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Item 69

# GEOLOGY AND GOLD DEPOSITS OF THE POST SUBDISTRICT, EUREKA COUNTY, NEVADA

by

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## ABSTRACT

The Post subdistrict is located at the northern end of the Carlin Trend in northeastern Nevada. The subdistrict includes the Post (Upper Post, Lower Post, and Deep Post) and Goldbug (Upper Zone, Lower Zone, and Structure Zone) deposits which are two of a series of NNW-aligned sediment-hosted disseminated gold deposits occurring in the western footwall of the Post Fault Zone. Goldbug is located one half mile north of the Post-Betze pit, which is jointly owned by Newmont Gold Company and Barrick Goldstrike Mines. Newmont reserves at Post exceed 5 million ounces of gold. Reserves at Post, Goldbug, Betze and Meikle total 33 million ounces of gold.

The Post and Goldbug deposits are large, deep, stratiform, refractory, high-grade gold deposits averaging 0.2 oz/st. Gold mineralization occurs along the northern margin of the Goldstrike stock within a NW-striking anticline. The east limb of this anticline is truncated by the N20°W high-angle Post Fault. Zones of dominantly stratiform gold mineralization within decalcified and silicified envelopes are hosted by Devonian Popovich Formation silty limestones beneath 500-700 feet of Devonian Rodeo Creek unit siliciclastic rocks. The Goldstrike stock irregularly penetrates the Paleozoic sedimentary rocks as dikes and sills, producing barren hornfels, skarn, and marble. At Deep Post, high-grade ponding of orpiment and realgar-rich +0.4 oz/st gold zones occurs beneath the Goldstrike granodiorite stock.

Gold mineralization at Post is subdivided into three zones based on geology, morphology, grade, and metallurgical character: Upper Post, Lower Post, and Deep Post. Upper Post represents oxide ore (0.040-0.050 oz/st) hosted in argillized and silicified mudstones, siltstones, and minor sandstones of the Rodeo Creek Unit. Lower Post refractory mineralization is hosted in silicified and pyritic carbonaceous silty limestones of the lower Popovich Formation. The high-grade portion of Lower Post (0.150-0.400 oz/st) is hosted by collapse breccias in the lower Popovich Formation. The Deep Post refractory orebody is host to high-grade gold mineralization (≥ 0.200 oz/st) within a clay-pyrite-silica altered shear zone. The shear zone occurs in the footwall of the contact metamorphic rocks.
Goldbug is a 900-1600 foot deep refractory high-grade gold deposit which measures 1000 feet E-W X 800 feet N-S in plan. Two stratiform +0.2 oz/st gold zones occur at depths of 900-1400 feet (Upper Zone = decalcified silty limestone) and 1400-1600 feet (Lower Zone = silicified collapse breccia). The steeply east-dipping Structure Zone occurs along the dike-filled footwall margin of the Post Fault Zone at depths of 400-700 feet.


## INTRODUCTION

The Post Subdistrict includes the Post and Goldbug gold deposits, located in Eureka County, Nevada, Section 19, T36N, R50E, and Section 24, T36N, R49E, approximately 26 miles northwest of the town of Carlin and 4.5 miles northwest of the Carlin #1 mill (Figure 1). Post and Goldbug are two of a series of NNW-aligned sediment-hosted disseminated gold deposits occurring in the western footwall of the Post Fault Zone. Post and Goldbug are located at the northern end of the Carlin Trend along a spur of the Tuscarora Mountains, which also hosts Newmont's Blue Star/Genesis and Deep Star mines and Barrick's Betze and Meikle mines.

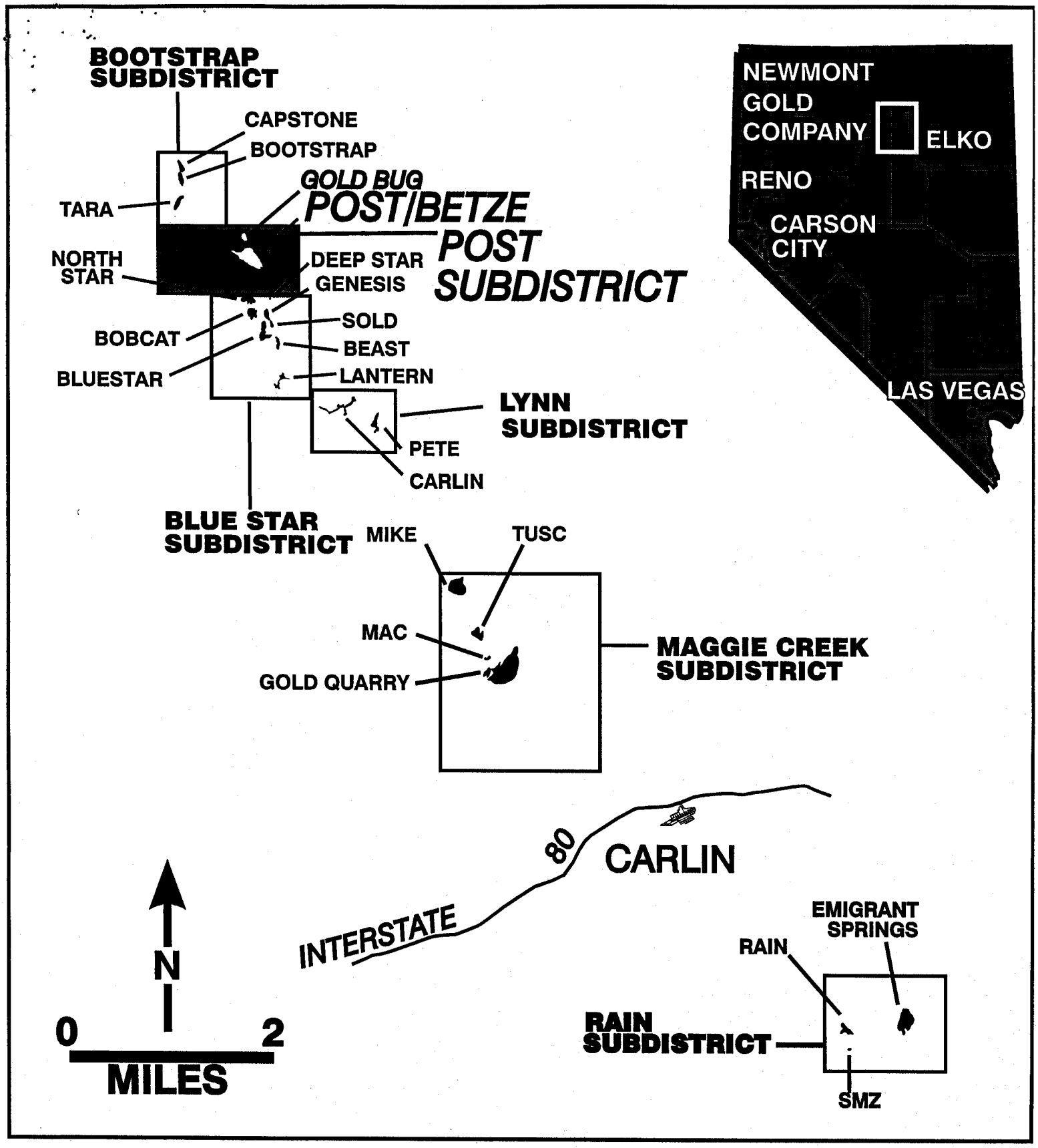



FIGURE 1 Location of Post mine & other significant deposits along the Carlin trend. Eureka & Elko Counties, Nevada.

## HISTORY AND PRODUCTION

Gold mineralization at Post was identified adjacent to a discovery made by Western States Minerals Corporation (WSMC) in 1982 (Bettles, 1989). Barrick Goldstrike Mines Inc. (BGMI) acquired WSMC's Post properties in 1987. Ownership of the Betze-Post deposit is divided between BGMI patented claims and Newmont Gold Company (NGC) TS Ranch property (Figure 2). Barrick began mining on their side of the property boundary in late 1988 with laybacks progressing onto Newmont property. During 1988-1989 Newmont discovered and delineated its Deep Post deposit. On December 4, 1992, Newmont and Barrick entered into a joint mining agreement to cooperatively mine Newmont's Deep Post and Barrick's Lower Post and Betze orebodies. Open pit mining is conducted by Barrick at a rate of 350,000 tons per day. Newmont reserves at Post exceed 5 million ounces of gold. Dewatering of the Post-Betze pit from 1992-1995 has occurred at rates of 55,000-68,500 gpm, making this the largest dewatering operation in North America. The water table has been lowered 100-150 feet per year since mining commenced in 1988.

The Goldbug deposit was discovered half a mile north of Post by Newmont in 1989 (Figure 2). The Lower Zone was delineated in 1991 and the Upper Zone in 1994. Pre-feasibility studies for the Goldbug deposit are in progress. Delineation drilling, metallurgical test work and engineering studies are likely to upgrade this large inferred resource to reserve status in 1997.

