Geology and mineralization of the Pipeline Gold Deposit, Lander County, Nevada

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ABSTRACT

The Pipeline deposit is an alluvium covered disseminated ("Carlin-type") gold discovery situated along the Cortez Rift approximately 2,440 meters west of the Gold Acres deposit along the west side of Crescent Valley in Lander County, Nevada. Host rocks are silty carbonates of the lower plate (eastern facies) Silurian Roberts Mountains Formation (Srm) similar to the Gold Acres deposit. Although a quartz monzonite pluton has been identified beneath the Gold Acres deposit no intrusive rocks have been encountered within the Pipeline deposit. North-northwest and northeast-striking high-angle faults served as the primary conduits for gold-bearing fluids, with gold hosted in a low-angle tabular zone. Thickness of the mineralized zone ranges from 15 to 105 meters thick. In plan view, the deposit occupies an area approximately 760 meters in a northerly direction by about 455 meters east-west. As, Sb, and Hg are geochemically anomalous, and display only weak to moderate, positive correlations with gold. Base metals are not significant in the deposit. Pyrite is present and typically forms as finely disseminated crystals or as isolated framboids. The mineralized zone is intensely sheared with deformed remnant bedding common. Oxidation, decalcification, argillization and silicification are significant forms of alteration. Carbon occurs as small pods and lenses within the ore zone, increasing in abundance with depth beneath the main ore zone. Shearing and decalcification enhanced host rock permeability that allowed access of mineralizing fluids; however, no direct correlations exist between alteration intensity and gold mineralization. Calcite veining is common peripheral to the gold mineralized zone. Quartz veining is rare and generally occurs as microveinlets within the deposit. The deposit consists of a measured resource of 46.2 million tonnes containing 4.7 million troy ounces of gold. From this resource, a proven and probable reserve of 30 million tonnes containing a total of 4.2 million troy ounces of gold with a waste to ore ratio of 6.8:1 has been derived, which includes oxidized and carbonaceous mill ore and lower grade heap leachable material. A 10 to 12 year mine life is currently projected, with an average of 310,000 troy ounces of gold per year expected from a new 4,500 tonne per day CIL mill. Current plans include a heap leach facility near the Pipeline millsite as well as utilizing of the 1,800 tonne per day circulating-fluid-bed roasting facility at the Cortez millsite.

SUMMARY

The Pipeline deposit is a significant, "Carlin-type" gold occurrence situated 2,440 meters due east of the Gold Acres deposit in Lander County, Nevada. Mineral rights to the deposit are the property of the Cortez Joint Venture (CJV). Placer Dome U.S. Inc. (PDUS) owns 60 percent of the CJV and is the operator of the property, with Kennecott controlling the remaining 40 percent. The deposit is the largest gold occurrence identified in the Cortez area. Geologic resource estimates indicate a mineralized zone consisting of approximately 46.2 million tonnes which contains 4,645,000 troy ounces of gold using a 0.34 grams per tonne cutoff. Expansion potential is evident.

LOCATION AND ACCESS

The Pipeline deposit is located approximately 130 kilometers southwest of Elko, Nevada, 11 kilometers northwest of the currently active Cortez Gold Mines (CGM) milling complex, and 2,440 meters due east of the Gold Acres open pit operation in Lander County, Nevada, Township 28 North, Range 47 East, in the SE 1/4 of Section 31. The deposit is situated along the Cortez trend. The project site is accessed via Nevada State Highway 306. Other gold deposits along the Cortez trend include Gold Acres, South Pipeline, Cortez, Hilltop, Horse Canyon, Mule Canyon, Tenabo, Fire Creek, Buckhorn, Gold Bar, Tonkin Springs and Ruby Hill (Fig. 1).

HISTORY OF MINING AND EXPLORATION

Mining in the area dates to 1862, when silver was discovered in the Cortez and Mill Canyon areas. Placer Dome U.S., formerly American Exploration and Mining Co. (AMEX), began exploring the district in 1959. The CJV was formed in 1964 to reduce the capital risk of continued exploration

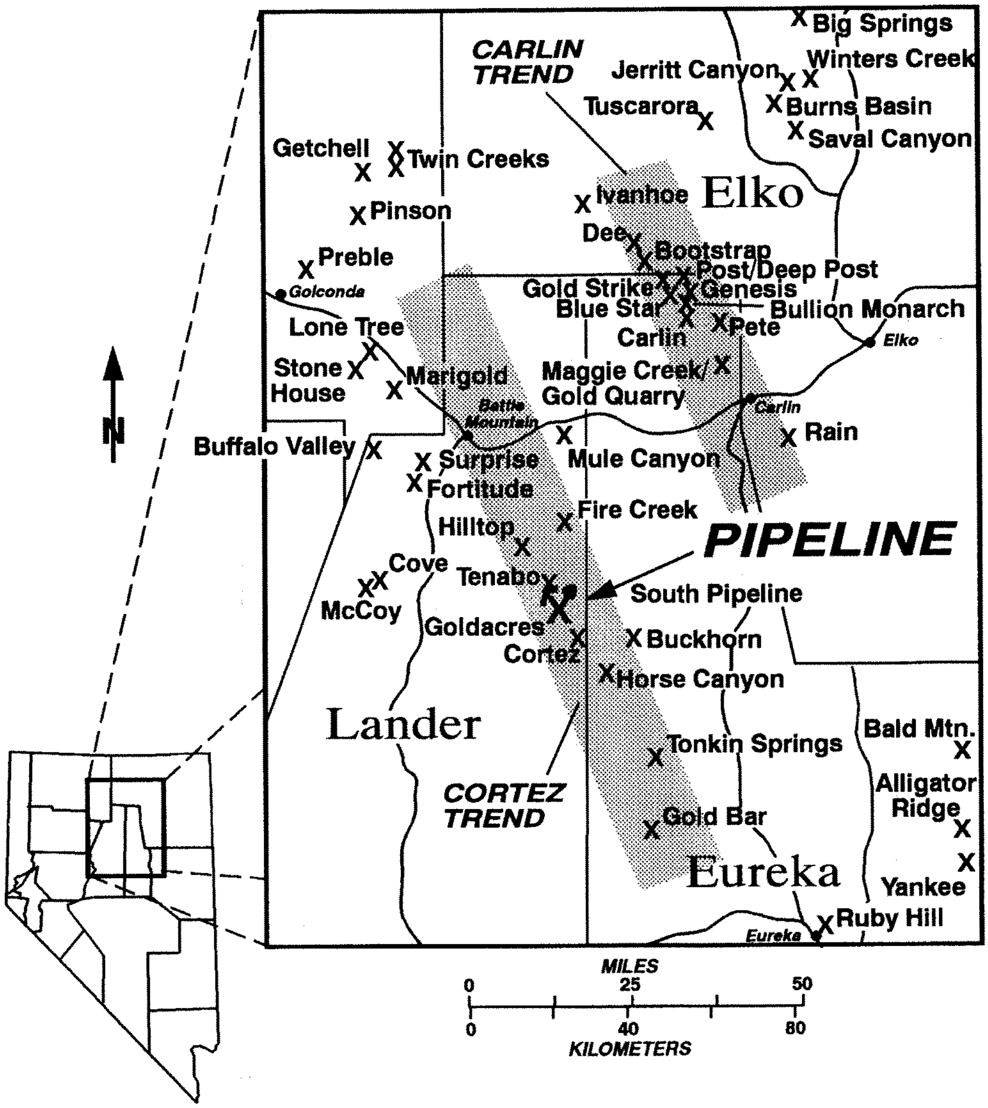

Figure 1—Location of the Pipeline deposit and various gold deposits in the region. The general locations of the Carlin and Cortez Trends are also shown.

