interpreted the structure to dip south, as Lac obviously believed.
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White Alps

White Alps knob is a bold outcrop of massive silica. The true dip of the White Alps fault has been debated in light of several Lac RC holes that seemingly missed the silicification. Some geologists thought the bold silica outcrops dipped north, whereas others interpreted the structure to dip south, as Lac obviously believed.
Two holes were drilled at White Alps in 1998. The first hole, RS-446, was drilled 1100 ft east-northeast of White Alps knob. It was collared in strongly altered Rosebud quartz latite in the hanging wall of the eastern extent of the White Alps fault. The alteration is coincident with anomalous soil geochemistry. The hole intersected a thick interval of moderately to strongly altered RQL before entering Chocolate flows, Bud volcanics. At a depth of 1752 feet the hole hit a silicified fault zone between Bud epiclastics above planar-laminated rhyolite (Wildrose=LBT). The highest mineralized zones were 0.8 ft of 0.037 oz/st Au and 33 oz/st Ag, 2.3 ft of 0.024 oz/st Au and 17 oz/st Ag, and 6.1 ft of 0.01 oz/st Au and 5.4 oz/st Ag. The best values were associated with dark gray to black sulfides in sulfide veins or quartz veins that varied from 25-65° to the core axis.

A visually encouraging lower mineralized zone contained only 200-300 ppb Au and no silver. This lower zone occurs in the footwall of a sharp silicified fault, possibly the Cave fault, and contains pyrite, marcasite, stibnite, and white clay. The hole was deepened to 3070 ft until it hit the Auld Lang Syne basement. This is the deepest basement piercement drilled to date at Rosebud.

The second hole, RS-456, was drilled 350 ft northwest of the White Alps knob, near the intersection of a series of east-west and northeast-striking extension joints. In the road north of this collar for more than 500 ft are numerous fractures with silica, clay, and limonite; the dips are variable but dominantly vertical to slightly northward. Additionally, the collar was located near a jog in the N25E-striking gravity gradient. Originally the gravity gradient was believed to represent an uplifted block of the basement, and as such, represented an attractive conceptual location. However, prior to drilling RS-455, the gravity gradient was remodeled (Ferneyhough, 1998) and interpreted to reflect unaltered volcanic rocks on the northwest side juxtaposed against altered rocks on the southeast. The geophysical model could not account for, or distinguish, the original basement interpretation.

The hole was collared on the southeast side of the gradient. RS-456 intersected a major alteration contact at 270 ft before intersecting Bud volcanics (and epiclastics) from approximately 320-675 ft. A long interval of mostly fresh Wildrose rhyolite was intersected from 675-2270 ft, followed by “mine Tos” from 2270-2370 ft. A major fault occurs at 2370 ft, followed by dark aphyric Wildrose rhyolite from 2370 to 2620 ft. The lack of altered rock compared to holes to the southeast supports the interpretation that the hole is in the footwall of the White Alps fault, which dips steeply to the southeast. The geometry of the strong surface alteration is unclear.

**Short Shot**

Four shallow holes were drilled by Lac at Short Shot. Given the strong surface geochemistry on the south side of the RQL dike, which strikes west-northwest on
top of the ridge (Mitchell, 1998a), and the attractive surface alteration, a single vertical hole (RS-455) was drilled on the edge of the soil anomaly to test the hanging wall side of the dike. The hole intersected strong but narrow alteration associated with several altered RQL dikes, and bottomed in epiclastics (mine Tos) beneath a 1500-foot thick sequence of largely unaltered Wildrose rhyolite. The Tos is uncharacteristically thick here (~400 feet) compared to 100 feet thick just 1000 feet east in RS-456. The Tos in RS-456 is faulted out along a low-angle fault (40° TCA), and weakly altered and mineralized (1.5 ft of 0.006 oz/st Au and 2 oz/st Ag at 2373.7 ft) in contact with possible RQL. Both holes deviated northwest into the regional bedding. Both holes provide valuable stratigraphic and structural data.

**North Equinox**

A single hole was drilled at North Equinox to test the down-dip extension of a mineralized fault named "C-NNW" (Langstaff, 1998e). The hole intersected a long sequence of unaltered volcanic breccia before the hammer flooded out at a depth of 1600 feet. Given the weak alteration throughout most of the hole, the hole was terminated. Subsequent cross-sections indicate the hole may not have reached the "C-NNW" fault, but the level of certainty is low.

The source and hydrothermal fluid pathway for the massive silicification on the summit of USMM212 at North Equinox is not understood. The highest gold values occur on the eastern edge of the prospect, where two rock samples yielded 1.4 and 0.8 ppm gold, with anomalous Ag, Sb, Se, As, and Hg. The relationship of the 212 fault to drill hole 97-387, collared in the apparent footwall, needs to be better defined. Additional drilling at North Equinox is warranted.

**Target 1A**

Target 1A, described in detail by Rogowski (1998), is located southeast of the South Zone in the footwall of the South Ridge fault. Underground drill holes DRSU-453 and -454 were drilled from an exploration drift off of the 2300 access. Both holes penetrated long intervals of variably altered Dozer rhyolite containing only weak gold values. No significant mineralized structures were intersected, despite the fact that DRSU-453 approached the vent raise in the East Zone, where narrow mineralized structures are present.

**Target 1B**

Target 1B is located about 1000 feet northeast of the North Zone. Four vertical RC holes (RS-448, -449, -451, -452) were drilled to the basement to test the northeastern extensions of the deposits in the hanging wall and footwall of the
possible Cave fault. The strongest alteration and highest gold values occur in the top 470 feet of hole RS-448. Although detectable gold is present from the collar to 470 feet, no gold values exceeded 0.015 oz/st. Alteration posted on sections suggests the altered zone dips moderately to the northwest.

**North Zone**

D-311-98, an underground delineation hole in the North Zone, intersected silicified and mineralized Auld Lang Syne phyllite at the bottom of the 102-foot hole. A 300-foot exploration hole (D-331-98) was quickly sited in the same station to drill beneath (-20°) previous holes toward the contact of Dozer rhyolite and Auld Lang Syne. The hole intersected more than 250 ft of moderately silicified carbonaceous phyllite cut by quartz and barite veins, and containing pyrite, stibnite and lesser bladed marcasite and silver sulfosalts. Assays in the basement yielded multiple 0.01-0.02 oz/st gold, with a high of 0.142 across 0.5 ft, and several 1-6 oz/st Ag intervals, with a high of 14 oz/st Ag associated with pyrgyrite.

The presence of silicified and mineralized basement is significant, because the roots of the Rosebud deposit have not been identified or specifically targeted for exploration, and the potential is large. There are several epithermal deposits in the world occurring along the unconformity between the volcanic pile and underlying basement rocks. As an example, the Hishikari deposit in Japan (>8 million ounces) contains very high-grade banded veins (>1 oz/st) immediately beneath the unconformity of Tertiary volcanic rocks and underlying Cretaceous-age black shale, sandstone, and mudstone (Izawa and others, 1990). About 2/3 of the gold resource is in the Cretaceous rocks, and 1/3 is in the overlying volcanics.

Upon review of drill holes that reached basement in the North Zone, several intersected silicified basement and a few intervals are greater than 0.1 oz/st gold. Because the base of the North Zone lies near the intersection of the Foundation and South Ridge faults (a basement high), it is not clear whether silica-rich fluids ponded beneath the Foundation fault, flowed parallel to the low-angle South Ridge fault, or both. In either case, exploration should focus on basement highs, whether they are bounded by low-angle or high-angle faults.

**South Kamma**

Late in the year visually encouraging alteration was identified at the South Kamma target in the southeast corner of the Rosebud claim block (Mitchell, 1998a). Twenty-four "Vase" claims were added to cover the exposed alteration out to the edges of the volcanic field. The area was previously poorly mapped and sampled. A rock survey was completed on the geophysical grid, but the geochemistry was disappointing (including very low Au and Se). No further work
was conducted. The relationship of the South Kamma alteration to the gold deposits at the Rosebud mine is unclear.

**Vertex**

At the request of Hecla, the "Vertex" target, located on the west end of South Ridge, was mapped in detail and sampled by consultant J. P. Rogowski (1999). He identified planar-laminated LBT underlain by "mine Tos," and a series of north to northeast striking dikes. A drill hole by Santa Fe (96-365) apparently failed to hit the targeted Vertex structure due to interpreted droop.

**Permitting**

Exploration activities during the first quarter of 1998 were conducted under the Dreamland Notice of Intent. Later work was conducted under a consolidated Plan of Operation (N20-97-002P), approved by the BLM on May 1, 1998, which superseded and incorporated four existing Notices of Intent (N26-89-008P, N26-90-085N, N20-97-030N, and N20-97-042N). The Plan incorporates 20.32 acres of existing disturbance and 33.3 acres of proposed new road and drill sites. The Plan was amended in September to allow 3000 feet of trenching with no net gain. The amount of disturbance in 1998 is shown in Table 5.

An archeological survey was contracted with ARS of Virginia City. The purpose of the survey was to install "T posts" on the ground, at the BLM's request, marking the boundaries of all archeological sites eligible for historic preservation. These include the Dreamland mine area, the large archeological site at the headwaters of Wildrose Canyon, and several others. Also, archeological clearance was given for three drill pads along the eastern edge of the Dreamland site.