PROVEN AND PROBABLE RESERVES (Dec. 31, 1994)

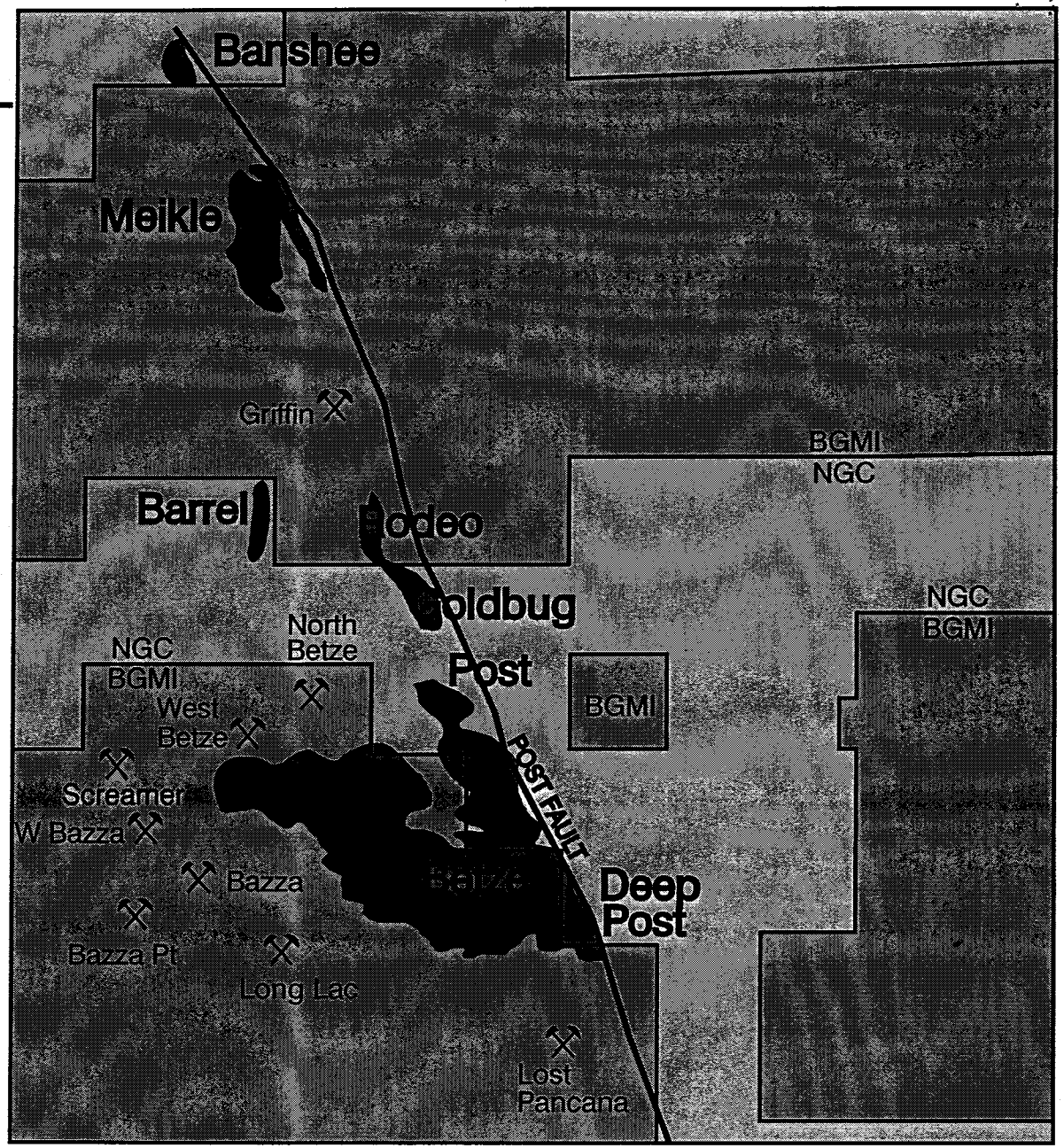
| COMPANY | OREBODY | TONS (st) | GRADE (oz/st) | OUNCES |
|---|---|---|---|---|
| Newmont | Post | 27,957,000 | 0.184 | 5,147,000 |
| Barrick | Betze | 113,855,000 | 0.199 | 22,651,000 |
| Barrick | Meikle | 8,373,000 | 0.683 | 5,719,000 |
| TOTAL | | 150,185,000 | 0.223 | 33,517,000 |

| 1994 PRODUCTION FROM THE POST DEPOSIT (Newmont) | | | |
|---|---|---|---|
| Mill Ore (st) | Leach Ore (st) | Waste (st) | Total (st) |
| 404,000 | 3,942,000 | 43,186,000 | 47,532,000 |

NEWMONT

# POST SUBDISTRICT GOLD DEPOSIT

## FIGURE 2

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## GEOLOGY

Deposits within the Post subdistrict are hosted in Devonian carbonate and clastic sedimentary rocks along the northern margin of the 158 Ma Goldstrike granodiorite stock (Figure 3). Paleozoic sedimentary rocks have been folded into a N30°W striking, NW-plunging anticline in the footwall of the Post Fault. Gold mineralization is hosted in these sedimentary rocks and is bound to the east by the N20°W-striking Post Fault. East of the Post Fault, the Little Boulder Basin graben is filled with Tertiary Carlin Formation sedimentary and tuffaceous sediments which unconformably overlie siltstones and cherty mudstones of the allochthonous Ordovician Vinini Formation. Goldbug occurs half a mile north of Post in a similar stratigraphic and structural setting.

The lowermost formation within the Post deposit is the Siluro-Devonian Roberts Mountains Formation (SDrm) (Figure 4), consisting of planar laminated dolomitic siltstone with bioclastic limestone interbeds. Alternating light and dark gray laminae are common. The top of the Roberts Mountains Formation marks the base of gold mineralization at Post. The Roberts Mountains Formation does not crop out at Post but has been penetrated by drilling to thicknesses of 400 feet.

The Roberts Mountains Formation is in transitional contact with the overlying Devonian Popovich Formation (Dp). The Popovich Formation is notably finer grained and more carbonaceous than the Roberts Mountains Formation. The Popovich Formation was deposited in a reef, reef slope and distal slope environment which includes a 300 to 600-foot thick massive bioclastic limestone bioherm located one mile NNW of Post. This reef shed bioclastic debris south and east toward Post and Goldbug. Occasionally, large boulders of bioclastic limestone several feet in diameter are identified in core drilling in the reef slope environment. The 1100-foot thick Popovich Formation consists of a lower unit (400 feet) of carbonaceous silty limestone with 5-20% interbedded bioclastic limestone. The lower Popovich Formation contains 1-6 inch thick fossil (bioclastic) beds, which increase in frequency and thickness down section. The bioclastic limestone interbeds are often selectively leached and silicified. Planar laminated silty limestone units of the lower Popovich Formation grade upward into wispy laminated silty limestone. Extensive carbonate dissolution caused a loss in volume and resulted in collapse brecciation of the lower Popovich Formation (Bakken et al, 1990 1991, Williams, 1992).

The 200-foot thick middle unit of the Popovich Formation consists of carbonaceous muddy limestone (micrite) with diagnostic soft sediment deformation. Calcite veining is accompanied by framboidal pyrite and pin-striped pyrite along bedding. Decalcification and mineralization are uncommon.

The 400-foot thick upper unit of the Popovich Formation is comprised of thin-bedded carbonaceous siltstone and silty limestone. The upper Popovich Formation is oxidized (and decalcified) to yellow-brown and maroon colors, contrasting sharply with underlying black carbonaceous Popovich rocks. Prominent carbonaceous black clay beds are the product of decalcification, leaving an insoluble residue of clay, silt, carbon and pyrite.

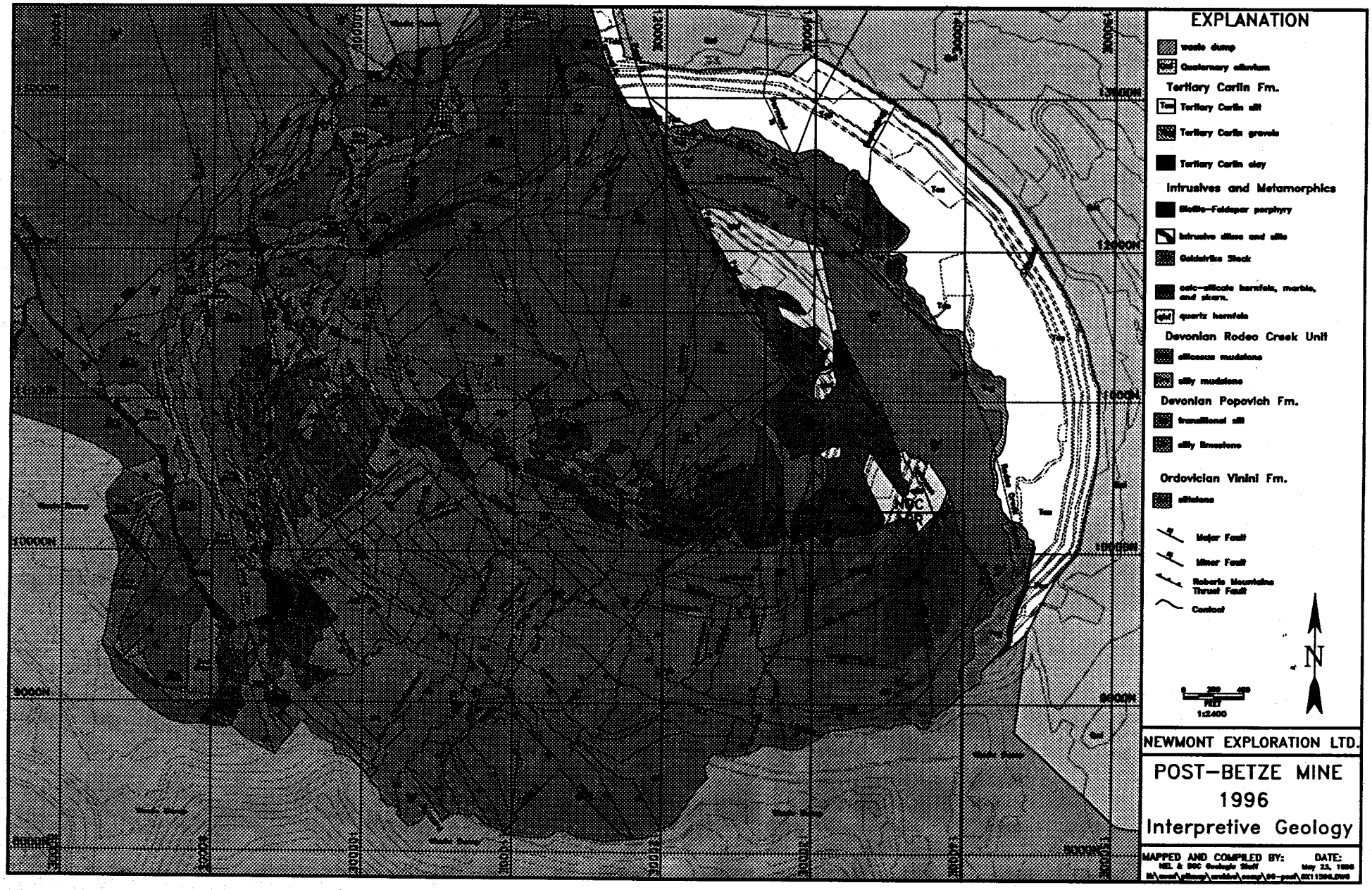
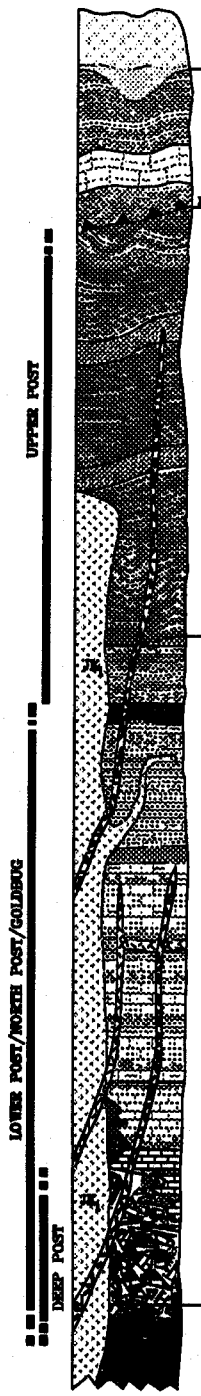