(McFarland and Kirshenbaum, 1990). At this time the United States Geological Survey (USGS) had initiated geological mapping and geochemical sampling programs throughout the area. In 1966, anomalous gold values were identified from an obscure subcrop of oxidized and weathered silty carbonate exposed through gravels along the range front (Wells, et al, 1969). Subsequent drilling by AMEX led to the discovery of the Cortez Gold deposit, from which 5.8 million tonnes containing approximately 872,870 troy ounces of gold have been mined to date. Initial production by the CJV began in 1969 and continued until 1973. Mining in the Cortez deposit area was reactivated from 1988 to 1993. Known mineralized material remaining at the Cortez deposit contains approximately 250,000 troy ounces of gold.

Gold Acres is approximately 13 kilometers northwest of the CGM millsite. Mining at Gold Acres was initiated in 1935 and continued until 1960. In 1969, the CJV began exploration drilling around the deposit, with acquisition of the property occurring shortly thereafter. Mining by the CJV continued from 1973 to 1976. Operations at Gold Acres resumed in 1987 and continue today, exploiting both higher grade carbonaceous refractory ore and lower grade oxidized material. Total estimated production from this deposit (historic and recent) exceeds 500,000 troy ounces of gold.

The Horse Canyon deposit, located approximately six kilometers southeast of the CGM millsite, was discovered in 1976 by sampling along a prominent and extensive outcrop of silicified breccia. Production began in 1983 and continued until 1987. Approximately 3.2 million tonnes containing 385,000 troy ounces of gold have been mined from this deposit (Foo and Hebert, 1987).

The Hilltop deposit was acquired by the CJV in 1989. Subsequent drilling of the deposit has defined 8.4 million tonnes of mineralized material containing approximately 473,000 troy ounces of gold. Drilling efforts continue in the deposit area to define a proven ore reserve (Kirwin and Abrams, 1990).

The Pipeline deposit was discovered in March 1991, as a result of deep condemnation drilling in a designated expansion site for Gold Acres heap leach pads. The deposit name refers to a water pipeline that crosses the area and supplies the Gold Acres operation. Drilling began in late March 1991, with reverse-circulation drillholes 91906 and 91907 completed to depths of 305 meters and 302 meters, respectively. Both holes encountered encouraging alteration to approximately 245 meters. No significant assay results were reported from 91906; however, 91907 encountered gold grades from 180 meters to 215 meters that averaged 10.5 grams per ton.

By mid-August 1991, acquisition of adjacent land holdings was completed and drilling resumed. By June 30, 1992, a total of 227 core and reverse-circulation holes totalling 66.1 kilometers were drilled, and utilized for delineation of the deposit.

Current estimates for the Pipeline deposit indicate a measured resource of 46.2 million tonnes containing 4.7 million troy ounces of gold at a cut-off grade of 0.34 grams per tonne. Within this resource, a proven and probable reserve of 30 million tonnes containing 4.2 million troy ounces of gold has been defined with a waste to ore ratio of 6.8:1. A feasibility study indicates that a 10 to 12 year mine life could be sustained in a stand-alone operation. Annual production is estimated to average 310,000 troy ounces of gold by employing a new 4,500 tonne per day carbon-in-leach milling facility. Production estimates also include gold ounces recovered by heap leaching lower grade, oxidized material near the new plant site and roasting carbonaceous ore at the Cortez millsite using the existing circulating-fluid-bed roaster.

REGIONAL GEOLOGY

Comprehensive regional geologic studies of the CJV area include Gilluly and Masursky (1965), Gilluly and Gates (1965), and Madrid (1987). In addition, several other publications exist which discuss the detailed geology of the Cortez (Wells and others, 1969)(Radtke and others, 1987), Gold Acres (Hays and Foo, 1990), Horse Canyon (Hefner, 1985)(Foo and Hebert, 1987) and Hilltop (Kirwin and Abrams, 1990) gold deposits.

The Pipeline deposit is located along the Cortez trend in north-central Nevada (Fig. 1). The deposit occurs within an alluvium covered erosional window in the Roberts Mountains thrust near the eastern flank of the northern Shoshone Range (Fig. 2) and is hosted within the Silurian Roberts Mountains Formation (Srm). The erosional window occurs on the west side of Crescent Valley. Thickness of alluvial cover in Crescent Valley increases from west to east, exceeding 3,050 meters near the eastern boundary of the valley. The Pipeline deposit is covered by alluvium ranging in thickness from less than 15 meters to greater than 75 meters.

The deposit occurs near the eastern margin of the Gold Acres stock, a buried quartz monzonite pluton centered approximately 1.5 kilometers south of the Gold Acres deposit. No igneous rocks have been identified within the Pipeline deposit area.

The region is underlain by Paleozoic, Mesozoic and Cenozoic sedimentary and igneous rocks (Gilluly and Masursky, 1965). The oldest sedimentary rocks exposed are Cambrian in age. The Paleozoic units, which represent the upper and lower plates of the Roberts Mountains Thrust, display two depositional environments. Both plates are known to host significant gold mineralization.

The upper plate is an allochthonous western assemblage, composed dominantly of deep water siliceous sediments and volcanic rocks deposited in a eugeosynclinal environment. The allochthon includes the Cambrian Harmony Formation, Ordovician Valmy and Vinini Formations, Silurian Elder Sandstone and Fourmile Canyon Formations, and the Devonian Slaven Chert.

The lower plate of the Roberts Mountains Thrust is the autochthonous transitional and/or eastern miogeosynclinal assemblage of dominantly carbonate units representing deposition in the shallow water environments of the continental shelf. Formations within the autochthonous assemblage include: Cambrian Prospect Mountain Quartzite, Pioche Shale, Eldorado Dolomite, Shwin Formation and Hamburg Dolomite, Ordovician Eureka Quartzite and Hanson Creek Formation, Silurian Roberts Mountains Formation; Devonian Wenban Limestone; and the Late-Devonian to Early-Mississippian Pilot Shale.

During the Late-Devonian to Early-Mississippian Antler Orogeny, the Roberts Mountains Thrust transported the western assemblage rocks eastward a distance estimated to exceed 80.5 kilometers over the time-equivalent autochthonous carbonate assemblage. Northerly trending folds are commonly found in both the upper and lower plates and may have formed contemporaneous with thrusting.

Rocks younger than the Antler Orogeny include Mid-Pennsylvanian Battle Conglomerate, Late-Pennsylvanian to Early-Permian Antler Peak Limestone, Lower-Permian Havallah Formation and Early-Triassic China Mountain