**Reclamation**

Newmont Gold Company's Drilling Services Group supervised a contractor (Legarza) to complete the reclamation and reseeding of exploration roads and drill pads. There was an attempt to reclaim approximately the same amount of new disturbance, without reclaiming trunk roads or key access roads. Mud sumps and pads were re-contoured soon after completion of the holes. This work was completed in late fall, and is summarized in Table 6.
Budget and Expenditures

The consolidated 1998 exploration budget for Rosebud was $1,377,000. The final 1998 expenditure was $1,362,614, or 98.96% of budget (Table 7). As established by the LLC agreement, Newmont’s share of the exploration expenditure is 2/3 and Hecla’s share is 1/3. The drilling portion of the program was 59.7% (including site prep but excluding reclamation), and labor accounted for approximately 27%.

Administrative

A fire was started in the core warehouse in early February when a diesel powered “torpedo” heater ignited wax and paper core boxes containing RC chips. The fire was extinguished by miners, but after significant damage occurred to materials, core, and the building. The RC chips from Lac’s early drill holes between and including RL-11 and RL-220 were lost. Lac had saved duplicate RC chip samples in small vials for some holes, so these were hand-screened to generate new chip trays for some of the destroyed holes. After completing the reconstruction, the missing holes are RL-12 through RL-18, and RL-20 through RL-112.

The fire-fighting effort destroyed the unlogged and unassayed interval (1522 to 2090 feet) of RS 422c, which was stacked on pallets adjacent the RC chips. After consultation with Rosebud’s insurance representative, a plan was devised to recover the lost portion of the hole, since it was still in progress. After completing the bottom portion of the hole (2300 feet), a wedge was set at 1450 feet, and the lost interval was re-drilled with N-sized core. The downhole surveys compared closely, and the geologic record of this hole was restored using the combined parts of H- and N-sized core. Eventually the insurance companies reimbursed nearly all costs and losses.

1999 PROGRAM

Prior to beginning the 1999 program, a comprehensive rating and ranking meeting was held in Winnemucca in early February in which 26 targets were compiled, rated, and ranked. A report documenting this process was assembled (Mitchell, 1999). The meeting was attended by 14 technical staff from Newmont and Hecla, and one consultant. This process identified the highest-ranking targets on the Rosebud claim block (Table 8), and allowed us to complete a manpower allocation table. The manpower allocation (Table 9) distributed the available labor pool across the highest priority targets, consistent with the 1999 budget. After the prioritization was finished in early February, a detailed time line with decision points (Figure 7) provided a guide for the 1999 program.
REFERENCES


Brady, Mike, 1996, Geologic map of the Rosebud district: consultant to Hecla, North and South Sheets, 9 cross sections, 1:6000 scale.


--------1998b, Management Committee Meetings minutes: Rosebud Mining Company, LLC, meetings #7 (2/25/98), #8 (5/27/98), #9 (9/1/98), #10 (11/2/98), and #11 (12/17/99).


Langstaff, George, 1998a, Results of logging RC chips from East Zone delineation holes: Newmont Exploration Ltd. memorandum dated 1/20/98, 6 p.
--------1998b, Update on interpretations of the structure contour maps of the top of basement and the top of the South Ridge fault: Newmont Exploration Ltd. memorandum dated 1/20/98, 4 p.


--------1998d, Results of whole-rock analyses: NEL memorandum dated 6/15/98, 9 p., 7 figs., 2 tables.


--------1998j, Chemical effects of alteration at Rosebud based on whole-rock and partial-digestion data: Newmont Gold Company memorandum dated 11/12/98, 4 p., 7 figs., several tables.


--------1999m, Interpretation of Rosebud whole-rock geochemical data: NGC memorandum dated 1/8/99, 22 p., appendix.


---------(editor), 1999, Rating and ranking report, Rosebud prospect evaluation: Newmont draft report summarizing the Rosebud prospect rating and rating meeting, February 3-4, 1999, Winnemucca, NV.


--------1998c, Soil Susceptibility Surveys: Rosebud, Chapter 7: Newmont memorandum dated 9/30/98, 7 figures pertaining to Rosebud.


--------1999, Vertex target summary in Rating and ranking report, Rosebud prospect evaluation, Mitchell, P. M., editor: Newmont draft report summarizing the Rosebud prospect rating and rating meeting, February 3-4, 1999, Winnemucca, NV.


--------1998b, Rosebud monthly reports: Newmont monthly reports (January through December).

--------1998c, Rosebud exploration monthly reports: Rosebud Mining Company LLC monthly reports to Ron Clayton, Rosebud General Manager, (January through December).


Acknowledgements:

The following Newmont and Hecla employees contributed to the 1998 Rosebud exploration program:

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<td>Sample/ Hole No.</td>
<td>Location/ Depth</td>
<td>Date</td>
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<td>RS-401</td>
<td>1495.8-1496.15</td>
<td>3/12/98</td>
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<td>RS-401</td>
<td>1518.0-1518.4</td>
<td>3/12/98</td>
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<td>RS-401</td>
<td>1944.0-1944.3</td>
<td>3/21/98</td>
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<td>RS-401</td>
<td>1956.3-1956.7</td>
<td>3/21/98</td>
</tr>
<tr>
<td>RS-406</td>
<td>1578.5-1578.7</td>
<td>3/12/98</td>
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<tr>
<td>RS-408</td>
<td>1435.0-1435.2</td>
<td>3/12/98</td>
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<tr>
<td>RS-408</td>
<td>1436.8-1437.1</td>
<td>3/12/98</td>
</tr>
<tr>
<td>RS-408</td>
<td>1501.6-1502.0</td>
<td>3/12/98</td>
</tr>
<tr>
<td>RS-410</td>
<td>865.7-865.9</td>
<td>3/12/98</td>
</tr>
<tr>
<td>RS-410</td>
<td>1055.0-1055.3</td>
<td>3/12/98</td>
</tr>
<tr>
<td>RS-415</td>
<td>938.7-939.0</td>
<td>3/12/98</td>
</tr>
<tr>
<td>RS-418</td>
<td>839.5-839.9</td>
<td>3/12/98</td>
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<tr>
<td>RS-418</td>
<td>886.7-887.1</td>
<td>3/12/98</td>
</tr>
<tr>
<td>RS-418</td>
<td>1058.3-1058.5</td>
<td>3/12/98</td>
</tr>
<tr>
<td>RS-425</td>
<td>2155.8-2156.1</td>
<td>3/17/98</td>
</tr>
<tr>
<td>SK-97-4</td>
<td>3 km S of jct. of Jungo E of access rd.</td>
<td>9/25/97</td>
</tr>
<tr>
<td>SuK-97-3B</td>
<td>1.3 km SE of jct. or mi</td>
<td>9/25/97</td>
</tr>
<tr>
<td>F-98-1</td>
<td>hill 1423, 2.4 km S of W of access rd.</td>
<td>3/21/98</td>
</tr>
<tr>
<td>RS-422</td>
<td>1238.5</td>
<td>4/3/98</td>
</tr>
<tr>
<td>RS-422</td>
<td>1253.8</td>
<td>4/3/98</td>
</tr>
<tr>
<td>RS-422</td>
<td>1321</td>
<td>4/3/98</td>
</tr>
</tbody>
</table>