Figure 3 - Geologic Map of the Post Pit

# NORTH POST–GOLDBUG TECTONOSTRATIGRAPHIC SECTION




**Tertiary Carlin Formation** — Tc

Tuffaceous sediments (100–600' thick)
Poorly consolidated, friable, interbedded light gray sandy air fall tuffs (aft) and tan lacustrine silt, minor 10 to 50-foot thick matrix-supported gravels (gvlm). Basal 10 to 30-foot thick light peach clay with variable green halloysite.

Basal gravels (30–200' thick)
Poorly to moderately consolidated, matrix- and clast-supported gravels lying unconformably on Goldstrike granodiorite and Vinini Formation. Clast-supported gravels include 70–100% Ovi and JKi clasts in tan silt matrix. Clast types are: (1) angular 1–6" gray Ovi cherty mudstone & siltstone (gvlc), (2) light green to brown clay-weathered granodiorite grus (gvli).

**Ordovician Vinini Formation** — Ovi

Roberts Mountains Thrust

Chert, mudstone
Black and gray cherty mudstone (chms) and siltstone. Planar to wavy banded with alternating dark gray siltstone beds and 1–5mm thick light gray dolomitic calcarenite interbeds. Becomes more siliceous with depth. Metamorphosed to quartz hornfels adjacent to Goldstrike intrusive. 20 to 50-foot thick light gray to black limestone in middle portion, metamorphosed to calc-silicate hornfels adjacent to Goldstrike intrusive. Allochthonous unit with mylonitic flaser structure, in thrust contact with underlying Drc unit. Strongly fractured and oxidized to produce widespread limonitic interlocked "ice-cube" tectonic breccia. >2,000' thick.

**Devonian Rodeo Creek Unit** — Drc

Dark gray inch-thick rhythmically bedded, banded siliceous mudstone (smst), with gray to tan planar laminated siltstone and minor fine-grained sandstone. Mixed siliceous mudstone and siltstone in upper 200–300 feet. Siliceous mudstone with shaly partings and quartz-filled tension gashes dominant in lower 300 feet. Basal 50 feet gradational with Dp silty limestone. Discontinuous 5 to 20-foot thick basal silicified calcarenite. Metamorphosed to quartz hornfels adjacent to Goldstrike intrusive. 500–600' thick.

gradational

**Devonian Popovich Formation**

Popovich Fm: 6 mappable units, gradational contacts. Matrix grain size and skeletal-rich limestone/calcarenite (bcls) interbeds increase in frequency and thickness from Dp1 to stls3. Dp0 to stls4 variably silicified and decalcified, often dolomitic. Metamorphosed to pale green blocky calc-silicate hornfels or diopside skarn adjacent to Goldstrike intrusive. 1,000–1,100' thick

Dp0

Dark gray carbonaceous, planar laminated silty limestone (pstl) grades downward into silty micrite with diagenetic pin-striped pyrite on bedding. Uppermost 50 feet gradational with basal Drc siliceous mudstone. 3 to 10mm-thick black chert lenses comprise 5% of middle 100' of Dp0. 200–300' thick.

Dp1

Dark gray carbonaceous, massive to thin-bedded lime mudstone (micrite). Diagnostic soft sediment deformation with slump bedding and flame structure. 250–300' thick.

Dp2

Dark gray carbonaceous, planar laminated silty micrite (stmic). Localized hockey puck cleavage and mm-thick bcls interbeds. 50–80' thick.

stls1

Transitional dark gray carbonaceous, planar to wispy laminated silty limestone. 10–40' thick.

stls2

Dark gray variably carbonaceous wispy laminated silty limestone (wstl). Minor fossil debris flows and cm-thick bcls interbeds. Coarser grained and less carbonaceous than Dp0–stls1. 50–200' thick.

stls3

Medium to dark gray fossiliferous wispy laminated silty limestone. Abundant debris flows with 5–30% angular lithic & skeletal debris (dfls), biosparite and fine-grained bioclastic limestone (bcls). Commonly silicified and collapse brecciated. Collapse breccias contain clasts of intrusive (multilithic breccia), wispy laminated silty limestone and bcls in a silty carbonaceous residue. Basal 30–50 feet gradational from wispy to planar laminated silty limestone. 150–300' thick (biosparite 300 feet thick at Barrel).

gradational

stls4

**Silurian/Devonian Roberts Mountains Formation** — SDrm

Medium to light gray planar banded to laminated calcareous siltstone (lmst) Alternating 2–4mm thick light and dark gray planar laminae. Minor 1" to 3' thick bcls interbeds and fossil debris flows. Coarser grained and less carbonaceous than stls1 to stls3. >800' thick.

**Igneous rocks**

JKi — Jurassic diorite to granodiorite of the Goldstrike sill-like intrusion (156 Ma). 1–3mm plagioclase, hornblende and biotite with interstitial quartz. Blocky, well-jointed and propylitized with calcite veins and disseminated pyrite. Up to 1600 feet thick, uppermost 100–200 feet is clay-weathered to grus.

Qmp — Quartz monzonite porphyry argillized dikes and sills (115 Ma) Three types: (1) 2–6mm blocky or lathy plagioclase phenocrysts in aphanitic plag+qtz groundmass, (2) 2–4mm resorbed quartz eyes in aphanitic plag+qtz groundmass, (3) biotite + hornblende-rich lamprophyre.

Bfp — Biotite feldspar porphyry (39 Ma) Tertiary dikes in the Post Fault Zone. 2–4mm biotite and kaolinized plagioclase phenocrysts in aphanitic plag groundmass.

Figure 4. North Post–Goldbug Stratigraphic Section.

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Post geologists March 1996

Overlying the Popovich Formation is the Devonian Rodeo Creek unit (Ettner, 1989). The contact between the Popovich Formation and the Rodeo Creek Unit is transitional. The Rodeo Creek Unit (500-700 feet thick) is a black rhythmically siliceous mudstone with interlaminated gray siltstone. Siliceous mudstones dominate the lower Rodeo Creek Unit, consisting of inch-thick beds with shaly partings and hairline quartz veinlets perpendicular to bedding. Thin-bedded siltstones and fine-grained sandstones are common in the upper Rodeo Creek Unit.

In thrust contact (Roberts Mountains Thrust) with the Rodeo Creek Unit is the allochthonous Ordovician Vinini Formation (+2,500 feet thick). The Vinini Formation (Ovi) consists of mylonitized siltstone, chert, mudstone, and minor limestone. Abundant intraformational low angle structures are mapped within the incompetent Vinini Formation.

Overlying Paleozoic rocks east of the Post fault are unconsolidated sediments of the 5 Ma Tertiary Carlin Formation. The Carlin Formation is composed of tan-brown tuffaceous silts with interbedded light gray airfall tuffs. The base of the Carlin Formation is commonly composed of gravels with angular to subrounded sand to cobble sized clasts of Vinini Formation and Goldstrike intrusive in a clay silt matrix. The Carlin Formation is up to 800 feet thick, filling a N-S to NNW paleotrough.

The Goldstrike Formation (JKi) is a propylitized, rarely mineralized, diorite to granodiorite stock which intrudes the Paleozoic section on the south side of the Post deposit (Figure 3). Arehart and others (1992) have K-Ar dated the Goldstrike stock at 158 Ma. The margin of the Goldstrike stock is strongly argillized and oxidized in the southeast corner of the Post pit. Within a 300-foot wide metamorphic aureole the Popovich Formation has been metamorphosed to skarn, calcsilicate hornfels, and marble.

Cretaceous quartz monzonite porphyry dikes (and sills) dated at 115 Ma (Arehart et al, 1992) occur throughout the Popovich section. The dikes (qmp) consist of phenocrysts of quartz and argillized plagioclase & orthoclase in a fine-grained clay-altered groundmass. Quartz monzonite porphyry dikes show a strong spatial relationship to gold mineralization. Mineralized dikes are characterized by quartz-sericite-pyrite veining.