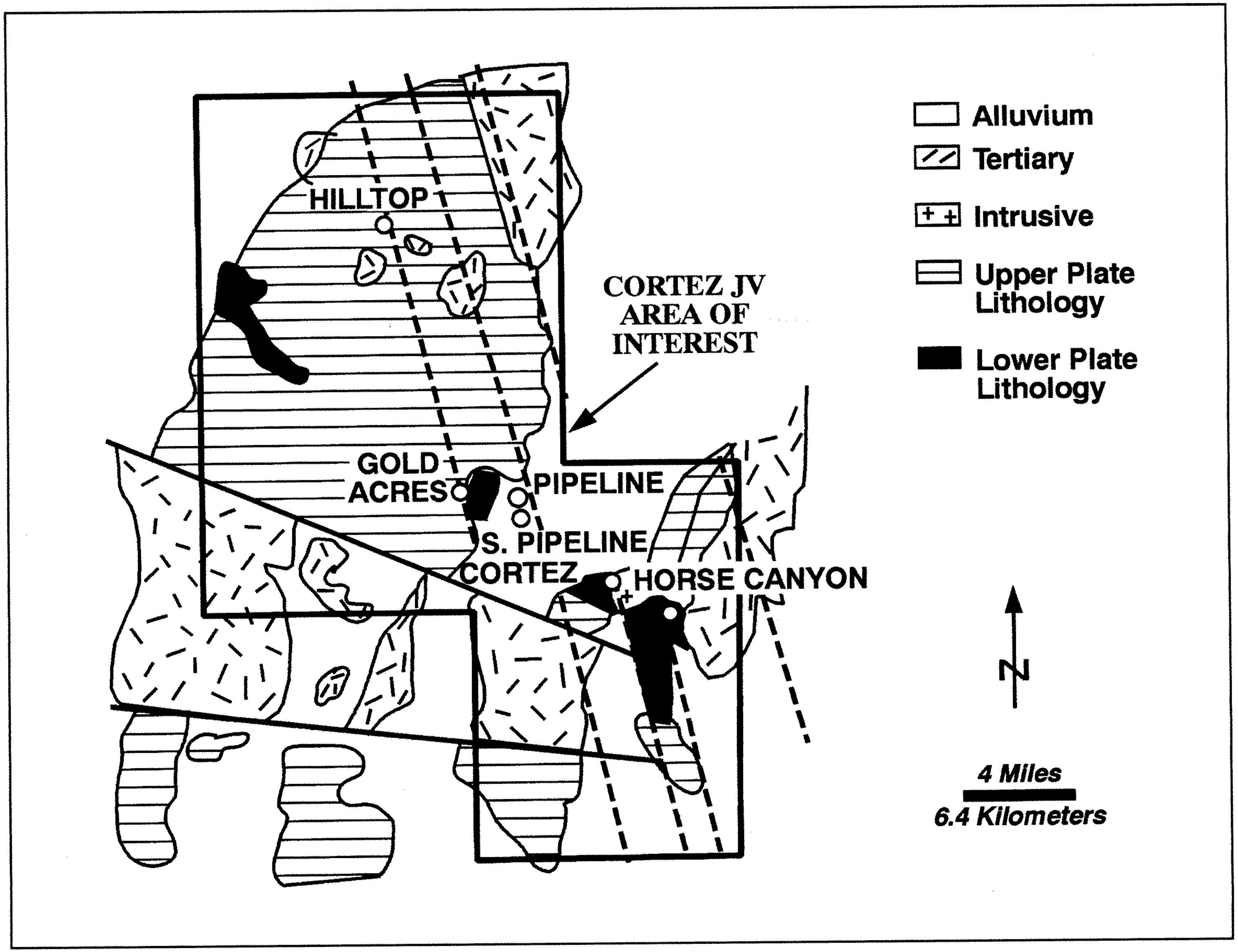

Figure 2–Simplified geology of the Cortez JV area of interest. The Pipeline and South Pipeline deposits are located along the eastern flank of the northern Shoshone Range within a buried erosional window.

Formation which unconformably overlie the Antler Peak Limestone.

A later orogenic event, postulated by Gilluly and Gates (1965) and Gilluly and Masursky (1965), is based on regional mapping evidence and suggests thrust faulting can be dated no more accurately than post Early-Triassic.

The intrusion of granitic stocks during the Mesozoic resulted in localized doming throughout the region. Doming accentuated regional folding patterns and caused upwarping of the Roberts Mountains Thrust contact. Subsequent erosion of these highlands formed windows through the upper plate, exposing lower-plate units. Regional contact metamorphism of adjacent sediments resulted in varying intensities of hornfels and skarn development with associated base metals deposition. Some precious metal mineralization may have also resulted from these events.

Tertiary igneous events include the intrusion of quartz porphyry dikes, quartz latite and rhyolite tuffs, and basaltic andesite flows. Rytuba (1985) postulates that the hydrothermal systems responsible for gold deposition throughout the area were generated by these igneous events. Recent mapping evidence suggests this igneous activity clearly postdates gold mineralization in the Cortez deposit (McCormack, 1991).

A complex structural setting created by thrusting and high-angle faulting allowed gold-bearing hydrothermal solutions to access zones favorable for gold deposition. These receptive zones were highly permeable due to original silty lithology and/or structural preparation. Favorable rock chemistry promoted reaction with the acidic hydrothermal solutions which enhanced permeability within the silty carbonate host rocks prior to gold deposition.

Block faulting related to high-angle fault systems with northerly, NNE, NNW and NW trends complete the regional structural setting. Both pre- and post-Antler ages for these fault systems are apparent (Gilluly and Masursky, 1965), with reactivation common to all systems. The most recent movement is thought to be associated with Basin and Range extension, creating the setting evident today.

Erosion of elevated fault blocks has partially filled the valley with alluvium. The composition of alluvial deposits range from coarse material, including cobbles and boulders in the alluvial fans near valley margins, to silty clays in the playa areas along the axis of the valley floor.

DEPOSIT GEOLOGY

The Pipeline deposit is a disseminated "Carlin-type" gold occurrence located near the eastern flank of the northern Shoshone Range in Lander County, Nevada. Carlin-type deposits are typified by structurally controlled, submicroscopic gold mineralization evenly distributed throughout carbonate host rocks, with anomalous levels of arsenic, antimony and mercury usually associated with gold. The Pipeline deposit lies along the Cortez Rift. The Cortez Rift is within the northern Nevada Rift defined by Stewart and others in 1975, and is a distinct geologic feature within the Battle Mountain-Eureka mineral belt defined by Roberts in 1960. The deposit is within the projected extent of the lower plate Gold Acres window. It is the largest gold occurrence discovered within the Cortez area, and is hosted in variably altered, silty carbonate units of the lower-plate Srm. The top of the mineralized zone is approximately 150 meters to 180 meters beneath the surface. The deposit is low angle and tabular and occupies an area approximately 760 meters in a northerly direction by 460 meters in an easterly direction. Thickness of the mineralized zone ranges from 15 to 105 meters. In plan, the shape of the deposit resembles a contorted, asymmetrical hourglass with two lobes connected by a narrower zone (Fig. 3).

Stratigraphy

Two principle lithologic units are identified within the immediate deposit area. Quaternary alluvium covers the area and contains a wide range of grain sizes from coarser cobbles and boulders of chert, argillite, siltstone, limestone and quartzite to fine sands and silts. Alluvial thickness over the deposit ranges from approximately 15 meters to greater than 75 meters. Although alluvium was not routinely assayed for gold during exploration drilling, randomly analyzed intervals suggest very limited potential for scattered low grade (less than 1.7 grams per tonne) gold. The alluvium-bedrock contact dips gradually to the east (less than 10°) at an angle shallower than, and sub-parallel to, the bedding of the strata below.

The most important rock unit within the deposit is defined, principally by lithologic description, as Srm Formation. This silty carbonate lithology has the same characteristics as established Srm found elsewhere in the Cortez area. The Srm is part of the laminated limestone province of north-central Nevada, which resulted from deposition on the outer continental shelf. Unaltered Srm is typically black to dark grey, thin- to medium-bedded, thinly laminated, calcareous to dolomitic siltstone, containing abundant, poorly sorted detrital silt-sized grains of quartz and feldspar. Carbonaceous material and pyrite are common. Graptolites can be locally abundant in Srm (Stewart, 1980), but no fossil evidence has been noted in the deposit.

Unaltered Srm, which is comprised of silt-sized grains of approximately 80 percent calcite, 15 percent angular fragments of quartz, five percent potassium feldspar, and less than one percent muscovite flakes (Gilluly and Masursky, 1965), is rare in the deposit area. It is usually moderately to intensely oxidized and variably silicified, decalcified and/or argillized. In the deposit area, it is typically composed of 50 to 80 percent sub-rounded, very fine sand-sized to sub-angular clay sized quartz grains; 0 to 40 percent microcrystalline calcite; 1 to 50 percent illite with rare rounded grains of silt-sized feldspars; and accessory levels of iron oxide pseudomorphs after pyrite. Carbonaceous Srm has been encountered at depth, but only to a minor degree within the currently defined deposit.