Table 2. Rosebud Thin-Sections

Miscsamp, thinsic  
ts=thin section, wr=whole rock, pts=polished thin section

8/3/99 - Page 1/4
<table>
<thead>
<tr>
<th>Sample/ Location/ Hole No.</th>
<th>Sample Depth</th>
<th>Date</th>
<th>Sample Type</th>
<th>Sample Size</th>
<th>Purpose</th>
<th>Rock Type</th>
<th>Alteration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-426 1207.6-1208.25</td>
<td>4/19/98</td>
<td></td>
<td>split core</td>
<td>3.2&quot; HQ</td>
<td>breccia of dk sulfidic qtz, grey qtz, cream to brn adularia(?),</td>
<td>100% alteration/vein</td>
<td>is it adularia? what are sulfides?</td>
<td></td>
</tr>
<tr>
<td>RS-424 1528.3-1528.6</td>
<td>4/19/98</td>
<td></td>
<td>whole core</td>
<td>3.5&quot; HQ</td>
<td>Chocolate?: hard, finely lam. rock and grn sdst(?)/w-x-strat(?)</td>
<td>slight bleaching, green clay &amp; spots</td>
<td>what is mineralogy and lithology?</td>
<td></td>
</tr>
<tr>
<td>RS-424 1647.5-1647.7</td>
<td>4/19/98</td>
<td></td>
<td>whole core</td>
<td>3.0&quot; HQ</td>
<td>Chocolate?: near vert. contact of vol. sdst and vol-pel bgl or lithic tuff, ctc oblique to bed.; reaction at contact</td>
<td>weak/mod green clay, calcite, rare tuffs or seds? Nature of contact?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-424 1698.5-1698.8</td>
<td>4/19/98</td>
<td></td>
<td>whole core</td>
<td>3.8&quot; HQ</td>
<td>Chocolate?: lithic-vitic tuff or sdst; lenticular vitrics up to .5&quot;; weakly magnetic; in conglomerate</td>
<td>devitr. of vitrics; weak green clay, calcite</td>
<td>tuff or sed? phenos in vitrics?</td>
<td></td>
</tr>
<tr>
<td>RS-424 1808.8-1809.0</td>
<td>4/19/98</td>
<td></td>
<td>whole core</td>
<td>2.4&quot; HQ</td>
<td>Chocolate?: lithic-vitic tuff or sdst; lenticular vitrics up to .5&quot;; weakly magnetic; in conglomerate</td>
<td>devitr. of vitrics; weak green clay, calcite</td>
<td>tuff or sed? phenos in vitrics?</td>
<td></td>
</tr>
<tr>
<td>RS-424 1994.5-1994.8</td>
<td>4/19/98</td>
<td></td>
<td>whole core</td>
<td>3.0&quot; HQ</td>
<td>Chocolate?: bedded sdst(?)/with grading of bblbby black things; in conglomerate</td>
<td>negligible?</td>
<td>tuff or sed? black things vitric clasts?</td>
<td></td>
</tr>
<tr>
<td>RS-424 2014.5-2014.7</td>
<td>4/19/98</td>
<td></td>
<td>whole core</td>
<td>2.4&quot; HQ</td>
<td>Chocolate?: vitric-lithic lapilli-ash tuff; volc. and ALS lithics, feldspar-pyritic vitrics; bed in conglomerate</td>
<td>negligible?</td>
<td>really tuff? how does texture differ from seds? any phenos?</td>
<td></td>
</tr>
<tr>
<td>S24-4532:13 stope 24, elev. 4532, 9/8</td>
<td>9/8</td>
<td>hand samp small</td>
<td>pts</td>
<td>sulfide-rich ore with 127 oz/ast Au and 1187 oz/ast Ag; abundant marc, lesser pyrargyrite, cpy? brass alloy?</td>
<td>100%</td>
<td>identify sulfide minerals, should be some weird ones, selenides?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-423 1206.3-1206.7</td>
<td>5/28/98</td>
<td></td>
<td>whole core</td>
<td>5&quot; HQ</td>
<td>Chocolate?: aphyric, aphanitic, clast-like variegated red to white patches floating in grey matrix</td>
<td>arg in white patches, hem in red; minor calcite, mostly in fractures</td>
<td>is grey unaltered or specularite-rich? does red replace white or vice versa?</td>
<td></td>
</tr>
<tr>
<td>RS-422.1 1959.0-1959.25</td>
<td>5/28/98</td>
<td></td>
<td>whole core</td>
<td>3.3&quot; NQ</td>
<td>Chocolate?: 3-5% eu-sub, zoned feld up to 2 mm in aphanitic matrix</td>
<td>some dark, v. fine hem?; calcite &amp; clay? in phenos; calcite and hem in fractures</td>
<td>how does this compare to BMB-type?</td>
<td></td>
</tr>
<tr>
<td>RS-422.1 1984.6-1984.8</td>
<td>5/28/98</td>
<td></td>
<td>whole core</td>
<td>2.2&quot; NQ</td>
<td>Chocolate?: 2% eu-sub, 1-mm hbl &amp; bi? phenocrysts, 1-2 mm pale sploishes; some could be feldspar phenos; aphanitic matrix</td>
<td>weak arg or possibly green clay; moderate dissem. calcite; rare fractures with bleached margins</td>
<td>flow or tuff? are there feldspar phenos</td>
<td></td>
</tr>
<tr>
<td>RS-422.1 2005.5-2005.8</td>
<td>5/28/98</td>
<td></td>
<td>whole core</td>
<td>3.0&quot; NQ</td>
<td>Chocolate?: 1-3 mm, pale lithics? and &lt;1 mm, inconspicuous crystals in dark red, aphanitic matrix</td>
<td>weak arg &amp; green clay in lithics? and moderate hem, tr. calcite in matrix</td>
<td>tuff or sed. rock? what is alteration?</td>
<td></td>
</tr>
<tr>
<td>RS-422 2112.9-2113.2</td>
<td>5/28/98</td>
<td></td>
<td>whole core</td>
<td>3.1&quot; HQ</td>
<td>Chocolate?: &lt;1 mm, dark sub-eu hbl &amp; irreg vitric? shards in dense matrix; &lt;1 mm white specks of sec. calcite</td>
<td>negligible arg? (no bleaching); strong dissem. calcite</td>
<td>1984.6? compare to 2140.9</td>
<td></td>
</tr>
<tr>
<td>RS-422 2140.9-2141.1</td>
<td>5/28/98</td>
<td></td>
<td>whole core</td>
<td>2.1&quot; HQ</td>
<td>Chocolate?: aphyric, aphanitic with 2-3% &lt;1 mm, irreg. vitric? shards, dark green clay in vitric? shards &amp; possibility in matrix; mod. dissem.</td>
<td>no contact with rock at 2112.9, could these be same unit? any mafic pheno</td>
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</tr>
</tbody>
</table>

**Miscsamp, thinsec**

**ts=thin section, wr=whole rock, pts=polished thin section**
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<thead>
<tr>
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<th>Alteration</th>
<th>Comments</th>
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<tbody>
<tr>
<td>RS-422</td>
<td>2317.9-2318.6</td>
<td>5/28/98</td>
<td>whole core</td>
<td>7.7&quot; HQ</td>
<td>ts</td>
<td>Chocolate?: 5% 1-mm, sub-eu hbl phenos and rare, irreg, dark shards? in aphanitic matrix</td>
<td>calcite</td>
<td>are dark things shards?</td>
</tr>
<tr>
<td>NWRA-2601</td>
<td>NW of USMM212</td>
<td>7/15/98</td>
<td>rock</td>
<td>2 kg</td>
<td>ts/wr</td>
<td>&quot;brown flow?&quot;/&quot;Wildrose&quot;: variably devitr. (pale), platy rock above dense brn rock; pos. pseudobreccia</td>
<td>bleaching related to devitr.?: no hydrothermal?</td>
<td>cp. textures to nondevitr. rock</td>
</tr>
<tr>
<td>NWRA-2602</td>
<td>NW of USMM212</td>
<td>7/15/98</td>
<td>rock</td>
<td>1.5 kg</td>
<td>ts/wr</td>
<td>&quot;brown flow?&quot;/&quot;Wildrose&quot;: dense, pinkish-grey, with rare, clay-altered felds (?) phenos? &lt; 1 mm with brown selvedges</td>
<td>minimal, local tiny qtz(?)- veinlets; rare glassy black hematite veinlets</td>
<td>compare textures to devitr. Rock and that E of ZZ Top</td>
</tr>
<tr>
<td>NWRA-2603</td>
<td>in draw E of ZZ Top 481,375E; 2212,500N</td>
<td>7/15/98</td>
<td>rock</td>
<td>1 kg</td>
<td>ts/wr</td>
<td>&quot;intrusion?&quot;/&quot;andesite&quot;: dense, red-grey vitrophyre; rare, clay-altered feldspar phenos &lt; 1 mm; like 2602</td>
<td>negligible?</td>
<td>compare textures to &quot;Wildrose&quot;</td>
</tr>
<tr>
<td>RS-443</td>
<td>1563.0-1565.0</td>
<td>9/24/98</td>
<td>split core</td>
<td>1.95' HQ</td>
<td>ts/wr</td>
<td>aphanitic pseudobreccia? with rare white, rounded, feld phenos and acicular hbl phenos &lt;1 mm; local, weak, irregular banding</td>
<td>weak green clay + calcite, mostly in &quot;matrix&quot; and fractures; generally grey</td>
<td>compare to similar samples to determine effects of pseudo-breccia and weak alteration</td>
</tr>
<tr>
<td>RS-443</td>
<td>1795.2-1797.1</td>
<td>9/24/98</td>
<td>split core</td>
<td>1.90' HQ</td>
<td>ts/wr</td>
<td>brecciated, aphanitic rock with irreg. mmb up to 2 cm and local banding (elongate mmb generally parallel to it); rarely, mmb have rounded white feld phenos &lt; 1 mm</td>
<td>weak hematite + calcite</td>
<td>compare to other mmb-bearing samples to gauge effects of alteration and to distinguish units; about 5% mmb</td>
</tr>
<tr>
<td>RS-444</td>
<td>1595.3-1599.0</td>
<td>9/24/98</td>
<td>split core</td>
<td>3.0' HQ</td>
<td>ts/wr</td>
<td>weakly porphyritic with &lt;1% irreg mmb &lt;2 cm &amp; &lt;2% total phenos; subhedral white(alt) &amp; vitreous feld (both with cal) &lt;3 mm; v. rare round qtz &lt; 1 mm; probably hbl, bi, possibly px phenos; local, faint foliation</td>
<td>negligible; hem+calcite in fractures; weak alteration of phenos to clay, calcite; mostly uniform grey color</td>
<td>many phenos look broken - could this be tuff? both plag &amp; Kspar? mafic phenos or small mmb?: least altered for comparison with others</td>
</tr>
<tr>
<td>RS-444</td>
<td>1716.6-1719.0</td>
<td>9/24/98</td>
<td>split core</td>
<td>2.4' HQ</td>
<td>ts/wr</td>
<td>2% yel-green, subhedral (rarely em-bayed), locally vitreous feld phenos up to 8 mm long in aphanitic matrix; rare glomeroporphyritic clots</td>
<td>weak clay + calcite with pale pinkish yellow matrix and phenos variably altered to green clay (not white)</td>
<td>some phenos with Carlsbad but no albite twins - all Kspar? compare geochm to other coarsely porphyritic units</td>
</tr>
<tr>
<td>RS-444</td>
<td>1725.9-1728.9</td>
<td>9/24/98</td>
<td>split core</td>
<td>2.8' HQ</td>
<td>ts/wr</td>
<td>5% yel-white, subhedral (rarely em-bayed), locally vitreous feld phenos up to 10 mm long in aphanitic matrix; 1% anhedral green clay chunks &lt; 2 m may be mafic phenos; rare glomeroporphyritic clots</td>
<td>pale grey but possibly weak alteration of matrix; variable clay + calcite alteration of phenos; trace hematite + green clay in fractures</td>
<td>Kspar + plag phenos? compare geochm to other coarsely porphyritic units</td>
</tr>
<tr>
<td>RS-444</td>
<td>2017.7-2020.2</td>
<td>9/24/98</td>
<td>split core</td>
<td>2.4' HQ</td>
<td>ts/wr</td>
<td>brecciated aphanitic rock, possibly with mafic microphenos</td>
<td>red and black hematite, primarily in matrix; trace calcite</td>
<td>any microphenos? compare to other aphyric rocks</td>
</tr>
<tr>
<td>RS-445</td>
<td>1863.4-1865.2</td>
<td>9/24/98</td>
<td>split core</td>
<td>1.7' HQ</td>
<td>ts/wr</td>
<td>brecciated, aphanitic, with 1% irreg. mmb &lt;12 mm, 1% subhedral, white to vitreous feld, and rare, round</td>
<td>mod. calcite + weak hematite; feld phenos soft and have calcite even though they look fresh</td>
<td>compare to more altered rocks above and to RS-444:1595.3; is it pyroclastic?</td>
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</table>
## MISCELLANEOUS SAMPLES FOR THIN SECTIONS