Biotite feldspar porphyry dikes (bfp), dated at 39 Ma (Arehart et al, 1992), are located in the Post Fault Zone and the Deep Post shear zone. The bfp is a barren porphyry with biotite and feldspar phenocrysts in an aphanitic groundmass which postdates the gold mineralization at Post.

## STRUCTURE

The most prominent structural feature within the Post subdistrict is the N10-20°W striking and 75-85°E dipping Post Fault (Figure 3). The Post Fault is a 200-foot wide shear zone defined by the West Post Fault and the Post Fault to the east. Drilling east of the Post Fault indicates that dip slip offset exceeds 2,500 feet. Movement along the Post Fault has a complex history of reactivation, cross cutting both Paleozoic sedimentary rocks and post-mineral Tertiary Carlin Formation sediments (Figure 5).

A northwest-striking, northwest-plunging anticline occurs in the footwall of the Post Fault. The east limb of this anticline dips more steeply than the west limb due to drag folding in the footwall of the Post fault. The east limb of the anticline is truncated by the NNW-striking Post Fault (Figure 5). The Rodeo Creek siliceous mudstones are intensely folded on the eastern limb of the anticline. The Roberts Mountains Thrust (Antler Orogeny, early Mississippian) forms the contact between the allochthonous Vinini Formation and the autochthonous Rodeo Creek unit.

Late movement along numerous Post Fault-parallel and northeast striking antithetic structures has offset gold mineralization, mostly normal faults down-dropped 20-100 feet to the west. Important horst-bounding dike-filled NNE faults which control mineralization include Christy's at Post and Hillside at Goldbug.
High-grade +0.4 oz/st mineralization occurs within north-south horst blocks. The Post horst is bound by the Grandjean Fault to the west and the West Post fault to the east. The Goldbug horst is defined by the Hillside Fault to the west and the West Post Fault to the east. At Goldbug, an internal N30°W structural fabric is controlled by steep east-dipping quartz-sericite-pyrite altered monzonite porphyry dikes and sooty sulfide-filled shears.

## ALTERATION

Decalcification and silicification are the dominant alteration types in the Post subdistrict. Alteration is controlled by structure and lithologic permeability. Widespread early decalcification caused volume loss in the Lower Popovich Formation, producing clast-supported collapse breccias with angular silty limestone clasts in an insoluble residue of clay, carbon, pyrite and silt (Figure 5). Complete decalcification formed stratiform carbonaceous black clays (CBC). Early decalcification of carbonate-rich debris flow and bioclastic limestone beds made these Lower Popovich zones especially susceptible to silica flooding. This decalcification greatly increased porosity and permeability for later introduction of ore fluids and the precipitation of silica, pyrite and gold. Silicification is dominantly stratiform, and also occurs as stockwork veinlets. Multilithic collapse breccias containing clasts of silicified silty limestone and unsilicified quartz monzonite porphyry formed where dikes occur within the zone of collapse brecciation.

Early pervasive sulfide-rich, gold-poor silicification flooded the permeable decalcified sediments (Figure 6). A second stage of silicification and sulfidization overprinted the earlier event, depositing fine-grained euhedral pyrite and marcasite overgrowths on the surface of diagenetic pyrite (Arehart, 1992). Gold occurs along sooty sulfide-filled shears and within late arsenian pyrite which rims larger pyrite grains. Late drusy quartz/barite fill vugs and fractures.

The uppermost 300-500 feet of the Rodeo Creek unit is oxidized, hosting the Upper Post deposit. The oxide/sulfide boundary roughly coincides with the top of the carbonaceous and sulfidic Popovich Formation silty limestones.