The type section of the Srm in the Roberts Mountains is 580 meters thick. In the Cortez Mountains, the thickest measured section is 305 meters (Gilluly and Masursky, 1965).

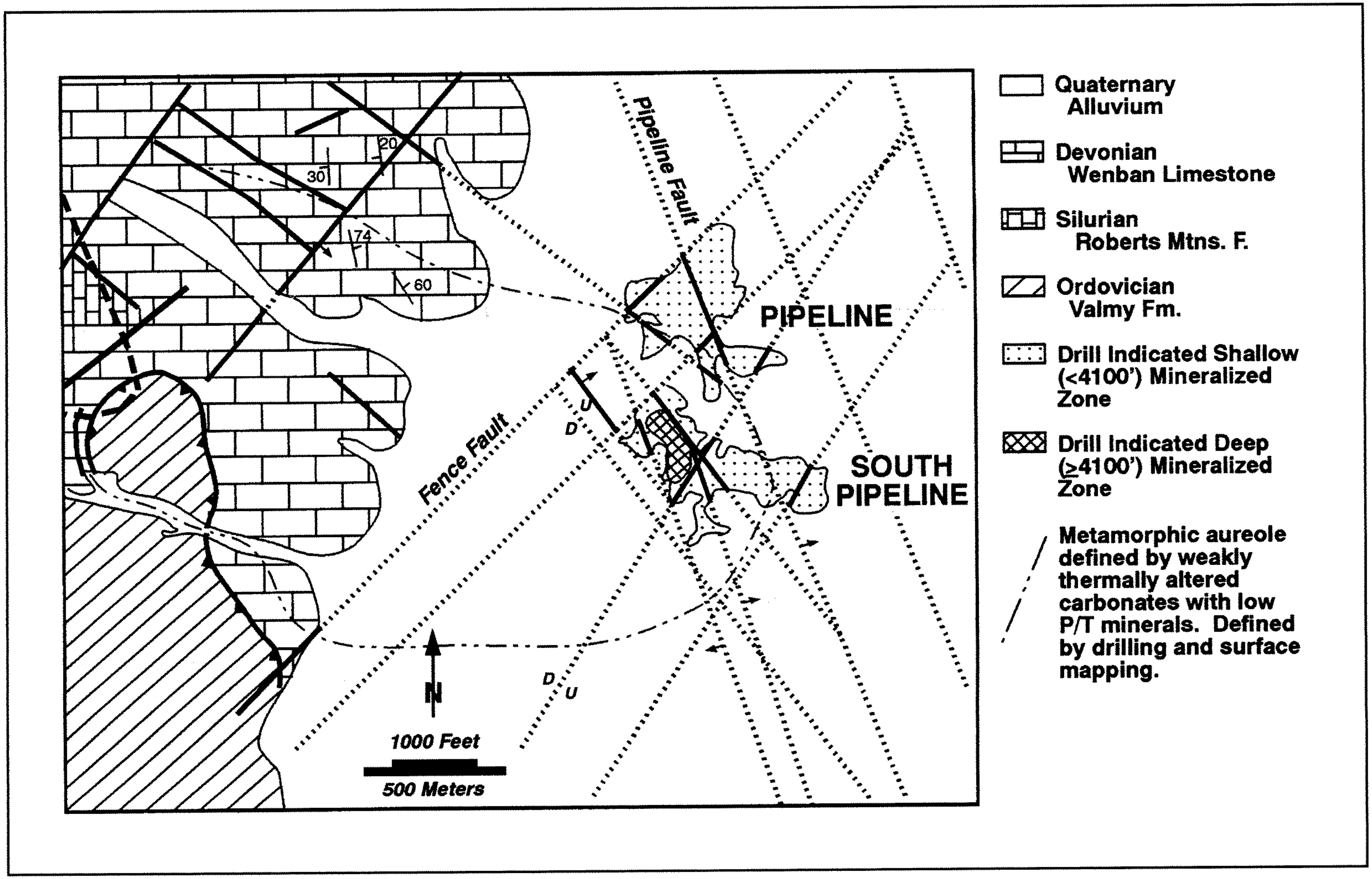

Figure 3—Simplified geologic map of the Pipeline/South Pipeline deposit areas. Drill-indicated Au-mineralized zone outlined for each deposit.

Drill data suggest the thickness of the Srm exceeds 760 meters in the Pipeline deposit area. Thickening is thought to be the result of repeated orogenic activity from the Antler through the Sevier Orogenies. Doming, related to the Mesozoic intrusives, may account for additional thickening along the margins of the igneous body.

The only other lithology of note is Devonian Wenban limestone (Dw) which is exposed approximately 460 meters to the west of the Pipeline deposit. The Dw is similar to the Srm, but is typically thicker bedded with less detrital silt grains. It is generally a more crystalline limestone that was deposited in the moderately deep outer shelf environment (Stewart, 1980). Although Dw is not evident within the deposit, it may be exposed in the ultimate western pit wall. The stratigraphy of the deposit area is summarized in Table 1.

Table 1—Stratigraphy of the Pipeline/South Pipeline area.

CENOZOIC	QUATERNARY	COLLUVIUM, ALLUVIUM, PLAYA GRAVELS	
CENOZOIC	TERTIARY	BASALTIC ANDESITE FLOWS QUARTZ LATITE AND RHYOLITE TUFF QUARTZ PORPHYRY DIKES	
MESOZOIC	CRETACEOUS	GRANITIC STOCK	
MESOZOIC	JURASSIC		
MESOZOIC	TRIASSIC	CHINA MOUNTAIN FM.	
PALEOZOIC	PERMIAN	HAVALLAH FM.	
PALEOZOIC	CARBONIFEROUS PENN.	ANTLER PEAK FM. BATTLE CONGLOMERATE	
PALEOZOIC	CARBONIFEROUS MISS.	UPPER PLATE (western facies)	LOWER PLATE (eastern facies)
PALEOZOIC	DEVONIAN	SLAVEN CHERT	PILOT SHALE WENBAN LIMESTONE
PALEOZOIC	SILURIAN	ELDER SANDSTONE	ROBERTS MOUNTAINS FM.
PALEOZOIC	ORDOVICIAN	VALMY FM.	HANSON CREEK FM. EUREKA QUARTZITE
PALEOZOIC	CAMBRIAN	HARMONY FM.	PROSPECT MOUNTAIN FM. PIOCHE SHALE ELDORADO DOLOMITE SHWIN FM.

Structure

The Gold Acres area is interpreted to lie in an eastwardly dipping fault block related to Basin and Range tectonism. Bedding in the Pipeline deposit area appears to follow a similar pattern. Oriented core data indicates bedding has a moderate easterly dip (up to 35°) in the western portion of the deposit which becomes more gentle (less than 20°) to the east. Locally, bedding can be highly contorted.

The primary ore controlling feature is a low-angle shear zone ranging from less than three meters thick at the outer edges of the defined deposit, to greater than 105 meters thick near the center. The shear zone has an overall easterly dip of approximately 18°. It is steeper to the west and becomes more gentle to the east, sub-parallel to bedding (Fig. 4). The zone is intensely sheared, shattered and/or brecciated. Bedding within this zone varies from low-angle to highly contorted, with some deformation probably resulting from the same stress patterns which caused the shearing. Soft sediment deformation is also apparent. Some of the intense shattering and fracturing appear to post-date gold mineralization.

Current interpretations suggest this shearing may represent a zone of imbricate thrusting sub-parallel to and beneath the Roberts Mountains Thrust. A similar southwesterly dipping feature is identified as a primary ore controlling feature at the Gold Acres deposit. It is hypothesized that the Pipeline deposit, with an easterly dip, occurs on the opposite limb of an anticline, or a domed feature, related to the intrusion of the Gold Acres stock (Fig. 5). The direction of movement along the hanging wall of the Pipeline shear zone is probably west to east.