<table>
<thead>
<tr>
<th>Sample/ Hole No.</th>
<th>Location/ Depth</th>
<th>Date</th>
<th>Sample Type</th>
<th>Sample Size</th>
<th>Purpose</th>
<th>Rock Type</th>
<th>Alteration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-445</td>
<td>1905.0-1907.0</td>
<td>9/24/98</td>
<td>split core</td>
<td>2.0' HQ</td>
<td>ts/wr</td>
<td>same as 1863.4; one smoky qtz is embayed</td>
<td>weak hematite, calcite mostly in fractures and phenoc; even vitreous feal are soft</td>
<td>compare to other similar rocks; to determine effects of alteration; broken phenoc suggest this is tuff</td>
</tr>
<tr>
<td>RS-446</td>
<td>1901.6-1902.0</td>
<td>9/3/98</td>
<td>whole core</td>
<td>5.7'' HQ</td>
<td>ts/wr</td>
<td>apparently aphyric, with abundant laminations (but same as 1918.3)</td>
<td>weak arg, py(&amp;(marc?)?) in laminations &amp; fractures &amp; in clouds 2 cm across</td>
<td>compare to 1907.2 and 1918.3</td>
</tr>
<tr>
<td>RS-446</td>
<td>1907.0-1907.4</td>
<td>9/3/98</td>
<td>whole core</td>
<td>4.9'' HQ</td>
<td>ts/wr</td>
<td>possibly rare wh. fidspr phenos &lt;1 mm; common laminations</td>
<td>v. weak arg, trace green clay, sparse</td>
<td>compare to 1901.8 and 1903.8</td>
</tr>
<tr>
<td>RS-446</td>
<td>1917.9-1918.65</td>
<td>9/3/98</td>
<td>whole core</td>
<td>8.8'' HQ</td>
<td>ts/wr</td>
<td>wky porph. vitrophyre with rare white feldspar phenos 2 mm, rare lamin.</td>
<td>dissem. py; moderate calcite</td>
<td>compare to 1907.2 and 1901.8</td>
</tr>
<tr>
<td>RS-446</td>
<td>2657.8-2658.7</td>
<td>9/10/98</td>
<td>whole core</td>
<td>9.7'' HQ</td>
<td>ts/wr</td>
<td>flow(?), with 5% white fidsprphenos 1-3 mm (some zoned with dark cores) and 2% hbl &lt;3 mm and rare biotite(?)</td>
<td>negl. but feld altered to clay+calcite and mod dissem cal, cal vnils</td>
<td>what is it? how does this compare to Brady's Oscar Andesite</td>
</tr>
<tr>
<td>RS-446</td>
<td>2756.0-2756.4</td>
<td>9/10/98</td>
<td>whole core</td>
<td>4.5'' HQ</td>
<td>ts</td>
<td>med-coarse-grained litharenite in 20 ft coarsening to upward bed; mod sorted subrounded-eng. grains, white to black; vitric? black specks</td>
<td>negligable but mod dissem calcite; high mag susceptibility</td>
<td>sedimentary or pyroclastic?</td>
</tr>
<tr>
<td>RS-446</td>
<td>2900.6-2901.6</td>
<td>9/24/98</td>
<td>whole core</td>
<td>11.5'' HQ</td>
<td>ts/wr</td>
<td>2% sub-euhdrl, wh. fids phenos &lt;10 mm long, 3% an-subdral, green, ? phenos &lt;5 mm repl. by green clay in aphanitic matrix; some glomerophyric cits</td>
<td>weak green clay and calcite with minor relic grey; bleaching along green clay+calcite veins; phenos all altered to white/green clay+cal; clay alteration</td>
<td>compare to 2942.5 and similar less altered units to determine original composition and effects of green clay alteration</td>
</tr>
<tr>
<td>RS-446</td>
<td>2942.5-2943.3</td>
<td>9/24/98</td>
<td>whole core</td>
<td>10.5'' HQ</td>
<td>ts/wr</td>
<td>same unit as 2900.6 with same textures</td>
<td>mod. green clay and cal with more uniform darker green color than 2900.6; wh./green all. phenos; more pyrite than 2900.6</td>
<td>compare to 2900.6 to determine effects of stronger green clay alteration; any epidote?</td>
</tr>
<tr>
<td>RS-446</td>
<td>2963.5-2963.9</td>
<td>9/24/98</td>
<td>whole core</td>
<td>5'' HQ</td>
<td>ts/wr</td>
<td>tuff or conglomerate with subrounded volc. sandst, and ALS phylilte clasts and irregular-wispy, vitric(?) lapilli with mafic phenos &lt;1 mm (bi, hbl(?)?); ALS clasts &lt;2 cm, vitric(?) &lt;5 cm</td>
<td>variable arg alteration in volc clasts, otherwise negligible; minor calcite in fractures</td>
<td>sedimentary or pyroclastic? is this record of earliest T volcanism?</td>
</tr>
<tr>
<td>RS-446</td>
<td>3005.8-3006.0</td>
<td>9/24/98</td>
<td>whole core</td>
<td>2.3'' HQ</td>
<td>ts</td>
<td>fmg granitoid? with mostly wh. altered feldspar, &lt;10% qtz, 5-10% green, altered hbl? as boulder or dike; or it could be sandstone</td>
<td>weak? clay alteration but no fresh feldspars or mafics</td>
<td>is it really granitoid? pre-16 Ma volcanism?</td>
</tr>
<tr>
<td>RS-446</td>
<td>3019.9-3020.7</td>
<td>9/24/98</td>
<td>whole core</td>
<td>8.5'' HQ</td>
<td>ts</td>
<td>conglomerate with subrounded pebbles up to 8 cm of volc. mudst, ? granitoid, ALS phylilte with minor, clayey, tuffaceous? matrix</td>
<td>variable arg in volc clasts, otherwise negligible; minor calcite in fractures</td>
<td>is matrix tuffaceous? how can tuffs be distinguished from sedimentary rocks with tuffaceous component?</td>
</tr>
<tr>
<td>RS-450</td>
<td>1810.4-1811.9</td>
<td>9/24/98</td>
<td>split core</td>
<td>1.4'' HQ</td>
<td>ts/wr</td>
<td>aphyric rock with 2% irreg mmb up to 15 mm and pervasive, fine spherulitic texture</td>
<td>weak bleaching along dark calcite+ clay veinlets and fractures</td>
<td>least altered for comparison with other aphyric rocks with mmb</td>
</tr>
</tbody>
</table>