## MINERALIZATION

POST

# NEWMONT

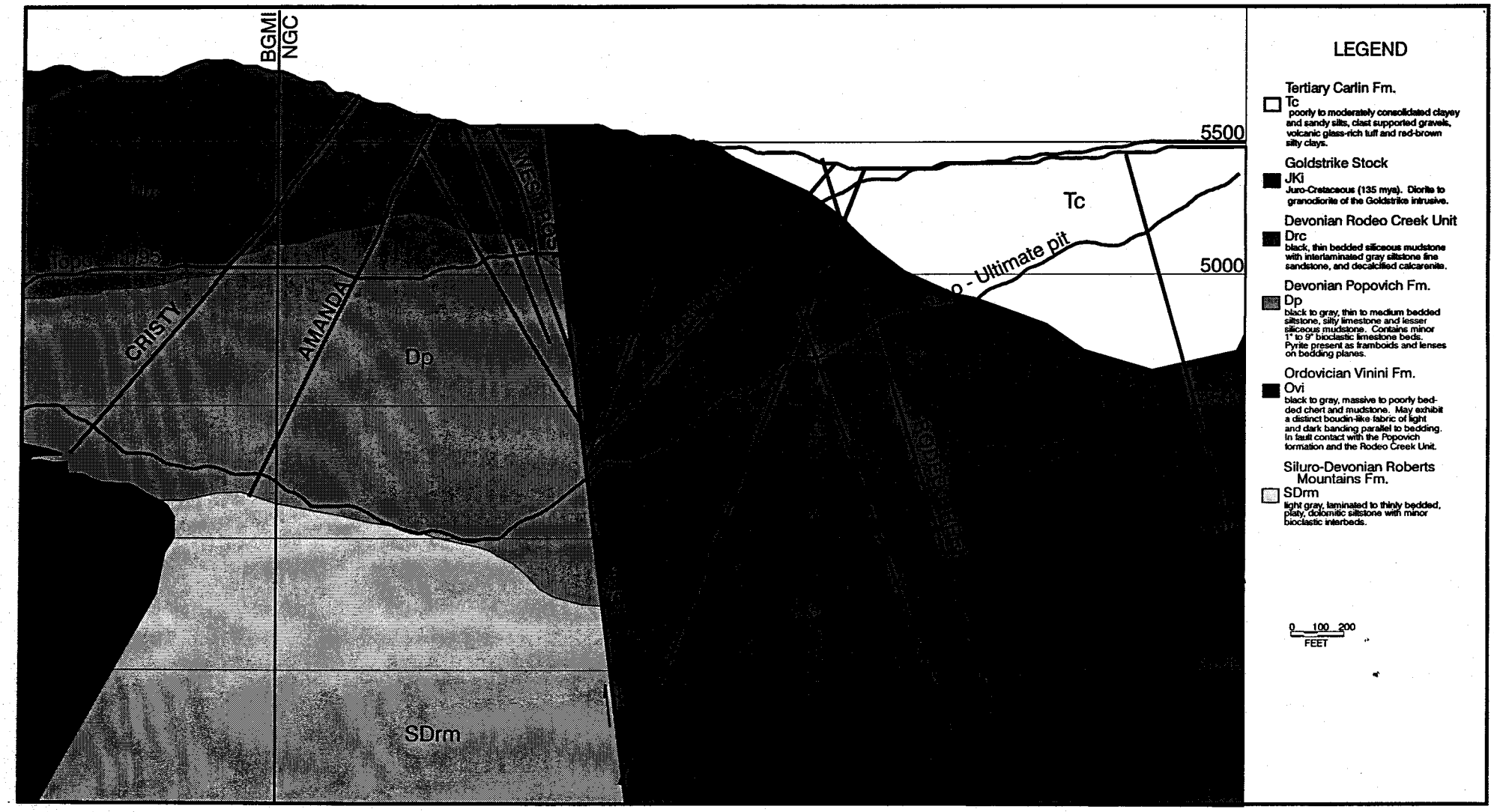


**Figure 5 - 12,000N GEOLOGY**

# NEWMONT

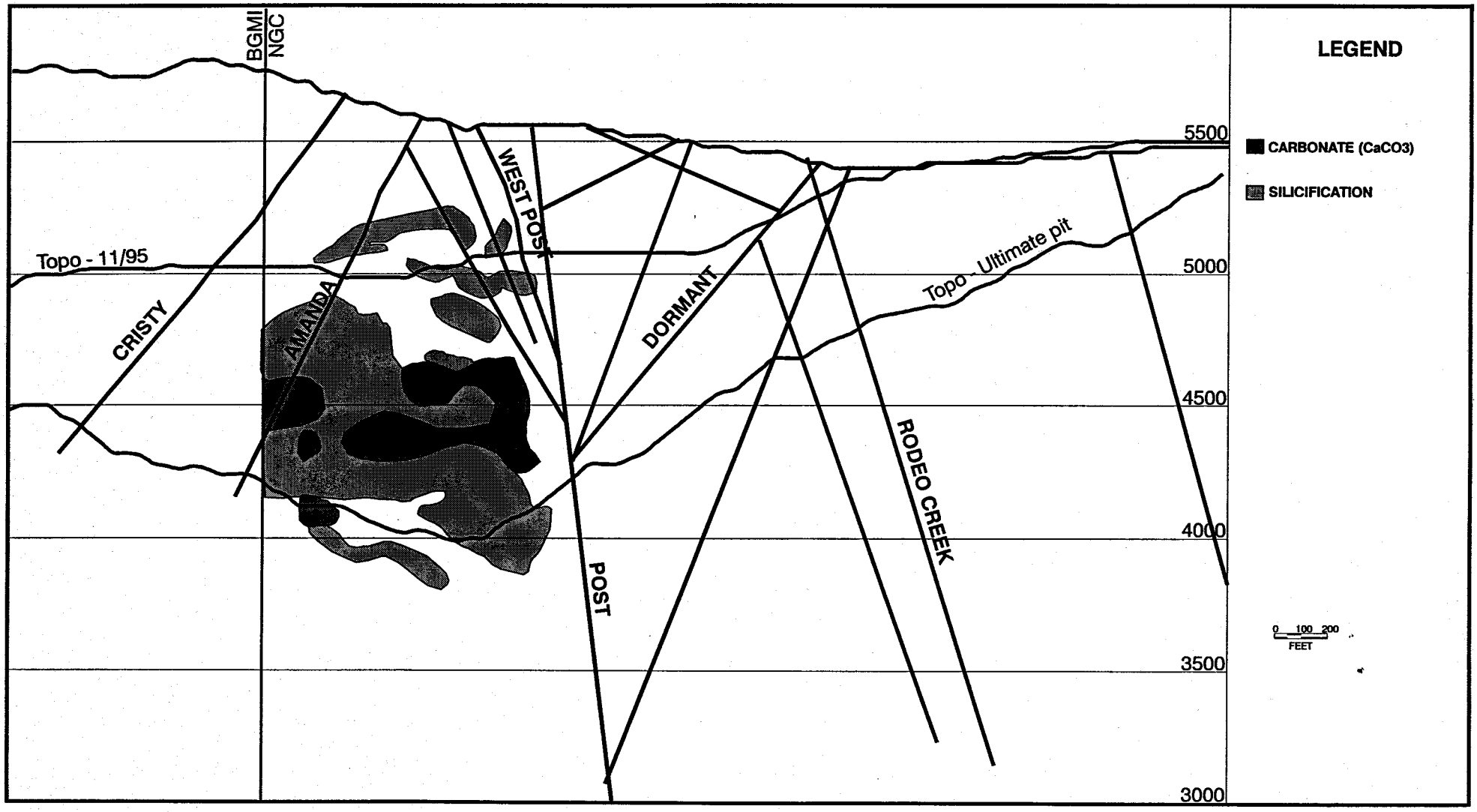


Figure 6 - 12,000N ALTERATION

Gold mineralization at Post is divided into three zones based on grade, metallurgy, and geology as Upper Post, Lower Post and Deep Post. Gold mineralization is bound to the east by the Post Fault and to the south by the Goldstrike Stock (Figure 7).

Upper Post

The Upper Post orebody is hosted in oxidized siltstones/siliceous mudstones of the Rodeo Creek Unit (Figure 5). Gold mineralization is stratigraphically controlled, with elevated grades occurring in argillized and bleached siltstone and sandstone lenses. Structurally controlled mineralization occurs as stockwork quartz veins and silicified fault breccias.

Lower Post

The Lower Post orebody is hosted by variably silicified and carbonaceous-pyritic siltstones and silty limestones of the Popovich Formation (Figure 8). Gold mineralization is stratigraphiclly controlled and forms a bedding-parallel orebody dipping 10-20°NW. The highest gold grades are hosted in decalcified collapse brecciated bioclastic limestone, debris flow limestone, and along sooty sulfide-filled shear zones (Figure 6). Sulfide content of ore in the Lower Post deposit is 3.6-5.5%. Stibnite is locally abundant as late veins in silicified zones.

Deep Post

The Deep Post orebody is a high-grade structurally controlled refractory orebody (+0.200 opt) in the lower Popovich Formation (Figure 9). Gold mineralization is controlled by a N50°W-striking, 60°SW-dipping shear zone (Figure 10). This shear zone defines the northeast margin of the Goldstrike stock at Deep Post, and extends northwesterly towards Barrick's stratiform Betze deposit. Numerous unmineralized blocks of granodiorite, biotite feldspar porphyry and metamorphic rocks occur within the shear zone. The hanging wall of the shear zone consists of unmineralized Goldstrike granodiorite and exoskarn. High-grade gold mineralization (+ 0.200 opt) is spatially associated with shearing and elevated concentrations of fine-grained pyrite. The Deep Post orebody is enriched in pyrite (+4%), arsenic (7000 ppm) and total clays (+14%) and low in quartz (66%). Elevated gold grades occur where orpiment and realgar veins ponded in decalcified silty limestone beneath unmineralized granodiorite and metamorphic rocks. Restricted shear-controlled mineralization occurs along the margins of the Goldstrike stock.

GOLDBUG

Goldbug is located half a mile north of Post (Figure 2). Gold mineralization at Goldbug is divided into three zones based on host rock, elevation and metallurgy as the Upper, Lower and Structure Zones (Figure 11). Ounces are distributed as follows: Upper Zone 55%, Lower Zone 40%, Structure Zone 5%. Gold mineralization is truncated to the east by the Post Fault.

Goldbug Upper Zone

The Upper Zone occurs at depths of 900 to 1400 feet in decalcified and dolomitic thinly planar

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# POST SUBDISTRICT PLAN VIEW

G x T Contour
(+0.2 oz/st, 10' Min.)

GT > 30

## FIGURE 7

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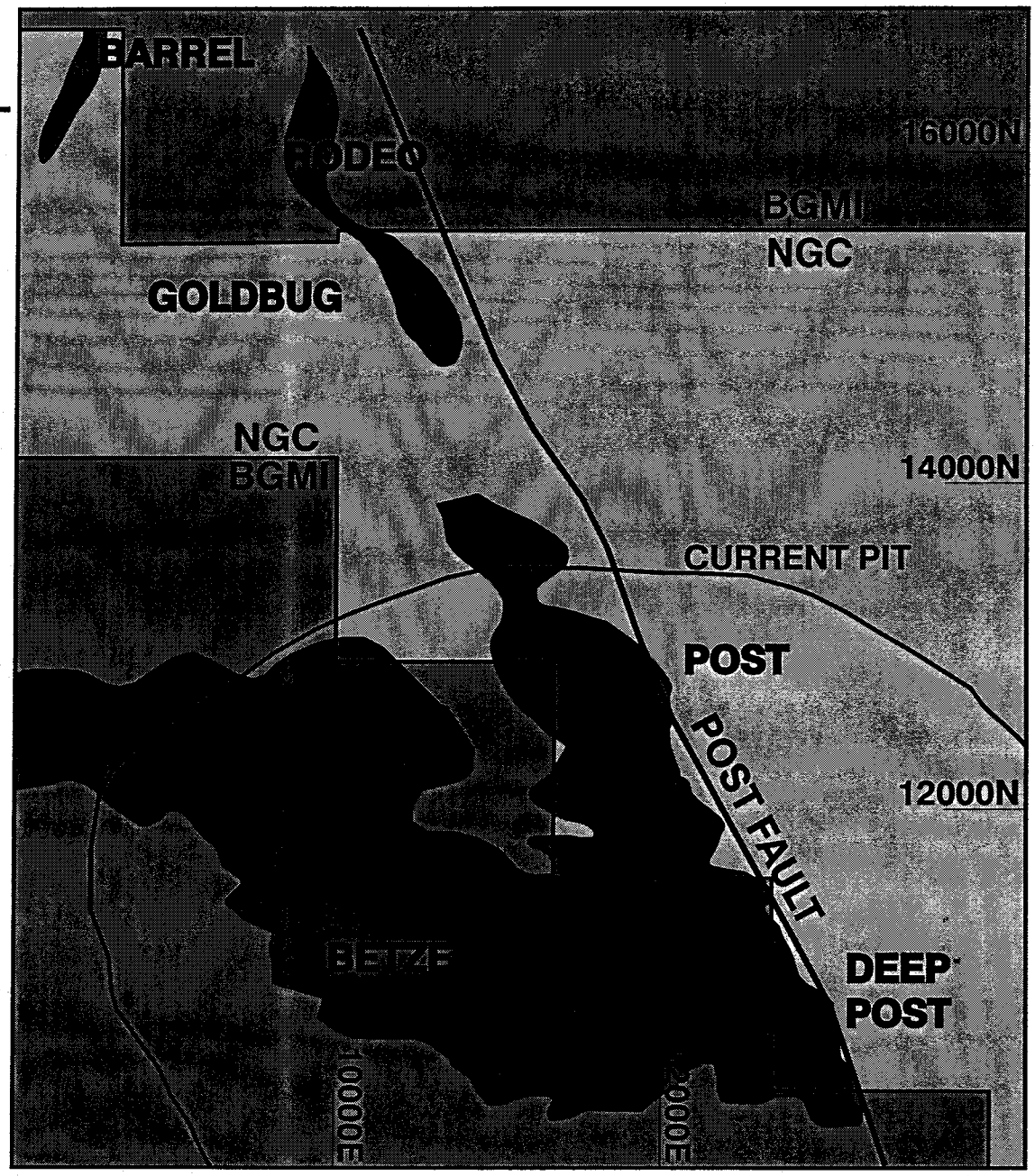