High-angle faulting include NNW-striking (N15W to N20W) and NE-striking fault sets. The Pipeline fault is the most readily identifiable NNW fault. This high-angle fault has a steep (75° to 85°) northeasterly dip and is parallel to the Cortez Rift (N15W). The Pipeline fault may be an offset extension of the Cortez fault which occurs on the opposite side of Crescent Valley (McCormack and Hays, 1995).

Intersecting the Pipeline fault system is a NE trending set of high-angle faults (N30E to N50E). At least three sub-parallel NE faults have been identified from drill data, or inferred

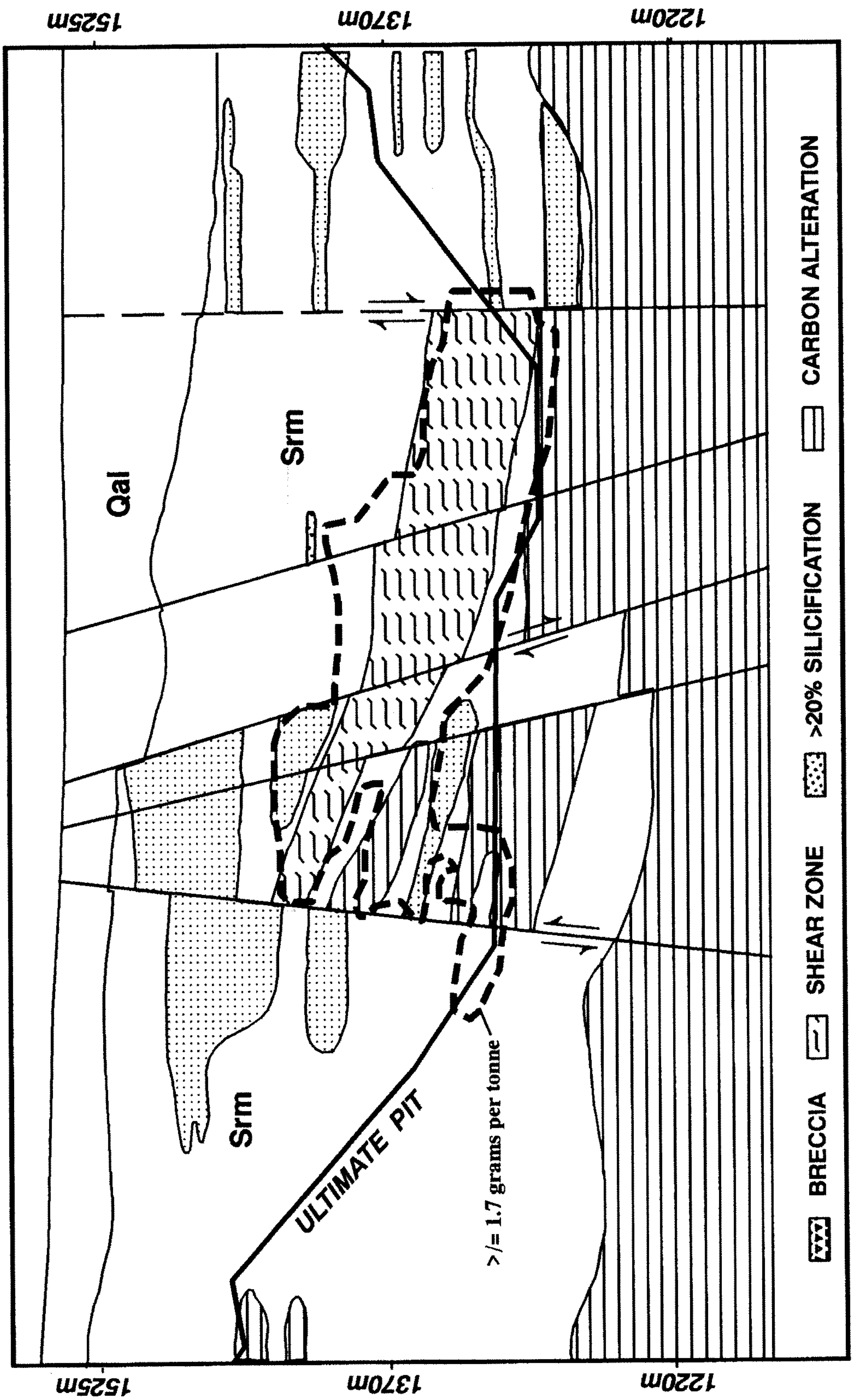

Figure 4—Simplified geologic cross-section through the Pipeline deposit. The section is oriented east-west, looking north.

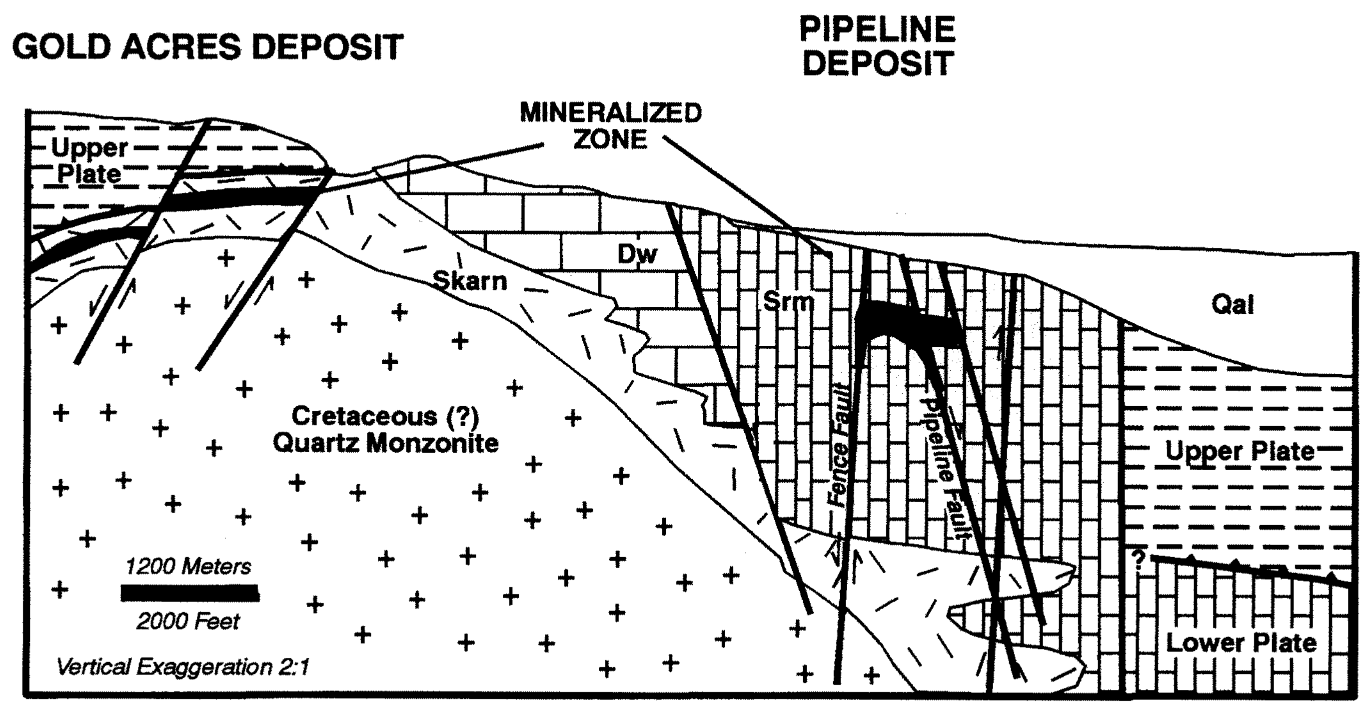

Figure 5—Idealized geologic section of the Pipeline deposit area. Pipeline is inferred to be on the eastern limb of a domed feature, while Gold Acres is on the western limb.

from linear projections, which coincide with gold deposition. The Fence fault is the most prominent NE fault identified to date. The Fence fault strikes N40E and dips 85° to the NW and abruptly truncates high-grade gold mineralization (Fig. 6). Shallow (within 60 meters), low-grade gold occurs in the hanging wall of the Fence fault, just northwest of the main ore zone.