Miscamp, thinsec
ts=thin section, wr=whole rock, pts=polished thin section
<table>
<thead>
<tr>
<th>Sample/Location/Deep</th>
<th>Sample/Date</th>
<th>Sample/Type</th>
<th>Sample/Size</th>
<th>Purpose</th>
<th>Rock Type</th>
<th>Alteration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RS-401</strong></td>
<td>1956.3-1956.7</td>
<td>whole core 4.4” NQ</td>
<td>wr</td>
<td>Chocolate; aphanitic grey rock</td>
<td>negligible; rare, narrow bleaching</td>
<td>how does this differ from Chocolate without(?) hbl microphenos</td>
<td>along fractures with chi, calcite; tr. dissem. calcite</td>
</tr>
<tr>
<td><strong>RS-410</strong></td>
<td>943.2-943.75</td>
<td>split core 6.3” HQ</td>
<td>wr</td>
<td>Dozer; v. pale grn-grey; weak caraway seed tex.; rarely darker xenoliths(?)</td>
<td>weak arg/grn clay; tr. dissem. pyrite; up to 1 cm</td>
<td>compare composition of weakly tr. dissem calcite; rare calcite vrs</td>
<td>altered to unaltered 1047.4</td>
</tr>
<tr>
<td><strong>RS-410</strong></td>
<td>1047.4-1047.8</td>
<td>split core 5.2” HQ</td>
<td>wr</td>
<td>Dozer; massive, grey, aphric, aphanitic rock</td>
<td>negligible; minor hematite &amp; calcite</td>
<td>should be primary igneous comp., possibly slightly higher Fe, Ca</td>
<td>along fractures; tr. dissem. calcite</td>
</tr>
<tr>
<td><strong>RS-425</strong></td>
<td>2142.7-2143.0</td>
<td>split core 4.6” HQ</td>
<td>wr</td>
<td>Chocolate; apparently aphric, aphric rock</td>
<td>weak arg with rare relict grey; sparse tiny grn specks; tr. dissem. calcite; possibly tr. dissem ext. fine pyrite</td>
<td>should be close to primary comp.;</td>
<td>compare to 2159.2’</td>
</tr>
<tr>
<td><strong>RS-425</strong></td>
<td>2159.2-2159.6</td>
<td>split core 3.2” + 2.3</td>
<td>wr</td>
<td>Chocolate; v. rare hbl microphenos HQ</td>
<td>negatively; minor bleached patches;</td>
<td>as close to a primary igneous tr. dissem. hematite &amp; calcite</td>
<td>comp. as it’s likely to get</td>
</tr>
<tr>
<td><strong>SK-96-1</strong></td>
<td>3 km S of jct. 9/25/97</td>
<td>hand sample 1 kg</td>
<td>wr</td>
<td>black, aphanitic, with fine feld(?) and 2-3 mm px (?) and possibly olv phenos; weakly magnetic</td>
<td>Feox and calcite on weathered surfaces and fractures</td>
<td>is this really basalt? same locality as SK-97-4</td>
<td></td>
</tr>
<tr>
<td><strong>SuK-97-3B</strong></td>
<td>1.3 km SE of j 9/25/97</td>
<td>hand sample 2 kg</td>
<td>wr</td>
<td>black, twinned, platy K-spar(?) up to 3 cm in black aphanitic matrix; possibly black cpox up to 5 mm; locally weakly magnetic</td>
<td>Feox and calcite on weathered surfaces and fractures; collected comp could be biased</td>
<td>selected for coarse phenos so down hill from SuK-97-3</td>
<td>what is comp?</td>
</tr>
<tr>
<td><strong>F-98-1</strong></td>
<td>hill 1423, 2.4 k 3/21/98</td>
<td>hand sample 1 kg</td>
<td>wr</td>
<td>10-15% 1-2 mm plag laths; 2% 2-3 mm tabular cpox(?); rare round 3 mm opx(?); black matrix; weakly magnetic</td>
<td>Feox on weathered surfaces no coarse K-spar phenos on outcrop;</td>
<td>should be same unit as SuK-97-3B but is it basalt?</td>
<td></td>
</tr>
<tr>
<td><strong>RS-426</strong></td>
<td>1360.8-1361.5</td>
<td>split core 8” HQ</td>
<td>wr</td>
<td>Chocolate?: grey, aphanitic, apparently aphyric</td>
<td>minor hematite banding and frxrs; rare bleached bands with(?) clay</td>
<td>is this same as aphric unit in 401? devitrified; hematite in fractures</td>
<td>is composition related to other volcanic units?</td>
</tr>
<tr>
<td><strong>RS-424</strong></td>
<td>2022.6-2010.1</td>
<td>whole core 6” HQ</td>
<td>wr</td>
<td>Chocolate?: vitric-lithic lapilli-ash tuff, &lt;3% volc. &amp; ALS lithics, &lt;1% vitrics</td>
<td>devitrified; hematite in fractures</td>
<td>is composition related to other</td>
<td></td>
</tr>
<tr>
<td><strong>RS-422.1</strong></td>
<td>1959.2-1960.0</td>
<td>whole core 3.3” NQ</td>
<td>wr</td>
<td>Chocolate?: 3-5% eu-sub, zoned feild up to 2 mm in aphanitic matrix</td>
<td>some dark, v. fine hem?; calcite &amp; clay? in phenos; calcite and hem in fractures</td>
<td>how does this compare to BMB-type?</td>
<td></td>
</tr>
<tr>
<td><strong>RS-422.1</strong></td>
<td>1984.8-1985.5</td>
<td>whole core 2.2” NQ</td>
<td>wr</td>
<td>Chocolate?: 2% eu-sub, 1-mm hbl &amp; bi? phenocrysts, 1-2 mm pale splotches some could be feldspar phenos; aphanitic matrix</td>
<td>weak arg or possibly green clay; moderate dissem. calcite; rare fractures with bleached margins</td>
<td>is this same composition as RS-422 2141.9?</td>
<td></td>
</tr>
<tr>
<td><strong>RS-422</strong></td>
<td>2141.1-2142.0</td>
<td>whole core 2.1” HQ</td>
<td>ts</td>
<td>Chocolate?: aphyric, aphanitic with</td>
<td>dark green clay in vitric? shards &amp; calcite 2-3% &lt;1mm, irregular; vitric? shards, &lt;1% irregular; white specks (secondary?)</td>
<td>could this be same rock unit as RS-422.1 1984.8? doesn’t seem to be contact</td>
<td>between them; what is effect of alteratio</td>
</tr>
<tr>
<td>Sample/ Hole No.</td>
<td>Location/ Depth</td>
<td>Date</td>
<td>Sample Type</td>
<td>Sample Size</td>
<td>Purpose</td>
<td>Rock Type</td>
<td>Alteration</td>
</tr>
<tr>
<td>-----------------</td>
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</tr>
<tr>
<td>RS-422</td>
<td>2317.9-2318.6</td>
<td>5/28/98</td>
<td>whole core</td>
<td>7.7&quot; HQ</td>
<td>ts</td>
<td>Chocolate?: 5% 1-mm, sub-eu hbl</td>
<td>matrix bleached, hbl probably altered</td>
</tr>
<tr>
<td>NWRA-26</td>
<td>NW of USMM 7/15/98</td>
<td>rock</td>
<td>2 kg</td>
<td>ts/wr</td>
<td>&quot;brown flow&quot;/&quot;Wildrose&quot;; variably devitr. (pale), platy rock above dense brn rock; pos. pseudobreccia</td>
<td>bleaching related to devitr.?, no hydrothermal?</td>
<td>compare chemical composition to others; what is effect of devitr.?</td>
</tr>
<tr>
<td>NWRA-26</td>
<td>NW of USMM 7/15/98</td>
<td>rock</td>
<td>1.5 kg</td>
<td>ts/wr</td>
<td>&quot;brown flow&quot;/&quot;Wildrose&quot;; cense, pinkish-grey, with rare, clay-altered feld(?) phenos? &lt;1 mm</td>
<td>minimal; local tiny qtz(?) veinlets; rare glassy black hematite veinlets with brown selvedges</td>
<td>compare chemical composition to others; near Lac sample #7</td>
</tr>
<tr>
<td>NWRA-26</td>
<td>NW of USMM 7/15/98</td>
<td>rock</td>
<td>1 kg</td>
<td>ts/wr</td>
<td>&quot;intrusion&quot;/&quot;andesite&quot;; dense, red-grey vitrophyre; rare, clay-altered feldspar phenos &lt;1mm; like 26C2</td>
<td>negligible?</td>
<td>compare chemical composition to others; near Lac sample #17</td>
</tr>
<tr>
<td>RS-443</td>
<td>1563.0-1565.0 9/24/98</td>
<td>split core</td>
<td>1.95' HQ</td>
<td>ts/wr</td>
<td>aphanitic pseudobreccia? with rare white, rounded, feld phenos and acicular hbl phenos &lt;1 mm; local, weak, irregular banding</td>
<td>weak green clay + calcite, mostly in &quot;matrix&quot; and fractures; generally grey</td>
<td>compare to similar samples to determine effects of pseudo-brecia and weak alteration</td>
</tr>
<tr>
<td>RS-443</td>
<td>1795.2-1797.1 9/24/98</td>
<td>split core</td>
<td>1.90' HQ</td>
<td>ts/wr</td>
<td>brecciated, aphanitic rock with irreg. mmf up to 2 cm and local fine banding (elongate mmf generally parallel to it); rarely, mmf have rounded white feld phenos &lt;1 mm</td>
<td>weak hematite + calcite</td>
<td>compare to other mmf-bearing samples to gauge effects of alteration and to distinguish units; about 5% mmf</td>
</tr>
<tr>
<td>RS-444</td>
<td>1595.3-1599.0 9/24/98</td>
<td>split core</td>
<td>3.0' HQ</td>
<td>ts/wr</td>
<td>weakly porphyritic with &lt;1% irreg mmf &lt;2 cm &amp; &lt;2% total phenos; subhdrl white(alt) &amp; vitreous feld (both with cal.) &lt;3 mm; v. rare round qtz &lt;1 mm; probably hbl, bi, possibly px phenos; local, faint foliation</td>
<td>negligible; hem+calcite in fractures; weak alteration of phenos to clay, could this be tuff? both calcite, mostly uniform grey color</td>
<td>many phenos look broken - plag &amp; Kspar? mafic phenos or small mmf?; least altered for comparison with others</td>
</tr>
<tr>
<td>RS-444</td>
<td>1716.6-1719.0 9/24/98</td>
<td>split core</td>
<td>2.4' HQ</td>
<td>ts/wr</td>
<td>2% yel-green, subhedral (rarely embayed), locally vitreous feld phenos up to 8 mm long in anaphanitic matrix; rare glomeroporphyritic clots</td>
<td>weak clay + calcite with pale pinkish yellow matrix and phenos variably altered to green clay (not white)</td>
<td>some phenos with Carlsbad but no albite twins - all Kspar? compare geochem to other coarsely porphyritic units</td>
</tr>
<tr>
<td>RS-444</td>
<td>1725.9-1728.9 9/24/98</td>
<td>split core</td>
<td>2.8' HQ</td>
<td>ts/wr</td>
<td>5% yel-white, subhedral (rarely embayed), locally vitreous feld phenos up to 10 mm long in anaphanitic matrix; 1% anhedral grn clay chunks &lt;2 mm may be mafic phenos; rare glomeroporphyritic clots</td>
<td>pale grey but possibly weak altera- tion of matrix; variable clay + calcite alteration of phenos; trace hematite + green clay in fractures</td>
<td>compare geochem to other coarsely porphyritic units Kspar + plag phenos? compare porphyritic units</td>
</tr>
</tbody>
</table>
## MISCELLANEOUS SAMPLES FOR WHOLE-ROCK ANALYSIS