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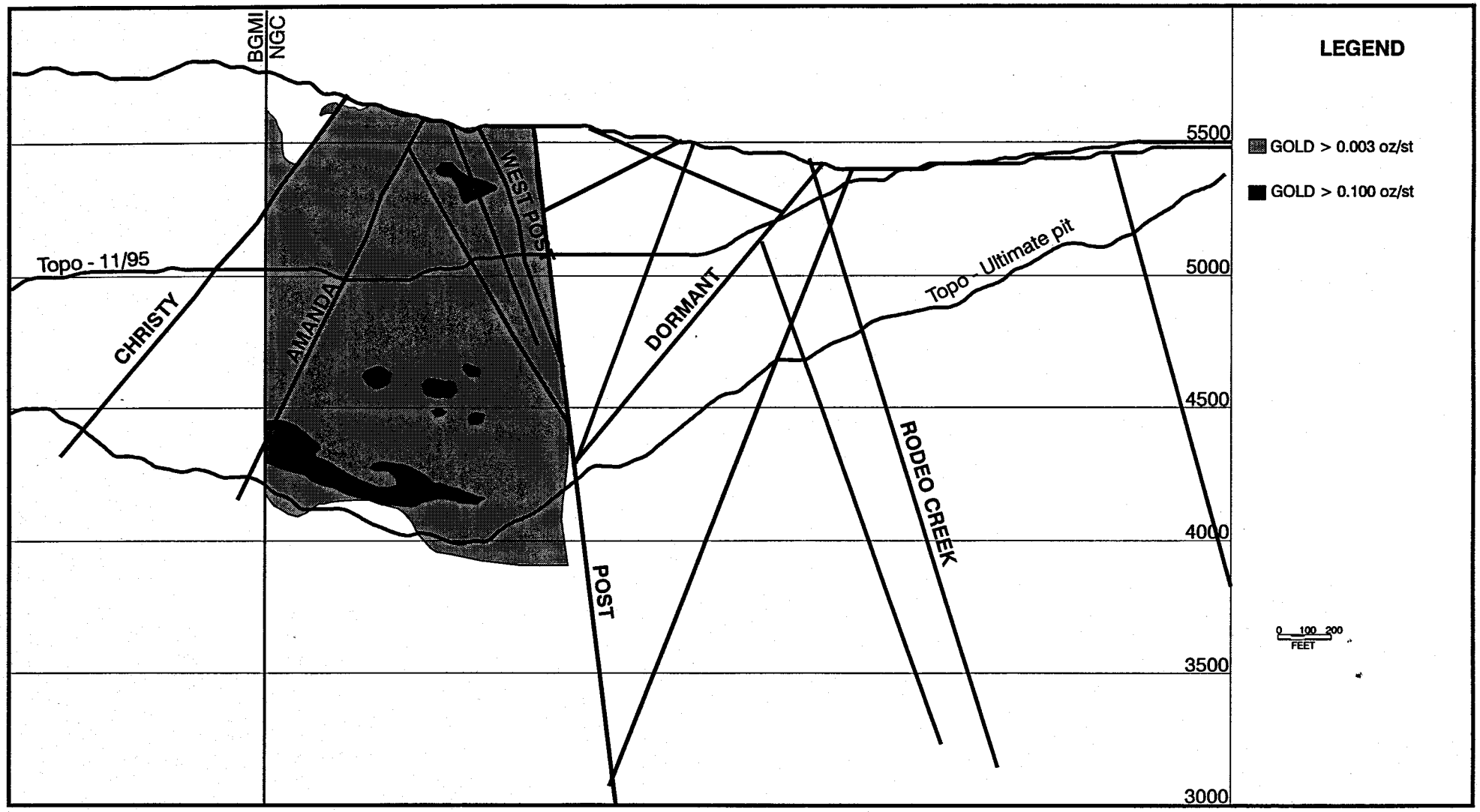


**Figure 8 - 12,000N GOLD SHAPES**

# NEWMONT

## View Looking NW

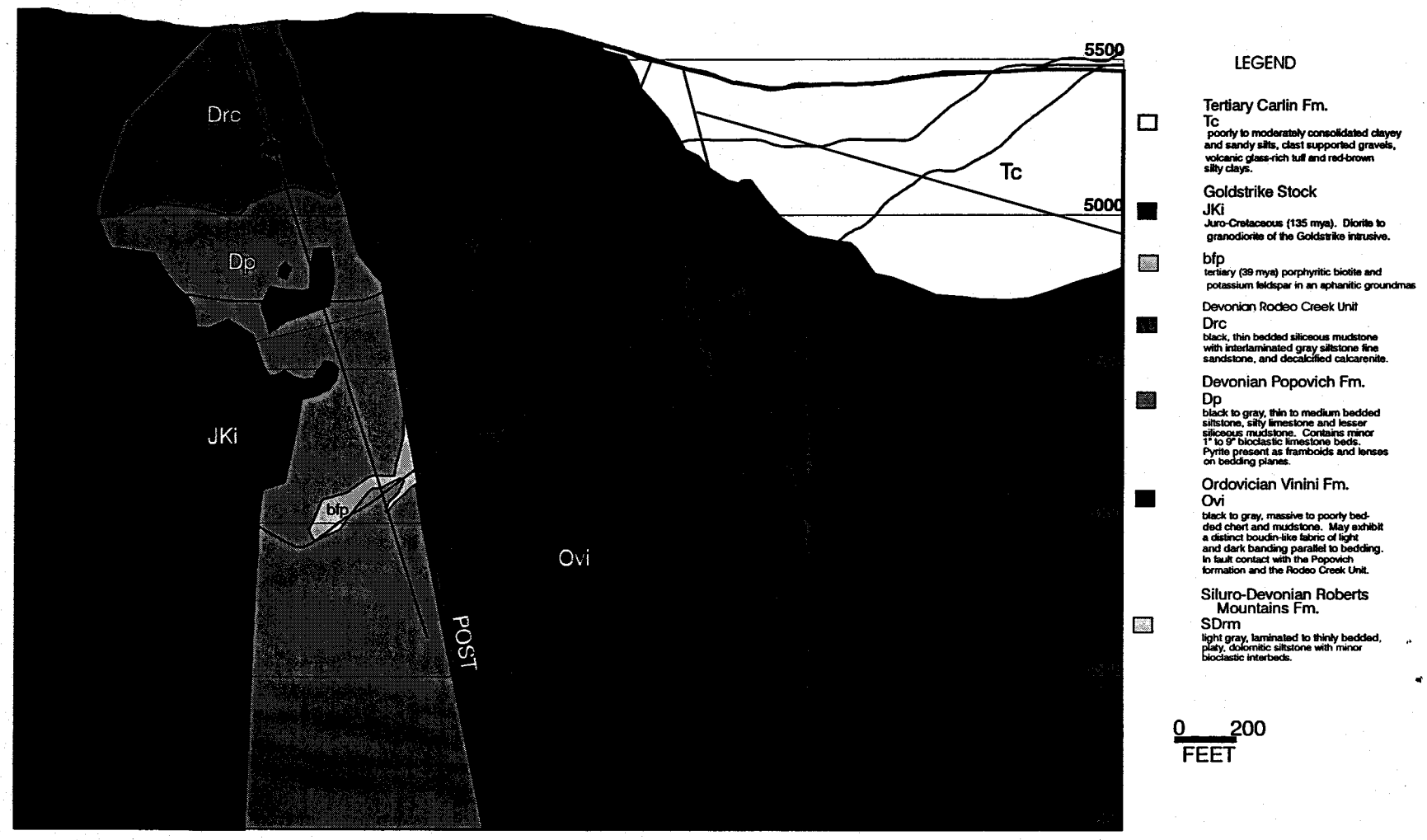


**Figure 9 - Deep Post Geology**

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View Looking NW

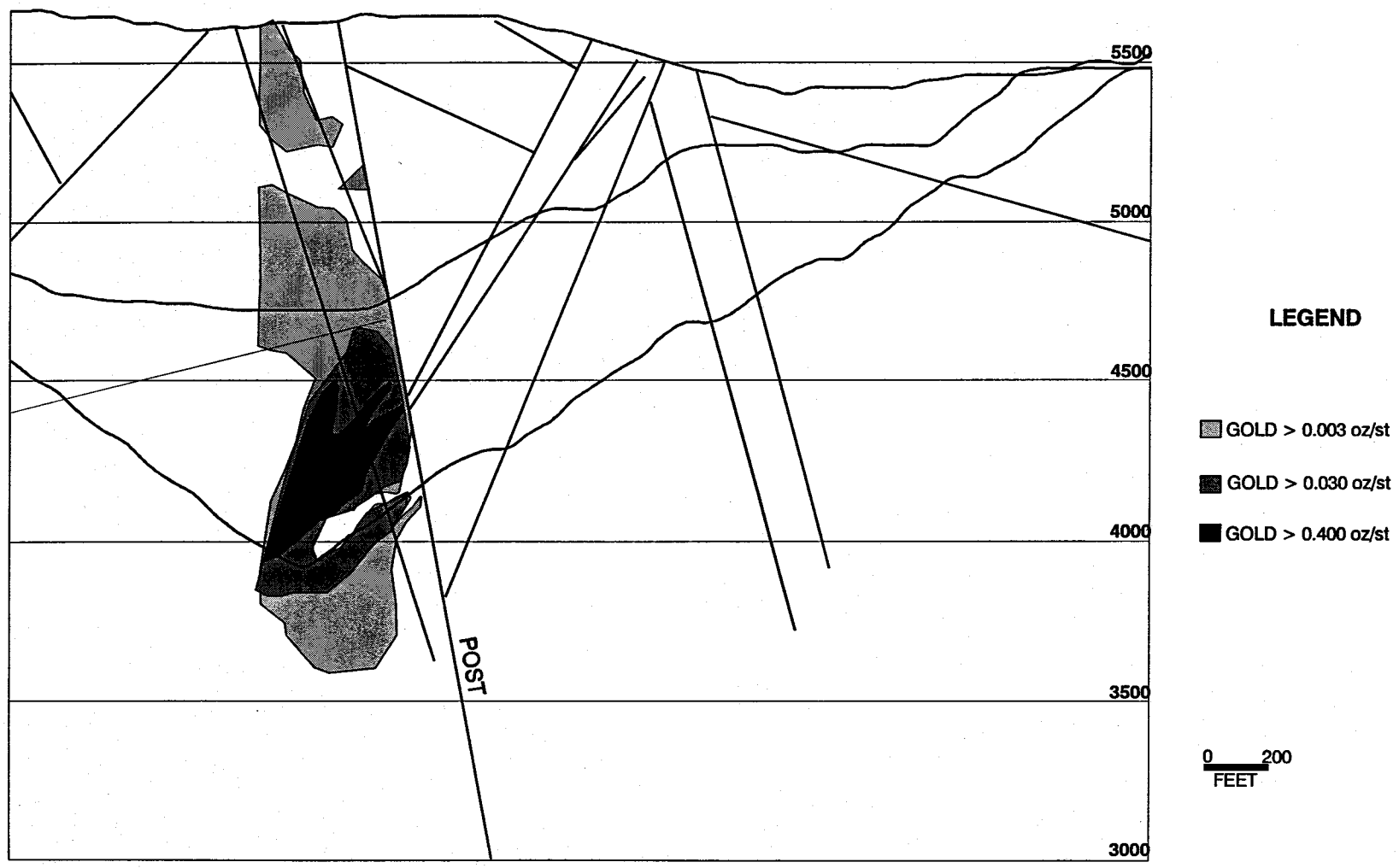


Figure 10 - Deep Post Mineralization Section 200NE

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# GOLDBUG PROJECT
# PLAN VIEW