Gold is concentrated along the intersection of the NNW Pipeline fault and the NE Fence fault. This is evident in the grade x thickness plot (Fig. 6) which displays a concentration of high values within the resultant wedge. Grade x thickness is a statistical tool which multiplies the average gold grade of an intercept by its length or thickness. The resultant value, although having no real economic implications, represents the relative quality or significance of the intercept.

Prominent joint sets observed are sub-parallel to the high-angle fault systems described above and are listed below:

Strike	Dip
N30W	66SW
N45E	65NW
N07E	74NW

The N07E joint set is interpreted to be orthogonal to bedding.

Alteration

The Pipeline deposit is contained within an extensively altered and mineralized system estimated to be approximately 3,050 meters long (N-S) and approximately 915 meters wide (E-W). Although economic gold mineralization does not occur over the full extent of this system, varying degrees of hydrothermal alteration occur throughout. Alteration includes oxidation, decalcification, weak contact metamorphism, argillization, silicification and carbonization. Different types of alteration commonly overlap one another, and can form in any combination; therefore, no distinct sequence of alteration has been defined. Several phases of hydrothermal processes are postulated. Gold can accompany any individual alteration type or any combination of alteration types.

The most common type of alteration is oxidation which affects almost the entire deposit area. The oxidation is typically disseminated to pervasive and forms a reddish stain varying from light mauve to deep wine red in most rock samples. Bedding and fractures control the oxidation which includes pseudomorphs after iron sulfides, hematite, limonite, goethite and other unidentified forms of iron oxides. Some pyrite was protected from oxidation by silica encapsulation or occurs in carbonaceous material. The carbonaceous samples have oxidation products occurring as fracture coatings, disseminations, and pseudomorphs. Oxidation reaches depths of 245 meters or greater (Plate 1).

Decalcification occurs throughout most of the deposit and is typified by the partial or complete removal of carbonate matrix material. Replacement of calcite is not always present which either results in the reduction of rock density and an increase in porosity and permeability, or in compaction and volume reduction and a higher rock density. Although there is an abundance of pore spaces and voids, no solution textures are present. Dissolved calcite was redeposited in veins and microveinlets throughout the deposit. The microveins crosscut all types of alteration and are monomineralic, except where they occur with late iron oxides or follow earlier quartz veining.

Contact metamorphism from the intrusion of the Gold Acres stock in the southern portion of the Pipeline deposit area has produced local low-grade/low temperature metasomatic changes in the Paleozoic host rock. In core samples, the presence of up to five percent of disseminated calc-silicate minerals, or the re-crystallization of limy or siliceous beds, marks the thermal aureole of the stock. Scapolite was identified in petrographic sections and was partially to completely replaced by a quartz rim with an illite-sericite core, or completely by quartz.

Argillization is characterized by illite and/or sericite and occurs pervasively throughout the rock or as concentrations along fractures. A minor amount of authigenic sericite typically occurs along bedding planes. Most high-grade, gold-bearing samples are partially to intensely argillized; some so strongly that the rock can be easily squeezed and crumbled in the hand.

Silicification occurs as pervasive bedding replacements after decalcification and microveins. Locally, microveining is intensely developed, forming an interconnected mesh of linear and irregular fillings. Bedding replacement occurs along what were carbonate-rich interbeds, forming a coarse, interlocking, crystalline, granular, central core which grades into a fine-grained exterior. With increasing intensity of silicification these interbeds become massive silicified zones.

In silicified rocks, it is common for segregated and interlocking, irregularly shaped, coarse quartz grains to be disseminated through a finer rock matrix. These may have formed by interstitial replacement of carbonate, or by partial redissolution or replacement of angular brecciated quartz fragments.

The silicification of scapolite confirms the occurrence of at least one phase of post metamorphic silicification. This silicification was either related to gold mineralization or was caused by low temperature ground water replacement. The grade of scapolitic samples are sometimes high (up to 6.9 grams per tonne), which indicates that this low grade contact metamorphism did not adversely affect gold mineralization.

Carbonization is typified by a pronounced, black, sooty appearance to the Srm resulting from thermal maturation of organic carbon (Edison and Hallager, 1987) (Plate 2). Carbonaceous-altered Srm is composed of the same mineralogy as oxidized material, and has similar alteration and structural characteristics. Carbon occurs as disseminations and wisps, which are commonly localized in bedding planes or fractures, in local concentrations as great as 2 to 3 percent. Carbon-rich zones often contain pyrite (up to 2%) and commonly contain significant concentrations of disseminated or fracture controlled hematite or other iron oxides. Graphite was not definitively identified in any of the carbonaceous petrographic samples examined.