<table>
<thead>
<tr>
<th>Sample/ Hole No.</th>
<th>Location/ Depth</th>
<th>Date</th>
<th>Sample Type</th>
<th>Sample Size</th>
<th>Purpose</th>
<th>Rock Type</th>
<th>Alteration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-444</td>
<td>1919.0-1921.7</td>
<td>9/24/98</td>
<td>split core 2.5' HQ</td>
<td>wr</td>
<td>4% yel-green, subhedral (rarely embayed), locally vitreous feld phenos up to 10 mm long in aphanitic matrix; rare glomeroporphyritic clots; &lt;1% chunks green clay</td>
<td>weak clay + calcite with pale pinkish</td>
<td>very similar rock/alt. to rock</td>
<td></td>
</tr>
<tr>
<td>RS-444</td>
<td>1934.6-1936.8</td>
<td>9/24/98</td>
<td>split core 2.0' HQ</td>
<td>wr</td>
<td>4% yel-white, subhedral (rarely embayed), locally vitreous feld phenos up to 10 mm long in aphanitic matrix; rare green clay chunks; rare glomeroporphyritic clots</td>
<td>pale grey but possibly weak alteration of matrix; variable clay + calcite alteration of phenos; hematite + green clay in fractures</td>
<td>very similar rock/alt. to rock at 1716.8 but this unit has xenoliths of brecc. aphyric rock - same composition?</td>
<td></td>
</tr>
<tr>
<td>RS-444</td>
<td>2017.7-2020.2</td>
<td>9/24/98</td>
<td>split core 2.4' HQ</td>
<td>ts/wr</td>
<td>brecciated aphanitic rock, possibly with mafic microphenos</td>
<td>red and black hematite, primarily</td>
<td>any microphenos? compare to other aphyric rocks</td>
<td></td>
</tr>
<tr>
<td>RS-444</td>
<td>2045.4-2047.4</td>
<td>9/24/98</td>
<td>split core 2.0' HQ</td>
<td>wr</td>
<td>pseudobreccia of generally aphyric rock with v. rare, subhedral, white feld phenos 1-2 mm</td>
<td>weak arg? and green clay + mod. calc primarily in matrix; some &quot;clasts&quot; units</td>
<td>compare to other aphyric rocks</td>
<td></td>
</tr>
<tr>
<td>RS-445</td>
<td>1774.7-1779.3</td>
<td>9/24/98</td>
<td>split core 3.5' HQ</td>
<td>wr</td>
<td>same unit as 1863.4 but texture not preserved; rare relic feld phenos &lt;2 mm; rare laminaitions</td>
<td>strong arg. weak silic., rare green clay in fractures; minor pyrite, altered rocks to determine</td>
<td>compare geochem to less</td>
<td></td>
</tr>
<tr>
<td>RS-445</td>
<td>1792.2-1795.0</td>
<td>9/24/98</td>
<td>split core 2.4' HQ</td>
<td>wr</td>
<td>same unit as 1863.4 but texture not preserved except some greenish mmb up to 15 mm and some, white subhedral feld phenos 1-3 mm</td>
<td>mod-strong arg. possibly weak silic.; mod pyrite, tr. marc?; hard brown veinlets; tr. green clay</td>
<td>compare geochem to less altered rocks to determine</td>
<td></td>
</tr>
<tr>
<td>RS-445</td>
<td>1852.5-1854.2</td>
<td>9/24/98</td>
<td>split core 1.7' HQ</td>
<td>wr</td>
<td>same unit as 1863.4 but texture not preserved except rare greenish mmb up to 7 mm and white feld phenos 1-2 mm; possibly rare hbl; 1 mm replaced by green clay/sulfide</td>
<td>weak-mod arg, possibly trace silic.; mod. pyrite, wk marc</td>
<td>compare geochem to less altered rocks to determine if any elements not changed</td>
<td></td>
</tr>
<tr>
<td>RS-445</td>
<td>1863.4-1865.2</td>
<td>9/24/98</td>
<td>split core 1.7' HQ</td>
<td>ts/wr</td>
<td>brecciated, aphanitic, with 1% irreg. mmb &lt;12 mm, 1% subhedral, white to vitreous feld, and rare, round qtz 1 mm; possibly rare hbl &lt;1 mm replaced by green clay</td>
<td>mod. calcite + weak hematite; feld phenos soft and have calcite even though they look fresh</td>
<td>compare to more altered rocks above and to RS-445:1595.3; is it pyroclastic?</td>
<td></td>
</tr>
<tr>
<td>RS-445</td>
<td>1905.0-1907.0</td>
<td>9/24/98</td>
<td>split core 2.0' HQ</td>
<td>ts/wr</td>
<td>same as 1863.4; one smoky qtz is embayed</td>
<td>weak hematite, calcite mostly in fractures and phenos; even vitreous feld are soft</td>
<td>compare to other similar rocks to determine effects of alteration; broken phenos suggest this is tuff</td>
<td></td>
</tr>
<tr>
<td>RS-446</td>
<td>1901.6-1902.0</td>
<td>9/3/98</td>
<td>whole core 5.7' HQ</td>
<td>ts/wr</td>
<td>apparently aphyric, with abundant laminations (but same as 1918.3) &amp; fractures &amp; in clouds 2 cm across</td>
<td>weak arg, py(6marc?) in laminations</td>
<td>compare to 1907.2 and 1918.3</td>
<td></td>
</tr>
</tbody>
</table>

Micsamp, whl rk.