GOLD ZONE > 0.4 oz/st

GOLD ZONE > 0.2 oz/st

QAL

RODEO CREEK UNIT (Drc)

VININI FORMATION (Ovi)

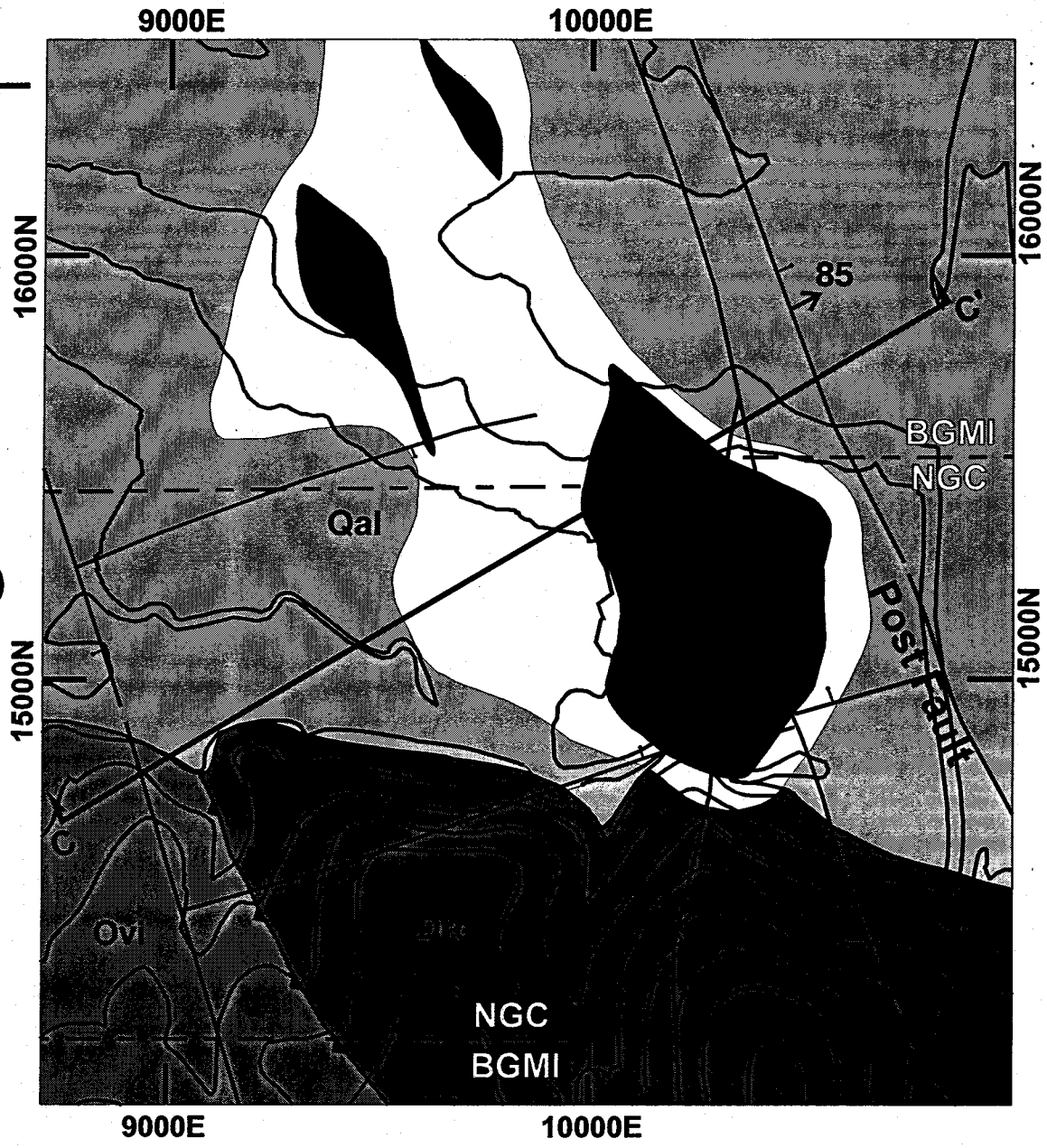


FIGURE 11

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laminated silty limestone of the upper and middle Popovich Formation (Figure 12). The Upper Zone measures 800 feet N-S by 700 feet E-W by 100-400 feet thick. The high-grade core of the Upper Zone averages 0.8 oz/st at the north end of Goldbug and occurs as a stratiform pod measuring 300 feet NE-SW X 100 feet NW-SE X 80 feet thick. Decalcification is subtle (1-10% carbonate carbon) within the Upper Zone; bedding is undisturbed and silicification is weak to absent. Dolomite contents range from 10-50%. Fine-grained sooty sulfide-filled shears and quartz-filled tension gashes superimpose high-grade +0.4 oz/st structurally controlled ore zones within a dominantly stratiform deposit, similar to the Lower Post orebody. The eastern margin of the Upper Zone includes a 20-foot wide high-grade zone along the 60°E-dipping Ounce Fault with gold grades commonly in excess of 1.0 oz/st.

Goldbug Lower Zone

The Lower Zone occurs at depths of 1400 to 1600 feet in variably silicified and collapse-brecciated silty limestone and debris flow limestone of the lower Popovich Formation. The Lower Zone occurs beneath the micritic limestone in a stratigraphic position similar to the Carlin orebody (Figure 12). The Lower Zone measures 800 feet N-S by 900 feet E-W by 200-400 feet thick, and forms the western portion of the Goldbug deposit. The +0.4 oz/st high-grade core of the Lower Zone occurs at the south end of Goldbug, lying approximately 400 feet south and 400 feet below the high-grade core of the Upper Zone. The high-grade core of the Lower Zone is commonly hosted by multilithic collapse breccia with 5-30% intrusive clasts beneath and within a silicified cap of monolithic collapse breccia.

Goldbug Structure Zone

The steeply east-dipping Structure Zone occurs along the dike-filled footwall margin of the Post Fault Zone at depths of 400-700 feet (Figure 12) and shows analogies to the Meikle style of mineralization. Mixed oxide/refractory 0.1-0.2 oz/st structurally-controlled gold zones occur within a 50 to 100-foot wide shear zone over a strike length of 500 feet.

## METALLURGY

With the exception of Upper Post, the gold deposits of the Post subdistrict are refractory and preg-robbing. Their refractory character is due to pyrite and silica encapsulation of gold, and preg-robbing carbon (table 1). Sulfide sulfur and organic carbon contents range from 1-2% and 1-5% respectively. Gold is closely associated with high sulfide content. Arsenian pyrite overgrowths coat pre-ore pyrite.

Mineralization at Post and Goldbug is hosted by decalcified and collapse brecciated silty limestone, and has been overprinted by hydrothermal silicification and fine-grained sooty sulfides. The upper Post oxide deposit occurs within the silicified and fracture-controlled siliceous Rodeo Creek Unit. Sulfide contents are low to absent with moderate alunite and jarosite concentrations. Collapse brecciation and silicification of the Lower Post deposit is similar to the Goldbug Lower Zone. The Deep Post orebody is argillized with elevated gold values correlating to high sulfide and arsenic zones. Deep Post and the Goldbug Upper Zone

NEWMONT

# GOLDBUG PROJECT
# SECTION 700N

> 0.60 oz/st Au

> 0.20 oz/st Au

> 0.03 oz/st Au

Qal

CARLIN FORMATION (Tc)

RODEO CREEK UNIT (Drc)

POPOVICH FORMATION (Dp)

ROBERTS MOUNTAINS FORMATION (SDrm)

VININI FORMATION (Ovi)