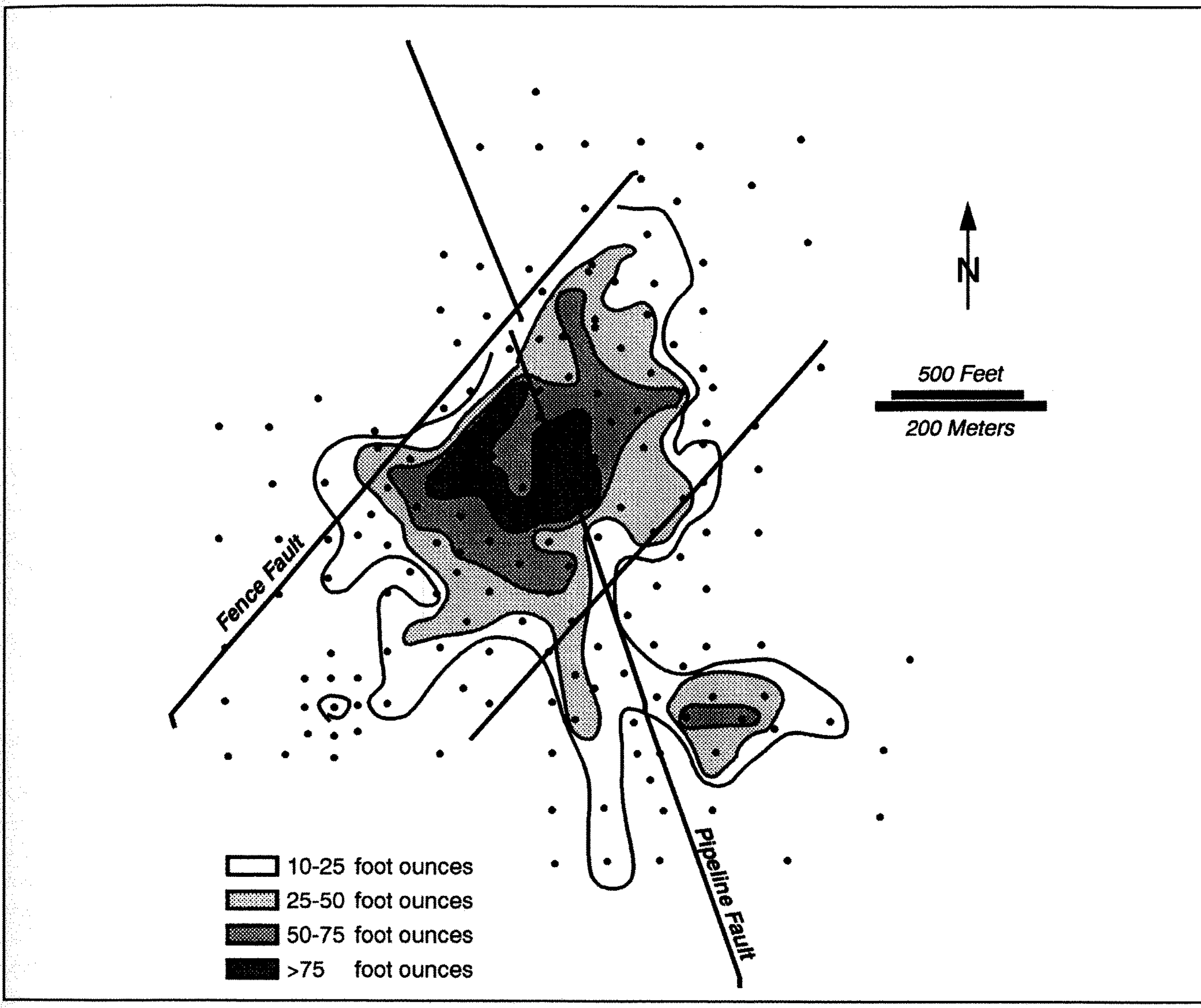

Figure 6—Grade x thickness plot of the Pipeline deposit. Mineralization is truncated at the northwest corner of the deposit by the Fence fault and elongated in a north-south direction along the Pipeline fault. The highest gold concentrations occur at the intersection of the two faults.

The presence of iron oxides along fractures, and as disseminations and pseudomorphs associated with pyrite and carbon, suggests that reduction/oxidation (redox) relationships in carbonaceous material are complex, perhaps indicating a fluctuating redox boundary from multiphase hydrothermal systems. Low concentrations of pyrite along with significant concentrations of oxides suggest that alteration types in this deposit are different from the carbonaceous ores in the Horse Canyon or Gold Acres deposits.

Mineralization

Gold occurs in both sheared and unsheared Srm associated with all alteration types. Petrographic examinations indicated microscopically visible gold in only 20 of 37 polished sections prepared from core samples with gold grades greater than 14 grams per tonne. This implies that much of the gold occurs as submicroscopic disseminated grains. Microscopic gold occurs as sparse, very fine (1 or 2 microns), irregularly

Table 2

PIPELINE
DOWNHOLE GEOCHEMICAL SUMMARY

	Mo ppm	*Cu ppm*	*Pb ppm*	*Zn ppm*	*Ag ppm*	*Fe ppm*	*As ppm*	*Sb ppm*	*Bi ppm*	*Ca %*	*Ba ppm*	*Al %*	*Na %*	*K %*	*W ppm*	*Tl ppm*	*Hg ppb*
Min	1.0	4.0	5.0	11.0	0.1	.42	16.0	2.0	.054	.06	28	.14	.01	.04	1.0	2.0	45
Max	48.0	92.0	541.0	1,410.0	2.3	5.22	1,542.0	370.0	8.0	34.8	.874	2.51	.04	.71	73.0	32.0	18,900
Mean	10.9	24.3	29.3	174.9	.35	1.77	266.26	19.16	2.04	10.77	181.15	.57	.011	.24	8.77	2.46	2,282
Std Dev	7.21	12.97	50.19	122.3	.275	.68	212.46	34.33	.409	7.85	205.06	.28	0	.113	9.66	2.31	2,864
Corr (r) w/FA Au	.287	.145	-.035	.056	.029	.081	558	.334	.054	-.271	-.111	-.024	.032	.040	.188	.219	.537

shaped blebs disseminated through the host matrix. Gold was observed in and on silica, in and on hematite, on pyrite, and in illitic or sericitic matrix material as well as discrete grains in open spaces and on fracture surfaces. Gold grains are coarsest in fractures and open spaces, and varied from <1 to 5 microns in unbroken matrix material, fine gouge, and in silica; up to 20 microns on pyrite; 10 microns in and on hematite; and the largest grain measuring approximately 30 microns was observed on a hematite grain in a quartz microvein (Plates 3 and 4). A single one micron bleb of gold was observed in one of nine carbonaceous samples examined. Visible gold, typically measuring less than 500 microns, was identified in only three drill samples.

An original presence of pyrite is inferred from limonite and hematite pseudomorphs; however, pyrite does occur locally in low concentrations (typically <2%) in carbonaceous samples along bedding planes, fractures, open-space fillings, and occasionally as framboids. Extremely fine (1 to 3 micron) pyrite commonly occurs in all samples encapsulated in silica. These occurrences suggest that both authigenic and syngenetic pyrite are present.

Geochemistry

Sample pulps from ten RC drillholes were composited to six meter intervals and analyzed with a 32 element ICP scan. The data set includes a representative group of drillholes within the deposit area and from surrounding low-grade material and waste rock. Anomalous levels of arsenic (As), mercury (Hg) and antimony (Sb) typically occur within the gold mineralized zone. Less significant occurrences of thallium (Tl), vanadium (V), molybdenum (Mo), boron (B), tungsten (W), cadmium (Cd), nickel (Ni) and copper (Cu) also exist. Silver (Ag) is insignificant. Table 2 summarizes these results.

CONCLUSIONS

The Pipeline deposit is the largest occurrence of gold discovered in the Cortez area and represents one of the most significant recent gold discoveries in the world. From 1969 to 1994, the CJV has produced more than 1.6 million troy ounces of gold. Current ore reserve estimates suggest that the Pipeline deposit alone may quadruple this total within the next 20 years. The discovery is a result of persistent exploration efforts in an active mining district and is indicative of the potential for additional discoveries throughout north-central and northeastern Nevada and the Great Basin.

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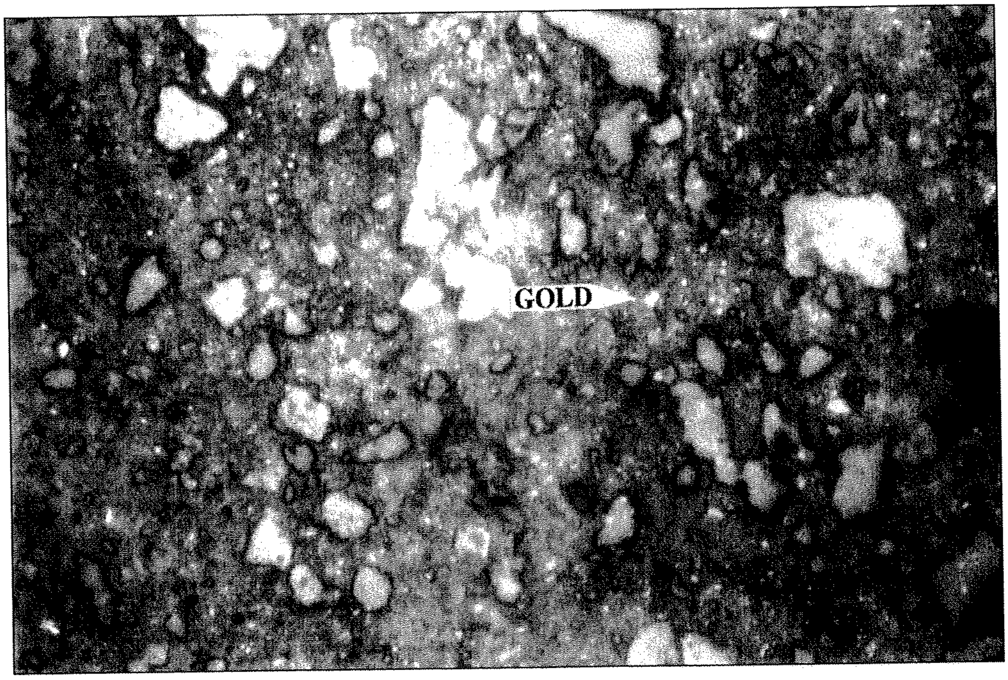

Plate 1—Typical gold bleb with undifferentiated iron oxides in argillized and oxidized groundmass, with quartz (irregular gray fragments), hole DP-78A, -177 meters, 18.1 grams Au per tonne, reflected light, uncrossed polars, field of view 150 microns.