ts=thin section, wr=whole rock
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<thead>
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<th>Sample/ Hole No.</th>
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<th>Sample/ Size</th>
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<th>Rock Type</th>
<th>Alteration</th>
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</tr>
</thead>
<tbody>
<tr>
<td>RS-446 1907.0-1907.4 9/3/98</td>
<td>whole core</td>
<td>4.9&quot; HQ</td>
<td>ts/wr</td>
<td>possibly rare wh. fdspr phenos &lt;1 mm; common laminations</td>
<td>v. weak arg, trace green clay, sparse dissem. py; moderate calcite</td>
<td>compare to 1901.8 and 1918.3</td>
<td></td>
</tr>
<tr>
<td>RS-446 1917.9-1918.6 9/3/98</td>
<td>whole core</td>
<td>8.8&quot; HQ</td>
<td>ts/wr</td>
<td>wly porphyritic vitrophyre with rare white fdsp phenos &lt;2mm, rare lamin.</td>
<td>dark red-brown, negligible alteration?, mod. calcite, veins of hem. +cal</td>
<td>compare to 1907.2 and 1901.8</td>
<td></td>
</tr>
<tr>
<td>RS-446 2657.8-2658.7 9/10/98</td>
<td>whole core</td>
<td>9.7&quot; HQ</td>
<td>ts/wr</td>
<td>flow(?) with 5% wh. fdspr phenos 1-3 mm (some zoned with dark cores) &amp; 2% hbl &lt;3mm and rare biotite(?)</td>
<td>negl. but fdspr altered to clay+cal and mod dissem cal, cal vnlts</td>
<td>what is it? how does this compare to Brady's Oscar Andesite</td>
<td></td>
</tr>
<tr>
<td>RS-446 2900.6-2901.6 9/24/98</td>
<td>whole core</td>
<td>11.5&quot; HQ</td>
<td>ts/wr</td>
<td>2% sub-euhdrl, wh. feld phenos &lt;10 mm long, 3% an-subh drl, green, ? phenos &lt;5 mm repl. by green clay in aphanitic matrix; some glomeroporphyritic clots</td>
<td>weak green clay and calcite with minor relict grey; bleaching along altered units to determine original composition and effects of green clay altered to white/green clay+cal; clay alteration</td>
<td>compare to 2942.5 and similar less</td>
<td></td>
</tr>
<tr>
<td>RS-446 2942.5-2943.3 9/24/98</td>
<td>whole core</td>
<td>10.5&quot; HQ</td>
<td>ts/wr</td>
<td>same unit as 2900.6 with same textures mod. green clay and cal with more uniform darker green color than 2900.6; white/grn alt. red phenos; more pyrite than 2900.6</td>
<td>calcite</td>
<td>compare to 2900.6 to determine effects of stronger green clay alteration; any epidote?</td>
<td></td>
</tr>
<tr>
<td>RS-450 1511.4-1512.9 9/24/98</td>
<td>split core</td>
<td>1.5&quot; HQ</td>
<td>wr</td>
<td>brecciated (or pseudobreccia), aphyric rock; local, poor banding due to or enhanced by alteration</td>
<td>weak green clay +/- weak arg.; mod calcite</td>
<td>compare to other aphyric rocks, particularly that at 2044.6</td>
<td></td>
</tr>
<tr>
<td>RS-450 1550.0-1551.0 9/24/98</td>
<td>split core</td>
<td>.95&quot; HQ</td>
<td>wr</td>
<td>fractured aphyric rock with local hints of fine spherulitic texture</td>
<td>weak green clay + cal. in fractures less calcite than 1511.4; compare with bleaching along fractures</td>
<td>to other aphyric rocks</td>
<td></td>
</tr>
<tr>
<td>RS-450 1810.4-1811.9 9/24/98</td>
<td>split core</td>
<td>1.4&quot; HQ</td>
<td>ts/wr</td>
<td>aphyric rock with 2% irreg mmb up to 15 mm and pervasive, fine spherulitic texture</td>
<td>weak bleaching along dark cal. + least altered for comparison with other aphyric rocks with clay veinlets and fractures mmb</td>
<td>to other aphyric rocks with</td>
<td></td>
</tr>
<tr>
<td>RS-450 2044.6-2046.2 9/24/98</td>
<td>split core</td>
<td>1.6&quot; HQ</td>
<td>wr</td>
<td>aphyric pseudobreccia with v. rare, white feld pheno?; possible fine spherulitic texture</td>
<td>mostly pale grey with weak arg in “matrix” of pseudobreccia; tr. grn clay; v. pale brown fractures</td>
<td>compare to other aphyric rocks; could it be intrusion same as rock at 1511.4?</td>
<td></td>
</tr>
</tbody>
</table>

Miscsamp, whl.rk.

ts=thin section, wr=whole rock
Table 4: 1998 Rosebud Drill Holes

<table>
<thead>
<tr>
<th>Hole_Id</th>
<th>Area</th>
<th>Easting</th>
<th>Northing</th>
<th>Elev.</th>
<th>RC Depth</th>
<th>T.D.</th>
<th>Core Footage</th>
<th>Collar Inclination</th>
<th>Collar Bearing</th>
<th>Significant Intercepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-401C</td>
<td>Dreamland</td>
<td>478586</td>
<td>2207849</td>
<td>5703</td>
<td>1494.5</td>
<td>2379</td>
<td>884.5</td>
<td>-90</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>RS-422C</td>
<td>Lucky Boy</td>
<td>477567</td>
<td>2207919</td>
<td>5749</td>
<td>1130</td>
<td>2380</td>
<td>1250</td>
<td>-90</td>
<td>---</td>
<td>890 ft of 30-160 ppb Au</td>
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<td>RS-422.1C</td>
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<td>477567</td>
<td>2207919</td>
<td>5749</td>
<td>---</td>
<td>2100</td>
<td>653</td>
<td>-90</td>
<td>---</td>
<td>---</td>
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<td>RS-425C</td>
<td>Deep Dreamland</td>
<td>479389</td>
<td>2207270</td>
<td>5642</td>
<td>1500</td>
<td>2418</td>
<td>918</td>
<td>-90</td>
<td>---</td>
<td>5.8 ft of 0.856 oz/st Au at 1655.7 ft</td>
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<tr>
<td>RS-426C</td>
<td>Dreamland</td>
<td>477913</td>
<td>2207672</td>
<td>5582</td>
<td>1038</td>
<td>1542</td>
<td>504</td>
<td>-90</td>
<td>---</td>
<td>3.4 ft of 0.04 oz/st Au at 1203.9 ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.2 ft of 0.09 oz/st Au at 1207.3 ft</td>
</tr>
<tr>
<td>RS443C</td>
<td>Deep Dreamland</td>
<td>479386</td>
<td>2206959</td>
<td>5612</td>
<td>1498.4</td>
<td>2060.3</td>
<td>561.9</td>
<td>-89.51</td>
<td>210</td>
<td>15 ft of 0.05 oz/st Au at 200 ft</td>
</tr>
<tr>
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<td>Deep Dreamland</td>
<td>479634</td>
<td>2207109</td>
<td>5548</td>
<td>1438</td>
<td>2047.4</td>
<td>609.4</td>
<td>-88.9</td>
<td>181</td>
<td>5 ft of 0.023 oz/st Au at 1630 ft</td>
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<tr>
<td>RS445C</td>
<td>Brown Palace</td>
<td>476941</td>
<td>2207882</td>
<td>5927</td>
<td>1660</td>
<td>2276.3</td>
<td>616.3</td>
<td>-89.2</td>
<td>39</td>
<td>0.8 ft of 0.037 Au, 33 oz Ag at 1756.2 ft</td>
</tr>
<tr>
<td>RS446C</td>
<td>White Alps</td>
<td>477493</td>
<td>2208901</td>
<td>6111</td>
<td>1739</td>
<td>3070</td>
<td>1331</td>
<td>-88.4</td>
<td>358</td>
<td>2.3 ft of 0.024 Au, 16.8 oz Ag at 1766.8 ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.1 ft of 0.01 Au, 5.4 oz Ag at 1883.2 ft</td>
</tr>
<tr>
<td>RS447</td>
<td>North Equinox</td>
<td>477282</td>
<td>2212201</td>
<td>6037</td>
<td>1600</td>
<td>1600</td>
<td>0</td>
<td>-89.7</td>
<td>193</td>
<td>detectable Au 0 - 470 ft</td>
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<tr>
<td>RS448</td>
<td>Target 1B</td>
<td>482906</td>
<td>2205083</td>
<td>5322</td>
<td>1205</td>
<td>1205</td>
<td>0</td>
<td>-89.3</td>
<td>211</td>
<td>24 - 108 ppb 0-160 ft</td>
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<tr>
<td>RS449</td>
<td>Target 1B</td>
<td>483435</td>
<td>2205175</td>
<td>5358</td>
<td>1130</td>
<td>1130</td>
<td>0</td>
<td>-88.9</td>
<td>210</td>
<td>0.5 ft 0.087 Au at 1764.1 ft</td>
</tr>
<tr>
<td>RS450C</td>
<td>Deep Dreamland</td>
<td>479550</td>
<td>2207532</td>
<td>5726</td>
<td>1449</td>
<td>2050</td>
<td>601</td>
<td>-89.0</td>
<td>139</td>
<td>6.1 ft of 0.01 Au, 5.4 oz Ag at 1883.2 ft</td>
</tr>
<tr>
<td>RS451</td>
<td>Target 1B</td>
<td>483270</td>
<td>2205670</td>
<td>5371</td>
<td>1220</td>
<td>1220</td>
<td>0</td>
<td>-89.0</td>
<td>84</td>
<td>2.3 ft of 0.024 Au, 16.8 oz Ag at 1766.8 ft</td>
</tr>
<tr>
<td>RS452</td>
<td>Target 1B</td>
<td>483600</td>
<td>2204702</td>
<td>5341</td>
<td>1050</td>
<td>1050</td>
<td>0</td>
<td>-89.5</td>
<td>162</td>
<td>6.1 ft of 0.01 Au, 5.4 oz Ag at 1883.2 ft</td>
</tr>
<tr>
<td>DRSU-453A</td>
<td>Target 1A</td>
<td>482113</td>
<td>2203682</td>
<td>4635</td>
<td>0</td>
<td>1000</td>
<td>1000</td>
<td>24.0</td>
<td>125</td>
<td>2.0 ft of 0.225 Au; 0.6 ft of 0.542 Au</td>
</tr>
<tr>
<td>DRSU-454</td>
<td>Target 1A</td>
<td>482113</td>
<td>2203685</td>
<td>4632</td>
<td>0</td>
<td>1001</td>
<td>1001</td>
<td>11.0</td>
<td>92</td>
<td>2.0 ft of 0.225 Au; 0.6 ft of 0.542 Au</td>
</tr>
<tr>
<td>RS455C</td>
<td>Short Shot</td>
<td>475556</td>
<td>2209281</td>
<td>6042</td>
<td>1259</td>
<td>2066</td>
<td>807</td>
<td>-89.1</td>
<td>285</td>
<td>0.01X in precollar</td>
</tr>
<tr>
<td>RS456C</td>
<td>White Alps</td>
<td>476159</td>
<td>2208897</td>
<td>6298</td>
<td>1698</td>
<td>2620</td>
<td>922</td>
<td>-89.2</td>
<td>47</td>
<td>1.5 ft of 0.005 Au, 2.2 oz Ag at 2373.7 ft</td>
</tr>
<tr>
<td>D-280-98</td>
<td>Target 2B</td>
<td>481998</td>
<td>2204393</td>
<td>4327</td>
<td>0</td>
<td>825</td>
<td>825</td>
<td>10.0</td>
<td>124</td>
<td>multiple intercepts of 0.03-0.05 Au</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.7 ft of 0.138 Au at 526.7 ft</td>
</tr>
<tr>
<td>RS-D331-98</td>
<td>North Zone</td>
<td>482189</td>
<td>2204536</td>
<td>4322</td>
<td>0</td>
<td>303</td>
<td>303</td>
<td>-20.5</td>
<td>125</td>
<td>80-690 ppb @ 60-300 ft (incl 0.5' of 0.142 Au)</td>
</tr>
</tbody>
</table>