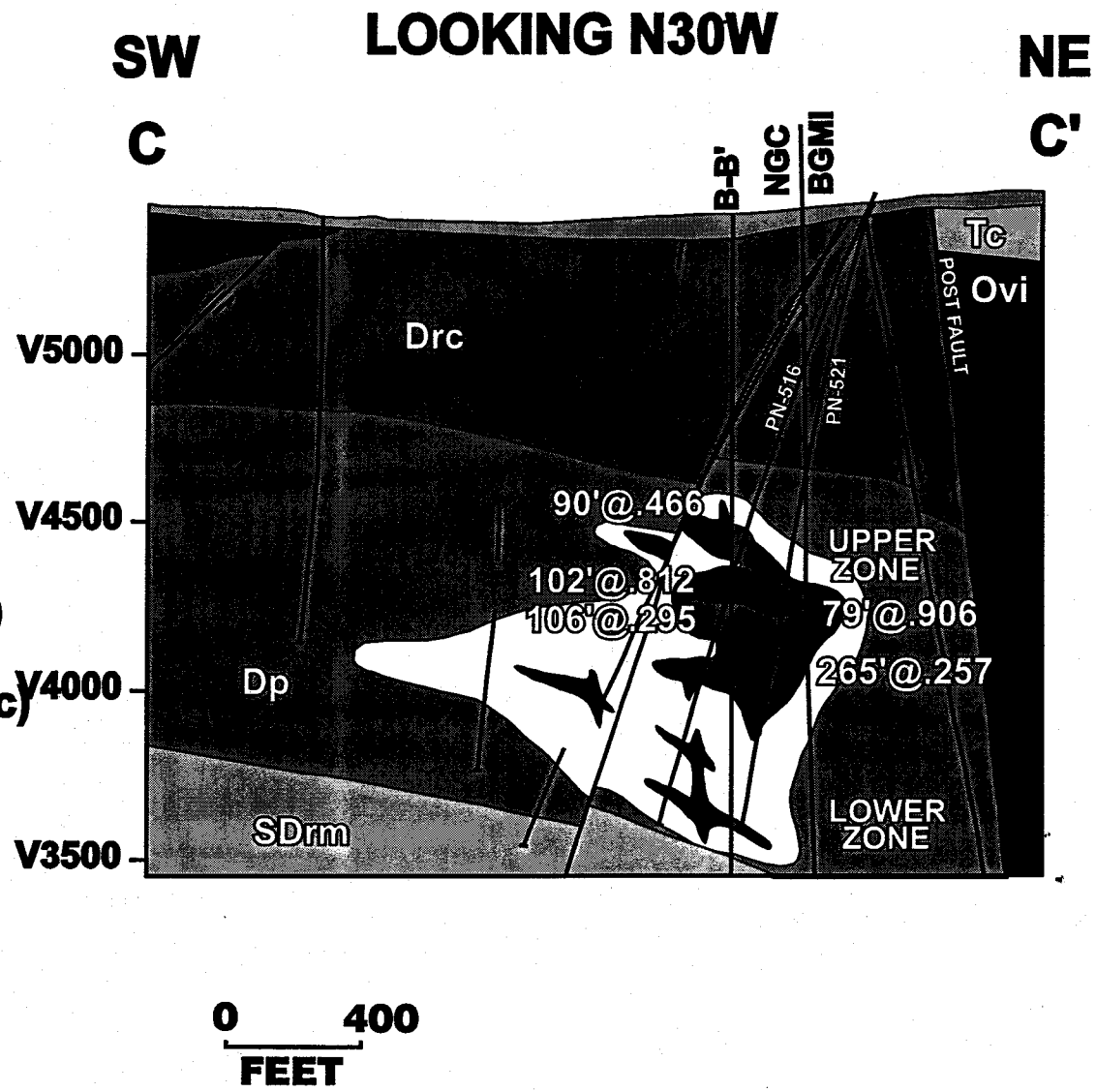


FIGURE 12

have the highest carbonate content (mostly as dolomite) owing to incomplete decalcification and weak silicification.

## PROCESSING

Post mill grade +0.070 oz/st ores are stockpiled for processing through Newmont's roaster at Gold Quarry. Barrick's +0.065 oz/st Betze ores are treated by pressure-oxidizing autoclaves. Favorable pilot test roaster recoveries have been reported for Goldbug.

Low-grade 0.030-0.070 oz/st Newmont ore will be bioleached, using sulfide-destructive bacteria prior to cyanide leaching. Ongoing research and pilot testing by Newmont metallurgists is continuing to evaluate the commercial viability of bioleaching.

## GEOCHEMISTRY

The Post and Goldbug deposits show typical Carlin-type geochemical enrichments. Gold is associated with elevated arsenic (>400 ppm), antimony (>50 ppm), mercury (>5 ppm) and thallium (>3 ppm) (table 2). Gold to silver ratios are generally >10:1. Base metal deficiency is notable, with Cu, Pb and Zn values all <100 ppm.
Arsenic values are highest in the sheared Deep Post deposit which averages 6,970 ppm As.

## GEOPHYSICS

A major geophysical gradient is defined by the Post Fault, which places an eastward thickening basin of low density, weakly magnetic Carlin Formation (= magnetic high) against higher density, non-magnetic carbonate and siliciclastic rocks (= gravity high). Gravity surveys have been particularly useful in defining major basin-bounding faults. Positive IP anomalies are recognized in response to the sulfide-rich gold deposits of the Post subdistrict.

## SUMMARY

The Post Fault is interpreted to have served as a major hydrothermal conduit which focused gold mineralization in one of the richest mining districts in the world. The NNW alignment of sediment-hosted gold deposits north of the Goldstrike stock contain gold reserves in excess of 30 million ounces. Drilling within a three-mile long NNW corridor in the footwall of the Post Fault has increased reserves annually since 1986.

The stratiform Post-Betze deposit, which straddles the Newmont-Barrick property boundary, is hosted by variably decalcified and silicified silty limestones of the Devonian Popovich Formation at depths of 600-1500 feet. The Post deposit is bound by the Goldstrike stock to the south and by the Post Fault to the east. Elevated N20°W to N50°W-striking gold values occur where structural conduits developed along the NW-striking Post-Betze anticline and within dike-filled N-S horst blocks. Stratiform gold zones are well developed in the Lower Popovich collapse breccias at Lower Post and Goldbug Lower Zone. Hydrothermal ponding of auriferous fluids occurred beneath relatively impermeably units such as the middle Popovich micrite and

decalcified carbonaceous black clays.

A simplified Post-Goldbug genetic model includes:

1. Emplacement of Goldstrike stock at 158 Ma.
2. Emplacement of quartz monzonite porphyry dikes 115 Ma.
3. Decalcification of Popovich Formation, especially via bioclastic limestone beds, forming collapse breccias.
4. Silicification and sulfidization of collapse breccias.
5. Main stage gold mineralization = quartz-pyrite veining of dikes + sooty sulfide-filled shears + late orpiment/realgar.
6. Late drusy quartz and barite filling vugs and open fractures.
7. Basin-and-range faulting along N-S faults, reactivating the Post Fault with downdropping over half a mile to the east.

Table 1
Mineralogy of the Post Deposit

| UPPER POST | Waste <.006 | Leach .006-.080 | Mill >.080 | High Mill |
|---|---|---|---|---|
| Carbonate (wt %) | 5.4 | 2.6 | 1.2 | |
| Quartz (wt %) | 66.5 | 77.6 | 80.0 | |
| Clays (wt %) | 10.1 | 3.7 | 2.8 | |
| Sulfides (wt %) | 3.1 | 1.9 | 1.2 | |
| Iron Oxides (wt %) | 1.1 | 1.2 | 1.0 | |
| Barite (wt %) | 0.7 | 0.8 | 1.0 | |
| Jarosite (wt %) | 3.0 | 4.5 | 5.8 | |
| Alunite (wt %) | 1.7 | 1.8 | 1.9 | |

| LOWER POST | Waste <.015 | Leach .015-.060 | Mill .060-.100 | High Mill >.100 |
|---|---|---|---|---|
| Carbonate (wt %) | 5.3 | 4.0 | 3.3 | 2.4 |
| Quartz (wt %) | 69.3 | 76.6 | 78.4 | 78.9 |
| Clays (wt %) | 8.3 | 4.4 | 3.8 | 3.4 |
| Sulfides (wt %) | 3.6 | 4.9 | 5.0 | 5.5 |
| Iron Oxides (wt %) | 1.0 | 0.9 | 0.8 | 1.0 |
| Barite (wt %) | 0.7 | 0.8 | 0.8 | 0.8 |
| Jarosite (wt %) | 2.9 | 2.9 | 3.0 | 3.0 |
| Alunite (wt %) | 1.3 | 0.7 | 0.5 | 0.6 |

| DEEP POST | Waste <.015 | Leach .015-.060 | Mill .060-.100 | High Mill >.100 |
|---|---|---|---|---|
| Carbonate (wt %) | 15.3 | 5.9 | 13.8 | 10.1 |
| Quartz (wt %) | 39.1 | 58.6 | 62.3 | 58.5 |
| Clays (wt %) | 12.6 | 7.3 | 5.7 | 10.9 |
| Sulfides (wt %) | 3.6 | 4.6 | 4.8 | 5.5 |
| Iron Oxides (wt %) | 4.3 | 2.1 | 1.8 | 2.7 |
| Barite (wt %) | 1.0 | 1.2 | 1.2 | 1.8 |
| Jarosite (wt %) | 1.3 | 2.6 | 2.8 | 2.8 |
| Alunite (wt %) | 0.6 | 0.4 | 0.4 | 0.4 |

Table 2
Geochemistry of the Post Deposit

| UPPER POST | Waste <.006 | Leach .006-.080 | Mill >.080 | High Mill |
|---|---|---|---|---|
| As ppm | 383.0 | 374.0 | 412.0 | |
| Sb ppm | 94.0 | 105.0 | 214.0 | |
| Hg ppm | 2.7 | 2.7 | 3.9 | |
| Tl ppm | 1.8 | 1.6 | 2.0 | |
| Ag ppm | 0.3 | 0.3 | 0.6 | |

| LOWER POST | Waste <.015 | Leach .015-.060 | Mill .060-.100 | High Mill >.100 |
|---|---|---|---|---|
| As ppm | 404.0 | 397.0 | 460.0 | 2,347.0 |
| Sb ppm | 60.0 | 80.0 | 81.0 | 107.0 |
| Hg ppm | 3.2 | 6.6 | 10.0 | 22.0 |
| Tl ppm | 2.5 | 4.6 | 7.1 | 20.2 |
| Ag ppm | 0.3 | 0.6 | 0.8 | 1.0 |

| DEEP POST | Waste <.015 | Leach .015-.060 | Mill .060-.100 | High Mill >.100 |
|---|---|---|---|---|
| As ppm | 1,143.0 | 1,567.0 | 2,427.0 | 6,970.0 |
| Sb ppm | 45.0 | 117.0 | 183.0 | 274.0 |
| Hg ppm | 4.7 | 7.8 | 14.1 | 56.5 |
| Tl ppm | 4.1 | 6.7 | 12.5 | 60.7 |
| Ag ppm | 0.28 | 1.2 | 1.5 | 1.2 |

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