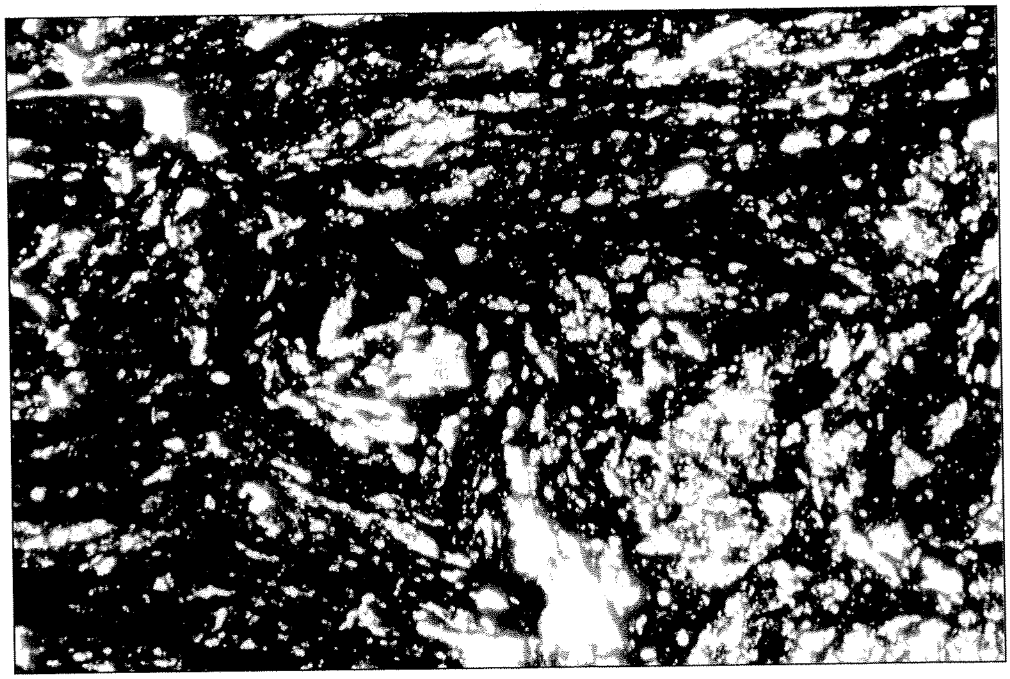

Plate 2—Typical black carbon in crenulated Roberts Mountains Formation, with quartz grains (bright white), hole DP-106, -179 meters, 26.2 grams Au per tonne, transmitted light, uncrossed polars, field of view 1.27 mm.

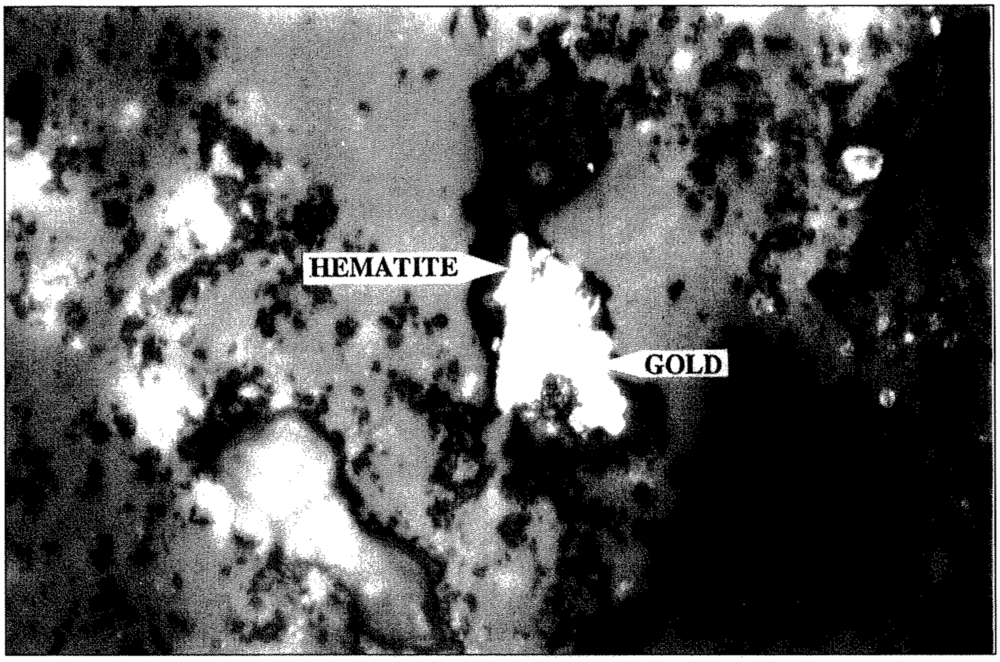

Plate 3—Very large gold bleb, on hematite (white-gray), in silicified groundmass (dark gray), hole DP-79, -201 meters, 36 grams Au per tonne, reflected light, uncrossed polars, field of view 150 microns.

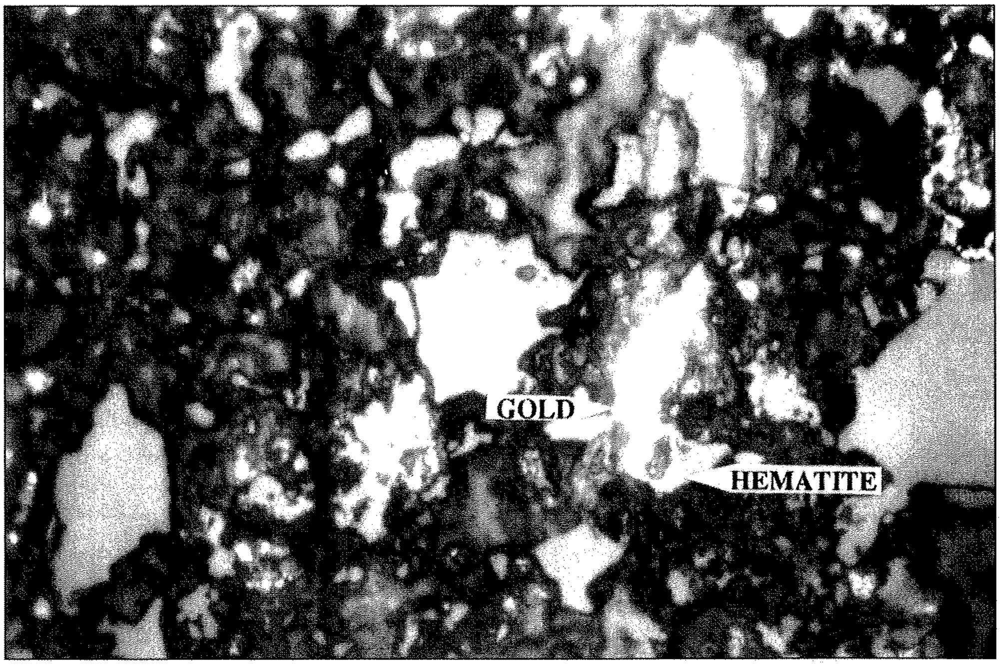

Plate 4—Large gold bleb with hematite (white-gray) and quartz (darker gray) and undifferentiated iron oxides, in oxidized groundmass, hole DP-106, -148 meters, 15.5 grams Au per tonne, reflected light, uncrossed polars, field of view 150 microns.