Note: Drill holes RS-427 through RS-442 were East Zone delineation holes, drilled by Newmont on behalf of the Rosebud J. V. The RC precollars for drill holes RS-401, -422, -422.1, -425, and -426 were drilled in 1997, and the core tails were drilled in 1998.
### Table 5. Surface Disturbance Summary

<table>
<thead>
<tr>
<th>Hole</th>
<th>Road</th>
<th>Pad</th>
<th>Sumps</th>
<th>Total Sq.Feet</th>
<th>Total Acres</th>
<th>Acres, Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS401</td>
<td>0</td>
<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>1,550</td>
<td>0.036</td>
</tr>
<tr>
<td>RS443</td>
<td>0</td>
<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>1,550</td>
<td>0.036</td>
</tr>
<tr>
<td>RS444</td>
<td>620</td>
<td>12,400</td>
<td>25X50</td>
<td>1250</td>
<td>13,950</td>
<td>0.320</td>
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<tr>
<td>RS445^</td>
<td>0</td>
<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>1,550</td>
<td>0.036</td>
</tr>
<tr>
<td>RS446^</td>
<td>0</td>
<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>1,550</td>
<td>0.036</td>
</tr>
<tr>
<td>RS447</td>
<td>2400</td>
<td>48,000</td>
<td>25X50</td>
<td>1250</td>
<td>49,550</td>
<td>1.138</td>
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<td>RS450</td>
<td>420</td>
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<td>1250</td>
<td>9,950</td>
<td>0.228</td>
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<tr>
<td>RS455</td>
<td>50</td>
<td>1,000</td>
<td>25X50</td>
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<td>2,550</td>
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<td>25X50</td>
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<td>1,550</td>
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<tr>
<td>Trenches</td>
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<td>23,200</td>
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<tr>
<td>Totals</td>
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<td>93,000</td>
<td>11,250</td>
<td>2,700</td>
<td>106,950</td>
<td>2.455</td>
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</table>

^ Rosebud Mining Company fee land (not BLM).
<table>
<thead>
<tr>
<th>Hole</th>
<th>Road feet</th>
<th>Pad sq. feet</th>
<th>Sumps feet</th>
<th>Sumps sq. feet</th>
<th>Total Sq. Feet</th>
<th>Total Acres</th>
<th>Acres, Public</th>
<th>Acres, Private</th>
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<tbody>
<tr>
<td>RS399</td>
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<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
<td>1,550</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>RS400</td>
<td>900</td>
<td>18,000</td>
<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
<td>19,550</td>
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<td>0.45</td>
</tr>
<tr>
<td>RS401</td>
<td>0</td>
<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
<td>1,550</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>RS402</td>
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<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
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<td>0.04</td>
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<td>RS404</td>
<td>700</td>
<td>14,000</td>
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<td>15X20 300</td>
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<td>0.04</td>
<td>0.04</td>
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<td>0</td>
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<td>1250</td>
<td>15X20 300</td>
<td>1,550</td>
<td>0.04</td>
<td>0.04</td>
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<td>0.04</td>
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<td>1250</td>
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<td>1250</td>
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<td>0.04</td>
<td>0.04</td>
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<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
<td>1,550</td>
<td>0.04</td>
<td>0.04</td>
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<tr>
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<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
<td>1,550</td>
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<td>0.04</td>
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<tr>
<td>RS445^</td>
<td>0</td>
<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
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<td>RS446^</td>
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<td>0</td>
<td>25X50</td>
<td>1250</td>
<td>15X20 300</td>
<td>1,550</td>
<td>0.04</td>
<td>0.04</td>
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<td>48,000</td>
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<td>1250</td>
<td>15X20 300</td>
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<td>2.34</td>
<td>2.23</td>
<td>0.11</td>
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</table>

^ Rosebud Mining Company fee land (not BLM).
Table 7. Rosebud 1998 Cumulative Budget & Expenditures
TABLE 8. 1999 Rosebud Target Ranking.

<table>
<thead>
<tr>
<th>ADVANCED</th>
<th>NEEDS MORE WORK</th>
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<tbody>
<tr>
<td></td>
<td>Priority</td>
</tr>
<tr>
<td>1. 2b – North Zone Feeders</td>
<td>1. School Bus Canyon</td>
</tr>
<tr>
<td>2. Far East</td>
<td>2. Deep Dreamland</td>
</tr>
<tr>
<td>3. South Zone Feeders</td>
<td>3. Degerstrom</td>
</tr>
<tr>
<td>4. 1b – Northeast of Mine</td>
<td>4. Valley</td>
</tr>
<tr>
<td>5. 1a – Southeast of South Zone</td>
<td>5. Lucky Boy</td>
</tr>
<tr>
<td>6. 3 – 96-356 Intercepts</td>
<td>6. Chance</td>
</tr>
<tr>
<td>7. Shark Fin</td>
<td>7. Gator</td>
</tr>
<tr>
<td>8. 2a – Vent Raise</td>
<td>8. Brown Palace</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>10. White Alps</td>
<td>10. Oscar</td>
</tr>
<tr>
<td>11. North Equinox</td>
<td>11. Short Shot</td>
</tr>
<tr>
<td>12. South Kamma</td>
<td>12. South Ridge</td>
</tr>
</tbody>
</table>

Note:
Target 2b – North Zone Feeders includes #24 fault
Target 1a – Southeast of South Zone includes Shark Fin extension
Mother Lode includes the Cave Fault East, Mother Lode, Gold Hill, and East Dreamland areas
Valley includes Cave Fault West.
TABLE 9. 1999 Rosebud Manpower Allocation Table.

<table>
<thead>
<tr>
<th>STATUS</th>
<th>STAGE</th>
<th>RANK</th>
<th>PROSPECT</th>
<th>TIME NEEDED</th>
<th>ASSIGNMENT</th>
<th>ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced</td>
<td></td>
<td>9.</td>
<td>Mother Lode</td>
<td>2 months</td>
<td>Mitchell (1), Rogowski (1)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.</td>
<td>White Alps</td>
<td>3 months</td>
<td>Vance (2), Mitchell (1)</td>
<td>Maybe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.</td>
<td>North Equinox</td>
<td>0.3 months</td>
<td>Langstaff, Peer Review</td>
<td>No</td>
</tr>
<tr>
<td>District</td>
<td>Priority</td>
<td>1.</td>
<td>School Bus Canyon</td>
<td>0.2 months</td>
<td>S.W.A.T. Team</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Priority</td>
<td>2.</td>
<td>Deep Dreamland</td>
<td>3 months</td>
<td>Langstaff (McLachlin)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Priority</td>
<td>3.</td>
<td>Degerstrom</td>
<td>3 months</td>
<td>Langstaff (Stiles)</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Priority</td>
<td>4.</td>
<td>Valley</td>
<td>3 months</td>
<td>Rogowski (2), Mitchell (1)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Priority</td>
<td>5.</td>
<td>Lucky Boy</td>
<td>2 months</td>
<td>Mitchell</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Priority</td>
<td>6.</td>
<td>Chance</td>
<td>2 months</td>
<td>Vance</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>May Not Work</td>
<td>7.</td>
<td>Gator</td>
<td>1 month</td>
<td>Mitchell (Rogowski)</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>May Not Work</td>
<td>8.</td>
<td>Brown Palace</td>
<td>2 months</td>
<td>Vance</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note: Target evaluation time is the time needed to gain sufficient encouragement to continue exploration.
Figure 4. TAS Diagram of Rosebud Rocks

Total Alkali vs. Silica Classification for Rosebud Volcanic Rocks

- Trachyte
- Rhyolite
- Trachyandesite
- Dreamland
- Dozer
- Tuff
- Por.
- Basaltic Andesite
- Andesite
- Dacite

SiO2 (wt.%): 41, 43, 47, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81
K2O + Na2O (wt.%): 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Whrock, KNvsSi
Figure 5. CIPW Plot of Rosebud Rocks

QAP Classification Using Normative Minerals (Volume Percent) for Rosebud Volcanic Rocks

*For SiO₂>63%, ab and an are combined in the ratio 1an:3ab (An25) to give P=4*an (if sufficient ab is present) and A =or+(ab-3*an); otherwise P=ab+an and A=or.

Whrock, normplot

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